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ROBERT LECOLAZET

5 décembre 1910 - 6 janvier 1990

Président de la Commission Internationale des Marées Terrestres de 1963 à 1979, Robert Lecolazet a apporté une contribution majeure aux projets de recherche en ce domaine, nés de l'Année Géophysique Internationale.

Le premier colloque restreint tenu à Bruxelles en 1958 fut l'occasion de notre première rencontre. Nous y étions nombreux: les britanniques Doodson et son assistant de l'époque G. Lennon, Suthons, les russes N. Pariiskii et Y. Boulanger, les allemands R. Tomaschek premier président de la Commission, R. Brein, Buchheim, Ellenberger et Schulze, le tchèque Picha et les français A. Gougenheim et R. Lecolazet aussi accompagné de son jeune assistant de l'époque L. Steinmetz, et moi-même, hôte belge.
Robert Lecolazet arrivait à la réunion avec deux contributions qui marquaient un renouveau total en ce domaine peu approfondi à l'époque: le premier gravimètre enregistreur réalisé dès 1954 et une méthode d'analyse - manuelle - inspirée des procédés de combinaisons linéaires d'ordonnées des géophysiciens H. et Y. Labrouste.

Pendant toutes les années qui suivirent Lecolazet travailla sans relâche à perfectionner deux gravimètres classiques, reconstruisant leur thermostatisation, améliorant le système d'enregistrement automatique avec méthode de zéro et les conditions d'environnement en installant l'appareil dans une ancienne fortification de la place de Strasbourg. Il fut l'un des premiers à se préoccuper de l'influence des variations de la pression atmosphérique sur les mesures. Des talents incontestables d'expérimentateur habile et rigoureux devaient assurer à la station de mesures de Strasbourg une qualification de la plus haute valeur sur le plan international.
Tout aussi rigoureux dans sa pensée scientifique Robert Lecolazet fut une référence pour tous les chercheurs qui s'engagèrent dans le domaine difficile de l'étude des marées.

Chercheur complet, il a abordé simultanément les problèmes de l'instrumentation, de l'analyse des données et de leur interprétation théorique.
Sa méthode d'analyse fut pratiquée pendant plusieurs années à l'échelle mondiale. J'eus le privilège d'en écrire le premier programme pour l'ordinateur IBM 650 en 1958 une époque où, il faut bien le dire, une grande méfiance entourait cette première machine. La pratique, rendue possible, d'un très grand nombre d'analyse mit en évidence une certaine supériorité de la "méthode Lecolazet" sur les procédés plus anciens que j'avais aussi programmé. Ceci me valut aussitôt l'amitié de Robert Lecolazet, amitié qui, pour des raisons purement humaines, perdura intacte jusqu'en 1990.

Robert Lecolazet était normand car né à Touques en Calvados le 5 décembre 1910. Après des études secondaires à Sancerre et à Bourges il étudie aux facultés des Sciences de Paris et de Clermont-Strasbourg.

Sa carrière à l'Institut de Physique du Globe de Strasbourg débute en avril 1937 comme assistant, se poursuit comme Maître de Conférences à la Faculté des Sciences en octobre 1948 et Professeur au 1 janvier 1955.

A partir de 1946, ses recherches ont porté principalement sur l'étude de l'électricité atmosphérique et plus particulièrement sur les phénomènes relatifs aux nuages orageux. Ces travaux ont été couronnés par une thèse de doctorat d'état ès-sciences physiques, intitulée: "La polarisation électrique des cumulus de beau temps, étude expérimentale et interprétation des résultats", soutenue à la Faculté des Sciences de l'Université de Paris le 7 décembre 1948. Il avait, avec la participation de son épouse Annie, effectué les mesures nécessaires en planeur !

Robert Lecolazet a également effectué quelques travaux sur la radioactivité des roches et de l'atmosphère et a entrepris ses premières investigations sur le champ de gravité qui le conduisirent à se consacrer entièrement à l'étude des marées terrestres.

Robert Lecolazet assignait un but précis à ses recherches: la compréhension du rôle des marées terrestres dans les anomalies de la rotation de la Terre. Il a ainsi apporté une contribution de haute qualité à la mise en évidence des effets dynamiques du noyau liquide et à la perturbation des nutations astronomiques qui en résulte.
Il a pensé à une corrélation entre une variation de l'effet de résonnance provoqué par le noyau sur les ondes P_1, K_1 et ψ_1 et les fluctuations de la vitesse de rotation de la Terre et cette éventualité appuyée par une série de données publiées de 1979 à 1983 est suffisamment intéressante pour que de nouvelles investigations en soient reprises avec les gravimètres à supraconductivité.

Son enseignement universitaire a porté, selon les époques, sur des domaines très divers: la Météorologie et Physique de l'Atmosphère, l'Electronique Appliquée, la Géodésie, la Pesanteur et la Gravimétrie, la Géodésie par satellites, les Marées Terrestres, la Prospection Gravimétrique, le Calcul Tensoriel, l'Elasticité linéaire et son application à la Terre.
Tous ceux qui ont assisté aux dix Symposiums Internationaux auxquels Robert Lecolazet a apporté sa contribution comme pionnier, Président (à Bruxelles 1965, Strasbourg 1969, Sopron 1973 et Bonn 1977), ou plus tard, comme vétéran ont reconnu sa rigueur de pensée, son exigence de précision, sa clarté d'exposition. Ils rejoindront en cela l'appréciation que ses anciens étudiants ont souvent exprimée à propos de ses cours. Nous ne pouvons manquer de joindre ici à son souvenir son épouse Annie Lecolazet qui l'a accompagné à tous nos Symposiums, manifestant une amitié chaleureuse à tous les collègues de son mari.

Mais, à notre époque, il ne suffit plus d'avoir fait progresser une recherche, il faut aussi fonder une école de haut niveau dont les membres vont poursuivre le travail et transmettre le message. En ceci Robert Lecolazet a excellé. Il a attiré dans son laboratoire de jeunes étudiants motivés qui sont devenus d'excellents chercheurs et qui assurent aujourd'hui à l'Université de Strasbourg la réputation d'une école de géophysique européenne de très haut niveau.
Son nom ne devra pas y être oublié.

P. MELCHIOR.

IMPROVED GRAVIMETRIC EARTH TIDE PARAMETERS FOR STATION HANNOVER

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Abstract

Earth tide observations with four electronic feedback LaCoste-Romberg (LCR) gravimeters have been carried out at station Hannover in 1992 using a high resolution digital data acquisition system. The instruments have been carefully calibrated in amplitude and phase, the observations have been evaluated with the earth tide preprocessing and analysis packages PRETERNA and ETERNA. The accuracy of the gravity tide parameters derived from averaging the individual results or from stacking the individual data sets is about 0.1% and $0.02^0 ... 0.06^0$ for the main waves O1, K1, M2 and S2.

1 Introduction

Between 1971 and 1977, gravimetric earth tide observations have been carried out with nine different gravimeters at station Hannover ($\phi = 52.3875^0$ N, $\lambda = 9.7130^0$ E, H = 50 m) located in a cellar of the Institut für Erdmessung, Universität Hannover (TORGE and WENZEL 1977). The following instruments have been used:

A130	Askania gravimeter Gs 12 no. 130 with photoelectric readout,
A130BN	Askania gravimeter Gs 12 no. 130 with capacitive readout,
G74	Geodynamics gravimeter no. 74 (non-feedback),
L260, L298, L318	three LCR model G gravimeters (non-feedback),
L8D	LCR model D gravimeter no. 8 (non-feedback),
L299BR	LCR model G gravimeter no. 299 with electromagnetic feedback,
L18ET	LCR earth tide meter no. 18 with mechanical feedback.

The observations have been performed by analog recording. Most of the recordings have been calibrated against the gravimeter's screw; the calibration of gravimeter Geodynamics no. 74 was derived from the Bruxelles calibration system (DUCARME 1975b). Direct determinations of the instrumental phase lags were available for a few of the instruments only. The recorded data has been digitized at hourly interval and analyzed using the method of CHOJNICKI 1973, the tidal potential catalog of CARTWRIGHT-TAYLER-EDDEN 1973 and applying the so-called inertial correction (DUCARME 1975a). The gravity tide parameters for the main waves taken from TORGE and WENZEL 1977 are given in Tab. 1 with inertial correction removed. The accuracy of the mean gravity tide parameters of the station Hannover for the main waves was estimated in 1977 to be about 0.2% and 0.1^0 resp.

These gravity tide parameters are in use up to day for e.g. the reduction of gravity observations carried out on the vertical gravimeter calibration line Hannover (KANNGIESER et al. 1983) and of absolute gravity observations at Hannover (TORGE 1991). But significant calibration errors are suspected for the 1977 observations, because one test observation using feedback LCR gravimeter no. D014F and digital data recording in 1985 has yielded about 0.8% lower amplitude factors. In addition, the amplitude factors of the Bruxelles calibration system has been decreased by 0.8% in 1992 (MELCHIOR 1992). Therefore, we have decided to use modern feedback LCR gravimeters, carefully calibrated on a modern gravimeter calibration line to the Système International d'Unités and modern recording and data processing techniques in order to determine improved gravimetric earth tide parameters for station Hannover.

Table 1: Gravity tide parameters at Hannover from 9 gravimeters (TORGE and WENZEL 1977), inertial correction removed

amplitude factors at left side, phase leads in $[^0]$ at right side of the columns.

Instr.	Days	wave O1		wave K1		wave M2		wave S2	
A130	296	1.1495	-0.30	1.1456	-0.08	1.1950	1.19	1.2021	-0.13
		±0.0139	±0.69	±0.0099	±0.49	±0.0101	±0.49	±0.0218	±1.04
L260	206	1.1512	0.05	1.1377	0.06	1.1871	1.79	1.1887	0.88
		±0.0016	±0.08	±0.0012	±0.06	±0.0014	±0.07	±0.0029	±0.14
L298	410	1.1634	-0.03	1.1502	0.45	1.1977	1.69	1.2018	0.92
		±0.0015	±0.07	±0.0011	±0.05	±0.0008	±0.04	±0.0017	±0.08
L8D	52	1.1709	-0.12	1.1529	-0.52	1.1953	1.58	1.1836	-0.31
		±0.0040	±0.20	±0.0029	±0.14	±0.0026	±0.13	±0.0056	±0.27
L299BR	63	1.1522	0.12	1.1414	0.08	1.1876	1.60	1.1943	0.13
		±0.0036	±0.18	±0.0025	±0.13	±0.0025	±0.12	±0.0053	±0.25
G74	170	1.1612	-0.75	1.1497	-0.53	1.1976	1.64	1.1969	0.45
		±0.0048	±0.24	±0.0034	±0.17	±0.0025	±0.12	±0.0055	±0.26
A130BN	332	1.1630	0.06	1.1569	0.29	1.1937	1.55	1.2028	0.05
		±0.0054	±0.26	±0.0038	±0.19	±0.0029	±0.14	±0.0061	±0.29
L318	103	1.1696	0.06	1.1590	0.27	1.1989	1.69	1.1978	0.52
		±0.0027	±0.13	±0.0019	±0.09	±0.0021	±0.10	±0.0045	±0.22
L18ET	304	1.1614	0.15	1.1517	0.22	1.1969	1.69	1.2015	0.83
		±0.0013	±0.07	±0.0009	±0.05	±0.0015	±0.07	±0.0031	±0.15
average	1936	1.1603	-0.08	1.1495	0.03	1.1944	1.60	1.1966	0.37
		±0.0026	±0.10	±0.0023	±0.12	±0.0014	±0.06	±0.0022	±0.15

2 Modern earth tide observations at Hannover

In 1985 and 1988, gravimetric earth tide observations have been performed at Hannover using LCR gravimeter model D no. 8, equipped with an electrostatic feedback of type SRW (SCHNÜLL et al. 1984, RÖDER et al. 1988). These feedback systems were originally constructed for the precise observation of small gravity differences in field surveys but have become more and more important also for earth tide observations. The data acquisition system was based on a Hewlett Packard HP9816S computer using a digital voltmeter (Keithley K195A with 18 bit resolution). The recording was carried out with 1 s sampling interval, starting 15 minutes before and stopping 15 minutes after full hour (there is an aliasing problem here). The compression to hourly samples was carried out by fitting a 3rd degree least squares polynomial to the data. The gravimeter's feedback had been calibrated on the vertical gravimeter calibration line at Hannover (KANNGIESER et al. 1983), the instrumental phase lag due to the analog filter built into the SRW feedback had been taken into account. Unfortunately, air pressure has not been recorded in 1985 and 1988. The gravity tide parameters derived from these observations are included in Tab. 3 and 4.

From April to October 1992, four feedback LCR gravimeters have been used to record gravimetric earth tides at Hannover. Gravimeters G079F, G087F and G995F were equipped with an SRW electrostatic feedback, gravimeter G299K was equipped with electromagnetic feedback SW-02. The observation site was a partly temperature controlled room in a large air-raid shelter made from concrete (a relict from world war II) with 2 m thick walls and floor (WGS84 coordinates are $\phi = 52.3353^0$ N, $\lambda = 9.7633^0$ E, h = 101 m). The gravimeters were installed on the floor covered with special boxes for additional temperature shielding.

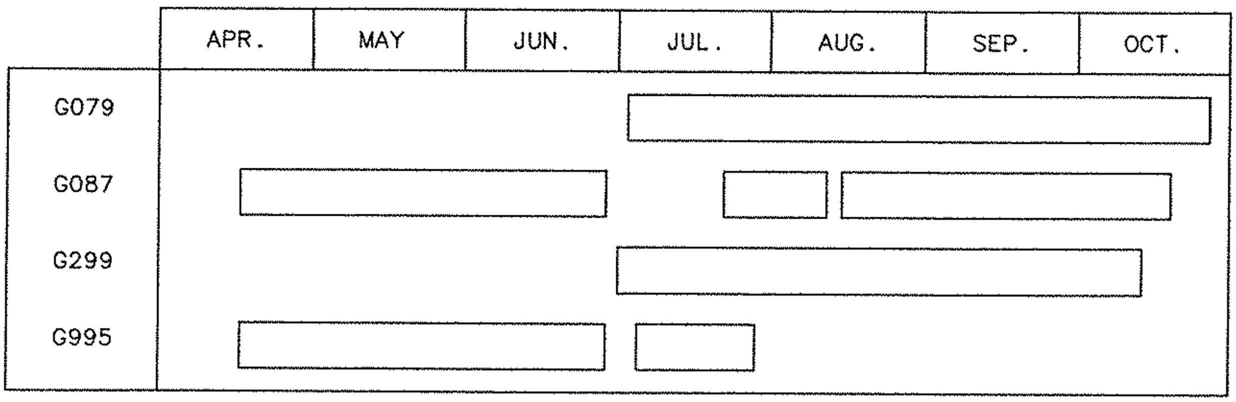

Figure 1: Time spans of earth tide observations at Hannover in 1992

The data recording has been carried out using the transportable low rate data acquisition BFO-TLD1 (Fig. 2). The data acquisition consists of an IBM Ps/2 8530 personal computer (80286/287 processor) with 12" colour graphics screen, 30 MB hard disc and 3.5" floppy disc, as well as a built-in 8 channel 16 bit analog to digital converter card ACPC-16-8 from Strawberry Tree Inc. A built-in DCF77 clock card ensured an accurate timing by updating the internal PC clock every hour. The filtered output signal of the gravimeter's feedback and the output signal of an electronic barometer were digitized with 5 s sampling interval (at full five sec UTC) and 16 bit resolution. The 5 s samples were plotted on the colour graphics screen of the PC in order to assist the maintenance. The 5 s samples were on-line filtered using a zero phase numerical filter of 20 min length and 3 min cut-off period, and subsequently on-line decimated to 1 min resampling interval and stored on a floppy disc. Because of restricted availability of the gravimeters and due to failures of the instruments (e.g. sticking of the gravimeter's beam after large earthquakes), the available records (Tab. 1 and Fig. 1) are of different length and partly have a few gaps.

The overall accuracy of gravity tide amplitude factors is limited by the calibration of the gravimeters, and the overall accuracy of the gravity tide phase leads is limited by the accuracy of the instrumental phase lag. Therefore, every effort has been made to achieve maximum calibration

Table 2: Gravimeters and time spans used for final earth tide analysis

LaCoste-Romberg gravimeter*)	Block	Start	End	no. of days
D014F	I	850409 12:00	850428 11:00	19.0
	II	880528 00:00	880713 05:00	46.3
G079F	I	920702 00:00	921025 23:00	116.0
G087F	I	920416 00:00	920627 23:00	73.0
	II	920721 12:00	920810 11:00	20.0
	III	920814 12:00	921018 05:00	64.8
G299K	I	920630 12:00	921012 23:00	104.5
G995F	I	920416 00:00	920627 23:00	73.0
	II	920704 00:00	920727 17:00	23.8

*) F: electrostatic feedback SRW, K: electromagnetic feedback

accuracy. The analog to digital converter used in the BFO-TLD1 data acquisition has been calibrated to a voltage standard before and after the earth tide recording, and the battery powered voltmeters used for the gravimeter calibration line observations have been calibrated to the same voltage standard to about $1 \cdot 10^{-4}$ relative accuracy.

The scale of the SRW-feedback systems (D014F, G079F, G087F and G995F) has been determined on the vertical gravimeter calibration line at Hannover (KANNGIESER et al. 1983) immediately before and after the earth tide recording. The precision estimation of the linear feedback calibration parameters from the least squares adjustment of the calibration observations was about $1 \cdot 10^{-4}$, but the time variations of the linear calibration parameters were in the order of $1 \cdot 10^{-3}$ for unknown reasons. Thus, the overall calibration accuracy is estimated to be about $1 \cdot 10^{-3}$ for these gravimeters.

The calibration of the electromagnetic feedback in gravimeter G299K was derived from a calibration of the gravimeter's screw at the Hornisgrinde gravimeter calibration line in the Black Forest Mountains (LINDNER et al. 1994) and from repeated laboratory calibrations of the feedback against the gravimeter's screw. The time variation of the linear feedback calibration parameter is about $2 \cdot 10^{-4}$ per year; the relative accuracy of the calibration of gravimeter G299K is estimated to be about than $\pm 1 \cdot 10^{-4}$. The calibration of gravimeter G299K is independent from the Hannover gravimeter calibration system, because the scale of the Hornisgrinde calibration line has been derived from absolute gravity observations performed at the bottom and the top of the calibration line.

The instrumental phase lags for gravimeters D014F, G079F, G087F and G995F have been determined by step response experiments using steps generated by manual dial rotation. The procedure is described in RICHTER and WENZEL 1991. WENZEL 1994a estimates the accuracy of the applied method to about 0.05^0 at wave M2. The instrumental phase lag for gravimeter G299K has been determined with much higher accuracy (0.00007^0 at wave M2) by applying electronically generated steps and electronically generated sine waves to the feedback system (WENZEL 1994a).

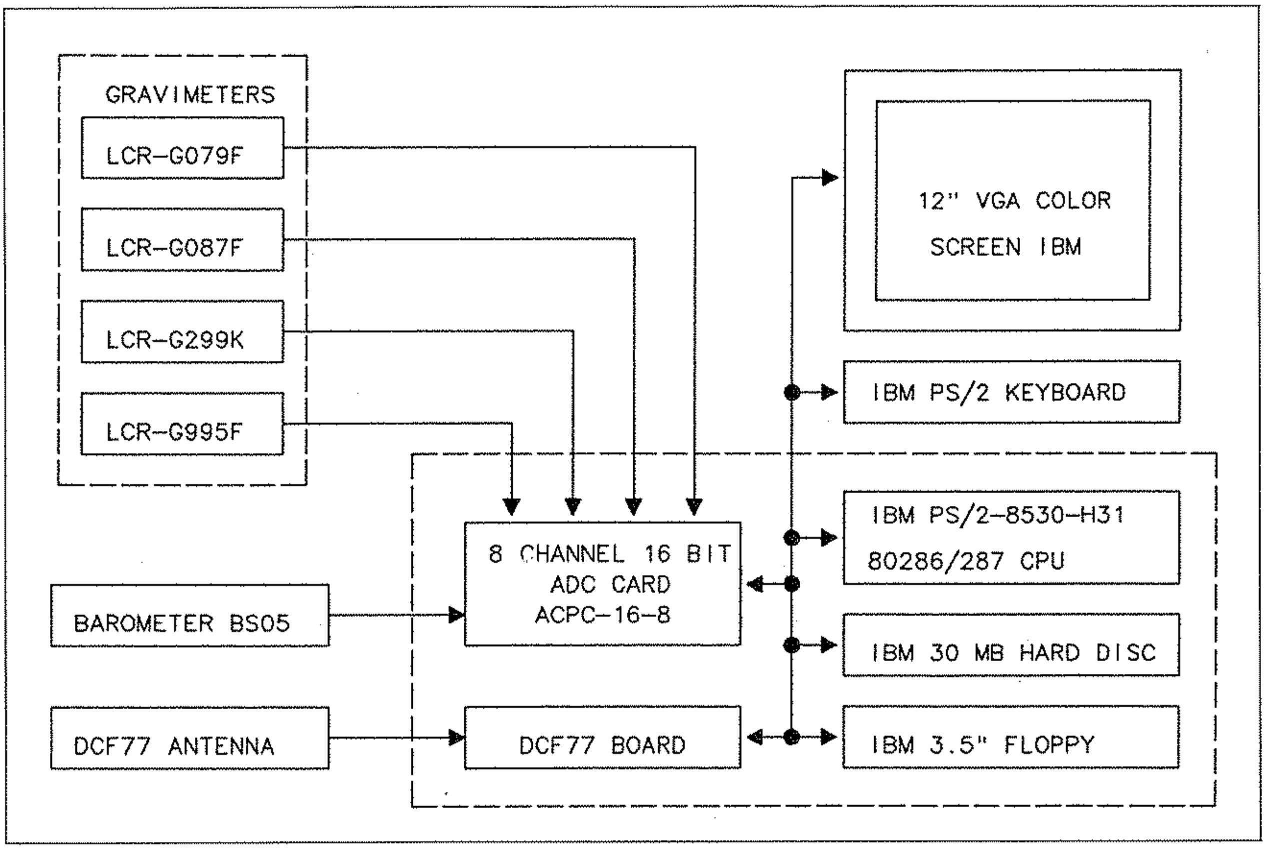

Figure 2: BFO-TLD1 data acquisition system digitizing four feedback LCR gravimeters and one electronic barometer

3 Data processing and analysis

The preprocessing and earth tide analysis of the observed data has been performed using the software packages PRETERNA and ETERNA (WENZEL 1994b, 1994c). The tidal data preprocessor PRETERNA calibrates the data, applies the instrumental phase lag corrections and cleans semi-automatically the 1 minute data from disturbances like steps, spikes and gaps e.g. due to earth quakes, resets or relevellings of the gravimeters, man-made distortions etc. The cleaned data are finally numerically filtered and decimated to 1 hour resampling interval. The decimated data were analyzed with program package ETERNA (WENZEL 1994c) which uses a least squares adjustment to determine the tidal parameters and meteorological regression coefficients. The tidal potential catalogue of TAMURA 1987 has been used for the analysis and the error estimation of the adjusted tidal parameters has been derived from Fourier-amplitude spectra of the residuals. The gravity tide parameters and their estimated standard deviations (calibration error not included) derived from the individual records are given in Tab. 3 and 4. There exist significant differences for both amplitude factors and phase leads at wave group S2K2, which may be related to the air pressure wave at S2 and different instrumental air pressure influence. Mean parameters and their standard deviations estimated from discrepancies of the individual results to the mean are also given in Tab. 3 and 4; they show accuracies in the order of about 0.1% and 0.05^0 for the main tidal waves O1, P1K1, M2 and S2K2. In Tab. 3 and 4 the adjusted air pressure regression parameters are also given; the air pressure seals for gravimeter G299K are suspected to be broken.

The data sets from gravimeters G079F, G087F and G995F have been stacked by simply introducing all three data sets into the adjustment with ETERNA. The data sets from gravimeters D014F and G299K resp. unfortunately had to be omitted from the stack because of missing air pressure recording and probably broken air pressure seas resp. Due to the increased total length of the stacked record, we were able to separate wave P1 from K1 and wave S2 from K2. The gravity tide parameters derived from the stack are compared in Tab. 5 with the simple average of the parameters of individual records from Tab. 3 and 4. There are no significant differences between both methods to derive average station parameters; the standard deviations of the parameters derived by very different methods show generally also a very good agreement.

Table 3: Amplitude factors from individual records at Hannover

Instrument	D014F	G299K	G079F	G087F	G995F	Mean
Epoch	1985/88	1992	1992	1992	1992	
No. of recorded days	65.3	104.5	116.0	157.8	96.8	540.4
Std.dev. [nms^{-2}]	3.30	3.65	1.30	3.06	2.13	
Air pres.reg.	-	(–6.12)	–3.99	–3.69	–2.99	–3.56
[nms^{-2}/hPa]	-	±0.11	±0.04	±0.07	±0.06	±0.30
Q1	1.1524	1.1531	1.1486	1.1504	1.1529	1.1515
	±0.0075	±0.0101	±0.0030	±0.0080	±0.0051	±0.0009
O1	1.1472	1.1501	1.1491	1.1511	1.1508	1.1497
	±0.0014	±0.0019	±0.0006	±0.0015	±0.0010	±0.0007
M1	1.1394	1.1412	1.1486	1.1444	1.1610	1.1469
	±0.0183	±0.0245	±0.0072	±0.0196	±0.0125	±0.0039
P1K1	1.1364	1.1429	1.1376	1.1416	1.1382	1.1393
	±0.0010	±0.0014	±0.0004	±0.0011	±0.0007	±0.0012
J1	1.1379	1.1551	1.1575	1.1599	1.1549	1.1531
	±0.0183	±0.0245	±0.0072	±0.0196	±0.0125	±0.0039
OO1	1.1698	1.1205	1.1554	1.1589	1.1509	1.1511
	±0.0334	±0.0448	±0.0132	±0.0358	±0.0228	±0.0083
2N2	1.2446	1.1711	1.1577	1.1586	1.1591	1.1782
	±0.0241	±0.0221	±0.0093	±0.0178	±0.0164	±0.0168
N2	1.1899	1.1764	1.1728	1.1753	1.1725	1.1774
	±0.0038	±0.0035	±0.0015	±0.0028	±0.0026	±0.0032
M2	1.1864	1.1856	1.1854	1.1881	1.1858	1.1863
	±0.0007	±0.0007	±0.0003	±0.0005	±0.0005	±0.0005
L2	1.1402	1.1499	1.1371	1.1248	1.1672	1.1438
	±0.0261	±0.0239	±0.0101	±0.0192	±0.0178	±0.0071
S2K2	1.1947	1.1933	1.1897	1.1879	1.1867	1.1905
	±0.0016	±0.0014	±0.0006	±0.0012	±0.0011	±0.0015
M3	1.0137	1.0815	1.0839	1.0678	1.0727	1.0639
	±0.0636	±0.0284	±0.0116	±0.0253	±0.0248	±0.0129
M4	3.8254	2.7592	0.8094	1.1598	0.5157	1.8139
	±3.3079	±1.2361	±1.0422	±1.4031	±1.4140	±0.6349

Table 4: Phase leads in [^{0}] from individual records at Hannover

Instrument	D014F	G299K	G079F	G087F	G995F	Mean
Epoch	1985/88	1992	1992	1992	1992	
No. of recorded days	65.3	104.5	116.0	157.8	96.8	540.4
Std.dev. [nms^{-2}]	3.30	3.65	1.30	3.06	2.13	
Air pres.reg.	-	(-6.12)	-3.99	-3.69	-2.99	-3.56
[nms^{-2}/hPa]	-	±0.11	±0.04	±0.07	±0.06	±0.30
Q1	0.17	0.32	-0.03	-0.31	0.48	0.13
	±0.37	±0.50	±0.15	±0.40	±0.26	±0.14
O1	0.11	0.18	0.09	0.16	0.22	0.15
	±0.07	±0.10	±0.03	±0.08	±0.05	±0.02
M1	0.22	0.68	0.13	-0.12	0.20	0.22
	±0.92	±1.23	±0.36	±0.98	±0.62	±0.13
P1K1	0.26	-0.02	0.15	0.18	0.03	0.12
	±0.05	±0.07	±0.02	±0.06	±0.04	±0.05
J1	0.45	0.61	0.26	0.40	-0.35	0.27
	±0.92	±1.22	±0.36	±0.97	±0.62	±0.17
OO1	-0.94	-0.57	-0.03	0.46	1.50	0.08
	±1.64	±2.29	±0.66	±1.77	±1.14	±0.43
2N2	1.42	2.24	2.99	3.17	3.20	2.60
	±1.11	±1.08	±0.46	±0.88	±0.81	±0.34
N2	2.52	2.24	2.31	2.31	2.39	2.36
	±0.19	±0.17	±0.07	±0.14	±0.13	±0.05
M2	1.66	1.64	1.66	1.70	1.72	1.68
	±0.04	±0.03	±0.01	±0.03	±0.02	±0.02
L2	1.41	3.49	1.85	1.82	2.67	2.25
	±1.31	±1.19	±0.51	±0.98	±0.87	±0.37
S2K2	0.55	0.05	0.41	0.61	0.18	0.36
	±0.08	±0.07	±0.03	±0.06	±0.05	±0.11
M3	2.52	-0.63	1.79	-0.49	-0.06	0.63
	±3.59	±1.51	±0.61	±1.36	±1.32	±0.64
M4	-124.82	-62.67	-75.50	-104.32	-15.73	-76.64
	±49.55	±25.67	±73.78	±69.31	±157.10	±18.72

The final station results given in Tab. 6 have been derived by a weighted mean of the results of the stack of gravimeters G079F, G087F and G995F given in Tab. 5 and of the individual results of gravimeters D014F and G299K given in Tab. 3 and 4. The length of the individual records and of the stack has been used as weights. For waves P1, K1, S2 and K2, the results of the stack solution have been used without modification. The estimated standard deviations of the final station results are about or below 0.05% and 0.03^0 for the main waves O1, K1, M2 and S2.

4 Conclusion

The comparison of gravity tide parameters from 1977 and 1992 observations (Tab. 7) gives an average error of 0.9% and 0.1^0 of the 1977 results; the accuracy of the 1992 results is estimated to about 0.1% and 0.02^0 ... 0.06^0 for the main waves O1, K1, M2 and S2 (95% confidence interval).

Table 5: Gravity tide parameters at Hannover from average of 5 gravimeters and from stack of 3 gravimeters

Instruments	Average of D014F,G299K,G079F, G087F andG995F		Stack of G079F,G087F,G995F	
Epoch	1985...1992		1992	
Recorded days	540.4		370.6	
Std.dev.[nms^{-2}]	1.30...3.30		2.49	
Air pres. reg. [nms^{-2}/hPa]	−3.56 ±0.30		−3.55 ±0.04	
	ampl.fact.	phase lead [^{0}]	ampl.fact.	phase lead [^{0}]
Q1	1.1515 ±0.0009	0.13 ± 0.14	1.1498 ±0.0036	−0.05 ±0.18
O1	1.1497 ±0.0007	0.15 ± 0.02	1.1503 ±0.0007	0.15 ±0.03
M1	1.1469 ±0.0039	0.22 ± 0.13	1.1491 ±0.0088	0.08 ±0.44
P1			1.1486 ±0.0015	0.11 ±0.07
K1	1.1393 ±0.0012	0.12 ± 0.05	1.1400 ±0.0005	0.13 ±0.02
J1	1.1531 ±0.0039	0.27 ± 0.17	1.1586 ±0.0088	0.19 ±0.43
OO1	1.1511 ±0.0083	0.08 ± 0.43	1.1541 ±0.0160	0.45 ±0.79
2N2	1.1782 ±0.0168	2.60 ± 0.34	1.1586 ±0.0082	3.02 ±0.40
N2	1.1774 ±0.0032	2.36 ± 0.05	1.1740 ±0.0013	2.33 ±0.06
M2	1.1863 ±0.0005	1.68 ± 0.02	1.1867 ±0.0002	1.70 ±0.01
L2	1.1438 ±0.0071	2.25 ± 0.37	1.1365 ±0.0088	1.81 ±0.45
S2	1.1905 ±0.0015	0.36 ± 0.11	1.1886 ±0.0005	0.41 ±0.03
K2			1.1909 ±0.0020	1.07 ±0.10
M3	1.0639 ±0.0129	0.63 ± 0.64	1.0737 ±0.0130	0.43 ±0.69
M4	1.8139 ±0.6349	−76.64 ±18.72	0.7573 ±0.7714	-85.52 ±58.36

Thus, the accuracy has been increased by a factor of about ten between 1977 and 1992 due to the application of feedback LCR gravimeters and of digital data recording and processing. The improved gravity tide parameters for station Hannover from 1992 observations yield in earth tide corrections for absolute and relative gravity observations at Hannover with an accuracy better than 3 nm/s^2 at any epoch.

Table 6: Final gravity tide parameters for station Hannover

Instruments	G079F,G087F,G995F (stack) and D014F and G299K					
Epoch	1985...1992					
Recorded days	540.4					
	ampl.fact.			phase lead [^{0}]		
Q1	1.1508	±	0.0033	0.048	±	0.163
O1	1.1499	±	0.0006	0.151	±	0.031
M1	1.1464	±	0.0080	0.215	±	0.398
P1	1.1486	±	0.0015	0.107	±	0.074
K1	1.1400	±	0.0005	0.126	±	0.025
J1	1.1554	±	0.0080	0.302	±	0.395
OO1	1.1495	±	0.0146	0.083	±	0.730
2N2	1.1714	±	0.0076	2.679	±	0.372
N2	1.1764	±	0.0012	2.335	±	0.059
M2	1.1865	±	0.0002	1.682	±	0.011
L2	1.1395	±	0.0082	2.085	±	0.415
S2	1.1886	±	0.0005	0.414	±	0.026
K2	1.1909	±	0.0020	1.072	±	0.095
M3	1.0680	±	0.0130	0.474	±	0.707
M4	1.5156	±	0.7049	-85.868	±	40.764

Table 7: Comparison between gravity tide parameters from 1977 and 1992 observations at station Hannover

	difference 1992 - 1977	
wave groups	ampl. fact.	phase lead [^{0}]
O1	–0.0104	+0.23
K1	–0.0095	+0.10
M2	–0.0079	+0.08
S2	–0.0080	+0.04
average	–0.0090 ±0.0006	+0.11 ±0.04

The average gravity tide parameters for station Hannover have been corrected for ocean gravitation and load using the $1^0 \times 1^0$ ocean tide model of SCHWIDERSKY 1980 and program LOADF of

AGNEW 1991. The average ocean corrected results for station Hannover at waves O1 and M2 are compared in Tab. 8 and Fig. 3 and 4 with other accurate gravity tide parameters determined in Central Europe with carefully calibrated electrostatic LCR feedback gravimeters (BAKER et al. 1991, WENZEL et al. 1991, DITTFELD and WENZEL 1993, unpublished results for station Karlsruhe). The M2 phase lead for station Hannover differs significantly from the average of all stations, most probably due to errors in the ocean tide model (distance to the North Sea is 167 km only). The other parameters of station Hannover fit well to the parameters of the other accurate gravity tide stations in Central Europe. We have not compared the ocean corrected gravity tide parameters to predicted parameters from recent earth models, simply because some of these model computations are currently beeing revised (DEHANT 1993). The ocean corrected gravity tide parameters given in Tab. 8 are accurate enough to constrain the latitude dependence of the gravimetric amplitude factor to be less than 0.1% and 0.15% resp. over 600 km at wave O1 and M2 resp. The average of the ocean corrected gravimetric amplitude factors of 1.1523 ± 0.0003 and 1.1584 ± 0.0005 should be accurate enough to judge between recent earth model computations.

Table 8: Ocean corrected gravity tide parameters in Central Europe

Amplitude factors at left side, phase leads in [^{0}] at right side of the columns. Standard deviations taken from the literature partly include calibration uncertainity.

Station	Latitude [^{0}]	Longitude [^{0}]	wave O1	[^{0}]	wave M2	[^{0}]
Potsdam	52.3806	13.0682	1.1533	+0.052	1.1578	+0.020
			(±0.0020)	(±0.060)	(±0.0020)	±0.030)
Hannover	52.3353	9.7633	1.1534	+0.067	1.1581	+0.096
			±0.0010	±0.062	±0.0010	±0.022
Bruxelles	50.7986	4.3580	1.1510	+0.110	1.1551	+0.010
			±0.0013	±0.040	±0.0013	±0.020
Bad Homburg	50.2290	8.6110	1.1518	-0.020	1.1591	-0.090
			±0.0013	±0.050	±0.0013	±0.030
Karlsruhe	49.0121	8.4126	1.1532	+0.050	1.1602	-0.104
			±0.0020	±0.060	±0.0020	±0.030
Schiltach	48.3300	8.3300	1.1515	+0.022	1.1589	-0.012
			±0.0026	±0.030	±0.0026	±0.030
Zürich	47.4094	8.5067	1.1522	-0.020	1.1594	-0.160
			±0.0013	±0.040	±0.0013	±0.020
Chur	46.8500	9.5333	1.1518	-0.020	1.1589	-0.090
			±0.0013	±0.040	±0.0013	±0.020
average:			1.1523	+0.030	1.1584	-0.041
			±0.0003	±0.017	±0.0005	±0.030
std.dev.:			0.0009	0.048	0.0015	0.083

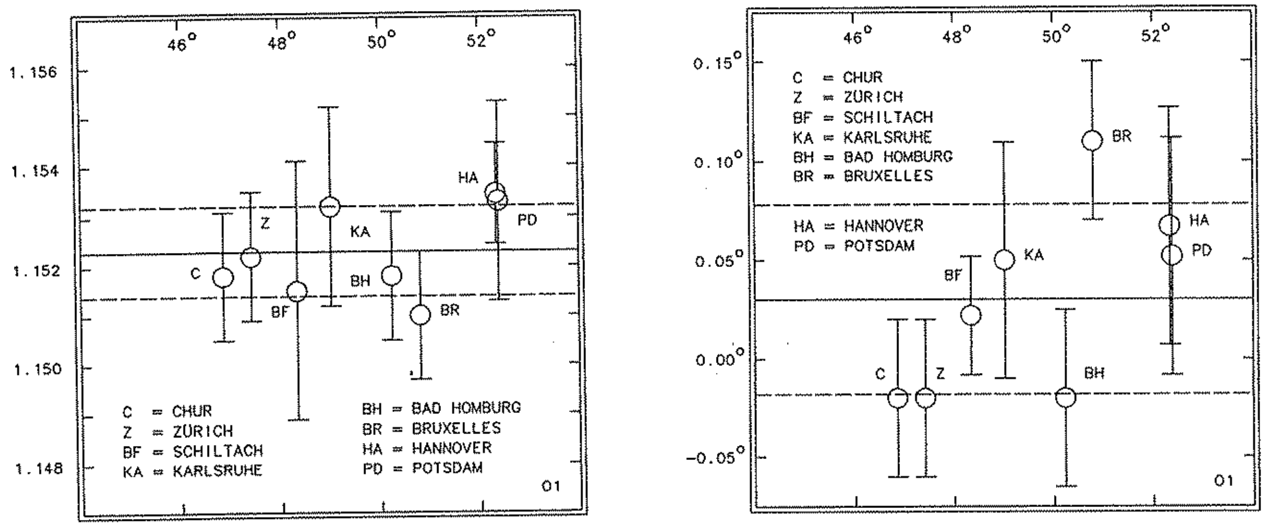

Figure 3: Ocean corrected gravity tide parameters at wave O1 in Central Europe. Solid line is average, dashed lines show standard deviation.

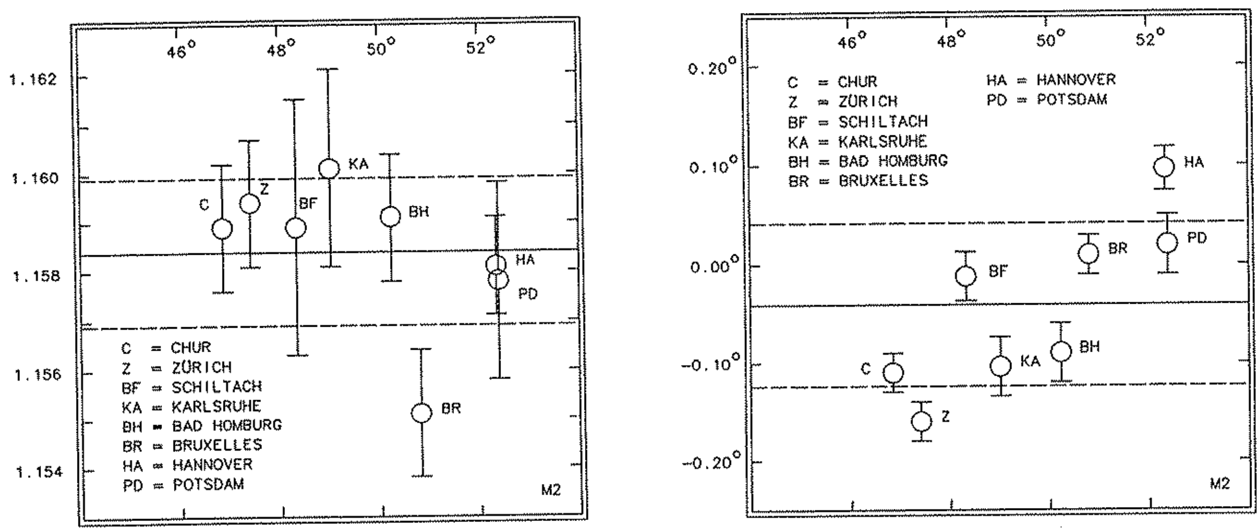

Figure 4: Ocean corrected gravity tide parameters at wave M2 in Central Europe. Solid line is average, dashed lines show standard deviation.

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CATALOGUE OF THE EARTH TIDE GENERATING POTENTIAL DUE TO THE PLANETS

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Abstract

A catalogue of the fully normalized potential coefficients of the earth tide generating potential due to the planets Mercury, Venus, Mars, Jupiter and Saturn has been computed. This catalogue is based on the DE102 numerical ephemeris of the planets between years 1900 and 2200 and contains 1483 waves. The accuracy of gravity tides due to the planets computed from the catalogue at the surface of the Earth is about 0.027 pm/s^2 (1 pm/s^2 = 10^{-12} m/s^2 = 0.1 ngal) rms and 0.160 pm/s^2 at maximum in time domain and 0.008 pm/s^2 at maximum in frequency domain, as derived from comparison with a benchmark tidal gravity series (Wenzel 1994).

1 Introduction

High precision gravimeters, such as superconducting gravimeters and LaCoste-Romberg gravimeters with electrostatic feedback, nowadays achieve a precision of a few ngal in frequency domain. The tide generating potential must be known much better than that in order not to contribute significantly to the analysis of these precise gravimeter records. The currently used tidal developments (Tamura 1987, Xi 1989) do not include the direct effects of the planets, which can reach up to 59 pm/s^2. We therefore present a catalogue of the tidal potential development at the Earth due to the planets in this article. In a subsequent paper, we will present an improved tidal potential catalogue for the luni-solar tidal development.

2 Computation of the tidal potential catalogue

The tidal potential $V_{(t)}$ due to a specific planet at the surface of the Earth is given by the well known formula (e.g. Lambeck 1988)

$$V_{(t)} = GM_{pl} \sum_{\ell=2}^{\infty} \sum_{m=0}^{\ell} \frac{r^\ell}{r_{pl}^{\ell+1}(t)} \frac{1}{(2\ell+1)} \overline{P}_{\ell m}(\cos\theta) \overline{P}_{\ell m}(\cos\Theta_{pl}(t)) \cos\left[m(\lambda - \Lambda_{pl}(t))\right] \qquad (1)$$

Here, r, θ, λ denote the geocentric spherical coordinates of an arbitrary point on (or near) the Earth and $r_{pl}, \Theta_{pl}, \Lambda_{pl}$ are those of the center of mass of the specific planet. The fully normalized Legendre functions $\overline{P}_{\ell m}$ used in this paper are defined by (e.g. Heiskanen and Moritz 1967)

$$\overline{P}_{\ell m}(x) = (-1)^m (1-x^2)^{m/2} \frac{d^m}{dx^m} \left[\frac{1}{2^\ell \ell!} \frac{d^\ell}{dx^\ell}(x^2-1)^\ell \right] \sqrt{(2\ell+1)\frac{(\ell-m)!}{(\ell+m)!}(2-\delta_{m,0})} \qquad (2)$$

Recurrence relations for the fully normalized Legendre functions and their first and second derivatives can be found e.g. in Wenzel (1985). Estimations for the maximum tidal potential and maximum tidal gravity at the Earth's surface due to the various planets are given in Tab. 1, where the major term of degree $\ell = 2$ is considered only.

Table 1: The maximum tidal potential due to the planets

planet	GM [m^3/s^2]	$r_{\min}$ [m]	$V_{(t)}$ [m^2/s^2]	$\partial V_{(t)}/\partial r$ [pm/s^2]
Mercury	2.20×10^{13}	9.17×10^{10}	1.16×10^{-6}	0.36
Venus	3.25×10^{14}	4.13×10^{10}	1.88×10^{-4}	58.85
Mars	4.28×10^{13}	7.73×10^{10}	3.77×10^{-6}	1.18
Jupiter	1.27×10^{17}	6.28×10^{11}	2.09×10^{-5}	6.54
Saturn	3.79×10^{16}	1.27×10^{12}	7.53×10^{-7}	0.24
Uranus	5.80×10^{15}	2.72×10^{12}	1.17×10^{-8}	< 0.01
Neptune	6.87×10^{15}	4.35×10^{12}	3.40×10^{-9}	< 0.01
Pluto	1.02×10^{12}	5.55×10^{12}	2.43×10^{-13}	< 0.01

Our catalogue of the earth tide generating potential due to the planets has been computed by using an expansion of the form

$$V_{(t)} = \sum_{\ell=2}^{\infty} \sum_{m=0}^{\ell} \left(\frac{r}{a}\right)^2 \overline{P}_{\ell m}(\cos\theta) \sum_i \left[C_i^{\ell m} \cos(\omega_i t + \phi_i) + S_i^{\ell m} \sin(\omega_i t + \phi_i) \right] \tag{3}$$

with a = major semi axis of the Earth = 6378136.3 m (McCarthy 1992). t is the time from epoch J2000 in Julian centuries. It should be mentioned that we have not normalized our tidal potential coefficients $C_i^{\ell m}$ and $S_i^{\ell m}$ by a so called Doodson-constant (e.g. Ducarme 1989) and that our potential coefficients given in the appendix have the dimension m/s^2. so called geodetic coefficents (e.g. Doodson 1921) but prefer to use fully normalized Legendre functions $\overline{P}_{\ell m}$ to describe the latitude dependence of the tidal potential. The phases ϕ_i and frequencies ω_i respectively refer to epoch J2000 and are taken to be integer combinations of the mean longitudes λ_j of the planets (Bretagnon 1982) and their time derivatives respectively, given in Tab. 2 and Tab. 3:

$$\phi_{(t)} = m \cdot \lambda + \sum_{j=1}^{j=6} k_j \cdot \lambda_j \tag{4}$$

$$\omega_{(t)} = m \cdot 15^0/\text{h} + \sum_{j=1}^{j=6} k_j \cdot \frac{\partial \lambda_j}{\partial t} \tag{5}$$

The time base of our tidal potential catalogue is TDB.

The numerical ephemeris DE102 from JPL (Newhall et al. 1983) are used to produce the tidal series. Although the ephemeris DE200 is slightly superior, the DE102 numerical ephemeris has been chosen because it extends over 4400 years time span, which is believed to be necessary for the later computation of the luni-solar tidal potential catalogue. The accuracy of the DE102 ephemeris is sufficient for our purpose. We have restricted the computation of the tidal potential due to the planets to degree $\ell = 2$, because the planetary tidal potential of higher degrees can be neglected at our accuracy threshold. Different time series of the tidal potential related to the planets Mercury, Venus, Mars, Jupiter and Saturn and to order $m = 0 \cdots 2$ have been computed from 1900 to

Table 2: Mean ecliptic longitudes of the planets referring to ecliptic and equinox of date taken from Bretagnon (1982), tables 4 and 5.
T is TDB in Julian centuries referring to J2000.

Mercury	$\lambda_1=$	$252.^0 2509055$	+	$149474.^0 0722491 \cdot T$	+	$0.^0 0003040 \cdot T^2$
Venus	$\lambda_2=$	$181.^0 9798008$	+	$58519.^0 2130302 \cdot T$	+	$0.^0 0003106 \cdot T^2$
Earth	$\lambda_3=$	$100.^0 4664485$	+	$36000.^0 7698231 \cdot T$	+	$0.^0 0003037 \cdot T^2$
Mars	$\lambda_4=$	$355.^0 4332746$	+	$19141.^0 6964746 \cdot T$	+	$0.^0 0003110 \cdot T^2$
Jupiter	$\lambda_5=$	$34.^0 3514839$	+	$3036.^0 3027889 \cdot T$	+	$0.^0 0002237 \cdot T^2$
Saturn	$\lambda_6=$	$50.^0 0774714$	+	$1223.^0 5110141 \cdot T$	+	$0.^0 0005195 \cdot T^2$

Table 3: Fundamental frequencies for planetary tides at J2000 after Bretagnon (1982)

Mercury	$\omega_1=$	$1494.^0 740722491$/year	=	$0.^0 1705157109846$/h
Venus	$\omega_2=$	$585.^0 192130302$/year	=	$0.^0 0667570306071$/h
Earth	$\omega_3=$	$360.^0 007698231$/year	=	$0.^0 0410686399990$/h
Mars	$\omega_4=$	$191.^0 416964746$/year	=	$0.^0 0218362953167$/h
Jupiter	$\omega_5=$	$30.^0 363027889$/year	=	$0.^0 0034637266586$/h
Saturn	$\omega_6=$	$12.^0 235110141$/year	=	$0.^0 0013957460804$/h

2200 with different time interval (Tab. 4). The geodetic and astronomical parameters used for the computation of the time series are listed in Tab. 5. It should be mentioned that we have carried out two independent computations with two different programs using FORTRAN- and C-code on two different computer platforms and two different non-overlapping time series in order to check the computations.

The celestial geocentric coordinates from DE102, $\mathbf{r}_{\mathrm{DE102}}$, were converted to terrestial geocentric coordinates, $\mathbf{r}_{\mathbf{pl}}$, by using the well-known transformation:

$$\mathbf{r}_{\mathbf{pl}} = \mathcal{P} \cdot \mathcal{N} \cdot \mathcal{S} \cdot \mathbf{r}_{\mathrm{DE102}} \tag{6}$$

where $\mathcal{P}$ denotes the precession matrix from Lieske et al. (1977), $\mathcal{N}$ the nutation matrix and $\mathcal{S}$ the Earth rotation matrix. The IAU 1980 nutation theory was used (e.g. Seidelmann 1982). The computation of $\mathcal{S}$ was made without regarding polar motion since at first it is not available over

Table 4: Time series used for the analysis of the tidal potential

degree ℓ	order m	time step [hours]	number of steps	time span [years]
2	0	20.0	131072	299.046
2	1	5.0	524288	299.046
2	2	2.5	1048576	299.046

Table 5: Relevant geodetic and astronomical parameters taken from IERS Standards 1992.

a	=	6378136.3 m	major semiaxis of the Earth's ellipsoid
J2	=	$1082.6362 \cdot 10^{-6}$	2nd degree zonal harmonic coefficient of the Earth's gravity field
f	=	1/298.2564219846	flattening of the Earth's ellipsoid
ω	=	$7.292115 \cdot 10^{-5}$ rad $\cdot$ s^{-1}	angular velocity of the Earth
c	=	299792458. m/s	speed of light
AU	=	$1.4959787061 \cdot 10^{11}$ m	astronomical unit
GM	=	$3.986004418 \cdot 10^{14}$ m^3 /s^2	geocentric gravitational constant
M/Ea	=	0.012300034	ratio of mass of Moon to that of the Earth
S/Me	=	6023600.	ratio of mass of Sun to that of the Mercury
S/Ve	=	408523.71	ratio of mass of Sun to that of the Venus
S/Ea	=	332946.045	ratio of mass of Sun to that of the Earth
S/Ma	=	3098708.	ratio of mass of Sun to that of the Mars
S/Ju	=	1047.3486	ratio of mass of Sun to that of the Jupiter
S/Sa	=	3497.90	ratio of mass of Sun to that of the Saturn

the time span 1900 ... 2200 and second it's effect on the tidal potential due to the planets is smaller than our accuracy threshold.

3 Analysis of tidal series

The analysis was made using an iterative procedure. First, we computed a FFT of the tidal series and interpolated the tidal frequencies for the highest peaks in the spectrum. These were replaced by linear combinations of the fundamental arguments mentioned in section 2. Preliminary amplitudes were determined by a least-square fit. Then, the tides found were subtracted and the next iteration is started with the reduced tidal potential until the highest amplitude in the spectrum was below a threshold chosen to be $2. \times 10^{-9}$ m/s^2 in frequency domain. This threshold corresponds roughly to about 0.005 pm/s^2 = 0.5 pgal in tidal gravity at mid-latitude. A last least-square fit determined the final amplitudes and residues of the tidal potential. The computed tidal potential coefficients for 1483 waves are given in the appendix; this catalogue and a FORTRAN 77 routine to evaluate the tidal potential is available on request from the authors.

As a final check we have computed the tidal gravity at the BFO Schiltach ($\phi = 48.3306^0$ N, $\lambda = 8.3300^0$ E, h = 589.0 m) from our tidal potential catalogue and compared this series to the benchmark tidal gravity series of Wenzel (1994). These results are given in Tab. 6 and Fig. 2, demonstrating an rms and maximum error in time domain of 0.026 and 0.160 pm/s^2 respectively. The Fourier-amplitude spectrum of discrepancies to the benchmark tidal gravity series is given in Fig. 3, showing a maximum peak of 0.008 pm/s^2.

4 Conclusions

A catalogue of fully normalized coefficients of the earth tide generating potential due to the planets Mercury, Venus, Mars, Jupiter and Saturn has been computed. The catalogue consists of 1483 waves and is given in the appendix. The comparison of gravity tides computed from our tidal potential catalogue with a benchmark tidal gravity series suggest an accuracy of our tidal potential

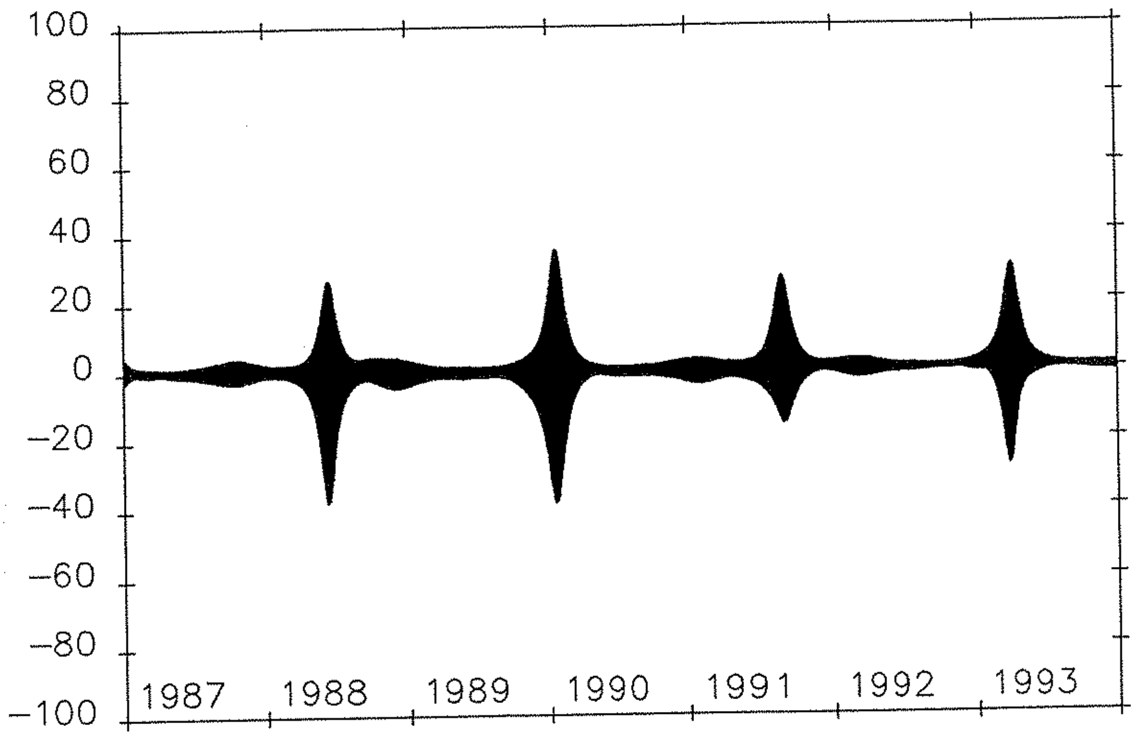

Figure 1: Planetary gravity tides in pm/s^2 at station BFO Schiltach

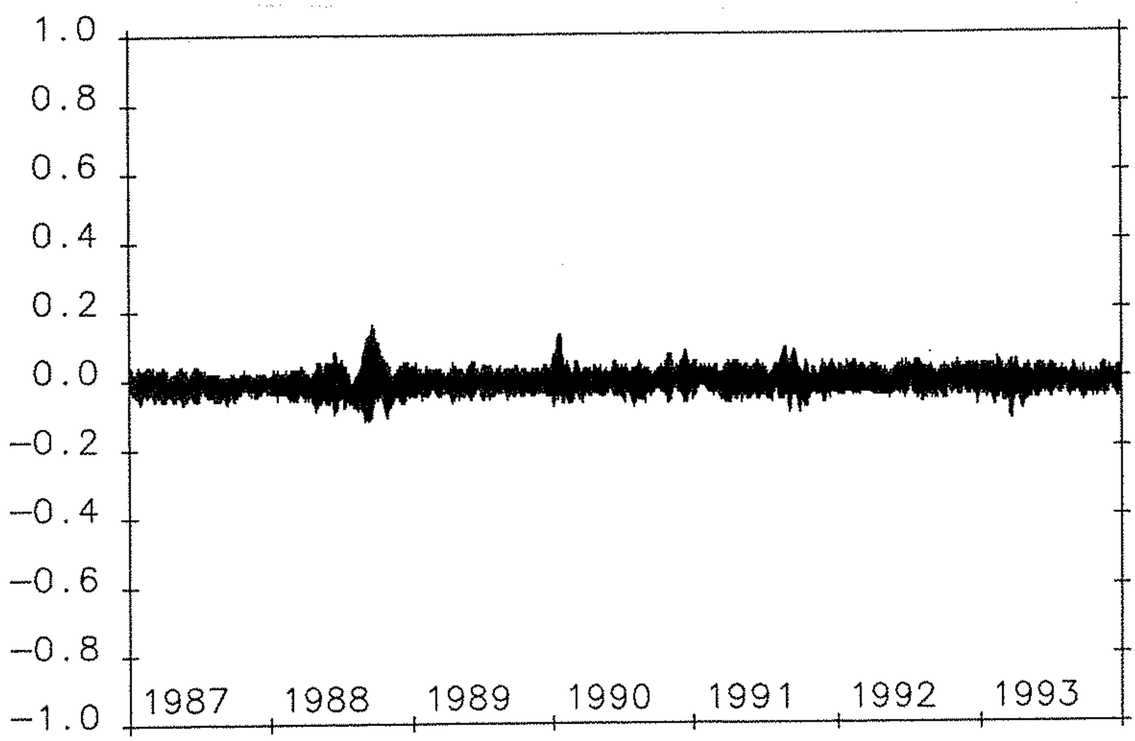

Figure 2: Discrepancies of our tidal potential catalogue in pm/s^2 to the benchmark gravity tide series (Wenzel 1994)

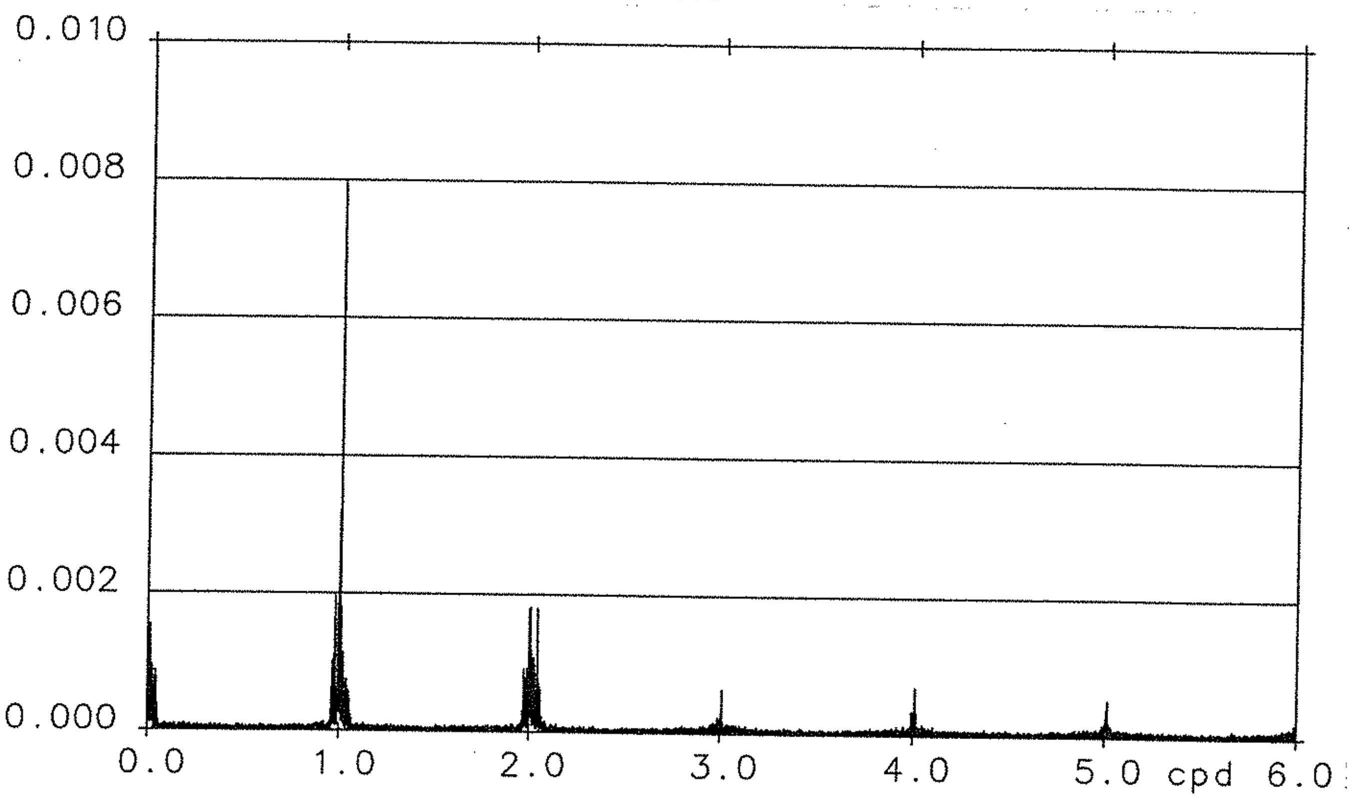

Figure 3: Fourier-amplitude spectrum in pm/s^2 of discrepancies of our tidal potential catalogue to the benchmark gravity tide series (Wenzel 1994)

Table 6: Comparison of gravity tides due to the planets at station BFO Schiltach from tidal potential catalogue and from benchmark gravity tide series BFAL8793

Body	Number of waves	Signal		Difference	
		rms $[pm/s^2]$	max. $[pm/s^2]$	rms $[pm/s^2]$	max. $[pm/s^2]$
Mercury	74	0.058	0.330	0.008	0.030
Venus	861	4.840	36.700	0.014	0.120
Mars	396	0.150	1.340	0.014	0.130
Jupiter	127	1.456	4.850	0.008	0.030
Saturn	25	0.059	0.140	0.007	0.020
total	1483	5.541	38.220	0.027	0.160

catalogue of 0.160 pm/s^2 in time domain and of 0.008 pm/s^2 in frequency domain. This accuracy is probably not necessary for current precise gravimeter observations. One could reduce the computational load by e.g. selecting the 283 waves with amplitudes exceeding 0.1 m^2/s^2, yielding in this case a maximum time domain error in gravity tide of about 10 pm/s^2 = 1 ngal.

Acknowledgements

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Appendix A: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2. ki are multipliers for the mean longitudes of the planets, k1 = Mercury, k2 = Venus, k3 = Earth, k4 = Mars, k5= Jupiter, k6 = Saturn.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
1	MER	2	0	0	0	0	0	0	0	0.00000000	-0.0686	0.0000
2	VEN	2	0	0	0	0	0	0	0	0.00000000	-3.3330	0.0000
3	MAR	2	0	0	0	0	0	0	0	0.00000000	-0.0890	0.0000
4	JUP	2	0	0	0	0	0	0	0	0.00000000	-2.0490	0.0000
5	SAT	2	0	0	0	0	0	0	0	0.00000000	-0.0953	0.0000
6	VEN	2	0	0	8	-13	0	0	0	0.00016392	0.0044	-0.0047
7	SAT	2	0	0	0	0	0	0	1	0.00139575	0.0007	-0.0157
8	MAR	2	0	0	0	-1	2	0	0	0.00260395	-0.0566	0.0281
9	SAT	2	0	0	0	0	0	0	2	0.00279149	-0.0246	-0.0049
10	JUP	2	0	0	0	0	0	1	0	0.00346373	-0.2974	-0.0583
11	VEN	2	0	0	-3	5	0	0	0	0.00507211	-0.6949	0.4126
12	MAR	2	0	0	0	-2	4	0	0	0.00520790	-0.0413	0.0119
13	VEN	2	0	0	5	-8	0	0	0	0.00523603	-0.0499	0.0941
14	MAR	2	0	0	0	6	-11	0	0	0.00621259	-0.0017	-0.0077
15	JUP	2	0	0	0	0	0	2	0	0.00692745	-0.6118	-0.0773
16	MAR	2	0	0	0	-3	6	0	0	0.00781185	-0.0236	0.0137
17	MAR	2	0	0	0	5	-9	0	0	0.00881654	-0.0092	-0.0125
18	VEN	2	0	0	-6	10	0	0	0	0.01014422	0.0173	-0.0106
19	VEN	2	0	0	2	-3	0	0	0	0.01030814	-0.0022	0.3943
20	JUP	2	0	0	0	0	0	3	0	0.01039118	-0.0983	-0.0329
21	MAR	2	0	0	0	-4	8	0	0	0.01041580	-0.0092	0.0118
22	VEN	2	0	0	10	-16	0	0	0	0.01047207	0.0019	-0.0037
23	MAR	2	0	0	0	4	-7	0	0	0.01142049	-0.0230	-0.0146
24	MAR	2	0	0	0	-5	10	0	0	0.01301975	-0.0018	0.0072
25	JUP	2	0	0	0	0	0	4	0	0.01385491	-0.0106	-0.0060
26	MAR	2	0	0	0	3	-5	0	0	0.01402444	-0.0388	-0.0141
27	VEN	2	0	0	-1	2	0	0	0	0.01538025	0.0109	-0.3632
28	VEN	2	0	0	7	-11	0	0	0	0.01554417	0.0170	0.0099
29	MAR	2	0	0	0	2	-3	0	0	0.01662839	-0.0552	-0.0287
30	MAR	2	0	0	0	1	-1	0	0	0.01923234	-0.1485	0.0014
31	VEN	2	0	0	-4	7	0	0	0	0.02045236	-0.0529	-0.0880
32	VEN	2	0	0	4	-6	0	0	0	0.02061628	-0.6765	-0.3625
33	MAR	2	0	0	0	0	1	0	0	0.02183630	-0.0492	0.0231
34	JUP	2	0	0	0	1	0	-5	0	0.02375001	-0.0093	0.0052
35	MAR	2	0	0	0	-1	3	0	0	0.02444025	-0.0395	0.0082
36	MAR	2	0	0	0	7	-12	0	0	0.02544494	-0.0016	-0.0079
37	VEN	2	0	0	-7	12	0	0	0	0.02552447	0.0046	0.0046
38	VEN	2	0	0	1	-1	0	0	0	0.02568839	-5.9167	-0.1625
39	VEN	2	0	0	9	-14	0	0	0	0.02585232	0.0042	-0.0048
40	MAR	2	0	0	0	-2	5	0	0	0.02704420	-0.0222	0.0115
41	JUP	2	0	0	0	1	0	-4	0	0.02721373	-0.0663	0.0222
42	MAR	2	0	0	0	6	-10	0	0	0.02804889	-0.0087	-0.0124
43	MAR	2	0	0	0	-3	7	0	0	0.02964815	-0.0085	0.0102
44	MAR	2	0	0	0	5	-8	0	0	0.03065284	-0.0209	-0.0144
45	JUP	2	0	0	0	1	0	-3	0	0.03067746	-0.2945	0.0392
46	VEN	2	0	0	-2	4	0	0	0	0.03076050	-0.6596	0.4554
47	VEN	2	0	0	6	-9	0	0	0	0.03092442	-0.0459	0.0954
48	MAR	2	0	0	0	-4	9	0	0	0.03225210	-0.0017	0.0062
49	MAR	2	0	0	0	4	-6	0	0	0.03325679	-0.0338	-0.0147
50	JUP	2	0	0	0	1	0	-2	0	0.03414119	-0.1570	0.0370
51	VEN	2	0	0	-5	9	0	0	0	0.03583261	0.0166	-0.0116
52	MAR	2	0	0	0	3	-4	0	0	0.03586074	-0.0486	-0.0264
53	VEN	2	0	0	3	-4	0	0	0	0.03599653	-0.0146	0.3954

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
54	VEN	2	0	0	11	-17	0	0	0	0.03616046	0.0019	-0.0036
55	SAT	2	0	0	0	1	0	0	-3	0.03688140	-0.0062	0.0013
56	JUP	2	0	0	0	1	0	-1	0	0.03760491	-1.1682	0.0138
57	MAR	2	0	0	0	2	-2	0	0	0.03846469	-0.1126	0.0019
58	SAT	2	0	0	0	1	0	0	-1	0.03967289	-0.0300	0.0005
59	MER	2	0	0	0	1	0	0	0	0.04106864	0.0068	0.0238
60	VEN	2	0	0	0	1	0	0	0	0.04106864	0.0228	-0.2976
61	MAR	2	0	0	0	1	0	0	0	0.04106864	-0.0336	0.0137
62	JUP	2	0	0	0	1	0	0	0	0.04106864	-0.0629	-0.0105
63	VEN	2	0	0	8	-12	0	0	0	0.04123256	0.0163	0.0090
64	MAR	2	0	0	0	0	2	0	0	0.04367259	-0.0317	0.0037
65	JUP	2	0	0	0	1	0	1	0	0.04453237	-0.0592	-0.0206
66	MAR	2	0	0	0	8	-13	0	0	0.04467728	-0.0014	-0.0077
67	VEN	2	0	0	-3	6	0	0	0	0.04614075	-0.0543	-0.0764
68	MAR	2	0	0	0	-1	4	0	0	0.04627654	-0.0185	0.0083
69	VEN	2	0	0	5	-7	0	0	0	0.04630467	-0.6251	-0.3109
70	MAR	2	0	0	0	7	-11	0	0	0.04728123	-0.0078	-0.0117
71	MER	2	0	1	0	-3	0	0	0	0.04730979	-0.0102	0.0008
72	JUP	2	0	0	0	1	0	2	0	0.04799609	-0.0076	-0.0047
73	MAR	2	0	0	0	-2	6	0	0	0.04888049	-0.0072	0.0079
74	MAR	2	0	0	0	6	-9	0	0	0.04988518	-0.0181	-0.0135
75	VEN	2	0	0	-6	11	0	0	0	0.05121286	0.0047	0.0043
76	VEN	2	0	0	2	-2	0	0	0	0.05137678	-4.9231	-0.2704
77	VEN	2	0	0	10	-15	0	0	0	0.05154071	0.0039	-0.0048
78	MAR	2	0	0	0	5	-7	0	0	0.05248913	-0.0280	-0.0141
79	MAR	2	0	0	0	4	-5	0	0	0.05509308	-0.0399	-0.0226
80	VEN	2	0	0	-1	3	0	0	0	0.05644889	-0.5469	0.4824
81	VEN	2	0	0	7	-10	0	0	0	0.05661281	-0.0412	0.0929
82	MAR	2	0	0	0	3	-3	0	0	0.05769703	-0.0807	0.0019
83	MAR	2	0	0	0	2	-1	0	0	0.06030098	-0.0203	0.0061
84	JUP	2	0	0	0	2	0	-6	0	0.06135492	-0.0049	0.0028
85	VEN	2	0	0	-4	8	0	0	0	0.06152100	0.0149	-0.0127
86	VEN	2	0	0	4	-5	0	0	0	0.06168492	-0.0248	0.3753
87	MAR	2	0	0	0	1	1	0	0	0.06290494	-0.0181	0.0002
88	MAR	2	0	0	0	9	-14	0	0	0.06390963	-0.0011	-0.0072
89	JUP	2	0	0	0	2	0	-5	0	0.06481865	-0.0288	0.0097
90	MAR	2	0	0	0	0	3	0	0	0.06550889	-0.0129	0.0046
91	MAR	2	0	0	0	8	-12	0	0	0.06651358	-0.0067	-0.0106
92	VEN	2	0	0	1	0	0	0	0	0.06675703	0.0325	-0.2134
93	VEN	2	0	0	9	-13	0	0	0	0.06692096	0.0152	0.0083
94	MAR	2	0	0	0	-1	5	0	0	0.06811284	-0.0055	0.0053
95	JUP	2	0	0	0	2	0	-4	0	0.06828237	-0.0998	0.0136
96	MAR	2	0	0	0	7	-10	0	0	0.06911753	-0.0149	-0.0120
97	MAR	2	0	0	0	6	-8	0	0	0.07172148	-0.0220	-0.0127
98	JUP	2	0	0	0	2	0	-3	0	0.07174610	-0.0533	0.0120
99	VEN	2	0	0	-2	5	0	0	0	0.07182914	-0.0536	-0.0593
100	VEN	2	0	0	6	-8	0	0	0	0.07199306	-0.5568	-0.2615
101	MAR	2	0	0	0	5	-6	0	0	0.07432543	-0.0310	-0.0184
102	JUP	2	0	0	0	2	0	-2	0	0.07520983	-0.2792	0.0053
103	VEN	2	0	0	-5	10	0	0	0	0.07690125	0.0046	0.0040
104	MAR	2	0	0	0	4	-4	0	0	0.07692938	-0.0557	0.0016
105	VEN	2	0	0	3	-3	0	0	0	0.07706517	-3.9644	-0.3266
106	VEN	2	0	0	11	-16	0	0	0	0.07722910	0.0036	-0.0045
107	JUP	2	0	0	0	2	0	-1	0	0.07867355	-0.0066	-0.0104
108	MAR	2	0	0	0	3	-2	0	0	0.07953333	-0.0111	0.0012

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
109	MER	2	0	0	0	2	0	0	0	0.08213728	-0.0111	0.0006
110	VEN	2	0	0	0	2	0	0	0	0.08213728	-0.3396	0.4828
111	MAR	2	0	0	0	2	0	0	0	0.08213728	-0.0113	-0.0016
112	JUP	2	0	0	0	2	0	0	0	0.08213728	-0.0079	-0.0052
113	VEN	2	0	0	8	-11	0	0	0	0.08230120	-0.0364	0.0875
114	MAR	2	0	0	0	10	-15	0	0	0.08314197	-0.0009	-0.0064
115	MAR	2	0	0	0	1	2	0	0	0.08474123	-0.0073	0.0015
116	MAR	2	0	0	0	9	-13	0	0	0.08574592	-0.0056	-0.0093
117	VEN	2	0	0	-3	7	0	0	0	0.08720939	0.0129	-0.0132
118	VEN	2	0	0	5	-6	0	0	0	0.08737331	-0.0320	0.3433
119	MAR	2	0	0	0	8	-11	0	0	0.08834987	-0.0120	-0.0103
120	MER	2	0	1	0	-2	0	0	0	0.08837843	0.0071	-0.0197
121	MAR	2	0	0	0	7	-9	0	0	0.09095382	-0.0167	-0.0109
122	VEN	2	0	0	2	-1	0	0	0	0.09244542	0.0394	-0.1491
123	VEN	2	0	0	10	-14	0	0	0	0.09260935	0.0139	0.0075
124	MAR	2	0	0	0	6	-7	0	0	0.09355777	-0.0232	-0.0144
125	MAR	2	0	0	0	5	-5	0	0	0.09616172	-0.0371	0.0011
126	VEN	2	0	0	-1	4	0	0	0	0.09751753	-0.0503	-0.0383
127	VEN	2	0	0	7	-9	0	0	0	0.09768145	-0.4824	-0.2165
128	MAR	2	0	0	0	3	-1	0	0	0.10136962	-0.0073	-0.0024
129	JUP	2	0	0	0	3	0	-6	0	0.10242356	-0.0102	0.0034
130	VEN	2	0	0	-4	9	0	0	0	0.10258964	0.0044	0.0035
131	VEN	2	0	0	4	-4	0	0	0	0.10275356	-3.1283	-0.3437
132	VEN	2	0	0	12	-17	0	0	0	0.10291749	0.0032	-0.0042
133	MAR	2	0	0	0	10	-14	0	0	0.10497827	-0.0046	-0.0080
134	JUP	2	0	0	0	3	0	-5	0	0.10588729	-0.0290	0.0039
135	MAR	2	0	0	0	9	-12	0	0	0.10758222	-0.0091	-0.0086
136	VEN	2	0	0	1	1	0	0	0	0.10782567	-0.0593	0.4452
137	VEN	2	0	0	9	-12	0	0	0	0.10798960	-0.0316	0.0802
138	JUP	2	0	0	0	3	0	-4	0	0.10935101	-0.0150	0.0030
139	MAR	2	0	0	0	8	-10	0	0	0.11018617	-0.0123	-0.0090
140	MAR	2	0	0	0	7	-8	0	0	0.11279012	-0.0167	-0.0109
141	JUP	2	0	0	0	3	0	-3	0	0.11281474	-0.0622	0.0013
142	VEN	2	0	0	-2	6	0	0	0	0.11289778	0.0106	-0.0134
143	VEN	2	0	0	6	-7	0	0	0	0.11306170	-0.0364	0.3050
144	MAR	2	0	0	0	6	-6	0	0	0.11539407	-0.0240	0.0007
145	VEN	2	0	0	3	-2	0	0	0	0.11813381	0.0411	-0.1011
146	VEN	2	0	0	11	-15	0	0	0	0.11829774	0.0125	0.0067
147	VEN	2	0	0	0	3	0	0	0	0.12320592	-0.0442	-0.0169
148	VEN	2	0	0	8	-10	0	0	0	0.12336984	-0.4091	-0.1767
149	MAR	2	0	0	0	11	-15	0	0	0.12421061	-0.0035	-0.0065
150	MAR	2	0	0	0	10	-13	0	0	0.12681456	-0.0068	-0.0068
151	VEN	2	0	0	5	-5	0	0	0	0.12844195	-2.4344	-0.3343
152	MAR	2	0	0	0	9	-11	0	0	0.12941851	-0.0087	-0.0072
153	MER	2	0	1	0	-1	0	0	0	0.12944707	-0.0762	-0.0034
154	MAR	2	0	0	0	8	-9	0	0	0.13202246	-0.0117	-0.0080
155	VEN	2	0	0	2	0	0	0	0	0.13351406	0.0376	0.3649
156	VEN	2	0	0	10	-13	0	0	0	0.13367799	-0.0269	0.0718
157	MAR	2	0	0	0	7	-7	0	0	0.13462641	-0.0151	0.0005
158	VEN	2	0	0	-1	5	0	0	0	0.13858617	0.0080	-0.0129
159	VEN	2	0	0	7	-8	0	0	0	0.13875009	-0.0382	0.2650
160	JUP	2	0	0	0	4	0	-6	0	0.14349220	-0.0077	0.0010
161	VEN	2	0	0	4	-3	0	0	0	0.14382220	0.0391	-0.0665
162	VEN	2	0	0	12	-16	0	0	0	0.14398613	0.0111	0.0059
163	MAR	2	0	0	0	11	-14	0	0	0.14604691	-0.0049	-0.0054

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
164	MAR	2	0	0	0	10	-12	0	0	0.14865086	-0.0060	-0.0056
165	VEN	2	0	0	1	2	0	0	0	0.14889431	-0.0360	-0.0010
166	VEN	2	0	0	9	-11	0	0	0	0.14905824	-0.3410	-0.1427
167	JUP	2	0	0	0	4	0	-4	0	0.15041965	-0.0133	0.0003
168	MAR	2	0	0	0	9	-10	0	0	0.15125481	-0.0079	-0.0058
169	MAR	2	0	0	0	8	-8	0	0	0.15385876	-0.0092	0.0003
170	VEN	2	0	0	6	-6	0	0	0	0.15413034	-1.8751	-0.3091
171	VEN	2	0	0	3	-1	0	0	0	0.15920245	0.0780	0.2871
172	VEN	2	0	0	11	-14	0	0	0	0.15936638	-0.0226	0.0631
173	VEN	2	0	0	0	4	0	0	0	0.16427456	0.0055	-0.0120
174	VEN	2	0	0	8	-9	0	0	0	0.16443848	-0.0381	0.2260
175	VEN	2	0	0	5	-4	0	0	0	0.16951059	0.0349	-0.0423
176	VEN	2	0	0	13	-17	0	0	0	0.16967452	0.0098	0.0051
177	MAR	2	0	0	0	10	-11	0	0	0.17048715	-0.0053	-0.0041
178	MER	2	0	1	0	0	0	0	0	0.17051571	0.0018	0.0100
179	VEN	2	0	0	2	1	0	0	0	0.17458270	-0.0271	0.0037
180	VEN	2	0	0	10	-12	0	0	0	0.17474663	-0.2803	-0.1140
181	MER	2	0	2	0	-4	0	0	0	0.17675686	-0.0060	0.0013
182	VEN	2	0	0	7	-7	0	0	0	0.17981873	-1.4330	-0.2758
183	VEN	2	0	0	4	-2	0	0	0	0.18489084	0.0915	0.2208
184	VEN	2	0	0	12	-15	0	0	0	0.18505477	-0.0189	0.0546
185	VEN	2	0	0	1	3	0	0	0	0.18996295	0.0032	-0.0107
186	VEN	2	0	0	9	-10	0	0	0	0.19012688	-0.0365	0.1900
187	VEN	2	0	0	6	-5	0	0	0	0.19519898	0.0298	-0.0258
188	VEN	2	0	0	14	-18	0	0	0	0.19536291	0.0085	0.0044
189	VEN	2	0	0	3	0	0	0	0	0.20027109	-0.0200	0.0052
190	VEN	2	0	0	11	-13	0	0	0	0.20043502	-0.2276	-0.0904
191	VEN	2	0	0	8	-8	0	0	0	0.20550712	-1.0882	-0.2395
192	VEN	2	0	0	5	-3	0	0	0	0.21057923	0.0914	0.1673
193	VEN	2	0	0	13	-16	0	0	0	0.21074316	-0.0156	0.0467
194	VEN	2	0	0	2	2	0	0	0	0.21565134	0.0014	-0.0091
195	VEN	2	0	0	10	-11	0	0	0	0.21581527	-0.0339	0.1577
196	MER	2	0	2	0	-3	0	0	0	0.21782550	0.0049	-0.0135
197	VEN	2	0	0	7	-6	0	0	0	0.22088737	0.0245	-0.0149
198	VEN	2	0	0	15	-19	0	0	0	0.22105130	0.0073	0.0037
199	VEN	2	0	0	4	-1	0	0	0	0.22595948	-0.0145	0.0051
200	VEN	2	0	0	12	-14	0	0	0	0.22612341	-0.1830	-0.0711
201	VEN	2	0	0	9	-9	0	0	0	0.23119552	-0.8222	-0.2038
202	VEN	2	0	0	6	-4	0	0	0	0.23626762	0.0846	0.1254
203	VEN	2	0	0	14	-17	0	0	0	0.23643155	-0.0128	0.0395
204	VEN	2	0	0	3	1	0	0	0	0.24133973	0.0001	-0.0076
205	VEN	2	0	0	11	-12	0	0	0	0.24150366	-0.0308	0.1296
206	VEN	2	0	0	8	-7	0	0	0	0.24657576	0.0196	-0.0078
207	VEN	2	0	0	16	-20	0	0	0	0.24673969	0.0063	0.0031
208	VEN	2	0	0	5	-2	0	0	0	0.25164787	-0.0104	0.0045
209	VEN	2	0	0	13	-15	0	0	0	0.25181180	-0.1459	-0.0556
210	VEN	2	0	0	10	-10	0	0	0	0.25688391	-0.6185	-0.1705
211	MER	2	0	2	0	-2	0	0	0	0.25889414	-0.0349	-0.0029
212	VEN	2	0	0	7	-5	0	0	0	0.26195601	0.0747	0.0933
213	VEN	2	0	0	15	-18	0	0	0	0.26211994	-0.0104	0.0330
214	VEN	2	0	0	4	0	0	0	0	0.26702812	-0.0007	-0.0062
215	VEN	2	0	0	12	-13	0	0	0	0.26719205	-0.0274	0.1055
216	VEN	2	0	0	9	-8	0	0	0	0.27226416	0.0154	-0.0035
217	VEN	2	0	0	17	-21	0	0	0	0.27242808	0.0053	0.0026
218	VEN	2	0	0	6	-3	0	0	0	0.27733626	-0.0075	0.0037

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
219	VEN	2	0	0	14	-16	0	0	0	0.27750019	-0.1154	-0.0432
220	VEN	2	0	0	11	-11	0	0	0	0.28257230	-0.4635	-0.1408
221	VEN	2	0	0	8	-6	0	0	0	0.28764440	0.0641	0.0690
222	VEN	2	0	0	16	-19	0	0	0	0.28780833	-0.0084	0.0274
223	VEN	2	0	0	13	-14	0	0	0	0.29288044	-0.0236	0.0845
224	VEN	2	0	0	10	-9	0	0	0	0.29795255	0.0125	-0.0011
225	VEN	2	0	0	7	-4	0	0	0	0.30302465	-0.0053	0.0029
226	VEN	2	0	0	15	-17	0	0	0	0.30318858	-0.0907	-0.0333
227	VEN	2	0	0	12	-12	0	0	0	0.30826069	-0.3463	-0.1149
228	VEN	2	0	0	9	-7	0	0	0	0.31333280	0.0538	0.0508
229	VEN	2	0	0	17	-20	0	0	0	0.31349672	-0.0068	0.0225
230	VEN	2	0	0	14	-15	0	0	0	0.31856883	-0.0204	0.0678
231	VEN	2	0	0	11	-10	0	0	0	0.32364094	0.0094	0.0004
232	VEN	2	0	0	16	-18	0	0	0	0.32887697	-0.0716	-0.0258
233	VEN	2	0	0	13	-13	0	0	0	0.33394908	-0.2580	-0.0928
234	VEN	2	0	0	10	-8	0	0	0	0.33902119	0.0445	0.0373
235	VEN	2	0	0	18	-21	0	0	0	0.33918511	-0.0054	0.0184
236	VEN	2	0	0	15	-16	0	0	0	0.34425722	-0.0174	0.0540
237	MER	2	0	3	0	-4	0	0	0	0.34727257	0.0028	-0.0082
238	VEN	2	0	0	17	-19	0	0	0	0.35456536	-0.0556	-0.0197
239	VEN	2	0	0	14	-14	0	0	0	0.35963747	-0.1918	-0.0744
240	VEN	2	0	0	11	-9	0	0	0	0.36470958	0.0363	0.0273
241	VEN	2	0	0	19	-22	0	0	0	0.36487350	-0.0043	0.0149
242	VEN	2	0	0	16	-17	0	0	0	0.36994561	-0.0147	0.0428
243	VEN	2	0	0	18	-20	0	0	0	0.38025375	-0.0430	-0.0150
244	VEN	2	0	0	15	-15	0	0	0	0.38532586	-0.1422	-0.0592
245	MER	2	0	3	0	-3	0	0	0	0.38834121	-0.0141	-0.0017
246	VEN	2	0	0	12	-10	0	0	0	0.39039797	0.0293	0.0199
247	VEN	2	0	0	20	-23	0	0	0	0.39056189	-0.0034	0.0120
248	VEN	2	0	0	17	-18	0	0	0	0.39563400	-0.0123	0.0338
249	VEN	2	0	0	19	-21	0	0	0	0.40594214	-0.0331	-0.0114
250	VEN	2	0	0	16	-16	0	0	0	0.41101425	-0.1052	-0.0469
251	VEN	2	0	0	13	-11	0	0	0	0.41608636	0.0235	0.0145
252	VEN	2	0	0	21	-24	0	0	0	0.41625028	-0.0027	0.0097
253	VEN	2	0	0	18	-19	0	0	0	0.42132239	-0.0102	0.0265
254	VEN	2	0	0	20	-22	0	0	0	0.43163053	-0.0254	-0.0086
255	VEN	2	0	0	17	-17	0	0	0	0.43670264	-0.0777	-0.0369
256	VEN	2	0	0	14	-12	0	0	0	0.44177475	0.0187	0.0106
257	VEN	2	0	0	22	-25	0	0	0	0.44193867	-0.0021	0.0077
258	VEN	2	0	0	19	-20	0	0	0	0.44701078	-0.0084	0.0208
259	VEN	2	0	0	21	-23	0	0	0	0.45731892	-0.0194	-0.0064
260	VEN	2	0	0	18	-18	0	0	0	0.46239103	-0.0573	-0.0288
261	VEN	2	0	0	15	-13	0	0	0	0.46746314	0.0148	0.0077
262	VEN	2	0	0	23	-26	0	0	0	0.46762706	-0.0017	0.0062
263	VEN	2	0	0	20	-21	0	0	0	0.47269917	-0.0069	0.0162
264	VEN	2	0	0	22	-24	0	0	0	0.48300731	-0.0148	-0.0048
265	VEN	2	0	0	19	-19	0	0	0	0.48807942	-0.0422	-0.0225
266	VEN	2	0	0	16	-14	0	0	0	0.49315153	0.0116	0.0056
267	VEN	2	0	0	24	-27	0	0	0	0.49331545	-0.0013	0.0049
268	VEN	2	0	0	21	-22	0	0	0	0.49838756	-0.0056	0.0126
269	VEN	2	0	0	23	-25	0	0	0	0.50869570	-0.0112	-0.0036
270	VEN	2	0	0	20	-20	0	0	0	0.51376781	-0.0310	-0.0174
271	VEN	2	0	0	17	-15	0	0	0	0.51883992	0.0091	0.0041
272	VEN	2	0	0	25	-28	0	0	0	0.51900385	-0.0010	0.0039
273	VEN	2	0	0	22	-23	0	0	0	0.52407595	-0.0045	0.0097

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
274	VEN	2	0	0	24	-26	0	0	0	0.53438409	-0.0085	-0.0027
275	VEN	2	0	0	21	-21	0	0	0	0.53945620	-0.0228	-0.0135
276	VEN	2	0	0	18	-16	0	0	0	0.54452831	0.0071	0.0030
277	VEN	2	0	0	26	-29	0	0	0	0.54469224	-0.0008	0.0030
278	VEN	2	0	0	23	-24	0	0	0	0.54976434	-0.0036	0.0075
279	VEN	2	0	0	25	-27	0	0	0	0.56007249	-0.0064	-0.0020
280	VEN	2	0	0	22	-22	0	0	0	0.56514459	-0.0167	-0.0104
281	VEN	2	0	0	24	-25	0	0	0	0.57545273	-0.0029	0.0058
282	VEN	2	0	0	23	-23	0	0	0	0.59083298	-0.0122	-0.0080
283	VEN	2	0	0	24	-24	0	0	0	0.61652137	-0.0090	-0.0061
284	VEN	2	0	0	25	-25	0	0	0	0.64220977	-0.0065	-0.0047
285	VEN	2	1	0	-25	26	0	0	0	14.39885887	0.0012	0.0025
286	VEN	2	1	0	-21	20	0	0	0	14.41947516	0.0027	-0.0010
287	VEN	2	1	0	-24	25	0	0	0	14.42454727	0.0016	0.0034
288	VEN	2	1	0	-20	19	0	0	0	14.44516355	0.0037	-0.0013
289	VEN	2	1	0	-23	24	0	0	0	14.45023566	0.0021	0.0047
290	VEN	2	1	0	-19	18	0	0	0	14.47085194	0.0050	-0.0017
291	VEN	2	1	0	-22	23	0	0	0	14.47592405	0.0028	0.0064
292	VEN	2	1	0	-23	25	0	0	0	14.49130430	-0.0025	0.0011
293	VEN	2	1	0	-18	17	0	0	0	14.49654033	0.0068	-0.0023
294	VEN	2	1	0	-21	22	0	0	0	14.50161244	0.0037	0.0087
295	VEN	2	1	0	-22	24	0	0	0	14.51699269	-0.0033	0.0014
296	VEN	2	1	0	-17	16	0	0	0	14.52222872	0.0092	-0.0030
297	VEN	2	1	0	-20	21	0	0	0	14.52730083	0.0049	0.0118
298	VEN	2	1	0	-18	18	0	0	0	14.53760897	-0.0005	0.0024
299	VEN	2	1	0	-16	15	0	0	0	14.54791711	0.0124	-0.0039
300	VEN	2	1	0	-19	20	0	0	0	14.55298922	0.0064	0.0161
301	VEN	2	1	0	-17	17	0	0	0	14.56329736	-0.0007	0.0030
302	VEN	2	1	0	-20	22	0	0	0	14.56836947	-0.0054	0.0020
303	VEN	2	1	0	-12	9	0	0	0	14.56853339	-0.0023	0.0004
304	VEN	2	1	0	-15	14	0	0	0	14.57360550	0.0167	-0.0051
305	VEN	2	1	0	-18	19	0	0	0	14.57867761	0.0085	0.0219
306	VEN	2	1	0	-16	16	0	0	0	14.58898575	-0.0008	0.0037
307	VEN	2	1	0	-19	21	0	0	0	14.59405786	-0.0069	0.0025
308	VEN	2	1	0	-11	8	0	0	0	14.59422178	-0.0030	0.0006
309	VEN	2	1	0	-14	13	0	0	0	14.59929389	0.0224	-0.0067
310	VEN	2	1	0	-17	18	0	0	0	14.60436600	0.0112	0.0297
311	VEN	2	1	0	-15	15	0	0	0	14.61467414	-0.0009	0.0047
312	VEN	2	1	0	-18	20	0	0	0	14.61974625	-0.0089	0.0031
313	VEN	2	1	0	-10	7	0	0	0	14.61991017	-0.0038	0.0009
314	VEN	2	1	0	-13	12	0	0	0	14.62498228	0.0300	-0.0089
315	VEN	2	1	0	-16	17	0	0	0	14.63005439	0.0147	0.0402
316	VEN	2	1	0	-19	22	0	0	0	14.63512650	0.0016	0.0024
317	VEN	2	1	0	-11	9	0	0	0	14.63529042	-0.0014	-0.0018
318	VEN	2	1	0	-14	14	0	0	0	14.64036253	-0.0009	0.0058
319	VEN	2	1	0	-17	19	0	0	0	14.64543464	-0.0114	0.0039
320	VEN	2	1	0	-9	6	0	0	0	14.64559856	-0.0048	0.0013
321	VEN	2	1	0	-12	11	0	0	0	14.65067067	0.0401	-0.0119
322	MER	2	1	-3	0	4	0	0	0	14.65272743	0.0003	0.0052
323	VEN	2	1	0	-15	16	0	0	0	14.65574278	0.0193	0.0544
324	VEN	2	1	0	-13	13	0	0	0	14.66605092	-0.0009	0.0071
325	VEN	2	1	0	-16	18	0	0	0	14.67112303	-0.0146	0.0048
326	VEN	2	1	0	-8	5	0	0	0	14.67128696	-0.0060	0.0019
327	VEN	2	1	0	-11	10	0	0	0	14.67635906	0.0534	-0.0159
328	VEN	2	1	0	-14	15	0	0	0	14.68143117	0.0253	0.0735

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [°/h]	C_i	S_i
329	VEN	2	1	0	-17	20	0	0	0	14.68650328	0.0028	0.0041
330	VEN	2	1	0	-9	7	0	0	0	14.68666720	-0.0026	-0.0039
331	VEN	2	1	0	-12	12	0	0	0	14.69173931	-0.0007	0.0086
332	MER	2	1	-3	0	5	0	0	0	14.69379607	0.0026	-0.0010
333	VEN	2	1	0	-15	17	0	0	0	14.69681142	-0.0186	0.0059
334	VEN	2	1	0	-7	4	0	0	0	14.69697535	-0.0075	0.0028
335	MER	2	1	-2	0	1	0	0	0	14.70003722	0.0030	-0.0005
336	VEN	2	1	0	-10	9	0	0	0	14.70204745	0.0710	-0.0215
337	VEN	2	1	0	-13	14	0	0	0	14.70711956	0.0329	0.0990
338	VEN	2	1	0	-16	19	0	0	0	14.71219167	0.0037	0.0053
339	VEN	2	1	0	-8	6	0	0	0	14.71235560	-0.0035	-0.0056
340	VEN	2	1	0	-11	11	0	0	0	14.71742770	-0.0002	0.0103
341	VEN	2	1	0	-14	16	0	0	0	14.72249981	-0.0235	0.0073
342	VEN	2	1	0	-6	3	0	0	0	14.72266374	-0.0093	0.0040
343	VEN	2	1	0	-9	8	0	0	0	14.72773584	0.0939	-0.0293
344	VEN	2	1	0	-12	13	0	0	0	14.73280795	0.0428	0.1331
345	VEN	2	1	0	-15	18	0	0	0	14.73788006	0.0048	0.0069
346	VEN	2	1	0	-7	5	0	0	0	14.73804399	-0.0048	-0.0080
347	VEN	2	1	0	-10	10	0	0	0	14.74311609	0.0008	0.0123
348	VEN	2	1	0	-13	15	0	0	0	14.74818820	-0.0295	0.0089
349	VEN	2	1	0	-5	2	0	0	0	14.74835213	-0.0115	0.0057
350	VEN	2	1	0	-16	20	0	0	0	14.75326031	-0.0021	0.0010
351	VEN	2	1	0	-8	7	0	0	0	14.75342424	0.1241	-0.0405
352	VEN	2	1	0	-11	12	0	0	0	14.75849634	0.0550	0.1783
353	VEN	2	1	0	-3	-1	0	0	0	14.75866027	0.0014	0.0018
354	VEN	2	1	0	-14	17	0	0	0	14.76356845	0.0063	0.0089
355	VEN	2	1	0	-6	4	0	0	0	14.76373238	-0.0067	-0.0112
356	VEN	2	1	0	-9	9	0	0	0	14.76880448	0.0025	0.0144
357	VEN	2	1	0	-12	14	0	0	0	14.77387659	-0.0369	0.0108
358	VEN	2	1	0	-4	1	0	0	0	14.77404052	-0.0141	0.0081
359	VEN	2	1	0	-15	19	0	0	0	14.77894870	-0.0024	0.0012
360	VEN	2	1	0	-7	6	0	0	0	14.77911263	0.1629	-0.0568
361	VEN	2	1	0	1	-7	0	0	0	14.77927655	-0.0008	-0.0006
362	MER	2	1	-2	0	3	0	0	0	14.78217450	0.0008	0.0131
363	VEN	2	1	0	-10	11	0	0	0	14.78418473	0.0709	0.2384
364	VEN	2	1	0	-2	-2	0	0	0	14.78434866	0.0019	0.0022
365	VEN	2	1	0	-13	16	0	0	0	14.78925684	0.0081	0.0113
366	VEN	2	1	0	-5	3	0	0	0	14.78942077	-0.0094	-0.0156
367	VEN	2	1	0	-8	8	0	0	0	14.79449288	0.0052	0.0165
368	VEN	2	1	0	-11	13	0	0	0	14.79956498	-0.0457	0.0129
369	VEN	2	1	0	-3	0	0	0	0	14.79972891	-0.0171	0.0113
370	VEN	2	1	0	-14	18	0	0	0	14.80463709	-0.0028	0.0014
371	VEN	2	1	0	-6	5	0	0	0	14.80480102	0.2121	-0.0812
372	VEN	2	1	0	2	-8	0	0	0	14.80496494	-0.0009	-0.0008
373	VEN	2	1	0	-9	10	0	0	0	14.80987312	0.0910	0.3175
374	VEN	2	1	0	-1	-3	0	0	0	14.81003705	0.0027	0.0027
375	VEN	2	1	0	-12	15	0	0	0	14.81494523	0.0104	0.0143
376	VEN	2	1	0	-4	2	0	0	0	14.81510916	-0.0136	-0.0215
377	VEN	2	1	0	-7	7	0	0	0	14.82018127	0.0094	0.0184
378	MER	2	1	-2	0	4	0	0	0	14.82324314	0.0047	-0.0019
379	VEN	2	1	0	-10	12	0	0	0	14.82525337	-0.0562	0.0154
380	VEN	2	1	0	-2	-1	0	0	0	14.82541730	-0.0204	0.0155
381	MER	2	1	-1	0	0	0	0	0	14.82948429	0.0059	-0.0060
382	VEN	2	1	0	-13	17	0	0	0	14.83032548	-0.0031	0.0017
383	VEN	2	1	0	-5	4	0	0	0	14.83048941	0.2740	-0.1185

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
384	VEN	2	1	0	3	-9	0	0	0	14.83065333	-0.0012	-0.0010
385	VEN	2	1	0	-8	9	0	0	0	14.83556152	0.1161	0.4210
386	VEN	2	1	0	0	-4	0	0	0	14.83572544	0.0035	0.0032
387	VEN	2	1	0	-11	14	0	0	0	14.84063362	0.0132	0.0180
388	VEN	2	1	0	-3	1	0	0	0	14.84079755	-0.0202	-0.0292
389	VEN	2	1	0	-6	6	0	0	0	14.84586966	0.0159	0.0199
390	VEN	2	1	0	-9	11	0	0	0	14.85094176	-0.0683	0.0182
391	VEN	2	1	0	-1	-2	0	0	0	14.85110569	-0.0239	0.0208
392	MAR	2	1	0	0	-10	12	0	0	14.85134914	0.0006	0.0025
393	MAR	2	1	0	0	-11	14	0	0	14.85395309	0.0015	0.0017
394	VEN	2	1	0	-12	16	0	0	0	14.85601387	-0.0035	0.0021
395	VEN	2	1	0	-4	3	0	0	0	14.85617780	0.3504	-0.1769
396	VEN	2	1	0	4	-10	0	0	0	14.85634172	-0.0014	-0.0013
397	VEN	2	1	0	-7	8	0	0	0	14.86124991	0.1475	0.5554
398	VEN	2	1	0	1	-5	0	0	0	14.86141383	0.0045	0.0037
399	VEN	2	1	0	-10	13	0	0	0	14.86632201	0.0166	0.0223
400	VEN	2	1	0	-2	0	0	0	0	14.86648594	-0.0313	-0.0389
401	MAR	2	1	0	0	-8	9	0	0	14.86797754	-0.0014	0.0028
402	MER	2	1	-1	0	1	0	0	0	14.87055293	-0.0038	-0.0019
403	MAR	2	1	0	0	-9	11	0	0	14.87058149	0.0010	0.0036
404	VEN	2	1	0	-5	5	0	0	0	14.87155805	0.0255	0.0205
405	MAR	2	1	0	0	-10	13	0	0	14.87318544	0.0020	0.0023
406	VEN	2	1	0	-8	10	0	0	0	14.87663016	-0.0820	0.0213
407	MER	2	1	0	0	-3	0	0	0	14.87679408	-0.0019	0.0017
408	VEN	2	1	0	0	-3	0	0	0	14.87679408	-0.0269	0.0270
409	VEN	2	1	0	-11	15	0	0	0	14.88170226	-0.0038	0.0024
410	VEN	2	1	0	-3	2	0	0	0	14.88186619	0.4414	-0.2717
411	MAR	2	1	0	0	-5	4	0	0	14.88200198	-0.0017	-0.0029
412	VEN	2	1	0	5	-11	0	0	0	14.88203011	-0.0018	-0.0016
413	VEN	2	1	0	-6	7	0	0	0	14.88693830	0.1860	0.7281
414	VEN	2	1	0	2	-6	0	0	0	14.88710222	0.0055	0.0041
415	MAR	2	1	0	0	-7	8	0	0	14.88720988	-0.0019	0.0047
416	MAR	2	1	0	0	-8	10	0	0	14.88981383	0.0015	0.0053
417	JUP	2	1	0	0	-3	0	4	0	14.89064899	-0.0003	0.0054
418	VEN	2	1	0	-9	12	0	0	0	14.89201040	0.0207	0.0274
419	VEN	2	1	0	-1	-1	0	0	0	14.89217433	-0.0515	-0.0506
420	MAR	2	1	0	0	-9	12	0	0	14.89241778	0.0027	0.0031
421	MAR	2	1	0	0	-10	14	0	0	14.89502173	0.0023	0.0012
422	VEN	2	1	0	-4	4	0	0	0	14.89724644	0.0391	0.0196
423	MAR	2	1	0	0	-3	1	0	0	14.89863038	-0.0001	-0.0024
424	MAR	2	1	0	0	-4	3	0	0	14.90123433	-0.0025	-0.0045
425	VEN	2	1	0	-7	9	0	0	0	14.90231855	-0.0970	0.0246
426	VEN	2	1	0	1	-4	0	0	0	14.90248247	-0.0289	0.0335
427	MAR	2	1	0	0	-5	5	0	0	14.90383828	-0.0024	-0.0019
428	MAR	2	1	0	0	-6	7	0	0	14.90644223	-0.0026	0.0076
429	VEN	2	1	0	-10	14	0	0	0	14.90739065	-0.0041	0.0029
430	VEN	2	1	0	-2	1	0	0	0	14.90755458	0.5441	-0.4335
431	VEN	2	1	0	6	-12	0	0	0	14.90771850	-0.0021	-0.0020
432	MAR	2	1	0	0	-7	9	0	0	14.90904618	0.0023	0.0074
433	MER	2	1	-1	0	2	0	0	0	14.91162157	0.0019	0.0291
434	MAR	2	1	0	0	-8	11	0	0	14.91165013	0.0035	0.0040
435	VEN	2	1	0	-5	6	0	0	0	14.91262669	0.2330	0.9471
436	VEN	2	1	0	3	-7	0	0	0	14.91279061	0.0065	0.0044
437	MAR	2	1	0	0	-9	13	0	0	14.91425408	0.0028	0.0016
438	MAR	2	1	0	0	-1	-2	0	0	14.91525877	0.0011	-0.0020

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
439	VEN	2	1	0	-8	11	0	0	0	14.91769880	0.0255	0.0332
440	MER	2	1	0	0	-2	0	0	0	14.91786272	0.0104	0.0050
441	VEN	2	1	0	0	-2	0	0	0	14.91786272	-0.1010	-0.0605
442	MAR	2	1	0	0	-2	0	0	0	14.91786272	0.0000	-0.0043
443	MAR	2	1	0	0	-3	2	0	0	14.92046667	-0.0038	-0.0071
444	JUP	2	1	0	0	-2	0	1	0	14.92132645	-0.0013	-0.0037
445	VEN	2	1	0	-3	3	0	0	0	14.92293483	0.0579	0.0163
446	MAR	2	1	0	0	-4	4	0	0	14.92307062	-0.0038	-0.0019
447	MAR	2	1	0	0	-5	6	0	0	14.92567457	-0.0036	0.0119
448	VEN	2	1	0	-6	8	0	0	0	14.92800694	-0.1128	0.0280
449	VEN	2	1	0	2	-5	0	0	0	14.92817086	-0.0298	0.0397
450	JUP	2	1	0	0	-2	0	3	0	14.92825390	-0.0016	0.0252
451	MAR	2	1	0	0	-6	8	0	0	14.92827852	0.0033	0.0102
452	MAR	2	1	0	0	-7	10	0	0	14.93088247	0.0045	0.0053
453	JUP	2	1	0	0	-2	0	4	0	14.93171763	-0.0018	0.0068
454	MAR	2	1	0	0	1	-5	0	0	14.93188716	0.0024	-0.0011
455	VEN	2	1	0	-9	13	0	0	0	14.93307904	-0.0044	0.0034
456	VEN	2	1	0	-1	0	0	0	0	14.93324297	0.6453	-0.7362
457	VEN	2	1	0	7	-13	0	0	0	14.93340689	-0.0024	-0.0023
458	MAR	2	1	0	0	-8	12	0	0	14.93348642	0.0034	0.0021
459	MAR	2	1	0	0	0	-3	0	0	14.93449111	0.0024	-0.0037
460	JUP	2	1	0	0	-2	0	5	0	14.93518135	-0.0011	0.0043
461	MAR	2	1	0	0	-9	14	0	0	14.93609037	0.0021	0.0005
462	MAR	2	1	0	0	-1	-1	0	0	14.93709506	0.0004	-0.0077
463	VEN	2	1	0	-4	5	0	0	0	14.93831508	0.2893	1.2192
464	VEN	2	1	0	4	-8	0	0	0	14.93847900	0.0073	0.0046
465	MAR	2	1	0	0	-2	1	0	0	14.93969902	-0.0056	-0.0110
466	MAR	2	1	0	0	-3	3	0	0	14.94230297	-0.0059	-0.0013
467	VEN	2	1	0	-7	10	0	0	0	14.94338719	0.0310	0.0394
468	VEN	2	1	0	1	-3	0	0	0	14.94355111	-0.1636	-0.0667
469	MAR	2	1	0	0	-4	5	0	0	14.94490692	-0.0048	0.0182
470	MAR	2	1	0	0	-5	7	0	0	14.94751087	0.0045	0.0137
471	VEN	2	1	0	-10	15	0	0	0	14.94845929	-0.0014	-0.0017
472	MAR	2	1	0	0	3	-8	0	0	14.94851556	0.0024	0.0004
473	VEN	2	1	0	-2	2	0	0	0	14.94862322	0.0822	0.0097
474	MAR	2	1	0	0	-6	9	0	0	14.95011482	0.0055	0.0067
475	MAR	2	1	0	0	2	-6	0	0	14.95111951	0.0046	-0.0017
476	MER	2	1	-1	0	3	0	0	0	14.95269021	0.0073	-0.0029
477	MAR	2	1	0	0	-7	11	0	0	14.95271877	0.0040	0.0026
478	VEN	2	1	0	-5	7	0	0	0	14.95369533	-0.1281	0.0314
479	MAR	2	1	0	0	1	-4	0	0	14.95372346	0.0059	-0.0071
480	VEN	2	1	0	3	-6	0	0	0	14.95385925	-0.0296	0.0449
481	MAR	2	1	0	0	-8	13	0	0	14.95532272	0.0025	0.0006
482	JUP	2	1	0	0	-1	0	-1	0	14.95546763	-0.0026	-0.0022
483	MAR	2	1	0	0	0	-2	0	0	14.95632741	0.0016	-0.0136
484	VEN	2	1	0	-8	12	0	0	0	14.95876744	-0.0048	0.0041
485	MER	2	1	0	0	-1	0	0	0	14.95893136	0.0052	-0.0461
486	VEN	2	1	0	0	-1	0	0	0	14.95893136	0.6877	-1.5195
487	MAR	2	1	0	0	-1	0	0	0	14.95893136	-0.0083	-0.0172
488	JUP	2	1	0	0	-1	0	0	0	14.95893136	-0.0058	-0.0232
489	VEN	2	1	0	8	-14	0	0	0	14.95909528	-0.0024	-0.0024
490	MAR	2	1	0	0	-2	2	0	0	14.96153531	-0.0089	0.0003
491	JUP	2	1	0	0	-1	0	1	0	14.96239509	0.0037	-0.0005
492	VEN	2	1	0	-3	4	0	0	0	14.96400347	0.3557	1.5474
493	MAR	2	1	0	0	-3	4	0	0	14.96413926	-0.0062	0.0270

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
494	VEN	2	1	0	5	-9	0	0	0	14.96416739	0.0081	0.0047
495	JUP	2	1	0	0	-1	0	2	0	14.96585881	-0.0075	0.1134
496	MAR	2	1	0	0	-4	6	0	0	14.96674321	0.0059	0.0179
497	MAR	2	1	0	0	4	-9	0	0	14.96774790	0.0037	0.0007
498	VEN	2	1	0	-6	9	0	0	0	14.96907558	0.0372	0.0456
499	VEN	2	1	0	2	-4	0	0	0	14.96923950	-0.2232	-0.0693
500	JUP	2	1	0	0	-1	0	3	0	14.96932254	-0.0063	0.0234
501	MAR	2	1	0	0	-5	8	0	0	14.96934716	0.0065	0.0083
502	VEN	2	1	0	10	-17	0	0	0	14.96940343	0.0011	0.0022
503	MAR	2	1	0	0	3	-7	0	0	14.97035185	0.0076	-0.0025
504	MAR	2	1	0	0	-6	10	0	0	14.97195111	0.0046	0.0031
505	JUP	2	1	0	0	-1	0	4	0	14.97278627	-0.0034	0.0140
506	MAR	2	1	0	0	2	-5	0	0	14.97295580	0.0109	-0.0117
507	VEN	2	1	0	-9	14	0	0	0	14.97414768	-0.0014	-0.0019
508	VEN	2	1	0	-1	1	0	0	0	14.97431161	0.1108	-0.0025
509	MAR	2	1	0	0	-7	12	0	0	14.97455506	0.0027	0.0008
510	MAR	2	1	0	0	1	-3	0	0	14.97555975	0.0061	-0.0267
511	JUP	2	1	0	0	-1	0	5	0	14.97624999	-0.0015	0.0036
512	MAR	2	1	0	0	0	-1	0	0	14.97816370	-0.0120	-0.0279
513	VEN	2	1	0	-4	6	0	0	0	14.97938372	-0.1414	0.0345
514	VEN	2	1	0	4	-7	0	0	0	14.97954764	-0.0285	0.0487
515	MAR	2	1	0	0	-1	1	0	0	14.98076766	-0.0129	0.0034
516	MAR	2	1	0	0	-2	3	0	0	14.98337161	-0.0080	0.0390
517	MAR	2	1	0	0	6	-12	0	0	14.98437630	0.0018	0.0015
518	VEN	2	1	0	-7	11	0	0	0	14.98445583	-0.0052	0.0049
519	VEN	2	1	0	1	-2	0	0	0	14.98461975	0.6789	-2.0758
520	VEN	2	1	0	9	-15	0	0	0	14.98478368	-0.0023	-0.0022
521	MAR	2	1	0	0	-3	5	0	0	14.98597556	0.0076	0.0224
522	MAR	2	1	0	0	5	-10	0	0	14.98698025	0.0051	0.0011
523	MAR	2	1	0	0	-4	7	0	0	14.98857951	0.0074	0.0098
524	MAR	2	1	0	0	4	-8	0	0	14.98958420	0.0108	-0.0033
525	JUP	2	1	0	0	0	0	-3	0	14.98960882	-0.0014	-0.0021
526	VEN	2	1	0	-2	3	0	0	0	14.98969186	0.4319	1.9237
527	VEN	2	1	0	6	-10	0	0	0	14.98985578	0.0087	0.0046
528	MAR	2	1	0	0	-5	9	0	0	14.99118346	0.0050	0.0036
529	MAR	2	1	0	0	3	-6	0	0	14.99218815	0.0160	-0.0164
530	JUP	2	1	0	0	0	0	-2	0	14.99307255	-0.0088	-0.0226
531	MAR	2	1	0	0	-6	11	0	0	14.99378741	0.0029	0.0009
532	VEN	2	1	0	-5	8	0	0	0	14.99476397	0.0442	0.0509
533	MAR	2	1	0	0	2	-4	0	0	14.99479210	0.0107	-0.0400
534	VEN	2	1	0	3	-5	0	0	0	14.99492789	-0.2695	-0.0685
535	VEN	2	1	0	11	-18	0	0	0	14.99509182	0.0015	0.0025
536	JUP	2	1	0	0	0	0	-1	0	14.99653627	-0.0246	-0.1610
537	MAR	2	1	0	0	1	-2	0	0	14.99739605	-0.0165	-0.0540
538	SAT	2	1	0	0	0	0	0	-1	14.99860425	-0.0011	-0.0038
539	VEN	2	1	0	-8	13	0	0	0	14.99983608	-0.0012	-0.0022
540	MER	2	1	0	0	0	0	0	0	15.00000000	-0.0106	-0.0020
541	VEN	2	1	0	0	0	0	0	0	15.00000000	0.1337	-0.0233
542	MAR	2	1	0	0	0	0	0	0	15.00000000	-0.0179	0.0089
543	JUP	2	1	0	0	0	0	0	0	15.00000000	0.0024	0.0161
544	VEN	2	1	0	8	-13	0	0	0	15.00016392	-0.0004	-0.0014
545	SAT	2	1	0	0	0	0	0	1	15.00139575	-0.0013	0.0117
546	MAR	2	1	0	0	-1	2	0	0	15.00260395	-0.0098	0.0541
547	JUP	2	1	0	0	0	0	1	0	15.00346373	-0.0310	0.4756
548	MAR	2	1	0	0	7	-13	0	0	15.00360864	0.0022	0.0019

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
549	VEN	2	1	0	-3	5	0	0	0	15.00507211	-0.1502	0.0372
550	MAR	2	1	0	0	-2	4	0	0	15.00520790	0.0091	0.0267
551	VEN	2	1	0	5	-8	0	0	0	15.00523603	-0.0268	0.0510
552	MAR	2	1	0	0	6	-11	0	0	15.00621259	0.0064	0.0014
553	MER	2	1	1	0	-4	0	0	0	15.00624115	-0.0025	0.0026
554	JUP	2	1	0	0	0	0	2	0	15.00692745	-0.0180	0.0669
555	MAR	2	1	0	0	-3	6	0	0	15.00781185	0.0080	0.0111
556	MAR	2	1	0	0	5	-9	0	0	15.00881654	0.0136	-0.0040
557	VEN	2	1	0	-6	10	0	0	0	15.01014422	-0.0054	0.0057
558	VEN	2	1	0	2	-3	0	0	0	15.01030814	0.6351	-2.3522
559	JUP	2	1	0	0	0	0	3	0	15.01039118	-0.0091	0.0395
560	MAR	2	1	0	0	-4	8	0	0	15.01041580	0.0052	0.0040
561	VEN	2	1	0	10	-16	0	0	0	15.01047207	-0.0021	-0.0020
562	MAR	2	1	0	0	4	-7	0	0	15.01142049	0.0201	-0.0202
563	MAR	2	1	0	0	-5	10	0	0	15.01301975	0.0029	0.0010
564	JUP	2	1	0	0	0	0	4	0	15.01385491	-0.0034	0.0081
565	MAR	2	1	0	0	3	-5	0	0	15.01402444	0.0136	-0.0491
566	VEN	2	1	0	-1	2	0	0	0	15.01538025	0.5165	2.3123
567	VEN	2	1	0	7	-11	0	0	0	15.01554417	0.0091	0.0046
568	MAR	2	1	0	0	2	-3	0	0	15.01662839	-0.0199	-0.0654
569	MAR	2	1	0	0	1	-1	0	0	15.01923234	-0.0223	0.0182
570	VEN	2	1	0	-4	7	0	0	0	15.02045236	0.0516	0.0539
571	VEN	2	1	0	4	-6	0	0	0	15.02061628	-0.2990	-0.0652
572	VEN	2	1	0	12	-19	0	0	0	15.02078021	0.0018	0.0026
573	MAR	2	1	0	0	0	1	0	0	15.02183630	-0.0116	0.0713
574	MAR	2	1	0	0	8	-14	0	0	15.02284099	0.0026	0.0023
575	JUP	2	1	0	0	1	0	-5	0	15.02375001	-0.0020	-0.0027
576	MAR	2	1	0	0	-1	3	0	0	15.02444025	0.0102	0.0298
577	MAR	2	1	0	0	7	-12	0	0	15.02544494	0.0075	0.0017
578	VEN	2	1	0	-7	12	0	0	0	15.02552447	-0.0010	-0.0024
579	VEN	2	1	0	1	-1	0	0	0	15.02568839	0.1356	-0.0485
580	VEN	2	1	0	9	-14	0	0	0	15.02585232	-0.0008	-0.0016
581	MAR	2	1	0	0	-2	5	0	0	15.02704420	0.0080	0.0119
582	JUP	2	1	0	0	1	0	-4	0	15.02721373	-0.0148	-0.0305
583	MAR	2	1	0	0	6	-10	0	0	15.02804889	0.0156	-0.0045
584	MAR	2	1	0	0	-3	7	0	0	15.02964815	0.0051	0.0043
585	MAR	2	1	0	0	5	-8	0	0	15.03065284	0.0226	-0.0225
586	JUP	2	1	0	0	1	0	-3	0	15.03067746	-0.0722	-0.2768
587	VEN	2	1	0	-2	4	0	0	0	15.03076050	-0.1511	0.0391
588	VEN	2	1	0	6	-9	0	0	0	15.03092442	-0.0246	0.0517
589	MAR	2	1	0	0	-4	9	0	0	15.03225210	0.0029	0.0011
590	MAR	2	1	0	0	4	-6	0	0	15.03325679	0.0144	-0.0526
591	JUP	2	1	0	0	1	0	-2	0	15.03414119	-0.0890	-1.6571
592	VEN	2	1	0	-5	9	0	0	0	15.03583261	-0.0052	0.0064
593	MAR	2	1	0	0	3	-4	0	0	15.03586074	-0.0213	-0.0639
594	VEN	2	1	0	3	-4	0	0	0	15.03599653	0.5712	-2.4030
595	VEN	2	1	0	11	-17	0	0	0	15.03616046	-0.0019	-0.0017
596	SAT	2	1	0	0	1	0	0	-3	15.03688140	-0.0140	0.0019
597	JUP	2	1	0	0	1	0	-1	0	15.03760491	0.0019	0.1628
598	SAT	2	1	0	0	1	0	0	-2	15.03827715	-0.0064	-0.0764
599	MAR	2	1	0	0	2	-2	0	0	15.03846469	-0.0232	0.0262
600	SAT	2	1	0	0	1	0	0	-1	15.03967289	0.0037	0.0004
601	MER	2	1	0	0	1	0	0	0	15.04106864	0.0032	0.0529
602	VEN	2	1	0	0	1	0	0	0	15.04106864	0.6057	2.5986
603	MAR	2	1	0	0	1	0	0	0	15.04106864	-0.0128	0.0857

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
604	JUP	2	1	0	0	1	0	0	0	15.04106864	-0.1001	1.6724
605	SAT	2	1	0	0	1	0	0	0	15.04106864	-0.0079	0.0745
606	VEN	2	1	0	8	-12	0	0	0	15.04123256	0.0095	0.0045
607	MAR	2	1	0	0	9	-15	0	0	15.04207333	0.0029	0.0026
608	SAT	2	1	0	0	1	0	0	1	15.04246439	-0.0059	-0.0009
609	MAR	2	1	0	0	0	2	0	0	15.04367259	0.0102	0.0303
610	SAT	2	1	0	0	1	0	0	2	15.04386013	-0.0008	0.0024
611	JUP	2	1	0	0	1	0	1	0	15.04453237	-0.0304	0.1236
612	MAR	2	1	0	0	8	-13	0	0	15.04467728	0.0083	0.0019
613	VEN	2	1	0	-3	6	0	0	0	15.04614075	0.0588	0.0530
614	MAR	2	1	0	0	-1	4	0	0	15.04627654	0.0073	0.0119
615	VEN	2	1	0	5	-7	0	0	0	15.04630467	-0.3118	-0.0603
616	VEN	2	1	0	13	-20	0	0	0	15.04646860	0.0019	0.0026
617	MAR	2	1	0	0	7	-11	0	0	15.04728123	0.0167	-0.0048
618	MER	2	1	1	0	-3	0	0	0	15.04730979	0.0133	0.0056
619	JUP	2	1	0	0	1	0	2	0	15.04799609	-0.0164	0.0781
620	MAR	2	1	0	0	-2	6	0	0	15.04888049	0.0047	0.0043
621	MAR	2	1	0	0	6	-9	0	0	15.04988518	0.0232	-0.0232
622	VEN	2	1	0	-6	11	0	0	0	15.05121286	-0.0010	-0.0025
623	VEN	2	1	0	2	-2	0	0	0	15.05137678	0.1216	-0.0694
624	JUP	2	1	0	0	1	0	3	0	15.05145982	-0.0050	0.0118
625	MAR	2	1	0	0	-3	8	0	0	15.05148444	0.0026	0.0012
626	VEN	2	1	0	10	-15	0	0	0	15.05154071	-0.0010	-0.0018
627	MAR	2	1	0	0	5	-7	0	0	15.05248913	0.0135	-0.0511
628	MAR	2	1	0	0	4	-5	0	0	15.05509308	-0.0210	-0.0550
629	VEN	2	1	0	-1	3	0	0	0	15.05644889	-0.1404	0.0399
630	VEN	2	1	0	7	-10	0	0	0	15.05661281	-0.0221	0.0510
631	MAR	2	1	0	0	3	-3	0	0	15.05769703	-0.0210	0.0304
632	MAR	2	1	0	0	2	-1	0	0	15.06030098	-0.0124	0.0739
633	MAR	2	1	0	0	10	-16	0	0	15.06130567	0.0031	0.0027
634	JUP	2	1	0	0	2	0	-6	0	15.06135492	-0.0022	-0.0030
635	VEN	2	1	0	-4	8	0	0	0	15.06152100	-0.0045	0.0069
636	VEN	2	1	0	4	-5	0	0	0	15.06168492	0.4988	-2.2996
637	VEN	2	1	0	12	-18	0	0	0	15.06184885	-0.0016	-0.0014
638	MAR	2	1	0	0	1	1	0	0	15.06290494	0.0085	0.0264
639	MAR	2	1	0	0	9	-14	0	0	15.06390963	0.0086	0.0020
640	JUP	2	1	0	0	2	0	-5	0	15.06481865	-0.0129	-0.0266
641	MAR	2	1	0	0	0	3	0	0	15.06550889	0.0058	0.0108
642	MAR	2	1	0	0	8	-12	0	0	15.06651358	0.0169	-0.0049
643	VEN	2	1	0	-7	13	0	0	0	15.06659311	-0.0011	0.0018
644	VEN	2	1	0	1	0	0	0	0	15.06675703	0.6954	2.2645
645	VEN	2	1	0	9	-13	0	0	0	15.06692096	0.0099	0.0046
646	MAR	2	1	0	0	-1	5	0	0	15.06811284	0.0038	0.0040
647	JUP	2	1	0	0	2	0	-4	0	15.06828237	-0.0483	-0.1848
648	MAR	2	1	0	0	7	-10	0	0	15.06911753	0.0223	-0.0225
649	MAR	2	1	0	0	-2	7	0	0	15.07071679	0.0022	0.0011
650	MAR	2	1	0	0	6	-8	0	0	15.07172148	0.0116	-0.0463
651	JUP	2	1	0	0	2	0	-3	0	15.07174610	-0.0411	-0.7755
652	VEN	2	1	0	-2	5	0	0	0	15.07182914	0.0646	0.0460
653	VEN	2	1	0	6	-8	0	0	0	15.07199306	-0.3104	-0.0545
654	VEN	2	1	0	14	-21	0	0	0	15.07215699	0.0020	0.0025
655	MAR	2	1	0	0	5	-6	0	0	15.07432543	-0.0194	-0.0432
656	JUP	2	1	0	0	2	0	-2	0	15.07520983	-0.0026	0.1060
657	SAT	2	1	0	0	2	0	0	-4	15.07655430	-0.0052	0.0007
658	VEN	2	1	0	-5	10	0	0	0	15.07690125	-0.0009	-0.0025

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
659	MAR	2	1	0	0	4	-4	0	0	15.07692938	-0.0174	0.0309
660	VEN	2	1	0	3	-3	0	0	0	15.07706517	0.0994	-0.0839
661	VEN	2	1	0	11	-16	0	0	0	15.07722910	-0.0012	-0.0018
662	SAT	2	1	0	0	2	0	0	-3	15.07795004	-0.0016	-0.0198
663	JUP	2	1	0	0	2	0	-1	0	15.07867355	-0.0433	0.4728
664	MAR	2	1	0	0	3	-2	0	0	15.07953333	-0.0112	0.0579
665	MAR	2	1	0	0	11	-17	0	0	15.08053802	0.0032	0.0028
666	SAT	2	1	0	0	2	0	0	-1	15.08074153	-0.0020	0.0113
667	MER	2	1	0	0	2	0	0	0	15.08213728	0.0087	-0.0033
668	VEN	2	1	0	0	2	0	0	0	15.08213728	-0.1155	0.0389
669	MAR	2	1	0	0	2	0	0	0	15.08213728	0.0051	0.0186
670	JUP	2	1	0	0	2	0	0	0	15.08213728	-0.0067	0.0241
671	VEN	2	1	0	8	-11	0	0	0	15.08230120	-0.0194	0.0492
672	MAR	2	1	0	0	10	-15	0	0	15.08314197	0.0086	0.0019
673	MAR	2	1	0	0	1	2	0	0	15.08474123	0.0038	0.0085
674	JUP	2	1	0	0	2	0	1	0	15.08560101	-0.0042	0.0076
675	MAR	2	1	0	0	9	-13	0	0	15.08574592	0.0162	-0.0047
676	VEN	2	1	0	-3	7	0	0	0	15.08720939	-0.0033	0.0073
677	MAR	2	1	0	0	0	4	0	0	15.08734518	0.0028	0.0034
678	VEN	2	1	0	5	-6	0	0	0	15.08737331	0.4253	-2.1039
679	MAR	2	1	0	0	8	-11	0	0	15.08834987	0.0202	-0.0207
680	MER	2	1	1	0	-2	0	0	0	15.08837843	0.0032	-0.0423
681	MAR	2	1	0	0	7	-9	0	0	15.09095382	0.0092	-0.0395
682	VEN	2	1	0	-6	12	0	0	0	15.09228150	-0.0014	0.0020
683	VEN	2	1	0	2	-1	0	0	0	15.09244542	0.7295	1.8465
684	VEN	2	1	0	10	-14	0	0	0	15.09260935	0.0098	0.0044
685	MAR	2	1	0	0	6	-7	0	0	15.09355777	-0.0171	-0.0316
686	MAR	2	1	0	0	5	-5	0	0	15.09616172	-0.0136	0.0289
687	VEN	2	1	0	-1	4	0	0	0	15.09751753	0.0677	0.0303
688	VEN	2	1	0	7	-9	0	0	0	15.09768145	-0.2979	-0.0482
689	VEN	2	1	0	15	-22	0	0	0	15.09784538	0.0019	0.0023
690	MAR	2	1	0	0	4	-3	0	0	15.09876567	-0.0097	0.0429
691	JUP	2	1	0	0	3	0	-7	0	15.09895983	-0.0014	-0.0019
692	MAR	2	1	0	0	12	-18	0	0	15.09977036	0.0032	0.0028
693	MAR	2	1	0	0	3	-1	0	0	15.10136962	0.0023	0.0116
694	MAR	2	1	0	0	11	-16	0	0	15.10237431	0.0083	0.0018
695	JUP	2	1	0	0	3	0	-6	0	15.10242356	-0.0069	-0.0141
696	VEN	2	1	0	-4	9	0	0	0	15.10258964	-0.0010	-0.0023
697	VEN	2	1	0	4	-4	0	0	0	15.10275356	0.0751	-0.0919
698	VEN	2	1	0	12	-17	0	0	0	15.10291749	-0.0012	-0.0018
699	MAR	2	1	0	0	2	1	0	0	15.10397358	0.0019	0.0053
700	MAR	2	1	0	0	10	-14	0	0	15.10497827	0.0150	-0.0044
701	JUP	2	1	0	0	3	0	-5	0	15.10588729	-0.0206	-0.0796
702	MAR	2	1	0	0	1	3	0	0	15.10657753	0.0017	0.0024
703	MAR	2	1	0	0	9	-12	0	0	15.10758222	0.0176	-0.0182
704	VEN	2	1	0	1	1	0	0	0	15.10782567	-0.0821	0.0344
705	VEN	2	1	0	9	-12	0	0	0	15.10798960	-0.0168	0.0466
706	JUP	2	1	0	0	3	0	-4	0	15.10935101	-0.0122	-0.2554
707	MAR	2	1	0	0	8	-10	0	0	15.11018617	0.0068	-0.0323
708	MAR	2	1	0	0	7	-8	0	0	15.11279012	-0.0145	-0.0216
709	JUP	2	1	0	0	3	0	-3	0	15.11281474	0.0036	0.0443
710	VEN	2	1	0	-2	6	0	0	0	15.11289778	-0.0015	0.0071
711	VEN	2	1	0	6	-7	0	0	0	15.11306170	0.3561	-1.8627
712	MAR	2	1	0	0	6	-6	0	0	15.11539407	-0.0101	0.0254
713	JUP	2	1	0	0	3	0	-2	0	15.11627847	-0.0146	0.1116

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [°/h]	C_i	S_i
714	SAT	2	1	0	0	3	0	0	-4	15.11762294	-0.0003	-0.0036
715	VEN	2	1	0	-5	11	0	0	0	15.11796989	-0.0016	0.0021
716	MAR	2	1	0	0	5	-4	0	0	15.11799802	-0.0082	0.0305
717	VEN	2	1	0	3	-2	0	0	0	15.11813381	0.7154	1.4570
718	VEN	2	1	0	11	-15	0	0	0	15.11829774	0.0094	0.0042
719	MAR	2	1	0	0	13	-19	0	0	15.11900271	0.0031	0.0027
720	JUP	2	1	0	0	3	0	-1	0	15.11974219	-0.0045	0.0019
721	MAR	2	1	0	0	4	-2	0	0	15.12060197	0.0006	0.0066
722	MAR	2	1	0	0	12	-17	0	0	15.12160666	0.0077	0.0017
723	VEN	2	1	0	0	3	0	0	0	15.12320592	0.0662	0.0043
724	MAR	2	1	0	0	3	0	0	0	15.12320592	0.0006	0.0034
725	VEN	2	1	0	8	-10	0	0	0	15.12336984	-0.2776	-0.0420
726	VEN	2	1	0	16	-23	0	0	0	15.12353377	0.0018	0.0021
727	MAR	2	1	0	0	11	-15	0	0	15.12421061	0.0133	-0.0039
728	MAR	2	1	0	0	10	-13	0	0	15.12681456	0.0147	-0.0155
729	VEN	2	1	0	-3	8	0	0	0	15.12827803	-0.0010	-0.0020
730	VEN	2	1	0	5	-5	0	0	0	15.12844195	0.0522	-0.0944
731	VEN	2	1	0	13	-18	0	0	0	15.12860588	-0.0012	-0.0017
732	MAR	2	1	0	0	9	-11	0	0	15.12941851	0.0046	-0.0253
733	MER	2	1	1	0	-1	0	0	0	15.12944707	-0.0080	-0.0001
734	MAR	2	1	0	0	8	-9	0	0	15.13202246	-0.0118	-0.0138
735	VEN	2	1	0	2	0	0	0	0	15.13351406	-0.0566	0.0267
736	VEN	2	1	0	10	-13	0	0	0	15.13367799	-0.0143	0.0433
737	MAR	2	1	0	0	7	-7	0	0	15.13462641	-0.0073	0.0212
738	MER	2	1	2	0	-5	0	0	0	15.13568822	-0.0023	0.0026
739	MAR	2	1	0	0	6	-5	0	0	15.13723036	-0.0068	0.0208
740	MAR	2	1	0	0	14	-20	0	0	15.13823505	0.0029	0.0025
741	VEN	2	1	0	-1	5	0	0	0	15.13858617	0.0007	0.0065
742	VEN	2	1	0	7	-8	0	0	0	15.13875009	0.2937	-1.6084
743	MAR	2	1	0	0	5	-3	0	0	15.13983431	-0.0004	0.0032
744	JUP	2	1	0	0	4	0	-7	0	15.14002847	-0.0029	-0.0059
745	MAR	2	1	0	0	13	-18	0	0	15.14083900	0.0069	0.0015
746	MAR	2	1	0	0	12	-16	0	0	15.14344295	0.0114	-0.0034
747	JUP	2	1	0	0	4	0	-6	0	15.14349220	-0.0071	-0.0279
748	VEN	2	1	0	-4	10	0	0	0	15.14365828	-0.0016	0.0019
749	VEN	2	1	0	4	-3	0	0	0	15.14382220	0.6681	1.1272
750	VEN	2	1	0	12	-16	0	0	0	15.14398613	0.0088	0.0039
751	MAR	2	1	0	0	11	-14	0	0	15.14604691	0.0118	-0.0128
752	JUP	2	1	0	0	4	0	-5	0	15.14695593	-0.0026	-0.0720
753	MAR	2	1	0	0	10	-12	0	0	15.14865086	0.0029	-0.0192
754	VEN	2	1	0	1	2	0	0	0	15.14889431	0.0583	-0.0291
755	VEN	2	1	0	9	-11	0	0	0	15.14905824	-0.2526	-0.0360
756	VEN	2	1	0	17	-24	0	0	0	15.14922216	0.0017	0.0019
757	JUP	2	1	0	0	4	0	-4	0	15.15041965	0.0028	0.0152
758	MAR	2	1	0	0	9	-10	0	0	15.15125481	-0.0094	-0.0080
759	MAR	2	1	0	0	8	-8	0	0	15.15385876	-0.0051	0.0169
760	JUP	2	1	0	0	4	0	-3	0	15.15388338	-0.0045	0.0245
761	VEN	2	1	0	-2	7	0	0	0	15.15396642	-0.0010	-0.0017
762	VEN	2	1	0	6	-6	0	0	0	15.15413034	0.0326	-0.0925
763	VEN	2	1	0	14	-19	0	0	0	15.15429427	-0.0012	-0.0015
764	MAR	2	1	0	0	7	-6	0	0	15.15646271	-0.0056	0.0137
765	MAR	2	1	0	0	15	-21	0	0	15.15746740	0.0026	0.0022
766	VEN	2	1	0	3	-1	0	0	0	15.15920245	-0.0381	0.0190
767	VEN	2	1	0	11	-14	0	0	0	15.15936638	-0.0120	0.0395
768	MAR	2	1	0	0	14	-19	0	0	15.16007135	0.0060	0.0013

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
769	MAR	2	1	0	0	13	-17	0	0	15.16267530	0.0096	-0.0030
770	VEN	2	1	0	0	4	0	0	0	15.16427456	0.0028	0.0055
771	VEN	2	1	0	8	-9	0	0	0	15.16443848	0.2392	-1.3618
772	MAR	2	1	0	0	12	-15	0	0	15.16527925	0.0093	-0.0102
773	MAR	2	1	0	0	11	-13	0	0	15.16788320	0.0016	-0.0141
774	VEN	2	1	0	-3	9	0	0	0	15.16934667	-0.0016	0.0018
775	VEN	2	1	0	5	-4	0	0	0	15.16951059	0.6017	0.8609
776	VEN	2	1	0	13	-17	0	0	0	15.16967452	0.0080	0.0035
777	MAR	2	1	0	0	10	-11	0	0	15.17048715	-0.0073	-0.0041
778	MER	2	1	1	0	0	0	0	0	15.17051571	0.0056	0.0251
779	MAR	2	1	0	0	9	-9	0	0	15.17309110	-0.0035	0.0131
780	VEN	2	1	0	2	1	0	0	0	15.17458270	0.0433	-0.0386
781	VEN	2	1	0	10	-12	0	0	0	15.17474663	-0.2254	-0.0306
782	VEN	2	1	0	18	-25	0	0	0	15.17491055	0.0015	0.0017
783	MAR	2	1	0	0	8	-7	0	0	15.17569505	-0.0045	0.0087
784	MAR	2	1	0	0	16	-22	0	0	15.17669974	0.0023	0.0020
785	MER	2	1	2	0	-4	0	0	0	15.17675686	0.0109	0.0043
786	JUP	2	1	0	0	5	0	-8	0	15.17763339	-0.0010	-0.0021
787	MAR	2	1	0	0	15	-20	0	0	15.17930369	0.0052	0.0011
788	VEN	2	1	0	7	-7	0	0	0	15.17981873	0.0168	-0.0878
789	JUP	2	1	0	0	5	0	-7	0	15.18109711	-0.0021	-0.0086
790	MAR	2	1	0	0	14	-18	0	0	15.18190764	0.0078	-0.0025
791	MAR	2	1	0	0	13	-16	0	0	15.18451159	0.0070	-0.0080
792	JUP	2	1	0	0	5	0	-6	0	15.18456084	-0.0003	-0.0186
793	VEN	2	1	0	4	-2	0	0	0	15.18489084	-0.0252	0.0124
794	VEN	2	1	0	12	-15	0	0	0	15.18505477	-0.0100	0.0355
795	MAR	2	1	0	0	12	-14	0	0	15.18711555	0.0007	-0.0100
796	JUP	2	1	0	0	5	0	-5	0	15.18802457	0.0013	0.0046
797	MAR	2	1	0	0	11	-12	0	0	15.18971950	-0.0055	-0.0016
798	VEN	2	1	0	1	3	0	0	0	15.18996295	0.0041	0.0042
799	VEN	2	1	0	9	-10	0	0	0	15.19012688	0.1927	-1.1349
800	JUP	2	1	0	0	5	0	-4	0	15.19148829	-0.0013	0.0051
801	MAR	2	1	0	0	10	-10	0	0	15.19232345	-0.0024	0.0098
802	MAR	2	1	0	0	9	-8	0	0	15.19492740	-0.0036	0.0052
803	VEN	2	1	0	-2	8	0	0	0	15.19503506	-0.0015	0.0015
804	VEN	2	1	0	6	-5	0	0	0	15.19519898	0.5273	0.6515
805	VEN	2	1	0	14	-18	0	0	0	15.19536291	0.0072	0.0031
806	MAR	2	1	0	0	17	-23	0	0	15.19593209	0.0020	0.0017
807	MAR	2	1	0	0	16	-21	0	0	15.19853604	0.0043	0.0009
808	VEN	2	1	0	3	0	0	0	0	15.20027109	0.0296	-0.0400
809	VEN	2	1	0	11	-13	0	0	0	15.20043502	-0.1978	-0.0256
810	VEN	2	1	0	19	-26	0	0	0	15.20059894	0.0014	0.0015
811	MAR	2	1	0	0	15	-19	0	0	15.20113999	0.0062	-0.0020
812	MAR	2	1	0	0	14	-17	0	0	15.20374394	0.0052	-0.0061
813	VEN	2	1	0	8	-8	0	0	0	15.20550712	0.0052	-0.0808
814	MAR	2	1	0	0	13	-15	0	0	15.20634789	0.0001	-0.0069
815	MAR	2	1	0	0	12	-13	0	0	15.20895184	-0.0041	-0.0002
816	VEN	2	1	0	5	-3	0	0	0	15.21057923	-0.0166	0.0070
817	VEN	2	1	0	13	-16	0	0	0	15.21074316	-0.0083	0.0315
818	MAR	2	1	0	0	11	-11	0	0	15.21155579	-0.0016	0.0071
819	MER	2	1	1	0	1	0	0	0	15.21158435	0.0028	-0.0016
820	MAR	2	1	0	0	10	-9	0	0	15.21415974	-0.0027	0.0030
821	VEN	2	1	0	2	2	0	0	0	15.21565134	0.0041	0.0028
822	VEN	2	1	0	10	-11	0	0	0	15.21581527	0.1538	-0.9334
823	MAR	2	1	0	0	17	-22	0	0	15.21776838	0.0036	0.0007

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
824	MER	2	1	2	0	-3	0	0	0	15.21782550	0.0014	-0.0264
825	JUP	2	1	0	0	6	0	-8	0	15.21870203	-0.0006	-0.0025
826	MAR	2	1	0	0	16	-20	0	0	15.22037233	0.0049	-0.0016
827	VEN	2	1	0	-1	7	0	0	0	15.22072345	-0.0013	0.0013
828	VEN	2	1	0	7	-6	0	0	0	15.22088737	0.4521	0.4899
829	VEN	2	1	0	15	-19	0	0	0	15.22105130	0.0064	0.0027
830	JUP	2	1	0	0	6	0	-7	0	15.22216575	0.0000	-0.0045
831	MAR	2	1	0	0	15	-18	0	0	15.22297628	0.0037	-0.0046
832	MAR	2	1	0	0	14	-16	0	0	15.22558023	-0.0002	-0.0046
833	VEN	2	1	0	4	-1	0	0	0	15.22595948	0.0187	-0.0376
834	VEN	2	1	0	12	-14	0	0	0	15.22612341	-0.1711	-0.0213
835	VEN	2	1	0	20	-27	0	0	0	15.22628733	0.0012	0.0012
836	MAR	2	1	0	0	13	-14	0	0	15.22818419	-0.0030	0.0006
837	MAR	2	1	0	0	12	-12	0	0	15.23078814	-0.0011	0.0050
838	VEN	2	1	0	9	-9	0	0	0	15.23119552	-0.0030	-0.0726
839	MAR	2	1	0	0	11	-10	0	0	15.23339209	-0.0021	0.0015
840	VEN	2	1	0	6	-4	0	0	0	15.23626762	-0.0108	0.0030
841	VEN	2	1	0	14	-17	0	0	0	15.23643155	-0.0068	0.0276
842	MAR	2	1	0	0	18	-23	0	0	15.23700073	0.0029	0.0005
843	MAR	2	1	0	0	17	-21	0	0	15.23960468	0.0037	-0.0012
844	VEN	2	1	0	3	1	0	0	0	15.24133973	0.0036	0.0017
845	VEN	2	1	0	11	-12	0	0	0	15.24150366	0.1217	-0.7593
846	MAR	2	1	0	0	16	-19	0	0	15.24220863	0.0026	-0.0033
847	MAR	2	1	0	0	15	-17	0	0	15.24481258	-0.0004	-0.0030
848	VEN	2	1	0	0	6	0	0	0	15.24641184	-0.0012	0.0011
849	VEN	2	1	0	8	-7	0	0	0	15.24657576	0.3810	0.3666
850	VEN	2	1	0	16	-20	0	0	0	15.24673969	0.0055	0.0023
851	MAR	2	1	0	0	14	-15	0	0	15.24741653	-0.0022	0.0009
852	MAR	2	1	0	0	13	-13	0	0	15.25002048	-0.0007	0.0034
853	VEN	2	1	0	5	-2	0	0	0	15.25164787	0.0107	-0.0335
854	VEN	2	1	0	13	-15	0	0	0	15.25181180	-0.1459	-0.0175
855	VEN	2	1	0	10	-10	0	0	0	15.25688391	-0.0083	-0.0642
856	MAR	2	1	0	0	18	-22	0	0	15.25883702	0.0028	-0.0010
857	MAR	2	1	0	0	17	-20	0	0	15.26144097	0.0018	-0.0024
858	VEN	2	1	0	7	-5	0	0	0	15.26195601	-0.0071	0.0001
859	VEN	2	1	0	15	-18	0	0	0	15.26211994	-0.0055	0.0239
860	MER	2	1	3	0	-6	0	0	0	15.26513529	-0.0017	0.0020
861	VEN	2	1	0	4	0	0	0	0	15.26702812	0.0030	0.0010
862	VEN	2	1	0	12	-13	0	0	0	15.26719205	0.0956	-0.6118
863	MAR	2	1	0	0	14	-14	0	0	15.26925283	-0.0005	0.0023
864	VEN	2	1	0	1	5	0	0	0	15.27210023	-0.0011	0.0009
865	VEN	2	1	0	9	-8	0	0	0	15.27226416	0.3165	0.2734
866	VEN	2	1	0	17	-21	0	0	0	15.27242808	0.0048	0.0020
867	VEN	2	1	0	6	-3	0	0	0	15.27733626	0.0049	-0.0288
868	VEN	2	1	0	14	-16	0	0	0	15.27750019	-0.1233	-0.0143
869	VEN	2	1	0	11	-11	0	0	0	15.28257230	-0.0114	-0.0558
870	VEN	2	1	0	8	-6	0	0	0	15.28764440	-0.0047	-0.0018
871	VEN	2	1	0	16	-19	0	0	0	15.28780833	-0.0045	0.0206
872	VEN	2	1	0	5	-1	0	0	0	15.29271651	0.0024	0.0005
873	VEN	2	1	0	13	-14	0	0	0	15.29288044	0.0746	-0.4891
874	VEN	2	1	0	10	-9	0	0	0	15.29795255	0.2596	0.2033
875	VEN	2	1	0	18	-22	0	0	0	15.29811647	0.0040	0.0016
876	MER	2	1	2	0	-1	0	0	0	15.29996278	0.0044	0.0094
877	VEN	2	1	0	7	-4	0	0	0	15.30302465	0.0010	-0.0240
878	VEN	2	1	0	15	-17	0	0	0	15.30318858	-0.1031	-0.0116

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
879	MER	2	1	3	0	-5	0	0	0	15.30620393	0.0071	0.0027
880	VEN	2	1	0	12	-12	0	0	0	15.30826069	-0.0129	-0.0479
881	VEN	2	1	0	9	-7	0	0	0	15.31333280	-0.0032	-0.0030
882	VEN	2	1	0	17	-20	0	0	0	15.31349672	-0.0036	0.0175
883	VEN	2	1	0	14	-15	0	0	0	15.31856883	0.0581	-0.3880
884	VEN	2	1	0	11	-10	0	0	0	15.32364094	0.2110	0.1509
885	VEN	2	1	0	19	-23	0	0	0	15.32380486	0.0034	0.0013
886	VEN	2	1	0	8	-5	0	0	0	15.32871304	-0.0014	-0.0197
887	VEN	2	1	0	16	-18	0	0	0	15.32887697	-0.0856	-0.0093
888	VEN	2	1	0	13	-13	0	0	0	15.33394908	-0.0132	-0.0406
889	VEN	2	1	0	18	-21	0	0	0	15.33918511	-0.0028	0.0142
890	VEN	2	1	0	15	-16	0	0	0	15.34425722	0.0448	-0.3060
891	MER	2	1	3	0	-4	0	0	0	15.34727257	0.0004	-0.0135
892	VEN	2	1	0	12	-11	0	0	0	15.34932933	0.1700	0.1119
893	VEN	2	1	0	20	-24	0	0	0	15.34949325	0.0029	0.0011
894	VEN	2	1	0	9	-6	0	0	0	15.35440144	-0.0028	-0.0159
895	VEN	2	1	0	17	-19	0	0	0	15.35456536	-0.0704	-0.0075
896	VEN	2	1	0	14	-14	0	0	0	15.35963747	-0.0127	-0.0341
897	VEN	2	1	0	11	-9	0	0	0	15.36470958	-0.0016	-0.0038
898	VEN	2	1	0	19	-22	0	0	0	15.36487350	-0.0023	0.0125
899	VEN	2	1	0	16	-17	0	0	0	15.36994561	0.0344	-0.2401
900	VEN	2	1	0	13	-12	0	0	0	15.37501772	0.1359	0.0829
901	VEN	2	1	0	21	-25	0	0	0	15.37518164	0.0024	0.0009
902	VEN	2	1	0	10	-7	0	0	0	15.38008983	-0.0035	-0.0126
903	VEN	2	1	0	18	-20	0	0	0	15.38025375	-0.0576	-0.0059
904	VEN	2	1	0	15	-15	0	0	0	15.38532586	-0.0118	-0.0284
905	MER	2	1	3	0	-3	0	0	0	15.38834121	0.0027	0.0000
906	VEN	2	1	0	12	-10	0	0	0	15.39039797	-0.0011	-0.0038
907	VEN	2	1	0	20	-23	0	0	0	15.39056189	-0.0018	0.0104
908	VEN	2	1	0	17	-18	0	0	0	15.39563400	0.0263	-0.1874
909	VEN	2	1	0	14	-13	0	0	0	15.40070611	0.1079	0.0614
910	VEN	2	1	0	22	-26	0	0	0	15.40087003	0.0020	0.0007
911	VEN	2	1	0	11	-8	0	0	0	15.40577822	-0.0037	-0.0100
912	VEN	2	1	0	19	-21	0	0	0	15.40594214	-0.0468	-0.0047
913	VEN	2	1	0	16	-16	0	0	0	15.41101425	-0.0106	-0.0235
914	VEN	2	1	0	13	-11	0	0	0	15.41608636	-0.0009	-0.0035
915	VEN	2	1	0	21	-24	0	0	0	15.41625028	-0.0014	0.0086
916	VEN	2	1	0	18	-19	0	0	0	15.42132239	0.0200	-0.1456
917	VEN	2	1	0	15	-14	0	0	0	15.42639450	0.0855	0.0454
918	MER	2	1	3	0	-2	0	0	0	15.42940985	0.0028	0.0035
919	VEN	2	1	0	12	-9	0	0	0	15.43146661	-0.0037	-0.0078
920	VEN	2	1	0	20	-22	0	0	0	15.43163053	-0.0378	-0.0037
921	MER	2	1	4	0	-6	0	0	0	15.43565100	0.0040	0.0014
922	VEN	2	1	0	17	-17	0	0	0	15.43670264	-0.0093	-0.0192
923	VEN	2	1	0	14	-12	0	0	0	15.44177475	-0.0007	-0.0032
924	VEN	2	1	0	22	-25	0	0	0	15.44193867	-0.0011	0.0071
925	VEN	2	1	0	19	-20	0	0	0	15.44701078	0.0152	-0.1127
926	VEN	2	1	0	16	-15	0	0	0	15.45208289	0.0672	0.0336
927	VEN	2	1	0	13	-10	0	0	0	15.45715500	-0.0034	-0.0060
928	VEN	2	1	0	21	-23	0	0	0	15.45731892	-0.0304	-0.0029
929	VEN	2	1	0	18	-18	0	0	0	15.46239103	-0.0080	-0.0157
930	VEN	2	1	0	15	-13	0	0	0	15.46746314	-0.0005	-0.0029
931	VEN	2	1	0	23	-26	0	0	0	15.46762706	-0.0009	0.0058
932	VEN	2	1	0	20	-21	0	0	0	15.47269917	0.0115	-0.0869
933	MER	2	1	4	0	-5	0	0	0	15.47671964	-0.0001	-0.0059

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
934	VEN	2	1	0	17	-16	0	0	0	15.47777128	0.0525	0.0249
935	VEN	2	1	0	14	-11	0	0	0	15.48284339	-0.0031	-0.0046
936	VEN	2	1	0	22	-24	0	0	0	15.48300731	-0.0243	-0.0023
937	VEN	2	1	0	19	-19	0	0	0	15.48807942	-0.0068	-0.0127
938	VEN	2	1	0	16	-14	0	0	0	15.49315153	-0.0004	-0.0025
939	VEN	2	1	0	24	-27	0	0	0	15.49331545	-0.0007	0.0048
940	VEN	2	1	0	21	-22	0	0	0	15.49838756	0.0086	-0.0668
941	VEN	2	1	0	18	-17	0	0	0	15.50345967	0.0409	0.0185
942	VEN	2	1	0	15	-12	0	0	0	15.50853178	-0.0027	-0.0035
943	VEN	2	1	0	23	-25	0	0	0	15.50869570	-0.0194	-0.0018
944	VEN	2	1	0	20	-20	0	0	0	15.51376781	-0.0057	-0.0103
945	MER	2	1	4	0	-4	0	0	0	15.51778828	0.0029	0.0000
946	VEN	2	1	0	17	-15	0	0	0	15.51883992	-0.0004	-0.0021
947	VEN	2	1	0	25	-28	0	0	0	15.51900385	-0.0006	0.0039
948	VEN	2	1	0	22	-23	0	0	0	15.52407595	0.0065	-0.0512
949	VEN	2	1	0	19	-18	0	0	0	15.52914806	0.0317	0.0137
950	VEN	2	1	0	16	-13	0	0	0	15.53422017	-0.0023	-0.0027
951	VEN	2	1	0	24	-26	0	0	0	15.53438409	-0.0154	-0.0014
952	VEN	2	1	0	21	-21	0	0	0	15.53945620	-0.0048	-0.0082
953	VEN	2	1	0	26	-29	0	0	0	15.54469224	-0.0003	0.0029
954	VEN	2	1	0	23	-24	0	0	0	15.54976434	0.0049	-0.0391
955	VEN	2	1	0	20	-19	0	0	0	15.55483645	0.0245	0.0102
956	MER	2	1	4	0	-3	0	0	0	15.55885692	0.0016	0.0017
957	VEN	2	1	0	17	-14	0	0	0	15.55990856	-0.0020	-0.0020
958	VEN	2	1	0	25	-27	0	0	0	15.56007249	-0.0121	-0.0011
959	VEN	2	1	0	22	-22	0	0	0	15.56514459	-0.0039	-0.0066
960	VEN	2	1	0	24	-25	0	0	0	15.57545273	0.0036	-0.0298
961	VEN	2	1	0	21	-20	0	0	0	15.58052484	0.0189	0.0076
962	VEN	2	1	0	18	-15	0	0	0	15.58559695	-0.0016	-0.0015
963	VEN	2	1	0	26	-28	0	0	0	15.58576088	-0.0096	-0.0008
964	VEN	2	1	0	23	-23	0	0	0	15.59083298	-0.0032	-0.0052
965	VEN	2	1	0	25	-26	0	0	0	15.60114113	0.0027	-0.0227
966	MER	2	1	5	0	-6	0	0	0	15.60616671	-0.0002	-0.0023
967	VEN	2	1	0	22	-21	0	0	0	15.60621323	0.0145	0.0056
968	VEN	2	1	0	27	-29	0	0	0	15.61144927	-0.0075	-0.0009
969	VEN	2	1	0	24	-24	0	0	0	15.61652137	-0.0026	-0.0042
970	VEN	2	1	0	26	-27	0	0	0	15.62682952	0.0020	-0.0172
971	VEN	2	1	0	23	-22	0	0	0	15.63190162	0.0111	0.0042
972	VEN	2	1	0	28	-30	0	0	0	15.63713766	-0.0059	-0.0007
973	VEN	2	1	0	25	-25	0	0	0	15.64220977	-0.0021	-0.0033
974	VEN	2	1	0	27	-28	0	0	0	15.65251791	0.0015	-0.0130
975	VEN	2	1	0	24	-23	0	0	0	15.65759001	0.0085	0.0031
976	VEN	2	1	0	29	-31	0	0	0	15.66282605	-0.0046	-0.0005
977	VEN	2	1	0	26	-26	0	0	0	15.66789816	-0.0017	-0.0026
978	VEN	2	1	0	28	-29	0	0	0	15.67820630	0.0011	-0.0098
979	VEN	2	1	0	25	-24	0	0	0	15.68327841	0.0065	0.0023
980	VEN	2	1	0	30	-32	0	0	0	15.68851444	-0.0036	-0.0004
981	VEN	2	1	0	27	-27	0	0	0	15.69358655	-0.0013	-0.0020
982	VEN	2	1	0	29	-30	0	0	0	15.70389469	0.0008	-0.0074
983	VEN	2	1	0	26	-25	0	0	0	15.70896680	0.0049	0.0018
984	VEN	2	1	0	31	-33	0	0	0	15.71420283	-0.0028	-0.0003
985	VEN	2	1	0	30	-31	0	0	0	15.72958308	0.0006	-0.0056
986	VEN	2	1	0	27	-26	0	0	0	15.73465519	0.0038	0.0013
987	VEN	2	1	0	31	-32	0	0	0	15.75527147	0.0004	-0.0042
988	VEN	2	1	0	28	-27	0	0	0	15.76034358	0.0029	0.0010

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
989	VEN	2	1	0	32	-33	0	0	0	15.78095986	0.0003	-0.0031
990	VEN	2	2	0	-17	17	0	0	0	29.56329736	0.0039	-0.0041
991	VEN	2	2	0	-16	16	0	0	0	29.58898575	0.0056	-0.0056
992	VEN	2	2	0	-15	15	0	0	0	29.61467414	0.0082	-0.0075
993	VEN	2	2	0	-14	14	0	0	0	29.64036253	0.0118	-0.0101
994	VEN	2	2	0	-17	19	0	0	0	29.64543464	0.0057	-0.0026
995	VEN	2	2	0	-10	8	0	0	0	29.66097881	-0.0065	-0.0012
996	VEN	2	2	0	-13	13	0	0	0	29.66605092	0.0171	-0.0136
997	VEN	2	2	0	-16	18	0	0	0	29.67112303	0.0077	-0.0035
998	VEN	2	2	0	-9	7	0	0	0	29.68666720	-0.0086	-0.0017
999	VEN	2	2	0	-12	12	0	0	0	29.69173931	0.0247	-0.0182
1000	VEN	2	2	0	-15	17	0	0	0	29.69681142	0.0104	-0.0047
1001	VEN	2	2	0	-13	14	0	0	0	29.70711956	0.0033	0.0052
1002	VEN	2	2	0	-8	6	0	0	0	29.71235560	-0.0114	-0.0025
1003	VEN	2	2	0	-11	11	0	0	0	29.71742770	0.0359	-0.0243
1004	VEN	2	2	0	-14	16	0	0	0	29.72249981	0.0141	-0.0063
1005	VEN	2	2	0	-12	13	0	0	0	29.73280795	0.0040	0.0068
1006	VEN	2	2	0	-7	5	0	0	0	29.73804399	-0.0150	-0.0035
1007	MER	2	2	-2	0	2	0	0	0	29.74110586	0.0080	-0.0012
1008	VEN	2	2	0	-10	10	0	0	0	29.74311609	0.0521	-0.0323
1009	VEN	2	2	0	-13	15	0	0	0	29.74818820	0.0190	-0.0083
1010	VEN	2	2	0	-8	7	0	0	0	29.75342424	-0.0036	-0.0051
1011	VEN	2	2	0	-11	12	0	0	0	29.75849634	0.0049	0.0089
1012	VEN	2	2	0	-6	4	0	0	0	29.76373238	-0.0197	-0.0048
1013	VEN	2	2	0	-9	9	0	0	0	29.76880448	0.0758	-0.0429
1014	VEN	2	2	0	-12	14	0	0	0	29.77387659	0.0257	-0.0111
1015	VEN	2	2	0	-7	6	0	0	0	29.77911263	-0.0053	-0.0079
1016	VEN	2	2	0	-10	11	0	0	0	29.78418473	0.0059	0.0116
1017	VEN	2	2	0	-13	16	0	0	0	29.78925684	0.0023	0.0057
1018	VEN	2	2	0	-5	3	0	0	0	29.78942077	-0.0254	-0.0075
1019	VEN	2	2	0	-8	8	0	0	0	29.79449288	0.1108	-0.0567
1020	VEN	2	2	0	-11	13	0	0	0	29.79956498	0.0341	-0.0154
1021	VEN	2	2	0	-3	0	0	0	0	29.79972891	-0.0010	0.0049
1022	VEN	2	2	0	-6	5	0	0	0	29.80480102	-0.0076	-0.0123
1023	VEN	2	2	0	-9	10	0	0	0	29.80987312	0.0070	0.0150
1024	VEN	2	2	0	-12	15	0	0	0	29.81494523	0.0029	0.0071
1025	VEN	2	2	0	-4	2	0	0	0	29.81510916	-0.0330	-0.0101
1026	VEN	2	2	0	-7	7	0	0	0	29.82018127	0.1624	-0.0745
1027	VEN	2	2	0	-10	12	0	0	0	29.82525337	0.0457	-0.0203
1028	VEN	2	2	0	-2	-1	0	0	0	29.82541730	-0.0015	0.0064
1029	VEN	2	2	0	-5	4	0	0	0	29.83048941	-0.0107	-0.0193
1030	VEN	2	2	0	-8	9	0	0	0	29.83556152	0.0081	0.0192
1031	VEN	2	2	0	-11	14	0	0	0	29.84063362	0.0035	0.0088
1032	VEN	2	2	0	-3	1	0	0	0	29.84079755	-0.0426	-0.0134
1033	VEN	2	2	0	-6	6	0	0	0	29.84586966	0.2392	-0.0973
1034	VEN	2	2	0	-9	11	0	0	0	29.85094176	0.0610	-0.0268
1035	VEN	2	2	0	-1	-2	0	0	0	29.85110569	-0.0021	0.0084
1036	VEN	2	2	0	-4	3	0	0	0	29.85617780	-0.0149	-0.0305
1037	VEN	2	2	0	-7	8	0	0	0	29.86124991	0.0092	0.0243
1038	VEN	2	2	0	-10	13	0	0	0	29.86632201	0.0043	0.0109
1039	VEN	2	2	0	-2	0	0	0	0	29.86648594	-0.0544	-0.0174
1040	MER	2	2	-1	0	1	0	0	0	29.87055293	0.0270	-0.0024
1041	VEN	2	2	0	-5	5	0	0	0	29.87155805	0.3549	-0.1262
1042	VEN	2	2	0	-8	10	0	0	0	29.87663016	0.0811	-0.0352
1043	VEN	2	2	0	0	-3	0	0	0	29.87679408	-0.0028	0.0106

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [°/h]	C_i	S_i
1044	VEN	2	2	0	-3	2	0	0	0	29.88186619	-0.0206	-0.0488
1045	VEN	2	2	0	-6	7	0	0	0	29.88693830	0.0101	0.0304
1046	VEN	2	2	0	-9	12	0	0	0	29.89201040	0.0052	0.0133
1047	VEN	2	2	0	-1	-1	0	0	0	29.89217433	-0.0684	-0.0219
1048	VEN	2	2	0	-4	4	0	0	0	29.89724644	0.5317	-0.1618
1049	VEN	2	2	0	-7	9	0	0	0	29.90231855	0.1073	-0.0461
1050	VEN	2	2	0	1	-4	0	0	0	29.90248247	-0.0035	0.0130
1051	VEN	2	2	0	-2	1	0	0	0	29.90755458	-0.0277	-0.0796
1052	MER	2	2	-1	0	2	0	0	0	29.91162157	-0.0020	-0.0044
1053	VEN	2	2	0	-5	6	0	0	0	29.91262669	0.0108	0.0374
1054	VEN	2	2	0	-8	11	0	0	0	29.91769880	0.0062	0.0160
1055	MER	2	2	0	0	-2	0	0	0	29.91786272	-0.0052	-0.0043
1056	VEN	2	2	0	0	-2	0	0	0	29.91786272	-0.0840	-0.0257
1057	VEN	2	2	0	-3	3	0	0	0	29.92293483	0.8081	-0.2045
1058	VEN	2	2	0	-6	8	0	0	0	29.92800694	0.1409	-0.0600
1059	VEN	2	2	0	2	-5	0	0	0	29.92817086	-0.0041	0.0152
1060	VEN	2	2	0	-1	0	0	0	0	29.93324297	-0.0359	-0.1339
1061	VEN	2	2	0	-4	5	0	0	0	29.93831508	0.0109	0.0448
1062	MAR	2	2	0	0	-3	3	0	0	29.94230297	0.0059	0.0010
1063	VEN	2	2	0	-7	10	0	0	0	29.94338719	0.0074	0.0191
1064	VEN	2	2	0	1	-3	0	0	0	29.94355111	-0.0999	-0.0277
1065	VEN	2	2	0	-2	2	0	0	0	29.94862322	1.2578	-0.2527
1066	MER	2	2	-1	0	3	0	0	0	29.95269021	0.0053	-0.0001
1067	VEN	2	2	0	-5	7	0	0	0	29.95369533	0.1836	-0.0776
1068	VEN	2	2	0	3	-6	0	0	0	29.95385925	-0.0045	0.0172
1069	MER	2	2	0	0	-1	0	0	0	29.95893136	-0.0093	0.0293
1070	VEN	2	2	0	0	-1	0	0	0	29.95893136	-0.0467	-0.2592
1071	MAR	2	2	0	0	-1	0	0	0	29.95893136	0.0047	0.0031
1072	MAR	2	2	0	0	-2	2	0	0	29.96153531	0.0100	0.0016
1073	JUP	2	2	0	0	-1	0	1	0	29.96239509	0.0096	0.0005
1074	VEN	2	2	0	-3	4	0	0	0	29.96400347	0.0103	0.0518
1075	MAR	2	2	0	0	-3	4	0	0	29.96413926	0.0047	-0.0013
1076	VEN	2	2	0	-6	9	0	0	0	29.96907558	0.0088	0.0222
1077	VEN	2	2	0	2	-4	0	0	0	29.96923950	-0.1143	-0.0280
1078	JUP	2	2	0	0	-1	0	3	0	29.96932254	0.0056	0.0007
1079	VEN	2	2	0	-1	1	0	0	0	29.97431161	2.0528	-0.3004
1080	MAR	2	2	0	0	1	-3	0	0	29.97555975	0.0034	0.0058
1081	MAR	2	2	0	0	0	-1	0	0	29.97816370	0.0093	0.0061
1082	VEN	2	2	0	-4	6	0	0	0	29.97938372	0.2366	-0.0998
1083	VEN	2	2	0	4	-7	0	0	0	29.97954764	-0.0047	0.0188
1084	MAR	2	2	0	0	-1	1	0	0	29.98076766	0.0171	0.0023
1085	MAR	2	2	0	0	-2	3	0	0	29.98337161	0.0068	-0.0017
1086	VEN	2	2	0	-7	11	0	0	0	29.98445583	-0.0016	-0.0054
1087	VEN	2	2	0	1	-2	0	0	0	29.98461975	-0.0589	-0.4148
1088	VEN	2	2	0	9	-15	0	0	0	29.98478368	-0.0020	0.0038
1089	MAR	2	2	0	0	-3	5	0	0	29.98597556	0.0062	-0.0006
1090	VEN	2	2	0	-2	3	0	0	0	29.98969186	0.0089	0.0558
1091	MAR	2	2	0	0	3	-6	0	0	29.99218815	0.0006	0.0093
1092	VEN	2	2	0	-5	8	0	0	0	29.99476397	0.0103	0.0253
1093	MAR	2	2	0	0	2	-4	0	0	29.99479210	0.0085	0.0142
1094	VEN	2	2	0	3	-5	0	0	0	29.99492789	-0.1261	-0.0267
1095	JUP	2	2	0	0	0	0	-1	0	29.99653627	0.0066	-0.0045
1096	MAR	2	2	0	0	1	-2	0	0	29.99739605	0.0190	0.0121
1097	MER	2	2	0	0	0	0	0	0	30.00000000	0.1206	-0.0015
1098	VEN	2	2	0	0	0	0	0	0	30.00000000	3.9734	-0.3198

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [°/h]	C_i	S_i
1099	MAR	2	2	0	0	0	0	0	0	30.00000000	0.0295	0.0034
1100	JUP	2	2	0	0	0	0	0	0	30.00000000	0.0594	0.0026
1101	MAR	2	2	0	0	-1	2	0	0	30.00260395	0.0095	-0.0021
1102	JUP	2	2	0	0	0	0	1	0	30.00346373	0.0078	0.0008
1103	VEN	2	2	0	-3	5	0	0	0	30.00507211	0.3003	-0.1272
1104	MAR	2	2	0	0	-2	4	0	0	30.00520790	0.0086	-0.0004
1105	VEN	2	2	0	5	-8	0	0	0	30.00523603	-0.0047	0.0199
1106	JUP	2	2	0	0	0	0	2	0	30.00692745	0.0249	0.0033
1107	MAR	2	2	0	0	-3	6	0	0	30.00781185	0.0049	-0.0020
1108	MAR	2	2	0	0	5	-9	0	0	30.00881654	-0.0030	0.0068
1109	VEN	2	2	0	-6	10	0	0	0	30.01014422	-0.0024	-0.0070
1110	VEN	2	2	0	2	-3	0	0	0	30.01030814	-0.0689	-0.5611
1111	JUP	2	2	0	0	0	0	3	0	30.01039118	0.0051	0.0017
1112	VEN	2	2	0	10	-16	0	0	0	30.01047207	-0.0027	0.0051
1113	MAR	2	2	0	0	4	-7	0	0	30.01142049	0.0011	0.0158
1114	MAR	2	2	0	0	3	-5	0	0	30.01402444	0.0163	0.0266
1115	VEN	2	2	0	-1	2	0	0	0	30.01538025	0.0071	0.0511
1116	MAR	2	2	0	0	2	-3	0	0	30.01662839	0.0450	0.0272
1117	MAR	2	2	0	0	1	-1	0	0	30.01923234	0.0531	0.0046
1118	VEN	2	2	0	-4	7	0	0	0	30.02045236	0.0118	0.0279
1119	VEN	2	2	0	4	-6	0	0	0	30.02061628	-0.1341	-0.0243
1120	MAR	2	2	0	0	0	1	0	0	30.02183630	0.0127	-0.0024
1121	MAR	2	2	0	0	-1	3	0	0	30.02444025	0.0117	0.0000
1122	VEN	2	2	0	1	-1	0	0	0	30.02568839	5.3175	-0.3162
1123	MAR	2	2	0	0	-2	5	0	0	30.02704420	0.0061	-0.0023
1124	MAR	2	2	0	0	6	-10	0	0	30.02804889	-0.0043	0.0097
1125	MAR	2	2	0	0	5	-8	0	0	30.03065284	0.0016	0.0228
1126	JUP	2	2	0	0	1	0	-3	0	30.03067746	0.0057	-0.0024
1127	VEN	2	2	0	-2	4	0	0	0	30.03076050	0.3727	-0.1604
1128	VEN	2	2	0	6	-9	0	0	0	30.03092442	-0.0045	0.0205
1129	MAR	2	2	0	0	4	-6	0	0	30.03325679	0.0245	0.0396
1130	JUP	2	2	0	0	1	0	-2	0	30.03414119	0.0590	-0.0111
1131	VEN	2	2	0	-5	9	0	0	0	30.03583261	-0.0031	-0.0085
1132	MAR	2	2	0	0	3	-4	0	0	30.03586074	0.0728	0.0428
1133	VEN	2	2	0	3	-4	0	0	0	30.03599653	-0.0758	-0.6744
1134	VEN	2	2	0	11	-17	0	0	0	30.03616046	-0.0033	0.0061
1135	JUP	2	2	0	0	1	0	-1	0	30.03760491	0.4054	0.0115
1136	MAR	2	2	0	0	2	-2	0	0	30.03846469	0.1152	0.0059
1137	SAT	2	2	0	0	1	0	0	-1	30.03967289	0.0103	0.0006
1138	MER	2	2	0	0	1	0	0	0	30.04106864	-0.0025	-0.0090
1139	VEN	2	2	0	0	1	0	0	0	30.04106864	0.0093	0.0156
1140	MAR	2	2	0	0	1	0	0	0	30.04106864	0.0153	-0.0020
1141	JUP	2	2	0	0	1	0	0	0	30.04106864	0.0262	0.0031
1142	MAR	2	2	0	0	0	2	0	0	30.04367259	0.0154	0.0006
1143	JUP	2	2	0	0	1	0	1	0	30.04453237	0.1029	0.0132
1144	MAR	2	2	0	0	8	-13	0	0	30.04467728	-0.0047	0.0037
1145	VEN	2	2	0	-3	6	0	0	0	30.04614075	0.0133	0.0295
1146	MAR	2	2	0	0	-1	4	0	0	30.04627654	0.0071	-0.0026
1147	VEN	2	2	0	5	-7	0	0	0	30.04630467	-0.1382	-0.0213
1148	MAR	2	2	0	0	7	-11	0	0	30.04728123	-0.0055	0.0124
1149	MER	2	2	1	0	-3	0	0	0	30.04730979	-0.0074	-0.0058
1150	JUP	2	2	0	0	1	0	2	0	30.04799609	0.0144	0.0048
1151	MAR	2	2	0	0	6	-9	0	0	30.04988518	0.0022	0.0292
1152	VEN	2	2	0	2	-2	0	0	0	30.05137678	5.9664	-0.2966
1153	JUP	2	2	0	0	1	0	3	0	30.05145982	0.0048	0.0016

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [°/h]	C_i	S_i
1154	MAR	2	2	0	0	5	-7	0	0	30.05248913	0.0314	0.0503
1155	MAR	2	2	0	0	4	-5	0	0	30.05509308	0.0923	0.0536
1156	VEN	2	2	0	-1	3	0	0	0	30.05644889	0.4460	-0.1994
1157	VEN	2	2	0	7	-10	0	0	0	30.05661281	-0.0042	0.0205
1158	MAR	2	2	0	0	3	-3	0	0	30.05769703	0.1452	0.0062
1159	MAR	2	2	0	0	2	-1	0	0	30.06030098	0.0127	0.0009
1160	VEN	2	2	0	-4	8	0	0	0	30.06152100	-0.0036	-0.0097
1161	VEN	2	2	0	4	-5	0	0	0	30.06168492	-0.0791	-0.7458
1162	VEN	2	2	0	12	-18	0	0	0	30.06184885	-0.0037	0.0067
1163	MAR	2	2	0	0	1	1	0	0	30.06290494	0.0193	0.0017
1164	MAR	2	2	0	0	9	-14	0	0	30.06390963	-0.0056	0.0044
1165	JUP	2	2	0	0	2	0	-5	0	30.06481865	0.0069	-0.0045
1166	MAR	2	2	0	0	0	3	0	0	30.06550889	0.0079	-0.0027
1167	MAR	2	2	0	0	8	-12	0	0	30.06651358	-0.0065	0.0147
1168	VEN	2	2	0	1	0	0	0	0	30.06675703	0.0112	-0.0397
1169	JUP	2	2	0	0	2	0	-4	0	30.06828237	0.0768	-0.0310
1170	MAR	2	2	0	0	7	-10	0	0	30.06911753	0.0025	0.0340
1171	MAR	2	2	0	0	6	-8	0	0	30.07172148	0.0356	0.0569
1172	JUP	2	2	0	0	2	0	-3	0	30.07174610	0.6861	-0.1325
1173	VEN	2	2	0	-2	5	0	0	0	30.07182914	0.0146	0.0294
1174	VEN	2	2	0	6	-8	0	0	0	30.07199306	-0.1383	-0.0179
1175	MAR	2	2	0	0	5	-6	0	0	30.07432543	0.1003	0.0580
1176	JUP	2	2	0	0	2	0	-2	0	30.07520983	4.0670	0.0345
1177	MAR	2	2	0	0	4	-4	0	0	30.07692938	0.1457	0.0062
1178	VEN	2	2	0	3	-3	0	0	0	30.07706517	6.0605	-0.2676
1179	SAT	2	2	0	0	2	0	0	-3	30.07795004	-0.0008	-0.0355
1180	JUP	2	2	0	0	2	0	-1	0	30.07867355	-0.0556	-0.0357
1181	SAT	2	2	0	0	2	0	0	-2	30.07934579	0.1914	0.0044
1182	MAR	2	2	0	0	3	-2	0	0	30.07953333	0.0049	0.0057
1183	SAT	2	2	0	0	2	0	0	-1	30.08074153	0.0007	-0.0067
1184	MER	2	2	0	0	2	0	0	0	30.08213728	0.0098	-0.0007
1185	VEN	2	2	0	0	2	0	0	0	30.08213728	0.4954	-0.2427
1186	MAR	2	2	0	0	2	0	0	0	30.08213728	0.0223	0.0033
1187	JUP	2	2	0	0	2	0	0	0	30.08213728	0.3571	0.0431
1188	SAT	2	2	0	0	2	0	0	0	30.08213728	0.0151	0.0032
1189	VEN	2	2	0	8	-11	0	0	0	30.08230120	-0.0039	0.0200
1190	MAR	2	2	0	0	10	-15	0	0	30.08314197	-0.0064	0.0050
1191	MAR	2	2	0	0	1	2	0	0	30.08474123	0.0080	-0.0024
1192	JUP	2	2	0	0	2	0	1	0	30.08560101	0.0263	0.0083
1193	MAR	2	2	0	0	9	13	0	0	30.08574592	-0.0072	0.0163
1194	VEN	2	2	0	-3	7	0	0	0	30.08720939	-0.0043	-0.0106
1195	VEN	2	2	0	5	-6	0	0	0	30.08737331	-0.0790	-0.7761
1196	VEN	2	2	0	13	-19	0	0	0	30.08753724	-0.0039	0.0070
1197	MAR	2	2	0	0	8	-11	0	0	30.08834987	0.0027	0.0366
1198	MER	2	2	1	0	-2	0	0	0	30.08837843	-0.0114	0.0355
1199	JUP	2	2	0	0	2	0	2	0	30.08906473	0.0090	0.0027
1200	MAR	2	2	0	0	7	-9	0	0	30.09095382	0.0370	0.0590
1201	VEN	2	2	0	2	-1	0	0	0	30.09244542	0.0066	-0.0909
1202	MAR	2	2	0	0	6	-7	0	0	30.09355777	0.0982	0.0569
1203	MAR	2	2	0	0	5	-5	0	0	30.09616172	0.1282	0.0061
1204	VEN	2	2	0	-1	4	0	0	0	30.09751753	0.0154	0.0269
1205	VEN	2	2	0	7	-9	0	0	0	30.09768145	-0.1350	-0.0146
1206	MAR	2	2	0	0	4	-3	0	0	30.09876567	-0.0038	0.0109
1207	MAR	2	2	0	0	3	-1	0	0	30.10136962	0.0193	0.0042
1208	MAR	2	2	0	0	11	-16	0	0	30.10237431	-0.0069	0.0054

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
1209	JUP	2	2	0	0	3	0	-6	0	30.10242356	0.0074	-0.0048
1210	VEN	2	2	0	4	-4	0	0	0	30.10275356	5.7776	-0.2341
1211	MAR	2	2	0	0	2	1	0	0	30.10397358	0.0071	-0.0018
1212	MAR	2	2	0	0	10	-14	0	0	30.10497827	-0.0075	0.0171
1213	JUP	2	2	0	0	3	0	-5	0	30.10588729	0.0667	-0.0273
1214	MAR	2	2	0	0	9	-12	0	0	30.10758222	0.0027	0.0372
1215	VEN	2	2	0	1	1	0	0	0	30.10782567	0.4089	-0.2858
1216	VEN	2	2	0	9	-12	0	0	0	30.10798960	-0.0034	0.0191
1217	JUP	2	2	0	0	3	0	-4	0	30.10935101	0.4583	-0.0898
1218	MAR	2	2	0	0	8	-10	0	0	30.11018617	0.0358	0.0573
1219	MAR	2	2	0	0	7	-8	0	0	30.11279012	0.0889	0.0518
1220	JUP	2	2	0	0	3	0	-3	0	30.11281474	1.9108	0.0126
1221	VEN	2	2	0	-2	6	0	0	0	30.11289778	-0.0052	-0.0111
1222	VEN	2	2	0	6	-7	0	0	0	30.11306170	-0.0762	-0.7711
1223	VEN	2	2	0	14	-20	0	0	0	30.11322563	-0.0039	0.0069
1224	MAR	2	2	0	0	6	-6	0	0	30.11539407	0.1030	0.0059
1225	JUP	2	2	0	0	3	0	-2	0	30.11627847	-0.0709	-0.0277
1226	SAT	2	2	0	0	3	0	0	-4	30.11762294	-0.0003	-0.0131
1227	MAR	2	2	0	0	5	-4	0	0	30.11799802	-0.0109	0.0146
1228	VEN	2	2	0	3	-2	0	0	0	30.11813381	-0.0017	-0.1302
1229	SAT	2	2	0	0	3	0	0	-3	30.11901868	0.0494	0.0013
1230	JUP	2	2	0	0	3	0	-1	0	30.11974219	0.1001	0.0197
1231	MAR	2	2	0	0	4	-2	0	0	30.12060197	0.0156	0.0042
1232	MAR	2	2	0	0	12	-17	0	0	30.12160666	-0.0071	0.0057
1233	VEN	2	2	0	0	3	0	0	0	30.12320592	0.0153	0.0213
1234	VEN	2	2	0	8	-10	0	0	0	30.12336984	-0.1290	-0.0116
1235	MAR	2	2	0	0	11	-15	0	0	30.12421061	-0.0074	0.0172
1236	MAR	2	2	0	0	10	-13	0	0	30.12681456	0.0025	0.0359
1237	VEN	2	2	0	5	-5	0	0	0	30.12844195	5.2715	-0.2000
1238	MAR	2	2	0	0	9	-11	0	0	30.12941851	0.0328	0.0527
1239	MER	2	2	1	0	-1	0	0	0	30.12944707	0.1069	-0.0005
1240	MAR	2	2	0	0	8	-9	0	0	30.13202246	0.0758	0.0446
1241	VEN	2	2	0	2	0	0	0	0	30.13351406	0.3066	-0.3018
1242	VEN	2	2	0	10	-13	0	0	0	30.13367799	-0.0030	0.0180
1243	MAR	2	2	0	0	7	-7	0	0	30.13462641	0.0771	0.0055
1244	MAR	2	2	0	0	6	-5	0	0	30.13723036	-0.0152	0.0164
1245	VEN	2	2	0	-1	5	0	0	0	30.13858617	-0.0067	-0.0110
1246	VEN	2	2	0	7	-8	0	0	0	30.13875009	-0.0714	-0.7390
1247	VEN	2	2	0	15	-21	0	0	0	30.13891402	-0.0037	0.0066
1248	MAR	2	2	0	0	5	-3	0	0	30.13983431	0.0122	0.0034
1249	JUP	2	2	0	0	4	0	-7	0	30.14002847	0.0047	-0.0031
1250	MAR	2	2	0	0	13	-18	0	0	30.14083900	-0.0071	0.0056
1251	MAR	2	2	0	0	12	-16	0	0	30.14344295	-0.0073	0.0165
1252	JUP	2	2	0	0	4	0	-6	0	30.14349220	0.0355	-0.0146
1253	VEN	2	2	0	4	-3	0	0	0	30.14382220	-0.0107	-0.1557
1254	MAR	2	2	0	0	11	-14	0	0	30.14604691	0.0022	0.0332
1255	JUP	2	2	0	0	4	0	-5	0	30.14695593	0.1975	-0.0386
1256	MAR	2	2	0	0	10	-12	0	0	30.14865086	0.0286	0.0464
1257	VEN	2	2	0	1	2	0	0	0	30.14889431	0.0139	0.0141
1258	VEN	2	2	0	9	-11	0	0	0	30.14905824	-0.1208	-0.0090
1259	JUP	2	2	0	0	4	0	-4	0	30.15041965	0.6320	0.0068
1260	MAR	2	2	0	0	9	-10	0	0	30.15125481	0.0614	0.0367
1261	MAR	2	2	0	0	8	-8	0	0	30.15385876	0.0542	0.0051
1262	JUP	2	2	0	0	4	0	-3	0	30.15388338	-0.0424	0.0024
1263	VEN	2	2	0	6	-6	0	0	0	30.15413034	4.6576	-0.1674

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
1264	MAR	2	2	0	0	7	-6	0	0	30.15646271	-0.0168	0.0165
1265	JUP	2	2	0	0	4	0	-2	0	30.15734711	0.0242	0.0062
1266	SAT	2	2	0	0	4	0	0	-4	30.15869158	0.0090	0.0002
1267	MAR	2	2	0	0	6	-4	0	0	30.15906666	0.0094	0.0022
1268	VEN	2	2	0	3	-1	0	0	0	30.15920245	0.2146	-0.2949
1269	VEN	2	2	0	11	-14	0	0	0	30.15936638	-0.0026	0.0167
1270	MAR	2	2	0	0	14	-19	0	0	30.16007135	-0.0068	0.0053
1271	MAR	2	2	0	0	13	-17	0	0	30.16267530	-0.0068	0.0153
1272	VEN	2	2	0	0	4	0	0	0	30.16427456	-0.0090	-0.0102
1273	VEN	2	2	0	8	-9	0	0	0	30.16443848	-0.0653	-0.6881
1274	VEN	2	2	0	16	-22	0	0	0	30.16460241	-0.0035	0.0061
1275	MAR	2	2	0	0	12	-15	0	0	30.16527925	0.0019	0.0296
1276	MAR	2	2	0	0	11	-13	0	0	30.16788320	0.0240	0.0393
1277	VEN	2	2	0	5	-4	0	0	0	30.16951059	-0.0186	-0.1684
1278	MAR	2	2	0	0	10	-11	0	0	30.17048715	0.0475	0.0290
1279	MER	2	2	1	0	0	0	0	0	30.17051571	-0.0007	-0.0064
1280	MAR	2	2	0	0	9	-9	0	0	30.17309110	0.0357	0.0046
1281	VEN	2	2	0	2	1	0	0	0	30.17458270	0.0111	0.0089
1282	VEN	2	2	0	10	-12	0	0	0	30.17474663	-0.1112	-0.0067
1283	MAR	2	2	0	0	8	-7	0	0	30.17569505	-0.0165	0.0152
1284	MER	2	2	2	0	-4	0	0	0	30.17675686	-0.0070	-0.0054
1285	MAR	2	2	0	0	7	-5	0	0	30.17829900	0.0072	0.0009
1286	MAR	2	2	0	0	15	-20	0	0	30.17930369	-0.0064	0.0049
1287	VEN	2	2	0	7	-7	0	0	0	30.17981873	4.0155	-0.1378
1288	JUP	2	2	0	0	5	0	-7	0	30.18109711	0.0148	-0.0061
1289	MAR	2	2	0	0	14	-18	0	0	30.18190764	-0.0062	0.0138
1290	MAR	2	2	0	0	13	-16	0	0	30.18451159	0.0015	0.0256
1291	JUP	2	2	0	0	5	0	-6	0	30.18456084	0.0692	-0.0132
1292	VEN	2	2	0	4	-2	0	0	0	30.18489084	0.1400	-0.2728
1293	VEN	2	2	0	12	-15	0	0	0	30.18505477	-0.0023	0.0153
1294	MAR	2	2	0	0	12	-14	0	0	30.18711555	0.0194	0.0322
1295	JUP	2	2	0	0	5	0	-5	0	30.18802457	0.1789	0.0038
1296	MAR	2	2	0	0	11	-12	0	0	30.18971950	0.0354	0.0222
1297	VEN	2	2	0	1	3	0	0	0	30.18996295	-0.0113	-0.0081
1298	VEN	2	2	0	9	-10	0	0	0	30.19012688	-0.0583	-0.6248
1299	JUP	2	2	0	0	5	0	-4	0	30.19148829	-0.0179	0.0054
1300	MAR	2	2	0	0	10	-10	0	0	30.19232345	0.0219	0.0040
1301	MAR	2	2	0	0	9	-8	0	0	30.19492740	-0.0148	0.0132
1302	JUP	2	2	0	0	5	0	-3	0	30.19495202	0.0057	0.0014
1303	VEN	2	2	0	6	-5	0	0	0	30.19519898	-0.0245	-0.1707
1304	MAR	2	2	0	0	8	-6	0	0	30.19753135	0.0055	-0.0002
1305	MAR	2	2	0	0	16	-21	0	0	30.19853604	-0.0058	0.0045
1306	VEN	2	2	0	3	0	0	0	0	30.20027109	0.0082	0.0054
1307	VEN	2	2	0	11	-13	0	0	0	30.20043502	-0.1009	-0.0048
1308	MAR	2	2	0	0	15	-19	0	0	30.20113999	-0.0055	0.0121
1309	MAR	2	2	0	0	14	-17	0	0	30.20374394	0.0012	0.0215
1310	VEN	2	2	0	8	-8	0	0	0	30.20550712	3.3955	-0.1118
1311	MAR	2	2	0	0	13	-15	0	0	30.20634789	0.0151	0.0256
1312	MAR	2	2	0	0	12	-13	0	0	30.20895184	0.0254	0.0164
1313	VEN	2	2	0	5	-3	0	0	0	30.21057923	0.0833	-0.2424
1314	VEN	2	2	0	13	-16	0	0	0	30.21074316	-0.0020	0.0139
1315	MAR	2	2	0	0	11	-11	0	0	30.21155579	0.0123	0.0034
1316	MAR	2	2	0	0	10	-9	0	0	30.21415974	-0.0125	0.0108
1317	VEN	2	2	0	2	2	0	0	0	30.21565134	-0.0119	-0.0059
1318	VEN	2	2	0	10	-11	0	0	0	30.21581527	-0.0515	-0.5578

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
1319	VEN	2	2	0	18	-24	0	0	0	30.21597919	-0.0028	0.0049
1320	MAR	2	2	0	0	17	-22	0	0	30.21776838	-0.0050	0.0040
1321	MER	2	2	2	0	-3	0	0	0	30.21782550	-0.0092	0.0284
1322	JUP	2	2	0	0	6	0	-8	0	30.21870203	0.0053	-0.0022
1323	MAR	2	2	0	0	16	-20	0	0	30.22037233	-0.0048	0.0103
1324	VEN	2	2	0	7	-6	0	0	0	30.22088737	-0.0281	-0.1652
1325	JUP	2	2	0	0	6	0	-7	0	30.22216575	0.0215	-0.0040
1326	MAR	2	2	0	0	15	-18	0	0	30.22297628	0.0009	0.0175
1327	MAR	2	2	0	0	14	-16	0	0	30.22558023	0.0115	0.0198
1328	JUP	2	2	0	0	6	0	-6	0	30.22562948	0.0463	0.0018
1329	VEN	2	2	0	4	-1	0	0	0	30.22595948	0.0055	0.0034
1330	VEN	2	2	0	12	-14	0	0	0	30.22612341	-0.0903	-0.0033
1331	MAR	2	2	0	0	13	-14	0	0	30.22818419	0.0175	0.0118
1332	JUP	2	2	0	0	6	0	-5	0	30.22909321	-0.0062	0.0028
1333	MAR	2	2	0	0	12	-12	0	0	30.23078814	0.0059	0.0027
1334	VEN	2	2	0	9	-9	0	0	0	30.23119552	2.8266	-0.0893
1335	MAR	2	2	0	0	11	-10	0	0	30.23339209	-0.0101	0.0085
1336	VEN	2	2	0	6	-4	0	0	0	30.23626762	0.0421	-0.2091
1337	VEN	2	2	0	14	-17	0	0	0	30.23643155	-0.0017	0.0125
1338	MAR	2	2	0	0	18	-23	0	0	30.23700073	-0.0044	0.0034
1339	MAR	2	2	0	0	17	-21	0	0	30.23960468	-0.0041	0.0086
1340	VEN	2	2	0	3	1	0	0	0	30.24133973	-0.0109	-0.0036
1341	VEN	2	2	0	11	-12	0	0	0	30.24150366	-0.0446	-0.4890
1342	VEN	2	2	0	19	-25	0	0	0	30.24166758	-0.0025	0.0043
1343	MAR	2	2	0	0	16	-19	0	0	30.24220863	0.0006	0.0140
1344	MAR	2	2	0	0	15	-17	0	0	30.24481258	0.0085	0.0149
1345	VEN	2	2	0	8	-7	0	0	0	30.24657576	-0.0297	-0.1544
1346	MAR	2	2	0	0	14	-15	0	0	30.24741653	0.0116	0.0083
1347	VEN	2	2	0	13	-15	0	0	0	30.25181180	-0.0797	-0.0016
1348	MAR	2	2	0	0	12	-11	0	0	30.25262443	-0.0078	0.0064
1349	MAR	2	2	0	0	19	-24	0	0	30.25623307	-0.0037	0.0029
1350	VEN	2	2	0	10	-10	0	0	0	30.25688391	2.3228	-0.0707
1351	MAR	2	2	0	0	18	-22	0	0	30.25883702	-0.0034	0.0070
1352	MER	2	2	2	0	-2	0	0	0	30.25889414	0.0659	-0.0003
1353	JUP	2	2	0	0	7	0	-8	0	30.25977067	0.0061	-0.0011
1354	MAR	2	2	0	0	17	-20	0	0	30.26144097	0.0004	0.0109
1355	VEN	2	2	0	7	-5	0	0	0	30.26195601	0.0136	-0.1761
1356	VEN	2	2	0	15	-18	0	0	0	30.26211994	-0.0015	0.0112
1357	JUP	2	2	0	0	7	0	-7	0	30.26323439	0.0112	0.0007
1358	MAR	2	2	0	0	16	-18	0	0	30.26404492	0.0060	0.0110
1359	MAR	2	2	0	0	15	-16	0	0	30.26664887	0.0073	0.0057
1360	VEN	2	2	0	4	0	0	0	0	30.26702812	-0.0095	-0.0018
1361	VEN	2	2	0	12	-13	0	0	0	30.26719205	-0.0382	-0.4226
1362	VEN	2	2	0	20	-26	0	0	0	30.26735597	-0.0021	0.0037
1363	MAR	2	2	0	0	13	-12	0	0	30.27185678	-0.0058	0.0047
1364	VEN	2	2	0	9	-8	0	0	0	30.27226416	-0.0297	-0.1403
1365	VEN	2	2	0	14	-16	0	0	0	30.27750019	-0.0698	-0.0009
1366	MAR	2	2	0	0	19	-23	0	0	30.27806937	-0.0027	0.0056
1367	MAR	2	2	0	0	18	-21	0	0	30.28067332	0.0002	0.0083
1368	VEN	2	2	0	11	-11	0	0	0	30.28257230	1.8882	-0.0554
1369	MAR	2	2	0	0	17	-19	0	0	30.28327727	0.0042	0.0079
1370	MAR	2	2	0	0	16	-17	0	0	30.28588122	0.0044	0.0038
1371	VEN	2	2	0	8	-6	0	0	0	30.28764440	-0.0050	-0.1455
1372	VEN	2	2	0	16	-19	0	0	0	30.28780833	-0.0013	0.0099
1373	MAR	2	2	0	0	14	-13	0	0	30.29108912	-0.0041	0.0033

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
1374	VEN	2	2	0	5	-1	0	0	0	30.29271651	-0.0080	-0.0006
1375	VEN	2	2	0	13	-14	0	0	0	30.29288044	-0.0323	-0.3608
1376	VEN	2	2	0	21	-27	0	0	0	30.29304436	-0.0018	0.0032
1377	MAR	2	2	0	0	20	-24	0	0	30.29730171	-0.0022	0.0044
1378	VEN	2	2	0	10	-9	0	0	0	30.29795255	-0.0285	-0.1248
1379	MAR	2	2	0	0	19	-22	0	0	30.29990566	0.0001	0.0062
1380	MER	2	2	2	0	-1	0	0	0	30.29996278	0.0023	0.0058
1381	MAR	2	2	0	0	18	-20	0	0	30.30250961	0.0028	0.0056
1382	VEN	2	2	0	15	-17	0	0	0	30.30318858	-0.0605	-0.0004
1383	MER	2	2	3	0	-5	0	0	0	30.30620393	-0.0054	-0.0040
1384	VEN	2	2	0	12	-12	0	0	0	30.30826069	1.5207	-0.0430
1385	VEN	2	2	0	9	-7	0	0	0	30.31333280	-0.0164	-0.1184
1386	VEN	2	2	0	17	-20	0	0	0	30.31349672	-0.0011	0.0087
1387	VEN	2	2	0	6	-2	0	0	0	30.31840490	-0.0065	0.0003
1388	VEN	2	2	0	14	-15	0	0	0	30.31856883	-0.0271	-0.3046
1389	VEN	2	2	0	22	-28	0	0	0	30.31873275	-0.0015	0.0027
1390	VEN	2	2	0	11	-10	0	0	0	30.32364094	-0.0264	-0.1090
1391	VEN	2	2	0	16	-18	0	0	0	30.32887697	-0.0521	0.0000
1392	VEN	2	2	0	13	-13	0	0	0	30.33394908	1.2150	-0.0330
1393	VEN	2	2	0	10	-8	0	0	0	30.33902119	-0.0227	-0.0950
1394	VEN	2	2	0	18	-21	0	0	0	30.33918511	-0.0009	0.0075
1395	VEN	2	2	0	7	-3	0	0	0	30.34409329	-0.0052	0.0008
1396	VEN	2	2	0	15	-16	0	0	0	30.34425722	-0.0224	-0.2548
1397	VEN	2	2	0	23	-29	0	0	0	30.34442114	-0.0013	0.0023
1398	MER	2	2	3	0	-4	0	0	0	30.34727257	-0.0059	0.0184
1399	VEN	2	2	0	12	-11	0	0	0	30.34932933	-0.0238	-0.0937
1400	VEN	2	2	0	17	-19	0	0	0	30.35456536	-0.0444	0.0003
1401	VEN	2	2	0	14	-14	0	0	0	30.35963747	0.9640	-0.0252
1402	VEN	2	2	0	11	-9	0	0	0	30.36470958	-0.0253	-0.0754
1403	VEN	2	2	0	19	-22	0	0	0	30.36487350	-0.0008	0.0065
1404	VEN	2	2	0	16	-17	0	0	0	30.36994561	-0.0190	-0.2112
1405	VEN	2	2	0	13	-12	0	0	0	30.37501772	-0.0211	-0.0795
1406	VEN	2	2	0	18	-20	0	0	0	30.38025375	-0.0376	0.0004
1407	VEN	2	2	0	15	-15	0	0	0	30.38532586	0.7602	-0.0190
1408	MER	2	2	3	0	-3	0	0	0	30.38834121	0.0333	-0.0003
1409	VEN	2	2	0	12	-10	0	0	0	30.39039797	-0.0255	-0.0593
1410	VEN	2	2	0	20	-23	0	0	0	30.39056189	-0.0006	0.0056
1411	VEN	2	2	0	17	-18	0	0	0	30.39563400	-0.0155	-0.1738
1412	VEN	2	2	0	14	-13	0	0	0	30.40070611	-0.0183	-0.0667
1413	VEN	2	2	0	19	-21	0	0	0	30.40594214	-0.0316	0.0006
1414	VEN	2	2	0	16	-16	0	0	0	30.41101425	0.5962	-0.0143
1415	VEN	2	2	0	13	-11	0	0	0	30.41608636	-0.0239	-0.0456
1416	VEN	2	2	0	18	-19	0	0	0	30.42132239	-0.0126	-0.1420
1417	VEN	2	2	0	15	-14	0	0	0	30.42639450	-0.0157	-0.0554
1418	MER	2	2	3	0	-2	0	0	0	30.42940985	0.0030	0.0101
1419	VEN	2	2	0	20	-22	0	0	0	30.43163053	-0.0264	0.0006
1420	VEN	2	2	0	17	-17	0	0	0	30.43670264	0.4654	-0.0106
1421	VEN	2	2	0	14	-12	0	0	0	30.44177475	-0.0219	-0.0352
1422	VEN	2	2	0	19	-20	0	0	0	30.44701078	-0.0101	-0.1153
1423	VEN	2	2	0	16	-15	0	0	0	30.45208289	-0.0133	-0.0457
1424	VEN	2	2	0	21	-23	0	0	0	30.45731892	-0.0219	0.0006
1425	VEN	2	2	0	18	-18	0	0	0	30.46239103	0.3616	-0.0078
1426	VEN	2	2	0	15	-13	0	0	0	30.46746314	-0.0195	-0.0270
1427	VEN	2	2	0	20	-21	0	0	0	30.47269917	-0.0081	-0.0931
1428	MER	2	2	4	0	-5	0	0	0	30.47671964	-0.0032	0.0103

Appendix A cont.: Fully normalized coefficients C_i and S_i of the tidal potential at the Earth due to the planets Mercury, Venus, Mars, Jupiter and Saturn in 10^{-6} m^2/s^2.

No.	Body	ℓ	m	k1	k2	k3	k4	k5	k6	Freqency [^{0}/h]	C_i	S_i
1429	VEN	2	2	0	17	-16	0	0	0	30.47777128	-0.0111	-0.0373
1430	VEN	2	2	0	22	-24	0	0	0	30.48300731	-0.0181	0.0006
1431	VEN	2	2	0	19	-19	0	0	0	30.48807942	0.2799	-0.0057
1432	VEN	2	2	0	16	-14	0	0	0	30.49315153	-0.0170	-0.0206
1433	VEN	2	2	0	21	-22	0	0	0	30.49838756	-0.0065	-0.0748
1434	VEN	2	2	0	18	-17	0	0	0	30.50345967	-0.0092	-0.0303
1435	VEN	2	2	0	23	-25	0	0	0	30.50869570	-0.0149	0.0005
1436	VEN	2	2	0	20	-20	0	0	0	30.51376781	0.2159	-0.0042
1437	MER	2	2	4	0	-4	0	0	0	30.51778828	0.0145	-0.0003
1438	VEN	2	2	0	17	-15	0	0	0	30.51883992	-0.0146	-0.0156
1439	VEN	2	2	0	22	-23	0	0	0	30.52407595	-0.0051	-0.0598
1440	VEN	2	2	0	19	-18	0	0	0	30.52914806	-0.0075	-0.0244
1441	VEN	2	2	0	24	-26	0	0	0	30.53438409	-0.0122	0.0005
1442	VEN	2	2	0	21	-21	0	0	0	30.53945620	0.1659	-0.0030
1443	VEN	2	2	0	18	-16	0	0	0	30.54452831	-0.0123	-0.0117
1444	VEN	2	2	0	23	-24	0	0	0	30.54976434	-0.0040	-0.0476
1445	VEN	2	2	0	20	-19	0	0	0	30.55483645	-0.0061	-0.0196
1446	MER	2	2	4	0	-3	0	0	0	30.55885692	0.0024	0.0087
1447	VEN	2	2	0	25	-27	0	0	0	30.56007249	-0.0099	0.0004
1448	VEN	2	2	0	22	-22	0	0	0	30.56514459	0.1272	-0.0021
1449	VEN	2	2	0	19	-17	0	0	0	30.57021670	-0.0103	-0.0088
1450	VEN	2	2	0	24	-25	0	0	0	30.57545273	-0.0032	-0.0378
1451	VEN	2	2	0	21	-20	0	0	0	30.58052484	-0.0049	-0.0156
1452	VEN	2	2	0	26	-28	0	0	0	30.58576088	-0.0080	0.0003
1453	VEN	2	2	0	23	-23	0	0	0	30.59083298	0.0972	-0.0015
1454	VEN	2	2	0	20	-18	0	0	0	30.59590509	-0.0085	-0.0066
1455	VEN	2	2	0	25	-26	0	0	0	30.60114113	-0.0025	-0.0298
1456	MER	2	2	5	0	-6	0	0	0	30.60616671	-0.0016	0.0052
1457	VEN	2	2	0	22	-21	0	0	0	30.60621323	-0.0040	-0.0124
1458	VEN	2	2	0	27	-29	0	0	0	30.61144927	-0.0065	0.0003
1459	VEN	2	2	0	24	-24	0	0	0	30.61652137	0.0741	-0.0010
1460	VEN	2	2	0	21	-19	0	0	0	30.62159348	-0.0070	-0.0049
1461	VEN	2	2	0	26	-27	0	0	0	30.62682952	-0.0019	-0.0235
1462	VEN	2	2	0	23	-22	0	0	0	30.63190162	-0.0032	-0.0098
1463	VEN	2	2	0	25	-25	0	0	0	30.64220977	0.0563	-0.0007
1464	MER	2	2	5	0	-5	0	0	0	30.64723535	0.0055	-0.0003
1465	VEN	2	2	0	22	-20	0	0	0	30.64728187	-0.0057	-0.0036
1466	VEN	2	2	0	27	-28	0	0	0	30.65251791	-0.0015	-0.0184
1467	VEN	2	2	0	24	-23	0	0	0	30.65759001	-0.0025	-0.0077
1468	VEN	2	2	0	26	-26	0	0	0	30.66789816	0.0428	-0.0005
1469	VEN	2	2	0	23	-21	0	0	0	30.67297026	-0.0046	-0.0026
1470	VEN	2	2	0	28	-29	0	0	0	30.67820630	-0.0012	-0.0144
1471	VEN	2	2	0	25	-24	0	0	0	30.68327841	-0.0020	-0.0060
1472	MER	2	2	5	0	-4	0	0	0	30.68830399	0.0016	0.0056
1473	VEN	2	2	0	27	-27	0	0	0	30.69358655	0.0324	-0.0003
1474	VEN	2	2	0	29	-30	0	0	0	30.70389469	-0.0009	-0.0113
1475	VEN	2	2	0	28	-28	0	0	0	30.71927494	0.0245	-0.0002
1476	VEN	2	2	0	30	-31	0	0	0	30.72958308	-0.0007	-0.0088
1477	VEN	2	2	0	29	-29	0	0	0	30.74496333	0.0185	-0.0001
1478	VEN	2	2	0	31	-32	0	0	0	30.75527147	-0.0005	-0.0068
1479	VEN	2	2	0	30	-30	0	0	0	30.77065172	0.0139	-0.0001
1480	VEN	2	2	0	32	-33	0	0	0	30.78095986	-0.0004	-0.0053
1481	VEN	2	2	0	31	-31	0	0	0	30.79634011	0.0104	0.0000
1482	VEN	2	2	0	32	-32	0	0	0	30.82202850	0.0078	0.0000
1483	VEN	2	2	0	33	-33	0	0	0	30.84771689	0.0059	0.0000

The Pendulum Astronomical Clock AChF-3 As a Gravimeter

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The pendulum astronomical clock AChF-3, designed by F.M.Fedchenko [1], has been recognized as the best mechanical clock (see, for example [2]). Its accuracy is better by an order of magnitude compared with the well-known Shortt clock. The clock is mounted in a pressure chamber, mercury pressure being 3 to 5 mm. Oscillation are maintained by pulses from an electromechanical circuit at the moment when pendulum passes equilibrium position. Unlike all other pendulum clocks it is isochronic, i.e. its oscillation period does not depend on amplitude due to the specific suspension device. Power unit of AChF-3 is an oxymercury element (1.25 V, 2.5 A-h) which ensures continuous work of the clock during 4-5 years.

In combination with an atomic (or quartz) clock AChF-3 may be used as a precision gravimeter to study gravity variations $g_\sim(t)$, which are related to an oscillation phase $\varphi(t)$ by the expression

$$\varphi(t) = \omega_0 t + \omega_0/(2g_0)\int_0^t g_\sim(t)dt, \tag{1}$$

where $\omega_0^2 = g_0/l$ is unperturbed oscillation frequency, l is the pendulum length, g_0 is a constant component of the acceleration due to gravity. The formula (1) is valid with a high degree of accuracy up to $\sim (g_\sim/g_0)^2 \sim 10^{-13}$. Comparing the pendulum clock and the etalon clock, which is not affected by the gravitation field (i.g. atomic clock) we get the divergence between them

$$v(t) = (\omega_0 - \omega_{et})t/\omega_{et} + \omega_0/(2g_0\omega_{et})\int_0^t g_\sim(t)dt \tag{2}$$

The information about the changes $g(t)(= g_0 + g_\sim(t))$ can be taken out of change $\Delta v(t) = v(t) - v(t-\tau_0)$ during the observation period τ_0

$$\Delta v(t) = \tau_0\overline{g_\sim(t)}/2g_0, \tag{3}$$

where $\overline{g_\sim(t)} = 1/\tau_0\int_{t-\tau_0}^t g_\sim(t)dt$. The equation (3) is correct when $\omega_0 = \omega_{et}$. If this condition isn't fulfilled, a constant component $v_0 = (\omega_0 - \omega_{et})\tau_0/\omega_{et}$ appears in (3). Consequently, we get a formula for the relative measurement error out of (3)

$$\delta g_\sim/g_0 = 2\delta\tau/\tau_0 \tag{4}$$

The highest accuracy obtainable is determined by the stability of the time marks compared. In AChF-3 the time marks are formed in each half of a period (1 s), they are compared with the second's time marks of an atomic clock. The scatter of marks formed by AChF-3 is 7 μs, hence during two hours of measurement ($\tau_0 = 7200s$) the accuracy of it would be $\delta g/g = 2\delta\tau/\tau_0 = 2 \cdot 10^{-9}$. The potential accuracy determined by the stability of an atomic clock is much higher: $\delta g/g \sim 3 \cdot 10^{-12}$. the obtained evaluations correspond to the independent accuracy estimations, which we got as a result of 2 months series observation in Mendelyeevo in 1968 and 1969. The interval between the samples (τ_0) was 2 hours. The time marks coming from AChF-3 was compared with the second's marks formed immediately by the frequency-time etalon. The main results of the 1968 analysis including evaluation of errors are given in the table:

Wave type	Amplitude factor	Error	
		absolute	relative
O_1	1.171	1.01	0.035
K_1	1.140	1.10	0.027
N_2	1.051	1.33	0.297
M_2	1.126	1.24	0.052
S_2	1.063	0.93	0.086

Besides the 24-hourly and 12-hourly harmonics the observation data include a fortnights moon harmonic M_f. Its presence apparently reveals itself in the autocorrelation function shown on Fig.1, where the 2-weeks periodicity is clearly seen, and also on Fig.2 – in the spectrum received with the fast Fourier transformation.

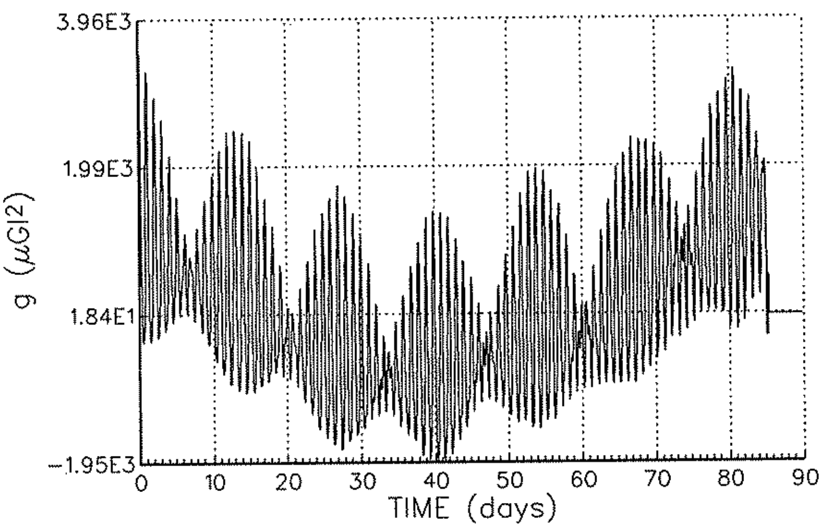

Fig. 1

Fig.3 shows the data on gravity observations at Pulkovo Astronomy Observatory in 1963-1965. The samples were taken each 24 hours. A quartz clock was used whose stability is approximately by orders lower than that of the atomic standard of frequency used in Mendelyeevo. Besides the temperature was measured too.

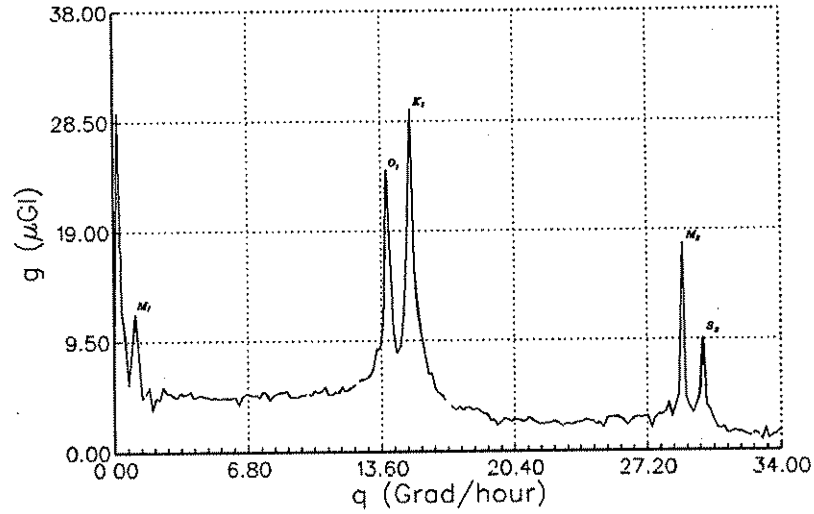

Fig. 2

On the background of linear drift the yearly periodicities observed (see Fig.3) are due to the season temperature changes. As a result of the regression analysis the drift of the zero-point and the temperature coefficient have been calculated. They were found 0.65 μGl/day and 143 μGl/°C respectively. The initial observation data

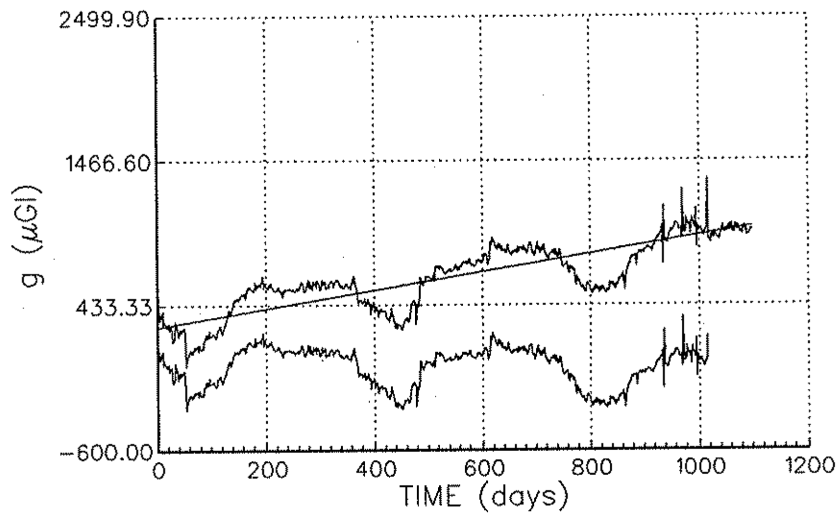

Fig. 3

were cleaned from the drift and the temperature influences and were transformed by the fast Fourier transformation. In the received spectrum (Fig. 4) the fortnight tide harmonic M_f is clearly distinguishable. The monthly harmonic M_m is also present but is less clear.

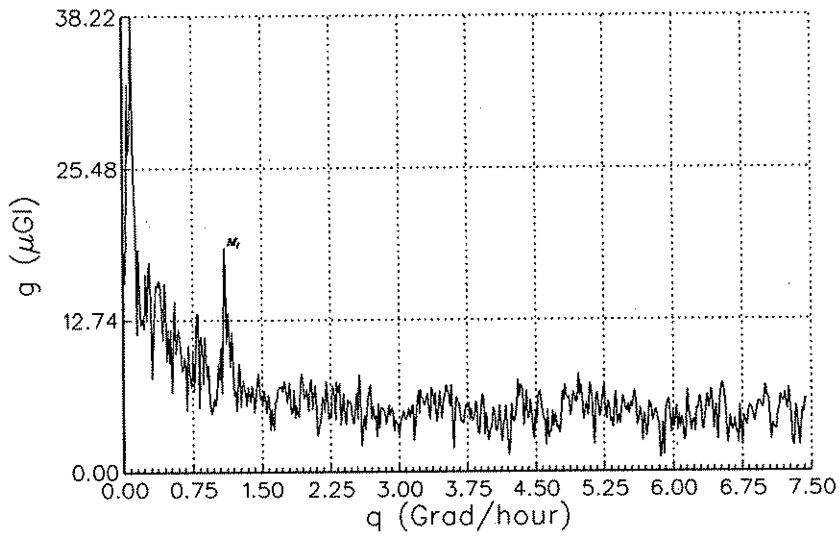

Fig. 4

These results show that the use of AChF-3 for the Moon and Sun tides observations proved to be quite successful. AChF-3 appeared to be a precise gravimeter with the measurement error about 1 μGl and the drift of the zero-point on the level 0.65 μGl/day. These characteristics are not the limit ones. If measures regarding the peculiarities of the gravitational measurements could be taken – that is the vibration isolation made better, the active thermostat used, the system of time marks forming made more perfect, etc., then the measurement could be more accurate for one order up to 0.1 μGl with the drift of the zero-point no more than 0.5 μGl/day.

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TILTMETER OBSERVATIONS AT OBSERVATORY "VITOSHA"

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In 1988 Science research and technology company "Geodesy and photogrammetry", the Institute of Geophysics of the Bulgarian Academy of Science and the Sofia University "K. Ochridski" organized mutual inclinometer observations at observatory "Vitosha". The observatory is situated 1490 meters above the sea level. The aim of the observations was to clarify the possibilities for organizing an inclinometer observatory.
The choice of the place is in conformity with the economic, technical and organization requirements [1].

Tiltmeters with photoelectric recording system "Ostrovski" were installed on a concrete base. They were attached to granite base and isolated from the chamber floor. The sizes of the chamber are 6 x 7m. The chamber is situated at 20m from a gallery entrance and at 20m depth from daylight surface approximately. Around the gallery there is a forest.

The registration regime of the Earth surface inclinations was non-stop one. To be convenient for operation the records duration on the photo film is for 2 or 4 days and nights. Except both tilt components a record of the temperature change was done.

For twenty four hours control of the equipment sensitivity K, a current impulse is registrated on the photo film. The current impulse is automatically fed twice a day at exactly definite time. The reciprocal value of the sensitivity - C ms/mm is used for convenience. It fluctuates by 0,40 - 0,42 for channel NS (North-South) and by 2,0 - 0,85 for channel EW (East-West) for tiltmeter 46. For tiltmeter 47 the data are 0,73 - 0,63 for channel NS and 0,32 - 0,67 for channel EW.

The observations are submitted to a harmonic analysis by the method Venedikov M74 to determine the amplitudes and phases of the basic tidal waves [2, 3]. The basic software program is worked out by the author and is suitable for PC. The results for γ and α are given in tables 1 - 4 and those of the global analysis in tables 5 -6.

The unit for the observed amplitude is 0"0001.

As the latitude of Vitosha is rather close to 45° the diurnal waves in NS component are not significant for what concerns tidal research. The M_2 semi diurnal wave however is significant in both directions:

NS	$\gamma = 0.711 \pm 0.005$	$\alpha = -1.49° \pm 0.42°$
EW	$\gamma = 0.712 \pm 0.006$	$\alpha = -1.23° \pm 0.47°$

One has then to compare the M_2 residues:

NS	B = 2.41	$\beta = -37.3°$
EW	B = 3.48	$\beta = -30.8°$
	(unit 0"0001)	

with the oceanic attraction and loading effects calculated by ICET on the basis of the Schwiderski map:

NS	L = 1.18	$\lambda = -60.6°$
EW	L = 5.25	$\lambda = -40.5°$

to obtain the final residues:

NS	X = 1.41	$\chi = -17.9°$
EW	X = 1.91	$\chi = 121.5°$
	(unit 0"0001)	

The observation analysis shows:

1. The results for the semi diurnal waves are satisfactory considering the shallow depth of the observation place (20 meters). Best conclusions for γ for the wave M_2 azimuth EW can be made.

2. The small amplitudes of the NS diurnal waves are due to the geographic situation of the observation point so that the results for γ and α for these waves have not to be taken into consideration.

3. The global analysis gave the possibility to diminish the mean square errors and more confidently to define the parameters looked for.

4. The results from the station "Vitosha" can be assumed as tentative filling the information deficiency for the Balkan Peninsula.

Observations at a new station established in the same region are to be done with the aim of obtaining smaller mean square error. They will give more complete picture for γ and α on the territory of Balkan Peninsula.

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TABLE 1

STATION VITOSHA COMPONENT NS BULGARIA
HORIZONTAL PENDULUM HP46
42 35 29 N 23 12 29 E H 1490.M AZIMUTH 0 0
INSTALLATION: STANCHEV, SHIROKOV
MAINTENANCE : STANCHEV
LEAST SQUARE ANALYSIS (VENEDIKOV/74),PROG.SV.,UNI KIEL/1989,MADRID/1990
FILTERS ON INTERVALS OF 48 HOURS, ELIMINATED DRIFT POWER= 1
COMPONENTS: S1 O1 S2 N2 S3 S4
POTENTIAL CARTWRIGHT-TAYLER-EDDEN / COMPLETE DEVELOPMENT
COMPONENTS ORIENTATED TOWARDS THE ELLIPSOID (SKALSKY)
GEOPHYSICAL INST., SOFIA, PROCESSED ON A PERSONAL COMP. ON
NORMALIZATION FACTOR -10.0000
TIME INTERVAL .6 YEARS 210 DAYS 2112 READINGS 14 BLOKS, WITH WEIGHTS
880624/880628 880630/880719 880722/880725 880801/880803
880805/880809 880908/880915 881122/881124 881126/881127
881130/881201 881203/881205 881207/881208 881209/881215
881217/890106 890110/890120

WAVE GROUP			ESTIMATED		AMPLIT.		PHASE		RESIDUALS	
ARGUM.	N	WAVE	AMPL.	R.M.S.	FACTOR	R.M.S.	DIFF.	R.M.S.	AMPL.	PHASE
105-139	65	Q1	.563	.780	.5146	.7134	226.480	79.520	1.21	19.7
143-149	26	O1	1.357	.686	.2376	.1200	13.385	29.481	2.63	-6.9
152-158	22	NO1	.186	.287	.4141	.6399	253.756	88.441	.40	26.3
161-163	10	P1	2.250	1.211	.8465	.4556	-69.113	30.870	2.35	63.3
164-168	23	K1	.719	1.113	.0895	.1386	107.783	88.603	6.14	-6.4
172-177	22	J1	.584	.497	1.3002	1.1072	-32.841	48.768	.37	120.1
181-1*3	37	OO1	.582	.446	2.3644	1.8104	139.495	43.876	.72	-31.7
207-23*	41	2N2	1.538	.516	.7707	.2587	-16.616	19.177	.45	-76.7
243-248	24	N2	10.670	.634	.7075	.0420	-2.054	3.393	.49	-50.8
252-258	26	M2	57.929	.597	.7354	.0076	-.572	.592	3.90	-8.5
262-267	17	L2	1.087	.621	.4880	.2789	-39.169	32.762	.97	-135.0
271-273	6	S2	25.945	.820	.7079	.0224	-2.893	1.824	1.51	-60.0
274-2*5	41	K2	6.446	.633	.6465	.0635	-6.343	5.633	.84	-121.6
327-375	17	M3	.935	.237	.8201	.2080	5.970	14.607	.11	118.0
382-382	1	S3	.4350	.2223						
455-455	1	M4	.3102	.1293						
491-491	1	S4	.2051	.1134						

STANDART DEVIATIONS D 7.77 SD 5.40 TD 2.25 QD 1.17
O1/K1 2.6565 1-O1/1-K1 .8373 M2/O1 3.0947

TABLE 2

STATION VITOSHA COMPONENT EW BULGARIA
HORIZONTAL PENDULUM HP46
42 35 29 N 23 12 29 E H 1490.M AZIMUTH 90 0
INSTALLATION: STANCHEV, SHIROKOV
MAINTENANCE : STANCHEV
LEAST SQUARE ANALYSIS (VENEDIKOV/74),PROG.SV.,UNI KIEL/1989,MADRID/1990
FILTERS ON INTERVALS OF 48 HOURS, ELIMINATED DRIFT POWER= 1
COMPONENTS: S1 O1 S2 N2 S3 S4
POTENTIAL CARTWRIGHT-TAYLER-EDDEN / COMPLETE DEVELOPMENT
COMPONENTS ORIENTATED TOWARDS THE ELLIPSOID (SKALSKY)
GEOPHYSICAL INST., SOFIA, PROCESSED ON A PERSONAL COMP. ON
NORMALIZATION FACTOR -10.0000
TIME INTERVAL .5 YEARS 195 DAYS 1680 READINGS 8 BLOKS, WITH WEIGHTS
880624/880626 880628/880710 880712/880724 880728/880809
881129/881205 881207/881214 881217/881219 881221/890105

WAVE GROUP ARGUM.	N	WAVE	ESTIMATED AMPL.	R.M.S.	AMPLIT. FACTOR	R.M.S.	PHASE DIFF.	R.M.S.	RESIDUALS AMPL.	PHASE
105-139	65	Q1	4.532	1.158	.5366	.1371	-27.202	14.700	2.73	-130.6
143-149	26	O1	32.376	1.077	.7339	.0244	-6.249	1.877	3.97	-62.6
152-158	22	NO1	.921	.893	.2656	.2573	38.972	55.590	1.77	160.9
161-163	10	P1	21.242	2.384	1.0346	.1161	-28.676	6.467	11.05	-67.3
164-168	23	K1	48.590	2.130	.7832	.0343	7.758	2.517	7.09	67.6
172-177	22	J1	3.729	1.225	1.0749	.3531	-33.142	18.847	2.17	-69.8
181-1*3	37	OO1	1.601	.732	.8423	.3849	1.447	26.094	.30	7.7
207-23*	41	2N2	3.770	.922	1.2783	.3127	3.574	14.425	1.75	7.7
243-248	24	N2	15.115	.928	.6783	.0416	-.915	3.524	.30	-127.2
252-258	26	M2	83.788	.856	.7199	.0074	-.083	.583	3.90	-1.8
262-267	17	L2	2.445	.773	.7430	.2348	-3.457	18.102	.23	-39.1
271-273	6	S2	32.669	1.481	.6033	.0274	1.407	2.585	4.58	169.9
274-2*5	41	K2	9.878	1.205	.6705	.0818	9.999	6.937	1.76	102.7
327-375	17	M3	1.002	.375	.5947	.2227	-7.474	21.445	.48	-164.1
382-382	1	S3	1.6639	.3225						
455-455	1	M4	.1461	.1792						
491-491	1	S4	.7932	.1567						

STANDARD DEVIATIONS D 10.47 SD 6.96 TD 3.27 QD 1.58
O1/K1 .9371 1-O1/1-K1 1.2273 M2/O1 .9809

TABLE 3

STATION VITOSHA COMPONENT NS BULGARIA
HORIZONTAL PENDULUM HP47
42 35 29 N 23 12 29 E H 1490.M AZIMUTH 0 0
INSTALLATION: STANCHEV, SHIROKOV
MAINTENANCE : STANCHEV
LEAST SQUARE ANALYSIS (VENEDIKOV/74),PROG.SV.,UNI KIEL/1989,MADRID/1990
FILTERS ON INTERVALS OF 48 HOURS, ELIMINATED DRIFT POWER= 1
COMPONENTS: S1 O1 S2 N2 S3 S4
POTENTIAL CARTWRIGHT-TAYLER-EDDEN / COMPLETE DEVELOPMENT
COMPONENTS ORIENTATED TOWARDS THE ELLIPSOID (SKALSKY)
GEOPHYSICAL INST., SOFIA, PROCESSED ON A PERSONAL COMP. ON
NORMALIZATION FACTOR -1.0000
TIME INTERVAL .5 YEARS 176 DAYS 2688 READINGS 11 BLOKS, WITH WEIGHTS
880622/880628 880630/880705 880707/880723 880801/880817
880922/881002 881007/881009 881010/881103 881105/881121
881122/881128 881130/881203 881209/881215

WAVE GROUP ARGUM.	N	WAVE	ESTIMATED AMPL.	R.M.S.	AMPLIT. FACTOR	R.M.S.	PHASE DIFF.	R.M.S.	RESIDUALS AMPL.	PHASE
105-139	65	Q1	1.352	.761	1.2363	.6957	-30.304	32.285	.80	121.3
143-149	26	O1	.951	.769	.1665	.1346	-24.555	46.686	3.09	7.3
152-158	22	NO1	.332	.302	.7390	.6714	22.714	51.996	.13	-88.5
161-163	10	P1	2.835	.938	1.0664	.3527	259.792	18.922	3.66	49.7
164-168	23	K1	3.348	.831	.4167	.1035	151.906	14.238	8.98	-10.1
172-177	22	J1	1.230	.540	2.7391	1.2033	165.400	25.393	1.53	-11.7
181-1*3	37	OO1	.875	.437	3.5553	1.7764	-69.173	28.642	.83	99.9
207-23*	41	2N2	1.849	.371	.9265	.1858	-24.485	11.419	.83	-67.8
243-248	24	N2	11.033	.570	.7316	.0378	-5.338	2.917	1.21	-58.3
252-258	26	M2	53.948	.543	.6849	.0069	-2.317	.578	2.19	-94.3
262-267	17	L2	1.884	.553	.8460	.2481	-59.472	16.798	1.72	-109.4
271-273	6	S2	25.355	.522	.6918	.0142	-3.819	1.179	1.69	-85.1
274-2*5	41	K2	7.592	.403	.7614	.0404	-2.881	3.039	.83	-27.3
327-375	17	M3	1.020	.242	.8948	.2123	-20.624	13.545	.36	-94.3
382-382	1	S3	1.1364	.2308						
455-455	1	M4	.1051	.1663						
491-491	1	S4	.1070	.1460						

STANDARD DEVIATIONS D 11.30 SD 6.73 TD 3.13 QD 1.95
O1/K1 .3995 1-O1/1-K1 1.4291 M2/O1 4.1136

TABLE 4

STATION VITOSHA   COMPONENT EW   BULGARIA
HORIZONTAL PENDULUM HP47
42 35 29 N   23 12 29 E   H 1490.M AZIMUTH 90 0
INSTALLATION: STANCHEV, SHIROKOV
MAINTENANCE :   STANCHEV
LEAST SQUARE ANALYSIS (VENEDIKOV/74),PROG.SV.,UNI KIEL/1989,MADRID/1990
FILTERS ON INTERVALS OF 48 HOURS, ELIMINATED DRIFT POWER= 1
COMPONENTS: S1 O1 S2 N2 S3 S4
POTENTIAL CARTWRIGHT-TAYLER-EDDEN / COMPLETE DEVELOPMENT
COMPONENTS ORIENTATED TOWARDS THE ELLIPSOID (SKALSKY)
GEOPHYSICAL INST., SOFIA, PROCESSED ON A PERSONAL COMP. ON
NORMALIZATION FACTOR   -1.0000
TIME INTERVAL   .4 YEARS 164 DAYS 1632 READINGS 15 BLOKS, WITH WEIGHTS
880704/880706 880708/880724 880812/880816 881008/881009
881010/881026 881027/881029 881101/881102 881105/881107
881108/881111 881114/881120 881122/881124 881126/881127
881130/881203 881210/881212 881213/881215

WAVE GROUP ARGUM.	N	WAVE	ESTIMATED AMPL.	R.M.S.	AMPLIT. FACTOR	R.M.S.	PHASE DIFF.	R.M.S.	RESIDUALS AMPL.	PHASE
105-139	65	Q1	8.073	2.353	.9557	.2786	-4.851	17.029	2.34	-17.0
143-149	26	O1	35.371	2.328	.8017	.0528	2.035	3.834	5.15	14.1
152-158	22	NO1	2.117	2.045	.6102	.5895	16.199	55.091	.69	121.3
161-163	10	P1	16.431	3.061	.8002	.1491	4.415	10.713	2.38	32.1
164-168	23	K1	49.334	2.556	.7951	.0412	5.621	3.005	6.06	52.9
172-177	22	J1	5.281	2.357	1.5222	.6795	30.930	25.536	3.47	51.5
181-1*3	37	OO1	2.589	1.384	1.3622	.7281	-83.397	30.440	2.76	-111.3
207-23*	41	2N2	1.743	1.033	.5909	.3501	-32.946	34.085	1.10	-120.7
243-248	24	N2	15.463	1.437	.6939	.0645	-5.583	5.382	1.51	-86.5
252-258	26	M2	83.291	1.416	.7156	.0122	-3.103	.970	5.57	-54.0
262-267	17	L2	2.268	1.248	.6894	.3794	50.011	31.520	1.91	114.7
271-273	6	S2	31.518	1.367	.5820	.0252	-.691	2.465	5.67	-176.2
274-2*5	41	K2	8.603	.949	.5839	.0644	-.994	6.379	1.52	-174.4
327-375	17	M3	2.392	.622	1.4198	.3690	38.776	14.908	1.55	74.5
382-382	1	S3	.3611	.5797						
455-455	1	M4	.1597	.3493						
491-491	1	S4	.5190	.3061						

STANDARD DEVIATIONS   D 22.81   SD 10.69   TD 5.78   QD 3.12
O1/K1 1.0083 1-O1/1-K1   .9678 M2/O1   .8925

TABLE 5

GLOBAL ANALYSIS OF 2 SERIES,COMPONENT NS
LEAST SQUARE ANALYSIS (VENEDIKOV/74),PROG.SV.,UNI KIEL/1989,MADRID/1990
FILTERS ON INTERVALS OF 48 HOURS, ELIMINATED DRIFT POWER= 1
COMPONENTS: S1 O1 S2 N2 S3 S4
POTENTIAL CARTWRIGHT-TAYLER-EDDEN / COMPLETE DEVELOPMENT
COMPONENTS ORIENTATED TOWARDS THE ELLIPSOID (SKALSKY)
GEOPHYSICAL INST., SOFIA, PROCESSED ON A PERSONAL COMP. ON

WAVE ARGUM.	GROUP N	WAVE	ESTIMATED AMPL.	R.M.S.	AMPLIT. FACTOR	R.M.S.	PHASE DIFF.	R.M.S.	RESIDUALS AMPL.	PHASE
105-139	65	Q1	.777	.549	.7109	.5016	-56.438	40.571	.72	63.6
143-149	26	O1	.962	.519	.1684	.0909	-20.695	31.300	3.05	6.4
152-158	22	NO1	.172	.205	.3836	.4562	-36.896	68.133	.20	31.0
161-163	10	P1	2.517	.687	.9467	.2583	-73.523	15.651	2.67	64.6
164-168	23	K1	2.372	.611	.2953	.0761	147.851	14.774	7.99	-9.1
172-177	22	J1	.393	.362	.8748	.8066	168.923	52.868	.70	-6.2
181-1*3	37	OO1	.259	.312	1.0528	1.2689	-72.340	68.936	.26	70.0
F(DIFF.IN SERIES) =			1.5 DEGREES OF FREEDOM				14/ 172			
207-23*	41	2N2	1.647	.309	.8253	.1546	-22.267	10.672	.64	-76.1
243-248	24	N2	10.736	.437	.7119	.0289	-6.014	2.308	1.17	-73.9
252-258	26	M2	55.630	.419	.7062	.0053	-1.682	.433	2.24	-46.7
262-267	17	L2	1.545	.419	.6938	.1881	-58.137	15.517	1.49	-118.5
271-273	6	S2	25.466	.436	.6949	.0119	-2.812	.982	1.28	-77.3
274-2*5	41	K2	7.206	.333	.7226	.0334	-2.493	2.646	.47	-41.5
F(DIFF.IN SERIES) =			3.2 DEGREES OF FREEDOM				12/ 176			
327-375	17	M3	1.025	.179	.8989	.1574	-9.926	10.022	.18	-81.0
382-382	1	S3	.4596	.1698						
F(DIFF.IN SERIES) =			5.9 DEGREES OF FREEDOM				4/ 192			
455-455	1	M4	.1414	.1090						
491-491	1	S4	.0715	.0955						
F(DIFF.IN SERIES) =			1.0 DEGREES OF FREEDOM				4/ 192			

STANDARD DEVIATIONS D 9.92 SD 6.55 TD 2.87 QD 1.61
O1/K1 .5705 1-O1/1-K1 1.1799 M2/O1 4.1925

TABLE 6

GLOBAL ANALYSIS OF 2 SERIES,COMPONENT EW
LEAST SQUARE ANALYSIS (VENEDIKOV/74),PROG.SV.,UNI KIEL/1989,MADRID/1990
FILTERS ON INTERVALS OF 48 HOURS, ELIMINATED DRIFT POWER= 1
COMPONENTS: S1 O1 S2 N2 S3 S4
POTENTIAL CARTWRIGHT-TAYLER-EDDEN / COMPLETE DEVELOPMENT
COMPONENTS ORIENTATED TOWARDS THE ELLIPSOID (SKALSKY)
GEOPHYSICAL INST., SOFIA, PROCESSED ON A PERSONAL COMP. ON

WAVE ARGUM.	GROUP N	WAVE	ESTIMATED AMPL.	R.M.S.	AMPLIT. FACTOR	R.M.S.	PHASE DIFF.	R.M.S.	RESIDUALS AMPL.	PHASE
105-139	65	Q1	6.078	1.263	.7196	.1496	-15.803	12.099	1.66	-88.6
143-149	26	O1	33.276	1.183	.7543	.0268	-2.464	2.029	3.23	-26.3
152-158	22	NO1	.380	.961	.1096	.2771	129.061	144.903	2.65	173.6
161-163	10	P1	18.147	1.673	.8838	.0815	-9.599	5.295	4.65	-40.6
164-168	23	K1	46.450	1.492	.7487	.0240	3.031	1.842	2.63	69.1
172-177	22	J1	4.430	1.303	1.2771	.3757	-2.896	16.902	2.06	-6.2
181-1*3	37	OO1	1.378	.774	.7249	.4070	-25.626	32.167	.60	-95.8
F(DIFF.IN SERIES) = 1.5 DEGREES OF FREEDOM 14/ 110										
207-23*	41	2N2	2.203	.639	.7469	.2168	-18.266	16.780	.69	-84.4
243-248	24	N2	15.983	.801	.7172	.0360	-4.296	2.902	1.36	-61.8
252-258	26	M2	82.897	.737	.7122	.0063	-1.661	.508	3.82	-39.0
262-267	17	L2	1.993	.647	.6057	.1965	26.263	18.562	1.00	118.1
271-273	6	S2	31.634	.788	.5842	.0146	-1.911	1.428	5.65	-169.2
274-2*5	41	K2	8.816	.623	.5984	.0423	-.545	4.062	1.30	-176.3
F(DIFF.IN SERIES) = 1.4 DEGREES OF FREEDOM 12/ 114										
327-375	17	M3	1.777	.367	1.0548	.2176	27.535	11.843	.83	81.3
382-382	1	S3	.8581	.3289						
F(DIFF.IN SERIES) = 3.0 DEGREES OF FREEDOM 4/ 130										
455-455	1	M4	.1498	.1916						
491-491	1	S4	.5477	.1685						
F(DIFF.IN SERIES) = 1.5 DEGREES OF FREEDOM 4/ 130										

STANDARD DEVIATIONS D 17.90 SD 9.10 TD 4.77 QD 2.46
O1/K1 1.0075 1-O1/1-K1 .9777 M2/O1 .9442

Traduction

OBSERVATIONS DES VARIATIONS DE MAREES DE LA FORCE DE PESANTEUR A SIMEIS.

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φΔκ 528.27.

Résumé

Nous donnons les résultats de l'analyse harmonique des observations des marées de la pesanteur à Simeis (base scientifique Astrosoviet) obtenus avec le gravimètre Askania GS 12 n° 185 d'octobre 1981 à décembre 1984. En partant de la valeur de δ obtenue dans cette analyse pour l'onde M_2, on a estimé la hauteur de la déformation verticale maximale de marée au site d'observations à H = 41 cm.

*

* *

En octobre 1981, à la demande de l'Astrosoviet de l'Académie des Sciences d'URSS l'Observatoire gravimétrique de Poltava a entrepris des observations des marées à la base scientifique de Simeis avec le gravimètre Askania GS 12 n° 185.

La base se trouve à quatre kilomètres au Nord-Ouest du village de Simeis sur la montagne Kochka (345 m au-dessus du niveau de la mer). L'une des tâches principales est la détermination du facteur de marée δ dont il faut connaître la valeur pour introduire les corrections dans les données de la localisation laser des satellites. Les observations seront effectuées jusqu'en 1986. Dans cette petite publication nous donnons les résultats de l'analyse de séries de 24 mois d'observations obtenues d'octobre 1981 à décembre 1984.

La salle d'observation de 2,7 x 1,7 x 2,4m^3 est située dans un local en sous-sol sous un bâtiment d'un étage de l'Observatoire. L'enfoncement dans le rocher n'est pas grand: le mur Sud n'est pas enfoncé de plus de quelques mètres, et le Nord Ouest sortant du côté est incliné de 0,3 m. En outre dans ce mur il y a une petite fenêtre. Pour cette raison et également parce que le local n'est pas chauffé les conditions de température dans la salle sont extrêmement peu favorables: les variations diurnes de la température atteignent un à deux degrés; en hiver la température descend jusqu'à zéro degré. En particulier lors de l'hiver 1985 la température est descendue à -5°C. En été, le thermomètre atteignait + 25°C. En hiver le thermostat ne se corrigeait pas avec le réchauffement et les observations à ce moment de l'année se caractérisent par une mauvaise qualité et étaient en général mises au rebut. L'humidité dans la salle pendant toute la période des observations était de 50% avec des variations d'environ ± 10%.

Le gravimètre et le galvanomètre enregistreur sont placés sur un socle en béton d'une dimension de 150 x 150 x 60 cm^3 reposant sur la roche. L'enregistrement s'effectuait photographiquement sur un enregistreur installé à une distance de 1,5 m du galvanomètre sur une petite table métallique. L'alimentation électrique de la lampe du photoélément et du thermostat du gravimètre utilisait un stabilisateur double de tension ou des ferrorésonances et ensuite un stabilisateur électronique avec un coefficient de stabilisation de 2 à 7.10^3. Le coefficient de calibration de l'enregistrement se déterminait par la méthode proposée dans le travail [1] qui permet d'éliminer le micromètre.

La valeur de la grande division de l'échelle de mesure a été déterminée avant l'installation du gravimètre en utilisant la bille et sa valeur est 17,745 μgal/ div.

La calibration a été déterminée irrégulièrement, le laps de temps variant de 4 à 20 jours. Lors de l'analyse harmonique par séries mensuelles, l'échelle d'enregistrement a été interpolée pour chaque intervalle de deux jours et est prise constante pour cet intervalle. Pour la période du 20 octobre 1981 au 25 décembre 1984 on a analysé 28 séries mensuelles par la méthode de Venedikov [2]. L'analyse harmonique a été faite en tenant compte d'un poids selon la méthode proposée par B.S. Doubik [3]. Les résultats de moyennes pondérées de 24 séries mensuelles (quatre mois ont été rejetés à cause de la mauvaise qualité de l'enregistrement) sont donnés dans la table. On y a introduit les corrections du retard instrumental [5], à la normale ellipsoïdale [6], de la nutation forcée de la Terre [7] et d'inertie [8]. Dans la dernière ligne de la table nous donnons les constantes harmoniques de l'onde principale lunaire semi diurne M_2 corrigées de l'influence de la marée océanique [9].

Il faut noter que ces résultats sont soumis aux perturbations de température de la résistance du diviseur dont on tiendra compte dans la suite.

Nous évaluons la déformation verticale de marée à Simeis en tenant compte de la valeur δ que nous avons pour l'onde M_2.

Partant [10] de:

$$\delta = 1 + h - 3/2\ k \tag{1}$$

et en prenant pour notre estimation approximative (à environ 1%) $k = \frac{1}{2} h$ [11] nous trouverons

$$h = 4\ (\delta - 1) \tag{2}$$

Alors, pour $\delta = 1.164$, $h = 0.656$

Nous prenons pour le potentiel de marée sa composante harmonique du second ordre

$$W_2 = D\ (\cos 2\ z + 1/3) \tag{3}$$

où D est la constante de Doodson et z est la distance zénithale de l'astre générateur de marée. Pour la Lune $D_L = 2,62\ m^2\ s^{-2}$ et pour le Soleil $D_S = 0,46\ D_L$. A Simeis les distances zénithales minimales sont $z_L = 16°$ et $z_S = 21°$ nous obtiendrons un déplacement maximum de la surface de niveau de 62 cm. Pour h = 0,656 le déplacement maximum de la surface est d'environ 41 cm. Pour introduire les corrections dans les résultats de la localisation laser des satellites il faut des calculs détaillés des valeurs horaires des déformations de marée de la surface de la Terre tenant compte de la valeur obtenue de δ et également la connaissance des mouvements des satellites dus aux marées.

O_1		K_1		N_2		M_2		S_2	
δ	$\Delta\varphi$	δ	$\Delta\varphi$	δ	$\Delta\varphi$	δ	$\Delta\varphi$	δ	$\Delta\varphi$
I,I3I8	+0,09	I,I385	-I,I4	I,I604	-0,06	I,I799	-0,7I	I,I649	-0,8I
69	30	9I	55	I04	79	28	33	53	39
						I,I635	-I,02		

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Traduction

Sur la stabilité du facteur gravimétrique d'après les observations à la station de marée terrestre de Alma Ata.

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Prévision des tremblements de terre n° 8 - pp 196-199, 1988.

Un problème essentiel de la géophysique est la mise au point d'une méthode de prévisions des tremblements de terre.

Dans l'approche de ce problème, qui n'est pas entièrement résolu, nous avons noté un nombre important de signes précurseurs de différents types. Apparemment il n'y a pas de branche en géophysique qui ne présente de signe précurseur. L'analyse de ces résultats montre que seule une approche commune associée a une théorie commune expliquant l'essence physique des phénomènes observés permet d'approcher la solution du problème.

D'autre part, les variations des différents paramètres géophysiques qui sont envisagés comme des précurseurs, doivent être étudiées soigneusement et il faut en trouver le fondement physique. Cela permet dans une mesure importante d'éliminer les signes précurseurs non sûrs ou accidentels.

A ce titre nous examinerons les résultats des observations à la station de marée terrestre de Talgar, voisine de Alma Ata [1, 2, 3]. Le problème réside dans la réduction des observations [4], le perfectionnement de l'ancien appareillage et les essais d'un nouvel appareillage et enfin de la valeur représentative des facteurs gravimétriques δ et $\Delta\phi$ pour le site donné. D'après les observations durant la période de 1961 jusqu'à présent on a obtenu

$$\delta = 1.1603, \qquad \Delta\phi = 0.10° \ [3]$$

qui résulte des observations avec les gravimètres Askania GS 11 et GS 12 n° 126, 134, 186, 167.

Les données se rapportant à différents appareils correspondent à différentes époques d'observations et différents intervalles d'enregistrement continu. Cependant la valeur moyenne pondérée ci-dessus concorde bien avec la théorie et la pratique des observations dans les autres stations.

La série d'observations la plus longue depuis 1967 a été réalisée par le gravimètre GS 11 n° 167.

En analysant les donnés publiées précédemment les spécialistes de l'Institut de Séismologie de l'Académie des Sciences ont traité les divergences dans les différents observatoires concernant la variation temporelle du paramètre δ [5].

Le fait est que le paramètre δ subit au cours de l'année des variations saisonnières atteignant 6 à 8%. La recherche de la variation temporelle du facteur δ implique la réduction par intervalles annuels. Nous nous affranchissons ainsi des variations saisonnières en outre cet intervalle est optimal pour la méthode d'analyse de Venedikov (1974). Pour une série de raisons techniques il n'a pas été possible de diviser les observations jusqu'en 1971 en intervalles rigoureusement annuels. C'est pourquoi les intervalles sont marqués par des lignes parallèles à l'axe des abscisses avec les mêmes conventions que les graphiques de la variation de δ. Quant aux valeurs de δ pour cette période elles ont été tirées des travaux [2, 3].

Le graphique montre que, pour la période de 1961 à 1967, il s'est produit une variation importante du paramètre δ différant pour les deux appareils. Pour le gravimètre 134 cette variation était de l'ordre de 3% et pour le gravimètre 126 de 4%. Par conséquent affirmer une variation réelle du facteur ne semble pas possible.

Dans son travail [5] A.K. Kouskeyev a relié les résultats des observations du gravimètre 126 avec les observations ultérieures du gravimètre 167, après avoir obtenu "un profond minimum" en 1966, l'a interprété ensuite comme le "témoignage de la prédominance dans la Terre des déformations de dilatation". Tenant compte de cette contradiction nous examinerons les résultats des observations ultérieures que nous avons faites avec le gravimètre 167 qui englobent la période de 1968 à 1981 inclus. Deux pics: en 1971 et en 1978 attirent l'attention. Les 11 autres valeurs sont dans les limites de 1% de la moyenne. En ce qui concerne le pic de 1971, ce qui attire l'attention est la phase opposée dans la variation des valeurs δ pour l'onde S_2 par rapport aux trois autres ondes - M_2, O_1, K_1.

En outre, la différence δ (O_1) - δ (K_1) était égale à - 0,025 bien que la théorie confirmée par de nombreuses expériences, donne une valeur voisine de + 0,020. Les auteurs, après consultation des spécialistes sont portés à considérer les résultats des observations de 1971 comme une erreur d'appareil et ne les ont pas utilisés dans les calculs ultérieurs.

En ce qui concerne le pic de 1978, apparemment tout paraît correct. Cependant la réflexion suivante peut servir de critère quant à la réalité de ce pic. La valeur moyenne de δ en 1978 diffère de 2% de la valeur moyenne pour la période de 1972 à 1981. Mais on constate que cela peut se produire si h - 3/2k varie de 15%. Il est très difficile de se représenter un processus physique changeant dans cette mesure les constantes physiques fondamentales de la Terre. Il n'est pas possible d'établir la preuve de la réalité de ce pic que dans le cas où cette anomalie sera confirmée par d'autres données validées.

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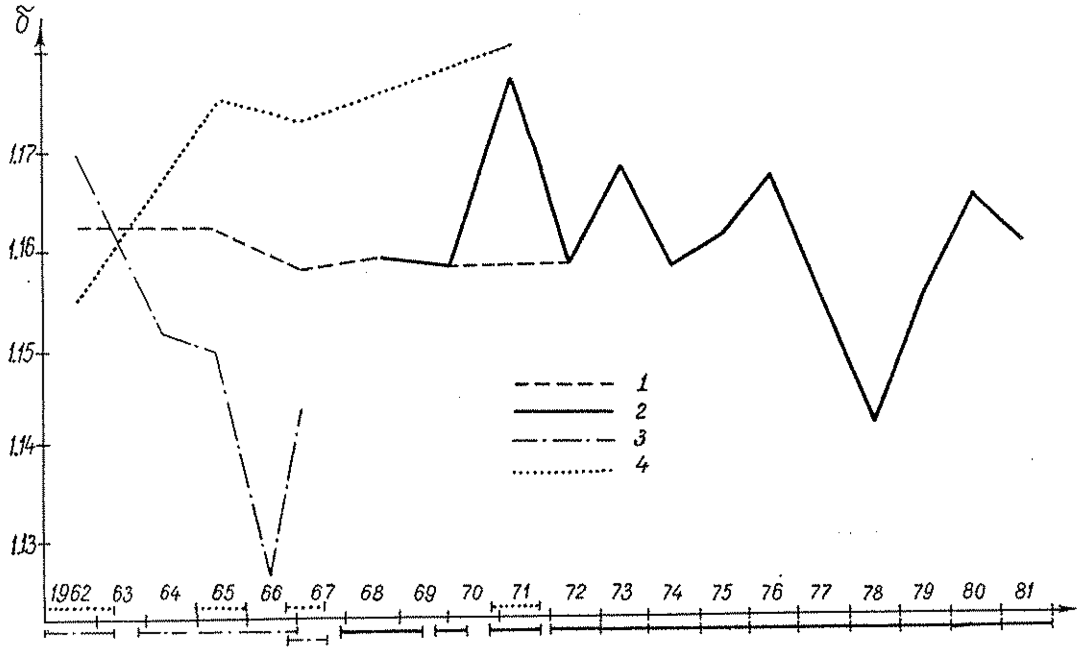

Figure 1

Facteur gravimétrique δ d'après les observations à la station de marée terrestre Alma Ata.

1- valeur moyennée de δ, prise dans le calcul;
2- observations avec le gravimètre 167;
3- observations avec le gravimètre 126;
4- observations avec le gravimètre 134.

CHECKING AND CORRECTING THE TIDAL GRAVITY PARAMETERS OF THE ICET DATA BANK

P. Melchior.

1. INTRODUCTION

The aim of this technical paper is to provide numerical justifications to the results recently published by us in "Physics of the Earth and Planetary Interiors" vol 82 n° 2 pages 125-156 under the title "A new data bank for tidal gravity measurements (DB92), hereafter referred as ME 94.

1.1. General remarks about the calibrations

The essential step of the revision of the Data Bank was a readjustment of all calibrations in order to put them in agreement with the high precision measurements made at Bruxelles, Chur, Madrid, Wuhan and Curitiba by Baker, Edge and Jeffries (1989) as well as with the results obtained by inertial force effects on an oscillating platform built in Bruxelles by Van Ruymbeke.

In principle the manufacturer's calibration factors were used at the very start of the experiences. However the comparison of different instruments at a same place showed discrepancies in the results reaching often more than 1%.

Such comparisons of many instruments allow to realize the homogeneity of the results by application of a "normalization factor", called hereafter F, to each instrument. These factors are computed here with 5 digits, which is surely too ambitious as, in the best conditions, a calibration is obtained with 0.2% precision. Considering this uncertainty, corrections which are less than 0.2% on the observed tidal amplitudes have not been applied.

Of course when starting the Trans World Tidal Gravity Profiles in 1973 we had to adopt provisional F factors to reduce the observations. These factors have been progressively improved or slightly changed from time to time during the 18 years of this programme. Moreover the transportation of tidal gravimeters, even if in special protective boxes, by car to and from a plane which takes off and lands with unavoidable vibrations, cannot be made without small shocks sometimes may happen despite the instruments were always accompanied and manipulated with the greatest care.

In a Geodynamics gravimeter this could perhaps change the calibration pulse amplitude by an extremely small displacement of the calibration plate. The levels could also be slightly displaced. Many controls of the calibration and of the minimum sensitivity to tilt points have therefore been carefully made.

1.2. General remarks about the Geodynamics gravimeters

1. These gravimeters are provided with a "Control Unit" for thermostatization, drift correction and electrostatic calibration.
   In 1975 Van Ruymbeke replaced the Zener diode systems to improve the stability of the calibration voltage and, since 1983, built new Control Units to improve also the internal and external heating controls and make them independent from frequency and voltage of the mains. This

explains the changes in the calibration factors of the different groups of stations occupied by these instruments.

2. As these instruments have no micrometer, their absolute calibration can only be obtained by comparing the tidal parameters (O_1 amplitude and phase, M_2 phase) derived from a sufficiently long series of continuous registrations (at least three months) at a reference station with the corresponding parameters obtained with calibrated instruments at the same place.
The "normalization factors F" of the Geodynamics gravimeters were obtained in this way as practically all Geodynamics gravimeters were operating at the Bruxelles fundamental station.

3. The calibrations, usually made twice a week by electrostatic attraction, permit to control possible changes of sensitivity of the instrument due to changes in inclination. They also permit to control the sensitivity when the instrument is moved from one station to a next one.
However one must take great care to measure, at every calibration operation, the voltage (about 50V) applied to the plates because the amplitude of the calibration pulse is proportional to the square of the voltage. It is not always sure this has been done but this is an essential check we made in all our stations.
In some cases, with the original Control Units, we have also observed and measured a small residual voltage (about 1.5V) on the plates when the calibration switch was off. A corresponding correction must evidently be made on the calibration pulse.

4. Four Geodynamics gravimeters (n° 084, 721, 730, 804) were brought to Bruxelles in 1970 by J.T. Kuo. The Royal Observatory bought two other instruments (n° 765, 783) respectively in 1973 and 1977 while the gravimeter 084 remained at the disposal of Royal Observatory for further measurements.

5. Owing to their volume and weight these gravimeters are not so easy to transport than the small LaCoste Romberg model G gravimeters. They also need more power for their thermostatization and, consequently, suffer larger gaps in data when power interruption occur. For these two reasons, after few experiences we decided not to use Geodynamics gravimeters anymore in Africa.

1.3. Corrections for oceanic tides

In the following discussion the δ, α parameters given for the waves O_1 and M_2 are always the parameters corrected for oceanic attraction and load calculated on the basis of the Schwiderski maps. They are also corrected for the inertial effect because this is not a geophysical effect.

2. MEASUREMENTS IN EUROPE

2.1. Geodynamics gravimeters

On the basis of the conclusions obtained from several experiences (ME 94) a systematic correction to the calibrations of all Geodynamics gravimeters amounting to - 0.8% has been applied at the following stations

0010	Godhavn (G 730)	0508	Padova (G 730)
0011	Narssaq (G 730)	0509	Trieste (G 721)
0101	Bidston (G 721)	0516	Torino (G 730)
0105	Cambridge (G 721)	0610	Chur (G 804)
0110	Herstmonceux (G 721)	0695	Graz (G 721)
0220	Brugge (G 730)	0821	Faeroe (G 730)
0221	Louvain L-N (G 74)	0822	Aarhus (G 730)
0226	Damme (G 74)	0867	Gavle (G 761)
0306	Strasbourg (G 730)	0868	Vivattnet (G 761)
0310	Clermont Ferrand (G 804)	0869	Boxholm (G 761)
0311	Grasse (G 804)	1035	Zagreb (G 151)
0312	Bordeaux (G 804)		

It is worth while to point out that, after this correction, the comparison with Baker et al. results at the station 0610 Chur (Switzerland) is

Wave O_1

			δ	α
Baker et al.	ET 13	105 days	1.1518 ± 0.0009	- 0.02 ± 0.04
ICET	G 804	130 days	1.1518 ± 0.0026	- 0.03 ± 0.13

Wave M_2

Baker et al.	ET 13	105 days	1.1589 ± 0.0005	- 0.09 ± 0.02
ICET	G 804	130 days	1.1599 ± 0.0011	0.12 ± 0.05

The excellent agreement results, of course, from the fact that Chur was one of the five stations where Baker et al. results have been used to readjust the Bruxelles calibration system but an independent check of the validity of this 0.8% correction to the calibrations of all Geodynamics gravimeters may be found in the a posteriori comparison of the results previously obtained at 0101 Bidston-Liverpool with another Geodynamics, the n^r 721, and with Baker et al. instrument ET 10:

Wave O_1

			δ	α
Baker et al.	ET 10	184 days	1.1448 ± 0.0016	0.19° ± 0.04°
Kuo (ICET revis.)	G 721	214 days	1.1405 ± 0.0019	- 0.27° ± 0.10°

Wave M_2

Baker et al.	ET 10	184 days	1.0657 ± 0.0007	- 6.37° ± 0.03°
Kuo (ICET revis.)	G 721	214 days	1.0653 ± 0.0011	- 6.75° ± 0.05°

(Note that Bidston is on the coast of the Irish Sea which is not included in the Schwiderski cotidal-corange maps).

The results at 0271 Witteveen obtained with the Geodynamics gravimeters 074 have not been modified because they were obtained with a calibration factor 0.97551 while this instrument gave $\delta(O_1)$ = 1.1610 at Bruxelles with 0.98554 (0.98554 x 0.992 = 0.97766)

2.2. Corrections to several LaCoste Romberg gravimeters

The same - 0.8% correction has been applied at the stations

0224	Veurne	(LCR 487)
0227	Gistel	(LCR 487)
0325	Avignon	(LCR 336)
0709	Hannover	(LCR 298)

because the factors F for these three gravimeters had been related to the former "Bruxelles calibration system".

2.3. 0257 Walferdange Laboratory

The three Askania GS 11: n° 145, 160, 191 are those having served to establish the Bruxelles calibration system in 1975.

The manufacturer's calibration in amplitude had been used while the instrumental phase lag due to the galvanometer system was corrected: + 0.67° for O_1, + 1.40° for M_2 (Ducarme 1975).

Now, at Walferdange, the gravimeter Askania GS 25 n° 233 (M. Bonatz, Bonn University) has been used as a calibration reference together with Askania GS 11, n° 191. After correction for oceanic loading and attraction (Schwiderski maps) we obtain

	$\delta(O_1)$	$\delta(M_2)$
with A 191	1.1628	1.1618
with A 233	1.1620	1.1625
Mean	1.1624	1.1621
World Mean (Melchior 1994)	1.1547	1.1568
Ratio	1.0067	1.0046

We have therefore introduced a decrease of 0.56% by multiplying the amplitudes by a factor 0.99441.

The results obtained with seven gravimeters installed at Walferdange, after correction for oceanic effects are now:

	Wave O_1		Wave M_2	
	δ	α	δ	α
A 145	1.1561	-0.13°	1.1539	-0.39°
A 160	1.1534	-0.30°	1.1538	0.45°
A 175	1.1579	-0.39°	1.1565	-0.57°
A 191	1.1563	-0.09°	1.1551	-0.20°
A 233	1.1555	-0.12°	1.1556	-0.36°
A*206	1.1586	-0.04°	1.1573	-0.54°
G 804	1.1590	-0.33°	1.1557	-0.16°

The Geodynamics 804 was used at 0610 Chur and corrected as indicated before (- 0.8%).

2.4. 0709 Hannover station - phase problem with Geodynamics 74

The series of measurements obtained in 1973 with this gravimeter (Liège University instrument - L. Bragard) at Hannover was based upon the following parameters

$F = 0.99914 \qquad O_1 + 1.34° \qquad M_2 + 2.05°$

as measured at Bruxelles in 1973.
This gives

$\alpha\ (O_1) = -\ 0.729°$
$\alpha\ (M_2) = \ \ 1.642°$

and, after oceanic effects corrections

$\alpha\ (O_1) = -\ 0.82°$
$\alpha\ (M_2) = -\ 0.02°$

Reanalysing the Bruxelles observations in october 1992 I found that one should have applied

$F = 0.98554 \qquad O_1 + 2.01° \qquad M_2 + 1.78°$

to fit, at Bruxelles

$\delta(O_1) = 1.1610°$
$\alpha(O_1) = 0.07°$
$\alpha(M_2) = 2.75°$

This indicates that $\alpha(O_1)$ was not corrected properly and that an additional correction + 0.67° is to be applied which could happily give a final zero phase at Hannover.
Very unfortunately it does not fit for M_2 because the phase should be decreased by applying - 0.27° which makes the result worse.
It is no more possible to check this instrument because, after the death of Dr Bragard, the instrument has been manipulated without care and experience and must be considered as definitively damaged.
Let us add that, in 1973, we had not much experience with the Geodynamics gravimeters as they just came in our hands.

2.5. Station 0315 Sèvres-Paris

No informations available about the calibration method of the Sakuma instrument. $\delta(M_2) = 1.1766$ is obviously high but we have no reasons to doubt about it.

2.6. Three "Historical stations" in Italy

At the time of IGY three stations were occupied with Askania GS 11 instruments. The results obtained without any instrumental corrections but corrected for oceanic effects (Schwiderski maps), Mediterranean sea not included are

0505 Genova Askania 97 1960-62

O_1	1.1619	±	0.0141	-1.60°	±	0.70°
M_2	1.1527	±	0.0073	-1.87°	±	0.36°

0507 Costozza/Vicenza Askania 108 1962

O_1	1.1762	±	0.0194	0.25°	±	0.95°
M_2	1.1522	±	0.0102	-2.15°	±	0.50°

0511 Resina/Napoli Askania 141 1966-68

O_1	1.1564	±	0.0104	0.37°	±	0.52°
M_2	1.1588	±	0.0047	-1.87°	±	0.23°

With the exception of O_1 wave at Costozza the delta factors fit fairly well with the european and world means but the phases do not.

At the time of IGY the Askania equipment comprised a galvanometric system for recording.
According to a study made by Ducarme in 1975 the galvanometer introduced a phase lag which, for three similar instruments in Bruxelles (A 145, A 160, A 191) was the same and evaluated to 0.67° for O_1 and 1.40° for M_2. If we apply such phase corrections the results are :

		O_1		M_2	
0505	Genova	1.1619	-0.93°	1.1518	-0.45°
0507	Costozza	1.1762	+0.91°	1.1514	-0.73°
0511	Resina	1.1564	+1.04°	1.1582	+0.05°

the correction seems justified for M_2. Nevertheless these three stations are provisionally not included in DB92.
If we were sure that these instruments were using the first original Askania galvanometer (with the tower of small diameter) we could safety apply the phase corrections and maintain these observations in the Data Bank. This is an example of the importance to keep historical descriptions of the stations and the instruments which were used in a recent past.

2.7. Station 0516 - Torino - Gravimeter Geodynamics 730

We applied a normalisation correction of -0.8%:

$$F = 0.30660 \qquad O_1 = +1.320° \qquad M_2 = +1.515°$$

The M_2 results, corrected with Schwiderski map are

$$\delta\ (M_2) = 1.1568 \qquad \alpha\ (M_2) = -\ 0.61°$$

We introduce the attraction and loading effects of the Mediterranean sea according to the Chiaruttini map:

$$L(Med) = 0.30 \qquad \lambda(Med) = -57.0°$$

or to the Canceil et al. map

$L(Med) = 0.163$ $\lambda(Med) = -58.71°$

and obtain respectively

$\delta(M_2) = 1.1524$ $\alpha(M_2) = -0.27°$
1.1545 $-0.42°$

The L(Med) efficiently reduces the phase α.

2.8 Station 0821 Faeroe - Gravimeter Geodynamics 730

We use the same revised instrumental corrections as for the station 0516 Torino and obtain

$\delta\ (O_1) = 1.1171$ $\alpha\ (O_1) = 0.972$

and, correcting on the basis of the Schwiderski O_1 map

$\delta\ (O_1) = 1.1512$ $\alpha\ (O_1) = 0.17°$

The wave M_2 gives $\delta = 1.35$ with $\alpha = -1.4°$(corrected with Schwiderski M_2 map). The station being installed at 700m height on the vicinity of Torshavn, at 2 km from the shore, specific corrections due to the altitude are still needed for M_2.

2.9. Station 0822 Aarhus - Gravimeter Geodynamics 730

We use the same revised instrumental corrections as for station 0516 Torino and obtain

$\delta\ (M_2) = 1.1859$ $\alpha\ (M_2) = 1.65°$
$\delta\ (O_1) = 1.1500$ $\alpha\ (O_1) = -0.18°$

and, correcting on the basis of the Schwiderski M_2 and O_1 maps :

$\delta\ (M_2) = 1.1572$ $\alpha\ (M_2) = -0.05°$
$\delta\ (O_1) = 1.1551$ $\alpha\ (O_1) = -0.34°$

2.10. Stations 0825-0828 Danish stations

M_2 Wave

Oceanic corrections

L, λ first line: ICET / Schwiderski
second line: Jahr et al (1987) / Schwiderski

L', λ' Schwiderski + Flather + DHI (Jahr et al. 1987)

		L	λ	L′	λ′
825	Varde	{ 1.078	61.53	1.274	70.6
		{ 0.955	78.5		
826	Monsted	{ 1.101	56.38	0.992	71.4
		{ 0.919	70.2		
827	Aalborg	{ 1.069	54.42	0.867	66.8
		{ 0.856	67.6		
828	Rolfsted	{ 1.058	49.84	0.975	70.8
		{ 0.849	62.2		

<u>δ, α corrected:</u>

		with (L, λ) ICET		with (L′, λ′)	
825	Varde	1.1627	0.39°	1.1664	- 0.14°
826	Monsted	1.1476	0.22°	1.1604	0.16°
827	Aalborg	1.1603	- 0.19°	1.1721	- 0.06°
828	Rolfsted	1.1474	0.16°	1.1622	- 0.06°
	Mean	1.1545		1.1652	

European mean	1.1559	- 0.09°
(84 stations)	± 0.0007	± 0.04°

Wahr Dehant Model 1.1546 at 55°

λ (Jahr) - λ (ICET) = 14.1°
λ′ - λ (ICET) = 14.4°

<u>O_1 Wave</u>

<u>Oceanic corrections (Schwiderski map)</u>

		L	λ
825	Varde	0.145	154.9
826	Monsted	0.153	151.0
827	Aalborg	0.194	145.7
828	Rolfsted	0.161	148.4

<u>δ, α corrected:</u>

		Observed		Corrected	
		δ	α	δ	α
825	Varde	1.178	0.52	1.1826	0.41
826	Monsted	1.147	- 0.11	1.1516	0.24
827	Aalborg	1.153	- 0.15	1.1587	- 0.34
828	Rolfsted	1.152	0.84	1.1540	0.09

Varde is very close to the coast: the correction do not appear as satisfactory.

2.11. Station 0864 Uppsala

No recent informations about the calibration. Results look correct, so we have no reasons to doubt about it.

2.12. Stations 0867-0889 Sweden/Finland - Geodynamics 761

For the stations 0883 Helsinki, 0885 Oulu, 0886 Kevo, 0887 Sodankyla, 0888 Vaasa, 0889 Joensuu and 0890 Vaajakoski occupied in 1972-76, the adopted coefficient

$$F = 0.98751$$

gives satisfactory results.
For some questionable reasons other values were adopted by Ducarme and Kaariainen (1980) at

0867 Gavle : 0.97140
0868 Vivattnet : 0.96915
0869 Boxholm : 0.97800

giving very low values for $\delta(M_2)$. We have reanalysed these three stations with the "Helsinki factor" 0.98751. The δ results are now within the 1.156 - 1.162 range.
Thus, we finally adopted for the period 1972-1976:

$F = 0.98751$ $\quad O_1 = + 1.35°$ $\quad M_2 = + 1.24°$

for the period 1979-1980 (Helsinki, Oulu, Sodankyla):

$F = 0.98751$ $\quad O_1 = + 1.20°$ $\quad M_2 = + 1.38°$

Then, for the nine stations reported one has the following δ mean values:

Ducarme - Kaariainen	$\delta(O_1) = 1.1543 \pm 0.0034$	$\delta(M_2) = 1.1427 \pm 0.0058$
Present revision	$\delta(O_1) = 1.1591 \pm 0.0023$	$\delta(M_2) = 1.1493 \pm 0.0041$

However the station 0866 Kramfors must surely be rejected due to extreme instabilities of the sensitivity (see Ducarme and Kaariainen, 1980, figure 3b page 17).

2.13. Station 0004 Longyearbyen (Spitsbergen)

Latitude 78.2° N.

Such a station is useful for the O_1 wave determination which has an observed amplitude of 16.69 μgal while it is not to be taken into account for the M_2 wave whose observed amplitude is only 1.8 μgal at this latitude.
We use the results obtained by M. Bonatz with the Askania GS 11,116 gravimeter (260 days) :

$\delta_{obs}(O_1) = 1.1345$ $\quad \alpha_{obs}(O_1) = + 0.59°$

Oceanic effects calculated on the basis of the Schwiderski map which includes the Arctic Ocean are :

$L(O_1) = 0.288\ \mu gal$ $\lambda(O_1) = 135.26°$

the corrected results are :

$\delta_{corr}\ (O_1) = 1.1484$ $\alpha_{corr}\ (O_1) = -\ 0.10°$

2.14. Stations observed with the Askania gravimeter 190

0695 Graz, 0950 Budapest, 0955 Pecs.
At our request P. Varga, owner of this instrument, carefully revised its calibration and confirmed us the original data (personal communication).

2.15. Station 1035 Zagreb

The gravimeter Geodynamics 151 from Graz University has been installed by H. Lichtenegger.
This instrument had been calibrated in Bruxelles. We therefore decreased its normalization factor by 0.8%.

2.16. Station 1152 Poltava

Latitude: 49°36'13"

D = 750 km
Theoretical M_2 amplitude 31.4578 μgal
Data published by Balenko et al. (1988)

$\delta_{obs.}\ (M_2) = 1.1749 \pm 0.0010$ $\alpha = -\ 0.47 \pm 0.05°$

Thus

$A(M_2) = 39.960$ $\alpha(M_2) = -\ 0.47°$
$L(M_2) = 0.5648$ $\lambda(M_2) = 1.09°$

$$\delta_{corr} = \frac{|\bar{A} - \bar{L}|}{A} \times \delta_{obs} = 1.1570 \qquad \alpha_{corr} = -\ 0.49°$$

Theoretical O_1 Amplitude 30.6795 μgal

$\delta_{obs}\ (O_1) = 1.1521 \pm 0.0021$ $\alpha = -\ 0.13° \pm 0.11°$
$A\ (O_1) = 35.4498$
$L\ (O_1) = 0.135$ $\lambda(O_1) = 140.43°$
$\delta_{corr} = 1.1555$ $\alpha_{corr} = -\ 0.27°$

2.17. Stations in Russia and Central Asia

Basic data taken from Pariiskii et al. (1980), translation in BIM 93 pp 6229-6244 (1985) - see table 6 page 6236.

Corrected for oceanic effects calculated on the basis of Schwiderski maps:

Russia	O_1		M_2	
	δ	α	δ	α
1105 Pulkovo	1.1643	- 0.59	1.1501	- 0.99
1117 Obninsk	1.1540	- 0.08	1.1617	- 0.01
1119 Krasnaya P.	1.1612	- 0.25	1.1678	- 0.24
1142 Kiev	1.1640	1.50	1.1740	0.16
1152 Poltava	1.1532	- 0.04	1.1592	- 0.15
Central Asia				
1270 Tashkent	1.1506	- 0.65	1.1447	- 0.72
1280 Pishpek (Frounze)	1.1477	- 0.05	1.1570	- 0.34
1293 Talgar	1.1576	- 0.18	1.1648	- 0.03

Station 1289 Novosibirsk.

New results from this station have just been published [Saritcheva and Timofeev 1992] who conclude to an error of calibration of 1.2% due to the micrometric screw which gave too low values for the δ factors in all previous publications.
We adopted the new results corrected for oceanic effects according to the Schwiderski maps:

$\delta\ (O_1) = 1.1464$ $\alpha\ (O_1) = -\ 0.50°$

$\delta\ (M_2) = 1.1613$ $\alpha\ (M_2) = -\ 0.46°$

3. ICET TRANS WORLD PROFILES

3.1. Stations occupied with the Geodynamics gravimeter 084

Stations in South East Asia

2501 Bangkok (1973-74)
2502 Chiang Mai (1974)
2450 Kathmandu (1974-75)

The calibration factor F = 1.18255 (with O_1: + 0.730°; M_2: + 0.760°) was determined in Bruxelles but the analysis unfortunately could not be retrieved. Nevertheless, the $\delta(M_2)$ factor corrected for oceanic effects (Schwiderski map) being

δ = 1.1534 at Bangkok
δ = 1.1542 at Chiang Mai
δ = 1.1486 at Kathmandu

We consider that the calibration is not to be decreased at these three places. Considering the low latitudes the O_1 wave is not to be considered for such a control.

Stations in Australia and China

We had some trouble with the instrument at the occasion of its transfer from Kathmandu to Canberra. The control unit was modified and consequently also the factor F. Measurements at Canberra, in comparison with our LCR 336 calibrated in Bruxelles (see section 3.6) indicated the need of a reduction of the calibration factor of about 1%. After the measurements at Canberra, Armidale and Alice Springs the instrument was returned to Bruxelles and recalibrated. The obtained factor was

$$F = 1.16778 \quad \text{with} \quad O_1 + 0.711° \quad M_2 + 0.959°$$

to fit $\delta(O_1) = 1.1517$ at Bruxelles, thus a correction of 1.3% which has been applied at all the concerned stations to obtain, after oceanic corrections:

		Wave O_1		Wave M_2	
		δ	α	δ	α
4205	Armidale	1.1608	- 0.19°	1.1468	0.17°
4206	Canberra	1.1624	- 0.47°	1.1609	0.06°
4209	Alice Springs	1.1602	0.13°	1.1671	0.02°
2606	Urumqi	1.1592	- 0.16°	1.1704	0.32°
2607	Wuhan	1.1569	- 0.31°	1.1611	- 0.21°
2610	Shenyang	1.1500	- 0.42°	1.1609	0.04°
2614	Qindao	1.1396	- 0.65°	1.1626	0.53°
2750	Séoul	1.1447	- 1.21°	1.1602	0.58°

The comparisons performed with three other instruments at Wuhan gave for this new calibration factor F = 1.1684 practically equal to the Bruxelles value 1.1678 given above (difference 0.05%, not significative).

Stations in Latin America

After the Seoul measurements the instrument was returned to Bruxelles where its control unit was replaced by a more modern one with a different calibration pulse. We had to determine this new calibration by comparison with our LaCoste Romberg 402/zero method at Santa Cruz which resulted to be:

$$F = 1.15704 \quad \text{with} \quad O_1: + 0.22° \quad M_2 + 0.46°$$

values which have been used at

7505	Santa Cruz	7251	Cartagena
7406	Nana	7252	Isl. San Andrès
7411	Iquitos	7253	Cucuta
7412	Nazca	7201	Caracas
7451	Guayaquil		

The O_1 and M_2 waves results, published in details in Melchior et al. (1991) were not subject to further corrections. They are in fair agreement with those obtained on the other continents as well as with the Earth's models (ME 94 and section 5 of this paper).

Moreover, three years after the Santa Cruz comparison, the Geodynamics 084 was again compared at Caracas station with our LaCoste Romberg 402 with feedback, with the following results:

	Wave O_1	Wave M_2
Amplitude in μgal	13.55	84.12
δ with L 402	1.2248	1.1681
δ with G 084	1.2176	1.1600
α with L 402	- 0.18	0.79
α with G 084	0.11	0.82

Thus the calibration factor of G 84 is surely not too high while its instrumental phase lag is correctly estimated.

3.2. Stations occupied with the Geodynamics gravimeter 765

As in the case of the Geodynamics 084 the control unit of this instrument was modernized and later replaced with a new one.
It results that there are three independent groups of stations each being treated with its own calibration system.

First Series - South Asia

			F	O_1	M_2	$\delta(M_2)$	$\alpha(M_2)$
1976	2550	Kuala Lumpur	1.10664	0.810	0.660	1.1577	0.71
1976	2551	Penang				1.1402	0.26
1977	2555	K. Kinabalu				1.1420	- 0.33
1978	2460	Colombo				1.1261	0.49
1978	2352	Peshawar				1.1917	- 0.96

The control unit was damaged at Peshawar at the end of the series, due to local difficult conditions. The results of this station could be questioned.

Second series - China

The control unit was repaired at Bruxelles. The new calibration, based upon a local $\delta(O_1) = 1.1610$:

$$F = 1.15840 \quad O_1: + 1.02° \quad M_2: + 0.78°$$

has to be decreased by 0.8% so that F = 1.1491 has been applied at the stations:

2603 Beijing
2605 Lanzhou
2607 Wuhan

Third series - Africa

A new control unit was constructed with the following parameters:

$F = 1.20032 \times 0.992 = 1.19072$
$O_1 + 0.80°$
$M_2 + 0.41°$

used for the reduction of three African stations:

3321 Lamto
3325 Ouagadougou
3410 Bangui

Fourth series - Argentina

After a new change of control unit we measured as new calibration parameters:

$F = 1.22034$ ($\delta(O_1)$ at Bruxelles 1.1517)
$O_1 + 0.72°$
$M_2 + 1.26°$

used for the reduction of the Argentina stations

7805 Buenos Aires
7810 Tandil
7812 Pilar
7813 Corrientes
7815 San Lorenzo
7816 Bariloche
7819 Santa Rosa

A series made in poor local conditions at Curitiba (Brazil) can be compared with the results obtained by Baker, Edge and Jeffries with the ET 16 LaCoste Romberg gravimeter. It indicates that a reduction of

$- 0.6\% \pm 0.2\%$

could be needed. Considering the poor quality of the G 765 Curitiba series and other arguments developed in ME 94 we consider that such a correction is not appropriate.

3.3. Stations occupied with the Geodynamics gravimeter G 783

Measurements in Asia

The usual calibration made at Bruxelles gave F = 0.95339 while the comparisons made at Wuhan gave:

$F = 0.94886 \qquad O_1 + 0.42° \qquad M_2 + 0.52°$

parameters which were applied, with the following results, to the observations made at

		$\delta(O_1)$	$\delta(M_2)$
2000	Istanbul	1.1564	1.1587
2005	Ankara	1.1629	1.1621
2600	Guangzhou	1.1513	1.1531
2612	Shanghai	1.1523	1.1475
2823	Kyoto	1.1604	1.1652
2877	Tokyo	1.1617	1.1656
Mean		1.1575	1.1587
Mean Asia (49 stations)		1.1550	1.1581
World Mean (215 stations)		1.1541	1.1564

Measurements in Latin America

On the basis of the rather difficult comparisons made at Curitiba (this station suffering from instabilities) we have adopted the following parameters

$$F = 0.95099 \qquad O_1 + 0.337° \qquad M_2 + 0.647°$$

not very different from those used in Asia and obtained:

		Wave O_1	Wave M_2
7305	Curitiba	1.1624	1.1663
7310	Goiania	1.1599	1.1460
7309	Cuiaba	1.1572	1.1507
7316	Belem	-	1.1428
7313	Teresina	-	1.1756
7314	Vassouras	1.1619	1.1684
	Mean		1.1583

The instrument was returned and equipped with a new control unit in 1988 with the following calibration parameters

$$F = 0.94570 \qquad O_1 + 0.552° \qquad M_2 + 1.180°$$

which gave the following results:

		Wave O_1	Wave M_2
7281	Kourou	1.1691	1.1606
6911	Morne d.C.	1.1682	1.1531
7119	Guayabo	1.1431	1.1708
7105	Guatemala	1.1774	1.1669
7303	Sao Paulo	1.1587	1.1639
7305	Curitiba	1.1693	1.1685

The δ factors look higher than the World mean values despite the decrease of the calibration factor by 0.56%. The difference between the three calibration factors is between 0.2% and 0.5%.

3.4. Stations occupied with the LaCoste Romberg gravimeter L 3

During the first series of measurements the sensitivity of this instrument was rather erratic, due to problems with the micrometer. This makes the results at the stations 4011 Manila, 2601 Hong Kong, 4208 Broken Hill uncertain and those at 4160 Port Moresby surely to be rejected, very unfortunately.
However Hong Kong results are in good agreement with later and independent measurements made at Guangzhou (100 km distant) with Geodynamics 783 (see section 3.3. and Tables) for the O_1 wave.
We can keep as probably good the revised results at 4207 Charter Towers obtained after a readjustment of the calibration by comparisons with 3 other instruments at Canberra:

$$F = 0.33973 \ (!)$$

Nevertheless we do not trust this station and do not use it in our statistics.

The gravimeter was then sent to the manufacturer for revision in april 1977 and was returned in november of this same year.

Measurements in Africa

After the calibration was redetermined at Bruxelles and, decreasing it by 0.8%, we obtain:

$$F = 0.97410 \times 0.992 = 0.96631$$
$$O_1: + 1.35°$$
$$M_2: + 1.24°$$

parameters used for the reductions of the stations

3005	Aswan	3601	Antananarivo
3010	Khartoum	3602	Nosy Bé
3495	Harare	3604	Tolagnaro

Due to a transportation incident between Harare and Stellenbosch we had to decide to use at 3807 Stellenbosch the calibration redetermined at the return to Bruxelles, immediately after this series was terminated:

$$F = 0.98408 \qquad O_1 + 0.934° \qquad M_2 + 0.968°$$

The validity of this factor F was reconfirmed by the comparison made at the next station Curitiba (in 1984) with the Baker et al. results of ET 16 which gave F = 0.98253 which differs by only 0.016%
Then we had again problems with this instrument in Brazil so that observations made with LCR 003 at the station 7308 Vicosa are to be rejected (unless we adopt F = 0.93818 to adjust the results to those obtained later with LCR 008 at this same station). The last stations 7307 Campo Grande and 7315 Manaus are not too satisfactory. Moreover the maintenance was not properly made at Manaus so that this station should be provisionally excluded from the statistics.

3.5. Stations occupied with the LaCoste Romberg gravimeter L 8

This instrument was, by far, more stable than the LCR 3.
The calibration made at Bruxelles (F = 1.00059) was reduced to F = 0.98662 and used to reduce the observations performed at the following stations:

4220	Hobart	2350	Quetta
4400	Hamilton	2351	Lahore
4420	Lauder	4105	Banjar Baru
4475	Apia	4115	Kupang

Unfortunately the measurements at Lahore must be rejected due to complete lack of maintenance.
The gravimeter was transformed into a zero method instrument at Curitiba by M. Van Ruymbeke. By comparison with Baker et al. results the calibration factor was found to be

F = 1.00247

with, of course, no instrumental phase corrections.

This factor was used to reduce the observations made in Brazil at

7311 Caico
7317 Salvador
7308 Vicosa

The instrument was then returned to Bruxelles and the RC filter was changed. Thereafter a new calibration factor

F = 0.9977 x 0.992 = 0.9897

very close to the original value 0.9866 was used for three african stations:

3102 Ifrane
3118 Tamanrasset
3311 M'Bour

A series of measurements was also made at 3112 Alger after M'Bour and before Tamanrasset but the results cannot be understood and accepted (the anomaly amounts to 5% !). We have no explanation because the results of the other three stations are very satisfactory. The Alger station is therefore excluded from DB92.

3.6. Stations occupied with the gravimeter LaCoste Romberg 336

This is the best LaCoste Romberg gravimeter we had in our hands. Its calibration, measured at six different epochs, from 1975 to 1990 at Bruxelles gives as general mean value

$F = 0.99449 \pm 0.00230$
$O_1 = + 0.47°$
$M_2 = + 0.58°$

Thus we used

F = 0.99449 x 0.992 = 0.98653

from 1975 (Canberra) to 1983 (Avignon).

The instrument was transformed into zero-method by Van Ruymbeke in 1983. The calibration was then redetermined by comparison with Baker et al. results for the M_2 wave:

$$F = 0.98278$$

which differs by no more than 0.38% from the value above with, of course, no instrumental phase correction.
We did not change the initial F value for the last group of African stations:

3400	Niamey	3312	Kedougou
3399	Arlit	3401	Bamako
3410	Bangui	3300	Nouakchott
3415	Brazzaville	3090	Lanzarote/Cueva
		3092	Lanzarote/Timanfaya

We note that a further decrease of F to 0.98278 should make the residues more negative in this area and consequently increase the correlation with heat flow!

3.7. Stations occupied with the gravimeter LaCoste Romberg 402

Early analyses were made with a factor $F_1 = 1.00857$ obtained at Bruxelles but it gave a particularly high amplitude

$$\delta\ (M_2) = 1.1988 \qquad \alpha\ (M_2) = 2.75°$$

The observations by Baker et al. with ET 13 at Bruxelles gave:

$$\delta\ (M_2) = 1.1776 \qquad \alpha\ (M_2) = 2.86°$$

which indicate that a factor $F_2 = 0.98232$ had to be used instead of 1.00857.

Recalibration of LCR 402 by intercomparisons with 5 other instruments at Wuhan (China) also gave $F_3 = 0.98462$.

This last factor had been applied at our stations 2604 Kunming in China, 2847 Mizusawa, 2897 Memambetsu, 2875 Kanoya in Japan and 2450 Kathmandu, Nepal. We consider that no further revision is to be made.

However we can not explain the high delta values obtained at Kunming:

$$\delta(O_1) = 1.1746 \qquad \delta(M_2) = 1.1743$$

The calibration seems to be 2% too high but with this same calibration, the results obtained after Kunming at Mizusawa, Memambetsu and Kanoya are perfectly "normal" while at Wuhan, before Kunming series, the results of LCR 402 give the lowest value amongst six instruments (1.1702 with respect to a mean value 1.1748).

Five stations however had already been analyzed with the preliminary factor F = 1.00857 but later on with the revised value. The results of this correction are:

	δ (M_2) :	initial	revised
2201	Teheran	1.1977	1.1659
2202	Tabriz	1.1986	1.1667
4450	Noumea	1.2366	1.2018
4460	Suva	1.1909	1.1561
4480	Papeete	1.1910	1.1596

The correction is obviously justified and there is no reason for a further decrease of F.

The result is of course also a decrease for δ (O_1) but less satisfactory.

	δ (O_1) :	initial	revised
2201	Teheran	1.2017	1.1703
2202	Tabriz	1.1998	1.1684
4450	Noumea	1.2239	1.1931
4460	Suva	1.2137	1.1829
4480	Papeete	1.2037	1.1717

After the series of measurements performed at Kathmandu, the instrument was returned to Bruxelles where Van Ruymbeke installed his feedback system to transform it into a zero method instrument.
All observations made thereafter at Kevo (Finland), Madrid and at eleven stations in Latin America have been reduced with F = 1.00000 and no instrumental phase corrections.
Moreover the LCR 402 - zero method was taken as reference instrument for the Geodynamics 084 calibrations at Santa Cruz (Bolivia) and at Caracas (Venezuela) (see section 2.1).

3.8. Station occupied with the gravimeter LaCoste Romberg 487

This instrument is equipped with feedback system. Only one station, Presidente Prudente, Brazil, has been observed with this instrument.
The coefficient used was already decreased:

$$F = 0.99641$$

(with no phase corrections), the results being

$$\delta(M_2) = 1.1580 \qquad \alpha(M_2) = -\ 0.19°$$
$$\delta(O_1) = 1.1589 \qquad \alpha(O_1) = -\ 0.54°$$

Obviously a further correction should not be justified.

3.9. Stations occupied with the gravimeter LaCoste Romberg 906

This instrument is equipped with feedback system. The initial calibration factor was F = 1.01660. After the transformation into zero method instrument by Van Ruymbeke we obtained at Bruxelles reference station F = 1.02188. Thus

$$F = 1.02188 \times 0.992 = 1.01370$$

is not significantly different from the initial value (0.3%) which was used to reduce the observations successively made at

7805	Buenos Aires	7817	Ushuaia
7895	Tacuarembo	7818	Comodoro Rivadavia
7814	Zonda.		

3.10. Stations occupied with the gravimeter LaCoste Romberg Model D, n° 32

The initial calibration at Bruxelles reference station in 1980 gave

$$F = 0.96535$$

We have adopted

$$F = 0.96535 \times 0.992 = 0.95763$$

with phase corrections O_1 + 1.56°, M_2 + 1.19° at the stations

3020 Mogadiscio
3040 Dar es-Salaam
3500 Maputo

We have some reasons to suspect a transportation problem between Maputo and Nampula in Mozambique because the next two stations

3505 Nampula
3801 Johannesburg

gave very low $\delta(M_2)$ factors. We recalibrate the instruments immediately after at Bruxelles and found

$$F = 0.97423 \times 0.992 = 0.96644$$

which was used for the reduction of these two stations.
It is worth while to point out that the very low value at Johannesburg reinforced the correlation of the tidal residues with tectonics features. By this change of calibration we have slightly reduced the residue in absolute value. Nevertheless we have some doubts about the performance of this Model D for tidal measurements.

4. INDEPENDENT NETWORKS

4.1. Japan

This concerns twelve tidal gravity stations established and analyzed by Takeshi Endo (1984, 1985).
The author used two classical LaCoste Romberg instruments: n° 34 and n° 447. Later on the LCR 447 was equipped with a zero method device for observations at Tokyo and Takayama. The author was obviously only interested in differences of the δ, α parameters between stations occupied with the same instrument, relative to Tokyo reference station and did not therefore corrected it for calibration and instrumental phase lag. He gave however enough details in his two papers to allow to perform such corrections what we do here.
We compared therefore the results obtained at the common station Tokyo:

(a) with respect to G783/ICET Bruxelles

L 34	F = 0.9684	O_1 : + 0.63°	M_2 : + 1.32° (1)

(b) with respect to LCR 447 Zero method

L 34	F = 0.9542	O_1 : + 1.06°	M_2 : + 1.28° (2)
L 447	F = 0.9846	O_1 : + 1.30°	M_2 : + 1.62° (3)

We have adopted corrections (1) and (3)
Then, following Endo himself, we adopt the oceanic corrections according to the Schwiderski map + Sea of Japan (as calculated by Endo) because this gives lower phase lags than the use of the Parke Hendershott map (systematic difference 0.39°). However all phases remain negative with a mean value - 0.40°. Having observed that the corrections due to the coastal seas of China (Raty and/or Sun computations) are not negligible but smoothly regular over Japan we applied also these corrections. The correction to the phases was important indeed: + 0.40° which brings their mean to 0° as shown by the wave M_2 table hereafter.

Wave O_1

Gravimeter G 34 adjusting corrections: F = 0.9684 O_1 + 0.63°

		Published		Adjusted		Corrected (*) (oceans load)	
		δ	α	δ	α	δ	α
2877	Tokyo	1.278	- 0.18	1.2376	0.45	1.1553	- 0.08°
2856	Fujigawa	1.289	- 0.97	1.2484	- 0.34	1.1737	- 1.14°
2836	Yahiko	1.267	- 0.62	1.2270	0.01	1.1773	- 0.56°
2832	Yatsugatake	1.240	0.17	1.2008	0.80	1.1392	0.09°
2883	Nagano	1.228	- 2.17	1.1892	- 1.54	1.1426	- 2.22°
2884	Kiryu	1.265	- 0.73	1.2250	- 0.10	1.1713	- 0.91°

Gravimeter G 447 adjusting corrections: F = 0.9846 O_1 + 1.30°

		δ	α	δ	α	δ	α
2877	Tokyo	1.242	- 0.42	1.2228	0.88	1.1562	0.04°
2885	Kakioka	1.228	0.22	1.2091	1.52	1.1479	0.59°
2853	Inuyama	1.232	- 1.08	1.2130	0.22	1.1463	- 0.36°
2840	Aburatsubo	1.271	0.72	1.2514	2.02	1.1535	0.97°

Gravimeter G 447 Z Zero method no instrumental corrections

		δ	α	δ	α	δ	α
2877	Tokyo	1.217	0.88	1.217	0.88	1.1458	0.04°
2886	Takayama	1.188	0.32	1.188	0.32	1.1428	- 0.36°

Wave M_2

Gravimeter G 34 adjusting corrections: F = 0.9684 M_2 + 1.32°

		Published		Adjusted		Corrected (*) (ocean load)	
		δ	α	δ	α	δ	α
2877	Tokyo	1.257	- 0.70	1.2173	0.63	1.1726	0.20°
2856	Fujigawa	1.261	- 0.93	1.2211	0.39	1.1672	0.04°
2836	Yahiko	1.251	- 0.54	1.2115	0.78	1.1799	- 0.01°
2832	Yatsugatake	1.236	- 0.08	1.1969	0.24	1.1551	- 0.16°
2883	Nagano	1.229	- 1.22	1.1902	0.10	1.1537	- 0.32°
2884	Kiryu	1.237	- 0.67	1.1979	- 0.65	1.1588	0.06°

Gravimeter G 447 adjusting corrections: F = 0.9846 O_1 + 1.30°

		δ	α	δ	α	δ	α
2877	Tokyo	1.215	- 1.04	1.1963	0.58	1.1516	0.14°
2885	Kakioka	1.209	- 0.70	1.1904	0.92	1.1537	0.09°
2853	Inuyama	1.212	- 1.31	1.1933	0.31	1.1432	0.21°
2840	Aburatsubo	1.246	0.70	1.2268	2.32	1.1607	- 0.08°

Gravimeter G 447 Z Zero method no instrumental corrections

		δ	α	δ	α	δ	α
2877	Tokyo	1.202	0.58	1.202	0.58	1.1573	0.14°
2886	Takayama	1.184	0.08	1.184	0.08	1.1432	- 0.13°

(*) To be compared with Endo's Table 6a page 499.

Station 2823 Kyoto

Several registrations have been obtained with different instruments.
We have adopted the most recent data obtained with a Superconducting instrument GWR 009

$\delta(M_2) = 1.1983$ $\alpha(M_2) = - 0.21$

Correction for oceanic effects is made with the World Schwiderski map + Sea of Japan (Endo) + Chinese seas (Raty/Sun H.P.). This gives

$\delta_{corr} (M_2) = 1.1591$ $\alpha_{corr} (M_2) = + 0.38°$

4.2. Measurements made in the U.S.A. with Geodynamics gravimeters

There are two networks : one by J.T. Kuo and the other by E.S. Robinson.
Corrections for instrumental phase delay at M_2 frequency are usually comprised between 0.5° and 1.25° (Melchior, Robinson and Holland).
We have no information about this correction for the instruments used by Kuo for his Trans U.S. Profile while the results suggest a correction of the order of 1°.
We consequently can not introduce presently these data in the New Data Bank at the exception however of the station 6331 Fairfax where the gravimeter Geodynamics 804 had been used in 1969-70 and has been calibrated at Bruxelles in 1972:

$F = 1.52170$ O_1: + 0.56° M_2: + 0.91°.

We obtain for this station:

$\delta(O_1) = 1.1522$ $\alpha(O_1) = - 0.12°$ $\delta(M_2) = 1.1462$ $\alpha(M_2) = 0.01°$

For the stations occupied by Robinson and Holland we have used the instrumental corrections given in BIM 102 (1988).

4.3. Station 6811 Alert (Canada).

Latitude 82.48°N

Such a station is useful for the O_1 wave determination which has an observed amplitude of 9.32 μgal while it is not to be taken into account for the M_2 wave whose amplitude is only 1.3 μgal at this latitude.
We use the results obtained by Bower et al. with the LaCoste Romberg ET 12 gravimeter (104 days)

$\delta_{obs} (O_1) = 1.1543$ $\alpha_{obs} (O_1) = - 1.315°$

Schwiderski effects (include Arctic Ocean)

$L (O_1) = 0.20$ $\lambda = - 61.7°$

Result

$\delta_{corr} (O_1) = 1.1422$ $\alpha_{corr} (O_1) = - 0.23°$

5. CONCLUSIONS

The following eleven tables present the results of our revision for what concerns the δ, α parameters of the O_1 and M_2 waves.
Equatorial stations had evidently to be discarded in the case of the O_1 wave. It is to be pointed out that, in these tables, the parameter D is the distance, in kilometres, to the nearest Schwiderski tidal polygon. It is specially important for the European stations.
The final results given in ME 94, tables 21 and 22 as reproduced here:

	N° of stations	$\delta(O_1)$	$\alpha(O_1)$
Europe	81	1.1528 ± 0.0010	- 0.10° ± 0.04°
Asia	45	1.1550 ± 0.0016	- 0.27° ± 0.09°
Latin America	34	1.1556 ± 0.0021	- 0.25° ± 0.15°
Miscellaneous	28	1.1543 ± 0.0020	- 0.47° ± 0.14°
Total	188	1.1541 ± 0.0008	- 0.22° ± 0.04°

	N° of stations	$\delta(M_2)$	$\alpha(M_2)$
Europe	84	1.1559 ± 0.0007	- 0.09° ± 0.04°
Asia	49	1.1581 ± 0.0011	- 0.02° ± 0.05°
Africa	26	1.1546 ± 0.0019	- 0.19° ± 0.09°
North America	10	1.1579 ± 0.0030	- 0.37° ± 0.11°
Latin America	46	1.1565 ± 0.0012	- 0.04° ± 0.07°
Total	215	1.1564 ± 0.0005	- 0.09° ± 0.03°

were obtained on the basis of these tables. Since this publications was in press we could add three stations in Europe and one in Latin America. However, in addition to the 33 eliminated stations of ME 94, table 12, four more stations had to be discarded from our statistics: 0866 Kramfors, 3112 Alger, 4160 Port Moresby and 7315 Manaus.

The homogeneity of these results and their agreement with the values calculated on the basis of earth models show that the objective, which was to eliminate systematic errors, has been reached. Of course accidental errors on individual values remain but this was not the purpose of this work.

The mean square errors derived from tidal analyses are indeed only internal errors.
We have not reproduced them in the tables, considering the facts that we cannot evaluate the accuracy of the calibration factor of each instrument at each station to better than 0.5%, the accuracy of the oceanic load and attraction corrections and the uncertainties due to areas not included in the Schwiderski maps.
We believe that one can obtain a better estimation by considering the dispersion of the δ values inside groups of about 20 stations provided that they pertain to a sufficiently narrow network (examples: Spain, N W Europe, Central Europe). One may obtain in this way estimations of about ± 0.005 on the individual $\delta(M_2)$ values to be compared with the general means given in the tables above but this presupposes that tectonic effects do not exist. The figure 7 in ME 1994 gives a good example of the dispersion of the δ values in Europe. The results look quite better if we consider pairs of very close and independent stations as those given in the following table which result from different groups of investigators.

		O_1		M_2	
		δ	α	δ	α
0201	Bruxelles	1.1577	0.00	1.1516	0.06
0221	Louvain L.N.	1.1564	- 0.26	1.1576	0.14
0401	Valle L.C.	1.1513	0.17	1.1575	0.01
0402	Madrid	1.1523	- 0.22	1.1574	- 0.05
0610	Chur	1.1515	0.00	1.1552	- 0.16
0615	Zürich	1.1507	- 0.01	1.1554	- 0.22
0928	C. Budejovice	1.1536	0.22	1.1557	0.02
0930	Pecny	1.1525	- 0.08	1.1543	- 0.15
2600	Guangzhou	1.1513	- 0.01		
2601	Hong Kong	1.1553	- 0.58	-	
2847	Mizusawa	1.1588	- 1.13	1.1570	- 0.26
2849	Esashi	1.1594	- 0.52	1.1571	- 0.10

We do not think this can be improved on the basis of the available data. Stations where we suspect the quality of original data should be reobserved with other instruments.

We have given here sincere and full explanations about our method of reduction of the data and about the difficulties we met. We think this is the best we could do with the available observational material.

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EUROPE **Tidal Gravity Factors Corrected for Oceanic Effects** **Wave O1**

84 stations

Station		Latitude	Longitude	D	δ	α		
406	S.Fernando	36.462	-6.205	1	1.1490	0.95	X	
403	Granada	37.187	-3.592	50	1.1485	0.31		S
552	Etna/Centuripe	37.617	14.750	1520	1.1525	0.19		B
551	Etna/Serra L.N.	37.693	14.975	1520	1.1578	0.05		B
413	Ciudad Real	38.986	-3.931	250	1.1343	0.58	X	S
417	Arcas	39.988	-2.115	360	1.1460	-0.56	X	
419	Placencia	40.033	-6.080	236	1.1422	0.00		
402	Madrid	40.452	-3.724	310	1.1523	-0.22		
401	Valle L.C.	40.633	-4.155	350	1.1513	0.17		L
414	S.Idelfonso	40.899	-4.004	280	1.1362	0.25		S
412	Carbonero	41.122	-4.266	315	1.1544	-0.11		
407	Sepulveda	41.299	-3.759	240	1.1365	0.49		S
433	Calatayud	41.376	-1.620	200	1.1397	0.41		S
411	Barcelona	41.503	2.089	380	1.1422	0.76	X	S
409	Cubillos	41.574	-5.740	220	1.1422	0.23		S
424	Cadi	42.283	1.850	310	1.1689	0.13		
405	Burgos	42.341	-3.705	120	1.1490	-0.30		
1010	Sofia	42.710	23.330	200	1.1546	-0.14		
420	Pamplona	42.806	-1.669	65	1.1505	-0.53	X	
427	Santiago	42.881	-8.545	40	1.1662	0.15		S
518	Larderello	43.237	10.885	1050	1.1318	-0.65	X	
434	Oviedo	43.350	-5.850	20	1.1560	0.06		
404	Santander	43.466	-3.807	2	1.1207	0.44		
311	Grasse	43.749	6.927	680	1.1411	-0.13		B
325	Avignon	43.920	5.040	500	1.1634	-0.54	X	B
312	Bordeaux	44.835	-0.527	20	1.1461	0.03		B
516	Torino	45.061	7.661	700	1.1453	-0.99	X	B
310	Clermont F.	45.763	3.103	320	1.1542	-0.18		B
955	Pecs	46.110	18.250	1220	1.1593	0.44		
610	Chur	46.850	9.530	700	1.1518	-0.03		B
610	Chur	46.850	9.530	700	1.1515	0.00		L
952	Tihany	46.900	17.870	1100	1.1663	-0.33		
695	Graz	47.075	15.439	950	1.1605	0.04		
615	Zürich	47.367	8.550	650	1.1507	-0.01		L
950	Budapest	47.550	19.020	1220	1.1514	-0.21		
711	Berchtesgaden	47.633	13.033	750	1.1358	0.01		
698	Wien	48.248	16.361	900	1.1578	-0.48		
716	Schiltach	48.331	8.333	450	1.1510	0.04		
300	Strasbourg	48.620	7.681	430	1.1507	-0.33		
928	C.Budejovice	48.970	14.480	800	1.1536	0.22		
705	Karlsruhe	49.012	8.413	450	1.1528	0.03		
1152	Poltava	49.604	34.550	1750	1.1532	-0.04		
257	Walferdange	49.665	6.153	270	1.1559	-0.12		B
930	Pecny	49.920	14.790	800	1.1525	-0.08		
706	Frankfurt	50.080	8.520	400	1.1526	-0.29		
202	Dourbes	50.100	4.600	170	1.1560	-0.33		
734	Bad Homburg	50.229	8.611	400	1.1492	-0.02		L
702	Effelsberg	50.525	6.884	230	1.1571	0.17		
221	Louvain L.N.	50.662	4.622	100	1.1564	-0.26		B
201	Bruxelles	50.799	4.358	90	1.1577	0.00		B
201	Bruxelles	50.799	4.358	90	1.1519	0.11		L
225	Veurne	51.074	2.658	10	1.1527	-0.21		B
227	Gistel	51.165	2.985	5	1.1616	-0.28		B
220	Brugge	51.200	3.220	15	1.1725	0.46		B
226	Damme	51.251	3.282	5	1.1705	-1.32	X	B
712	Clausthal	51.800	10.333	230	1.1554	0.04		
710	Bad Grund	51.806	10.245	260	1.1404	0.58	X	B
905	Varsovie	52.230	21.010	800	1.1564	-0.20		
765	Potsdam	52.383	13.067	400	1.1522	0.09		
709	Hannover	52.387	9.714	180	1.1518	0.06		
271	Witteveen	52.813	6.668	60	1.1427	-0.38		B
1117	Obninsk	55.170	36.450	1700	1.1540	-0.08		
828	Rolfsted	55.321	10.570	120	1.1540	0.09		

EUROPE **Tidal Gravity Factors Corrected for Oceanic Effects** **Wave O1**

1119	Kr.Pakhra	55.470	37.310	1750	1.1612	-0.25	
150	Edinburgh	55.923	3.177	2	1.1492	-0.14	L
822	Aarhus	56.171	10.189	120	1.1551	-0.34	B
826	Monsted	56.461	9.163	65	1.1516	0.24	
827	Aalborg	57.027	9.951	15	1.1587	-0.34	
860	Göteborg	57.688	11.983	350	1.1552	0.03	
869	Boxholm	58.202	15.055	450	1.1546	-0.79 X	
1102	Tallinn	59.405	24.740	900	1.1501	-0.03	
1105	Pulkovo	59.770	30.320	1200	1.1643	-0.59 X	
864	Uppsala	59.848	17.550	580	1.1518	0.21	
883	Helsinki	60.161	24.937	900	1.1535	-0.10	
862	Dannemora	60.200	17.864	600	1.1644	-0.15	
892	Metsahovi	60.220	24.396	900	1.1553	0.11	
867	Gavle	60.597	17.263	550	1.1657	-0.26	
890	Vaajakoski	62.245	25.862	800	1.1581	-0.69 X	
889	Joensuu	62.592	29.779	900	1.1657	-0.50	
888	Vaasa	63.085	21.647	500	1.1616	-0.81 X	
885	Oulu	65.100	25.842	550	1.1577	-0.32	
868	Vivattnet	66.067	23.017	100	1.1718	0.49	
887	Sodankylä	67.420	26.395	350	1.1622	-0.26	B
886	Kevo	69.756	27.127	100	1.1586	-0.19	
004	Longyearbyen	78.200	15.567	2	1.1503	-0.59 X	

S: Spanish Stations with LCR 301: amplitudes are multiplied by 0.9958
B: Stations related to Bruxelles new calibration system (factor 0.992)
L: Stations observed by Baker et al.
X: Phase exceeds 0.5°
Inertial correction (-0.0009) is applied

D: Distance to the nearest Schwiderski tidal polygon

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EUROPE **Tidal Gravity Factors Corrected for Oceanic Effects** **Wave M2**

87 stations

Station		Latitude	Longitude	D	δ	α		
406	S.Fernando	36.462	-6.205	1	1.1555	0.14		BV
403	Granada	37.187	-3.592	50	1.1626	0.33		SM
552	Etna/Centuripe	37.617	14.750	1520	1.1610	-0.32		B
551	Etna/Serra L.N.	37.693	14.975	1520	1.1670	-0.11		B
413	Ciudad Real	38.986	-3.931	250	1.1578	-0.09		SV
417	Arcas	39.988	-2.115	360	1.1659	-0.34		V
419	Placencia	40.033	-6.080	236	1.1593	-0.49		V
402	Madrid	40.452	-3.724	310	1.1574	-0.05		V
401	Valle L.C.	40.633	-4.155	350	1.1575	0.01		LV
414	S.Idelfonso	40.899	-4.004	280	1.1509	0.09		SV
412	Carbonero	41.122	-4.266	315	1.1582	-0.33		V
407	Sepulveda	41.299	-3.759	240	1.1486	0.10		SV
433	Calatayud	41.376	-1.620	200	1.1559	-0.34		SV
411	Barcelona	41.503	2.089	380	1.1487	0.14		SM
409	Cubillos	41.574	-5.740	220	1.1581	-0.03		SV
424	Cadi	42.283	1.850	310	1.1672	-0.40		M
405	Burgos	42.341	-3.705	120	1.1629	-0.20		V
1010	Sofia	42.710	23.330	200	1.1554	-0.29		
420	Pamplona	42.806	-1.669	65	1.1635	-0.92	X	M
427	Santiago	42.881	-8.545	40	1.1781	0.43		SV
518	Larderello	43.237	10.885	1050	1.1437	-0.57	X	BM
434	Oviedo	43.350	-5.850	20	1.1547	1.57	X	
404	Santander	43.466	-3.807	2	1.1577	-0.16		
311	Grasse	43.749	6.927	680	1.1497	-0.27		BM
325	Avignon	43.920	5.040	500	1.1761	0.29		BM
1151	Yalta	44.667	34.200	2000	1.1515	0.58	X	
1165	Bakhtchissarai	44.766	33.916	2000	1.1484	-0.15		
312	Bordeaux	44.835	-0.527	20	1.1680	-0.09		BM
1150	Simferopol	45.000	34.000	2000	1.1563	0.36		
516	Torino	45.061	7.661	700	1.1545	-0.42		BM
310	Clermont F.	45.763	3.103	320	1.1685	0.07		BM
610	Chur	46.850	9.530	700	1.1599	0.12		B
610	Chur	46.850	9.530	700	1.1552	-0.16		L
952	Tihany	46.900	17.870	1100	1.1663	-0.33		
695	Graz	47.075	15.439	950	1.1612	-0.02		
615	Zürich	47.367	8.550	650	1.1554	-0.22		L
950	Budapest	47.550	19.020	1220	1.1545	-0.05		
711	Berchtesgaden	47.633	13.033	750	1.1574	-0.41		
698	Wien	48.248	16.361	900	1.1587	-0.06		
716	Schiltach	48.331	8.333	450	1.1544	-0.10		
300	Strasbourg	48.620	7.681	430	1.1544	-0.80	X	
928	C.Budejovice	48.970	14.480	800	1.1557	0.02		
705	Karlsruhe	49.012	8.413	450	1.1525	-0.11		
1152	Poltava	49.604	34.550	1750	1.1592	-0.15		
257	Walferdange	49.665	6.153	270	1.1549	-0.32		B
930	Pecny	49.920	14.790	800	1.1543	-0.15		
706	Frankfurt	50.080	8.520	400	1.1543	-0.83	X	
202	Dourbes	50.100	4.600	170	1.1538	-0.67	X	
734	Bad Homburg	50.229	8.611	400	1.1531	-0.03		L
702	Effelsberg	50.525	6.884	230	1.1564	0.26		
221	Louvain L.N.	50.662	4.622	100	1.1576	0.14		B
201	Bruxelles	50.799	4.358	90	1.1516	0.06		B
201	Bruxelles	50.799	4.358	90	1.1513	0.01		L
225	Veurne	51.074	2.658	10	1.1466	-0.32		B
227	Gistel	51.165	2.985	5	1.1541	-0.31		B
220	Brugge	51.200	3.220	15	1.1508	1.05	X	B
226	Damme	51.251	3.282	5	1.1568	0.06		B
712	Clausthal	51.800	10.333	230	1.1536	0.06		
710	Bad Grund	51.806	10.245	260	1.1561	-0.25		B
905	Varsovie	52.230	21.010	800	1.1550	-0.28		
765	Potsdam	52.383	13.067	400	1.1533	0.14		
709	Hannover	52.387	9.714	180	1.1493	-0.01		
271	Witteveen	52.813	6.668	60	1.1590	0.77	X	B
1117	Obninsk	55.170	36.450	1700	1.1617	0.01		

EUROPE **Tidal Gravity Factors Corrected for Oceanic Effects** **Wave M2**

828	Rolfsted	55.321	10.570	120	1.1474	0.16		
1119	Kr.Pakhra	55.470	37.310	1750	1.1678	-0.24		
825	Varde	55.616	8.483	8	1.1627	0.39		
822	Aarhus	56.171	10.189	120	1.1572	-0.05		B
826	Monsted	56.461	9.163	65	1.1476	0.22		
827	Aalborg	57.027	9.951	15	1.1603	-0.19		
860	Göteborg	57.688	11.983	350	1.1574	-0.45		
829	Kobenhavn	57.757	12.559	280	1.1507	-0.04		
869	Boxholm	58.202	15.055	450	1.1575	-0.48		
1102	Tallinn	59.405	24.740	900	1.1481	-0.19		
1105	Pulkovo	59.770	30.320	1200	1.1501	-0.99	X	
864	Uppsala	59.848	17.550	580	1.1542	-0.07		
883	Helsinki	60.161	24.937	900	1.1532	0.04		B
862	Dannemora	60.200	17.864	600	1.1577	-0.62	X	
892	Metsahovi	60.218	24.396	900	1.1520	-0.01		
867	Gavle	60.597	17.263	550	1.1616	-0.70	X	
890	Vaajakoski	62.245	25.862	800	1.1561	-0.58	X	
889	Joensuu	62.592	29.779	900	1.1548	-0.24		
888	Vaasa	63.085	21.647	500	1.1505	-0.85	X	
885	Oulu	65.100	25.842	550	1.1512	0.24		
868	Vivattnet	66.067	23.017	100	1.1559	0.52	X	
887	Sodankyla	67.420	26.395	350	1.1315	-0.16		
886	Kevo	69.756	27.127	100	1.1355	0.08		B

S: Spanish Stations with LCR 301: amplitudes are multiplied by 0.9958
B: Stations related to Bruxelles new calibration system (factor 0.992)
L: Stations observed by Baker et al.
M: Corrected for Mediterranean sea (Canceill - Vincent map)
V: Corrected for Iberia regional map
X: Phase exceeds 0.5°
Inertial correction (-0.0038) is applied

D: Distance to the nearest Schwiderski tidal polygon

A0102.txt/ date:05/05/1994

ASIA **Tidal Gravity Factors Corrected for Oceanic Effects** **Wave O1**

45 stations

	Station	Latitude	Longitude	D	δ	α		
2501	Bangkok	13.792	100.598	25	1.1589	-0.16		B
2402	Hyderabad	17.417	78.553	320	1.1259	-0.43		B
2601	Hong Kong	22.304	114.172	3	1.1553	-0.58	X	
2600	Guangzhou	23.100	113.300	40	1.1513	-0.01		BS
2450	Kathmandu	27.667	85.300	724	1.1397	-0.52	X	B
2650	Lhasa	29.800	91.030	850	1.1565	-0.43		H
2607	Wuhan	30.530	114.350	670	1.1557	-0.39		WRS
2639	Wanxian	30.800	108.400	860	1.1601	-0.56	X	H
2623	Chengdu	30.910	103.760	820	1.1601	0.20		H
2612	Shanghai	31.096	121.186	40	1.1537	-0.08		BS
2875	Kanoya	31.421	130.882	10	1.1291	-0.28		BR
2638	Heifei	31.850	117.183	350	1.1601	0.01		H
2636	Zhenzhou	34.650	113.590	490	1.1600	-0.01		H
2870	Shizuoka	34.973	138.407	4	1.1630	-0.90	X	JR
2823	Kyoto	35.028	135.786	40	1.1576	-0.31		BR
2840	Aburatsubo	35.156	139.616	2	1.1535	0.97	X	JR
2856	Fujigawa	35.228	138.420	20	1.1737	-1.14	X	JR
2853	Inuyama	35.349	137.033	30	1.1463	-0.36		JR
2877	Tokyo	35.716	139.763	5	1.1617	-0.59	X	BRS
2877	Tokyo	35.716	139.763	5	1.1553	-0.08		JRS
2201	Teheran	35.737	51.382	600	1.1703	-0.13		B
2614	Qingdao	36.086	120.339	2	1.1396	-0.65	X	WR
2832	Yatsugatake	36.094	138.486	110	1.1413	-0.04		JS
2605	Lanzhou	36.100	103.850	1250	1.1605	-0.29		BS
2886	Takayama	36.133	137.184	70	1.1428	-0.36		JS
2885	Kakioka	36.233	140.183	30	1.1479	0.59	X	JS
2884	Kiryu	36.419	139.352	110	1.1713	-0.91	X	JS
2882	Kanazawa	36.565	136.663	50	1.1526	-0.59	X	JS
2883	Nagano	36.665	138.186	60	1.1426	2.22	X	JS
2750	Seoul	37.450	126.950	20	1.1447	-1.21	X	WS
2879	Fukushima	37.678	140.457	50	1.1619	0.70	X	JS
2836	Yahiko	37.733	138.800	5	1.1773	-0.56	X	JR
2202	Tabriz	38.068	46.327	920	1.1684	-0.62	X	B
2847	Mizusawa	39.136	141.132	44	1.1588	-1.13	X	BR
2849	Esashi	39.148	141.335	30	1.1594	-0.52	X	R
2005	Ankara	39.844	32.779	190	1.1629	-0.39		B
2603	Beijing	40.058	116.092	150	1.1672	0.09		BR
2000	Istanbul	41.067	29.058	5	1.1564	-0.28		B
1270	Tashkent	41.333	69.300	2100	1.1506	-0.65	X	
2610	Shenyang	41.830	123.580	170	1.1500	-0.42		WR
1280	Frounze/Pishpek	42.833	74.690	2200	1.1477	-0.05		
1293	Talgar/Alma Ata	43.270	77.380	2200	1.1576	-0.18		
2606	Urumqi	43.807	87.604	2200	1.1592	-0.16		WR
2897	Memambetsu	43.907	144.193	20	1.1612	-0.66	X	B
1289	Novosibirsk	54.842	83.247	3500	1.1464	-0.50		

B : ROB stations, related to Bruxelles new calibration system (factor 0.992)
W : Calibration revised at Wuhan
J : Data and oceanic corrections calculated with Schwiderski map + Sea of Japan according to Endo (1985) and to Okubo et al. (1987) Endo calibrations revised by ICET
H : Data according to Mao et al. (1989)
R : Coastal seas of China introduced by Raty
S : Coastal seas of China introduced by Sun
X : phase exceeds 0.5°
Inertial correction (-0.0009) is applied

A2001.txt/ date: 05/05/1994

ASIA **Tidal Gravity Factors Corrected for Oceanic Effects** **Wave M2**

49 stations

	Station	Latitude	Longitude	D	δ	α		
2550	Kuala Lumpur	3.122	101.654	450	1.1577	0.71	X	B
2551	Penang	5.357	100.301	200	1.1402	0.26		B
2555	K.Kinabalu	5.950	116.067	2	1.1420	-0.33		B
2501	Bangkok	13.792	100.598	25	1.1534	0.68	X	B
4011	Manila	14.639	121.068	20	1.1437	0.05		B
2402	Hyderabad	17.417	78.553	320	1.1513	0.50		B
2502	Chiang Mai	18.790	98.977	300	1.1530	0.41		B
2600	Guangzhou	23.100	113.300	40	1.1531	0.01		BS
2450	Kathmandu	27.667	85.300	724	1.1539	-0.19		B
2650	Lhasa	29.800	91.030	850	1.1652	-0.38		H
2607	Wuhan	30.530	114.350	670	1.1641	-0.10		WRS
2639	Wanxian	30.800	108.400	860	1.1604	-0.17		H
2623	Chengdu	30.910	103.760	820	1.1629	-0.09		H
2612	Shanghai	31.096	121.186	40	1.1471	0.43		BS
2875	Kanoya	31.421	130.882	10	1.1625	-0.21		BR
2638	Heifei	31.850	117.183	350	1.1556	-0.20		H
2636	Zhenzhou	34.650	113.590	490	1.1600	-0.01		H
2870	Shizuoka	34.973	138.407	4	1.1625	-0.74	X	JR
2823	Kyoto	35.028	135.786	40	1.1611	-0.38		BR
2840	Aburatsubo	35.156	139.616	2	1.1607	-0.08		JR
2856	Fujigawa	35.228	138.420	20	1.1672	0.04		JR
2853	Inuyama	35.349	137.033	30	1.1503	-0.24		JR
2877	Tokyo	35.716	139.763	5	1.1668	0.20		BRS
2877	Tokyo	35.716	139.763	5	1.1550	-0.24		J
2201	Teheran	35.737	51.382	600	1.1659	0.28		B
2614	Qingdao	36.086	120.339	2	1.1626	0.53	X	WR
2832	Yatsugatake	36.094	138.486	110	1.1588	-0.54	X	JR
2605	Lanzhou	36.100	103.850	1250	1.1570	-0.29		WR
2886	Takayama	36.133	137.184	70	1.1432	-0.13		JR
2885	Kakioka	36.233	140.183	30	1.1537	0.09		JR
2884	Kiryu	36.419	139.352	110	1.1588	0.06		JR
2882	Kanazawa	36.565	136.663	50	1.1666	0.20		JR
2883	Nagano	36.665	138.186	60	1.1537	-0.32		JR
2750	Seoul	37.450	126.950	20	1.1602	0.58	X	WR
2879	Fukushima	37.678	140.457	50	1.1515	0.15		JR
2836	Yahiko	37.733	138.800	5	1.1799	-0.01		JR
2202	Tabriz	38.068	46.327	920	1.1667	-0.01		B
2847	Mizusawa	39.136	141.132	44	1.1570	-0.26		BR
2849	Esashi	39.148	141.335	30	1.1571	-0.10		R
2005	Ankara	39.844	32.779	190	1.1621	0.07		B
2603	Beijing	40.058	116.092	150	1.1710	0.40		BR
2000	Istanbul	41.067	29.058	5	1.1587	-0.04		B
1270	Tashkent	41.333	69.300	2100	1.1447	-0.72	X	
2610	Shenyang	41.830	123.580	170	1.1609	0.04		WR
1280	Frounze/Pishpek	42.833	74.690	2200	1.1570	-0.34		
1293	Talgar/Alma Ata	43.270	77.380	2200	1.1648	-0.03		
2606	Urumqi	43.807	87.604	2200	1.1704	0.32		WR
2897	Memambetsu	43.907	144.193	20	1.1520	-0.13		B
1289	Novosibirsk	54.842	83.247	3500	1.1613	-0.46		

B : ROB stations, related to Bruxelles new calibration system (factor 0.992)
W : Calibration revised at Wuhan
J : Data and oceanic corrections calculated with Schwiderski map + Sea of Japan according to Endo (1985) and to Okubo et al. (1987) Endo calibrations revised by ICET
H : Data according to Mao et al. (1989)
R : Coastal seas of China introduced by Raty
S : Coastal seas of China introduced by Sun
X : phase exceeds 0.5°
Inertial correction (-0.0038) is applied

A2002.txt/ date: 06/05/1994

AFRICA **Tidal Gravity Factors Corrected for Oceanic Effects** **Wave M2**

26 stations

	Station	Latitude	Longitude	D	δ	α		
3102	Ifrane	33.520	-5.130	165	1.1582	0.02		
3000	Helwan	29.850	31.333	150	1.1639	-1.92	X	M
3090	Cueva V.	29.160	-13.461	1	1.1601	-0.26		
3005	Aswan	24.100	32.600	220	1.1683	-0.14		
3118	Tamanrasset	22.792	5.523	1250	1.1506	-0.26		
3399	Arlit	18.834	7.324	1300	1.1442	-0.15		
3300	Nouakchott	18.082	-15.989	4	1.1493	0.00		
3010	Khartoum	15.583	32.500	700	1.1582	0.22		
3311	M'Bour	14.391	-16.955	2	1.1521	-0.31		
3400	Niamey	13.516	2.104	810	1.1406	0.02		
3401	Bamako	12.646	-8.001	600	1.1562	-0.16		
3312	Kedougou	12.555	-12.192	500	1.1550	-0.23		
3014	Addis Ababa	9.030	38.730	500	1.1436	-0.08		
3321	Lamto	6.224	-5.028	120	1.1583	0.45		
3410	Bangui	4.433	18.546	1000	1.1402	0.00		
3020	Mogadishu	2.030	45.370	5	1.1752	-0.31		
3030	Nairobi	-2.570	36.857	430	1.1709	-0.31		
3451	Butare	-2.592	29.755	1050	1.1524	0.00		
3031	Voi	-3.333	38.592	150	1.1629	-0.07		
3415	Brazzaville	-4.167	15.145	400	1.1517	-0.04		
3040	Dar Es Salaam	-6.830	39.220	10	1.1502	-0.44		
3505	Nampula	-15.090	39.253	100	1.1324	0.46		
3495	Harare	-17.781	31.052	475	1.1612	-0.26		
3601	Antananarivo	-18.902	47.552	160	1.1628	-0.28		
3801	Johannesburg	-26.020	28.030	450	1.1505	-0.44		
3807	Stellenbosch	-33.932	18.863	30	1.1505	-0.46		

All stations are related to Bruxelles new calibration system (factor 0.992)
X : Phase exceeds 0.5°
M : Corrected for Mediterranean sea (Canceill - Vincent map)
Inertial correction (-0.0038) is applied

A3002.txt/ date: 22/11/93

SOUTH PACIFIC Tidal Gravity Factors Corrected for Oceanic Effects Wave O1

15 stations

	Station	Latitude	Longitude	D	δ	α	
4420	Lauder	-45.040	169.687	100	1.1889	-1.01	X
4220	Hobart	-42.917	147.317	1	1.1910	-1.34	X
4405	Wellington	-41.292	174.768	1	1.1987	0.05	
4400	Hamilton	-37.783	175.317	40	1.1988	-1.87	X
4206	Canberra	-35.321	148.999	125	1.1624	-0.47	
4211	Perth	-31.978	116.208	40	1.2544	4.60	X
4208	Broken Hill	-31.943	141.464	525	1.1318	-0.23	
4205	Armidale	-30.579	151.893	135	1.1463	-0.20	
4209	Alice Springs	-23.710	133.830	1000	1.1602	0.13	
4450	Noumea	-22.308	166.452	1	1.1931	-2.41	X
4207	Charters Towers	-20.088	146.254	105	1.1704	-0.89	X
4460	Suva	-18.043	178.464	15	1.1829	-0.67	X
4480	Papeete	-17.569	-149.576	4	1.1717	-1.63	X
4475	Apia	-13.800	-171.783	0	1.2425	-4.58	X
4210	Darwin	-12.846	131.130	60	1.2346	-6.02	X

Inertial correction (-0.0038) is applied
X: phase exceeds 0.5°

A4001.txt/ date: 22/11/1993

SOUTH PACIFIC Tidal Gravity Factors Corrected for Oceanic Effects Wave M2

15 stations

	Station	Latitude	Longitude	D	δ	α	
4420	Lauder	-45.040	169.687	100	1.1775	-0.38	
4220	Hobart	-42.917	147.317	1	1.1858	-0.86	X
4405	Wellington	-41.292	174.768	1	1.1882	-0.83	X
4400	Hamilton	-37.783	175.317	40	1.1870	-0.77	X
4206	Canberra	-35.321	148.999	125	1.1609	0.06	
4211	Perth	-31.978	116.208	40	1.2061	-0.20	
4208	Broken Hill	-31.943	141.464	525	1.1520	0.49	
4205	Armidale	-30.579	151.893	135	1.1468	0.17	
4209	Alice Springs	-23.710	133.830	1000	1.1671	0.02	
4450	Noumea	-22.308	166.452	1	1.2018	-3.96	X
4207	Charters Tower	-20.088	146.254	105	1.1671	-1.55	X
4460	Suva	-18.043	178.464	15	1.1561	0.01	
4480	Papeete	-17.569	-149.576	4	1.1596	-0.36	
4475	Apia	-13.800	-171.783	0	1.2168	-2.97	X
4210	Darwin	-12.846	131.130	60	1.1738	0.27	

Inertial correction (-0.0038) is applied
X: phase exceeds 0.5°

A4002.txt/ date: 22/11/1993

NORTH AMERICA Tidal Gravity Factors Corrected for Oceanic Effects Wave M2

10 stations

	Station	Latitude	Longitude	D	δ	α	
6295	Bay St Louis	30.337	-89.635	5	1.1680	-0.53	X
6024	Pinon Flat	33.609	-116.455	200	1.1687	-1.01	X
6328	Columbia	34.017	-81.193	170	1.1532	-0.70	X
6330	Blacksburg	37.230	-80.423	380	1.1454	-0.34	
6336	Charlottesville	38.040	-78.520	340	1.1638	-0.65	X
6331	Fairfax	38.870	-77.270	100	1.1462	0.01	
6337	Morgantown	39.633	-79.954	340	1.1667	-0.30	
6339	Pittsburgh	40.470	-79.730	450	1.1655	0.05	
6803	Ottawa	45.380	-75.720	450	1.1534	-0.27	
6804	Holland Mills	45.750	-75.650	700	1.1480	0.08	

Inertial correction (-0.0038) is applied
X : phase exceed 0.5°

A6005.txt/ date: date: 21/09/1993

Tidal Gravity Factors Corrected for Oceanic Effects Wave O1

28 stations

	Station	Latitude	Longitude	D	δ	α	
6811	Alert	82.480	-62.400	4	1.1422	-0.23	
6804	Holland Mills	45.750	-75.650	700	1.1578	0.20	
6809	Ottawa	45.380	-75.720	450	1.1623	-0.10	
6339	Pittsburgh	40.470	-79.730	450	1.1719	-0.14	
6331	Fairfax	38.870	-77.270	50	1.1522	-0.12	
6336	Charlottesville	38.040	-78.520	340	1.1315	-0.65	X
6330	Blacksburg	37.230	-80.423	380	1.1459	0.02	
6024	Pinon Flat	33.609	-116.455	200	1.1602	-0.04	
3102	Ifrane	33.520	-5.130	165	1.1569	0.50	
3000	Helwan	29.850	31.333	150	1.1532	-2.21	X
3005	Aswan	24.010	32.600	220	1.1612	1.06	X
3118	Tamanrasset	22.792	5.523	1250	1.1496	-0.38	
3399	Arlit	18.834	7.324	1300	1.1417	-2.33	X
3300	Nouakchott	18.082	-15.989	4	1.1474	-0.51	X
3010	Khartoum	15.583	32.500	700	1.1585	-0.56	X
3311	M'Bour	14.391	-16.955	2	1.1696	-0.82	X
3400	Niamey	13.516	2.104	810	1.1570	-1.17	X
3401	Bamako	12.646	-8.001	600	1.1727	-1.00	X
3312	Kedougou	12.555	-12.192	500	1.1532	-0.52	X
3014	Addis Ababa	9.030	38.730	500	1.1504	-1.45	X
3321	Lamto	6.224	-5.028	120	1.1508	0.14	
3495	Harare	-17.781	31.052	475	1.1701	-1.46	X
3601	Antananarivo	-18.902	47.552	160	1.1627	-0.54	X
4209	Alice Springs	-23.710	133.830	1000	1.1597	0.01	
3500	Maputo	-25.968	32.594	1	1.1415	-0.12	
3801	Johannesburg	-26.020	28.030	450	1.1314	0.07	
4205	Armidale	-30.579	151.893	135	1.1608	-0.19	
3807	Stellenbosch	-33.932	18.863	30	1.1493	-0.51	X

All stations are related to Bruxelles calibration system
X: phase exceeds 0.5°
Inertial correction (-0.0009) is applied

A6001.txt/ date: 22/11/1993

SOUTH AMERICA **Tidal Gravity Factors Corrected for Oceanic Effects** **Wave O1**

36 stations

Station		Latitude	Longitude	D	δ	α	
7002	Mexico	19.327	-99.175	250	1.1532	-0.29	
6911	Morne C.	14.733	-61.150	3	1.1679	-0.17	
7105	Guatemala	14.586	-90.533	83	1.1766	-0.58	X
7201	Caracas	10.507	-66.927	20	1.1716	-0.97	X
7281	Kourou	5.169	-52.681	5	1.1691	-0.79	X
7411	Iquitos	-3.731	-73.238	1000	1.1491	1.16	X
7410	Chiclayo	-6.760	-79.841	18	1.1610	3.83	XX
7409	Nania	-11.988	-76.842	20	1.1665	0.00	
7317	Salvador	-12.966	-38.483	5	1.1477	-0.45	
7412	Nazca	-14.823	-74.938	40	1.1573	-1.83	X
7309	Cuiaba	-15.609	-56.126	1882	1.1572	-0.96	X
7408	Arequipa	-16.433	-71.567	20	1.1457	0.06	
7500	La Paz	-16.495	-68.133	300	1.1568	-0.19	
7310	Goiania	-16.620	-49.255	875	1.1478	-0.13	
7505	Santa Cruz	-17.775	-63.193	800	1.1546	-0.52	X
7601	Iquique	-20.289	-70.044	20	1.1500	0.03	
7307	C.Grande	-20.464	-54.615	1000	1.1270	-1.41	X
7312	P.Prudente	-22.122	-51.408	500	1.1589	-0.54	X
7314	Vassouras	-22.400	-43.652	80	1.1619	-0.80	X
7319	Valinhos	-23.104	-46.964	110	1.1568	-0.45	
7303	Sao Paulo	-23.559	-46.733	54	1.1554	-0.38	
7815	San Lorenzo	-24.728	-65.494	526	1.1458	-0.76	X
7305	Curitiba	-25.454	-49.238	80	1.1653	-0.58	X
7305	Curitiba	-25.454	-49.238	80	1.1535	-0.28	L
7813	Corrientes	-27.467	-58.729	820	1.1493	-0.29	
7306	Santa Maria	-29.671	-53.823	300	1.1212	-0.31	
7814	Zonda	-31.546	-68.679	290	1.1462	0.08	
7895	Tacuarembo	-31.667	-55.933	330	1.1543	-0.10	
7812	Cordoba	-31.668	-63.886	730	1.1604	0.21	
7805	Buenos Aires	-34.566	-58.410	20	1.1521	-0.32	
7810	Tandil	-37.320	-59.076	170	1.1539	-0.73	X
7816	Bariloche	-41.116	-71.418	150	1.1553	-0.45	

ANTARCTICA

9910	C.Ferraz	-62.086	-58.398	0	1.1710	0.31	
9960	Syowa	-69.006	39.587	1	1.1594	-0.20	
9941	Asuka	-71.525	24.130	120	1.1648	-0.65	X
9950	Vostok	-78.467	106.833	1110	1.1654	0.85	X

Curitiba L : Baker et al. calibration system
All other stations are ROB stations related to Bruxelles calibration system
Inertial correction (-0.0009) is applied
X : phase exceeds 0.5°

A7001.txt/ date: 25/11/1993

SOUTH AMERICA Tidal Gravity Factors Corrected for Oceanic Effects Wave M2

47 stations

	Station	Latitude	Longitude	D	δ	α	
7002	Mexico	19.327	-99.175	250	1.1582	-0.47	
6911	Morne C.	14.733	-61.150	3	1.1531	-0.02	
7105	Guatemala	14.586	-90.533	83	1.1657	-0.11	
7252	San Andres	12.620	-81.690	0	1.1678	-0.80	X
7119	Guayabo	10.708	-85.234	74	1.1708	0.03	
6975	S.Augustine	10.648	-61.403	9	1.1597	-0.15	
7201	Caracas	10.507	-66.927	20	1.1465	-0.45	
7251	Cartagena	10.394	-75.537	1	1.1479	-0.64	X
7118	San Jose	9.939	-84.054	60	1.1639	-0.45	
7253	Cucuta	7.901	-72.491	200	1.1421	-0.42	
7281	Kourou	5.169	-52.681	5	1.1606	-0.47	
7250	Bogota	4.650	-74.100	300	1.1624	-0.50	X
7254	Cali	3.450	-76.560	80	1.1586	-0.99	X
7450	Quito	-0.190	-78.500	170	1.1492	-0.35	
7316	Belem	-1.500	-48.500	4	1.1428	1.17	X
7451	Guayaquil	-2.182	-79.874	40	1.1577	-0.78	X
7315	Manaus	-3.166	-59.833	1250	1.1539	-0.85	X
7411	Iquitos	-3.731	-73.238	1000	1.1464	0.08	
7313	Teresina	-5.060	-42.766	350	1.1756	0.08	
7311	Caico	-6.526	-37.138	200	1.1552	0.30	
7410	Chiclayo	-6.760	-79.841	18	1.1510	0.25	
7409	Nania	-11.988	-76.842	20	1.1571	0.12	
7317	Salvador	-12.966	-38.483	5	1.1521	0.35	
7412	Nazca	-14.823	-74.938	40	1.1533	-0.28	
7309	Cuiaba	-15.609	-56.126	1882	1.1507	0.31	
7408	Arequipa	-16.433	-71.567	20	1.1543	0.16	
7500	La Paz	-16.495	-68.133	300	1.1524	-0.10	
7310	Goiania	-16.620	-49.255	875	1.1502	0.32	
7505	Santa Cruz	-17.775	-63.193	800	1.1545	-0.17	
7601	Iquique	-20.289	-70.044	20	1.1463	-0.11	
7307	C.Grande	-20.464	-54.615	1000	1.1589	-0.10	
7312	P.Prudente	-22.122	-51.408	500	1.1580	-0.19	
7314	Vassouras	-22.400	-43.652	80	1.1684	-0.05	
7319	Valinhos	-23.104	-46.964	110	1.1578	0.04	
7303	Sao Paulo	-23.559	-46.733	54	1.1571	0.02	
7815	San Lorenzo	-24.728	-65.494	526	1.1545	-0.11	
7305	Curitiba	-25.454	-49.238	80	1.1667	0.26	
7305	Curitiba	-25.454	-49.238	80	1.1584	0.24	L
7813	Corrientes	-27.467	-58.783	820	1.1665	-0.05	
7306	Santa Maria	-29.671	-53.823	300	1.1494	0.12	
7814	Zonda	-31.546	-68.679	290	1.1425	0.08	
7895	Tacuarembo	-31.667	-55.933	330	1.1502	0.03	
7812	Cordoba	-31.668	-63.886	730	1.1608	0.05	
7805	Buenos Aires	-34.566	-58.410	20	1.1599	0.45	
7810	Tandil	-37.320	-59.076	170	1.1561	0.21	
7816	Bariloche	-41.116	-71.418	150	1.1400	-0.12	

ANTARCTICA

9910	C.Ferraz	-62.086	-58.398	0	1.1525	1.48	X

Curitiba L : Baker et al. calibration system
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Inertial correction (-0.0038) is applied
X: phase exceeds 0.5°