

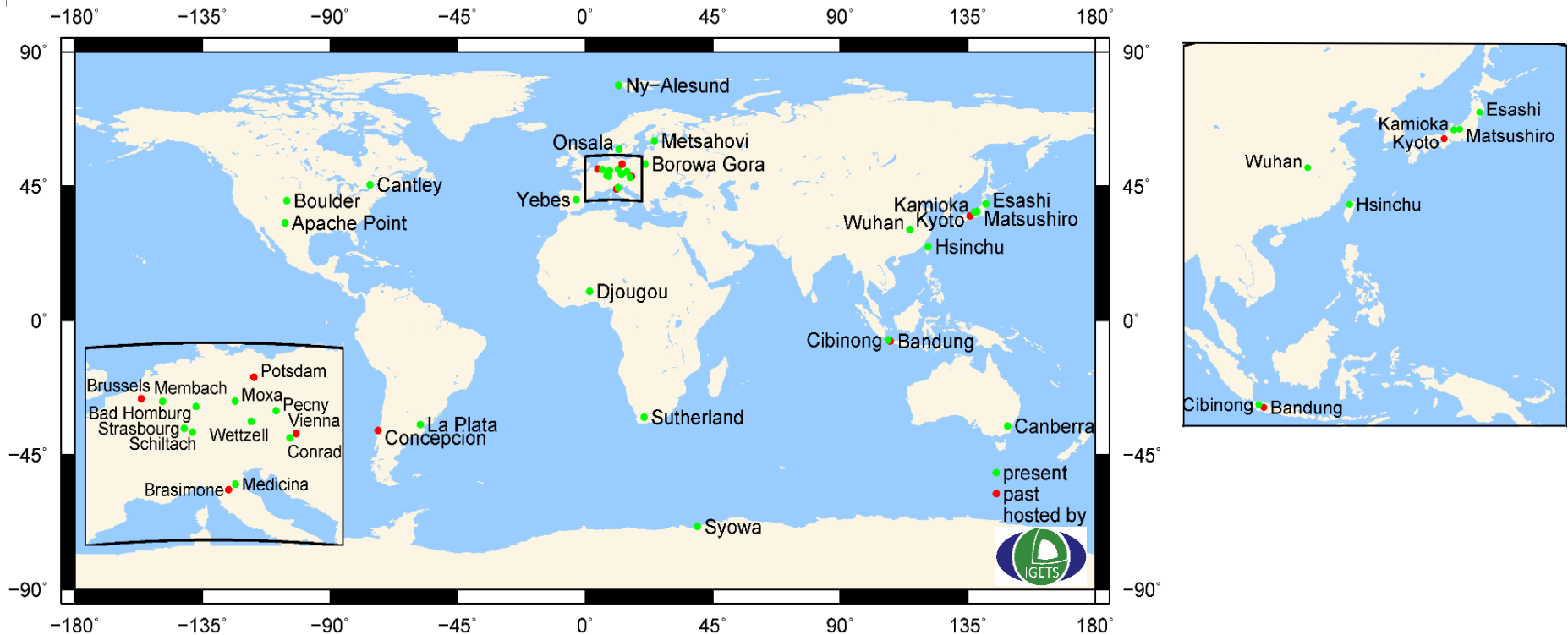
# IGETS Data Base – Status Report



Christian Voigt, Christoph Förste

IGETS Business Meeting at the  
IAG-IASPEI Joint Scientific Assembly,  
Kobe, Japan, 3 August 2017

# 35 stations (● present, ● past)



<http://igets.gfz-potsdam.de>

# Recently added stations and sensors

Date	Station	Sensor	Begin of data
2016-10-18	La Plata, Argentina	SG038	2016-01
2017-01-09	Borowa Gora, Poland	iGrav027, LaCoste&Romberg 1036	2016-05
2017-01-24	Wuhan, China	SG065	2013-03
2017-03-31	Djougou, Benin	SG060	2010-07
2017-06-09	Wettzell, Germany	iGrav006	2015-03



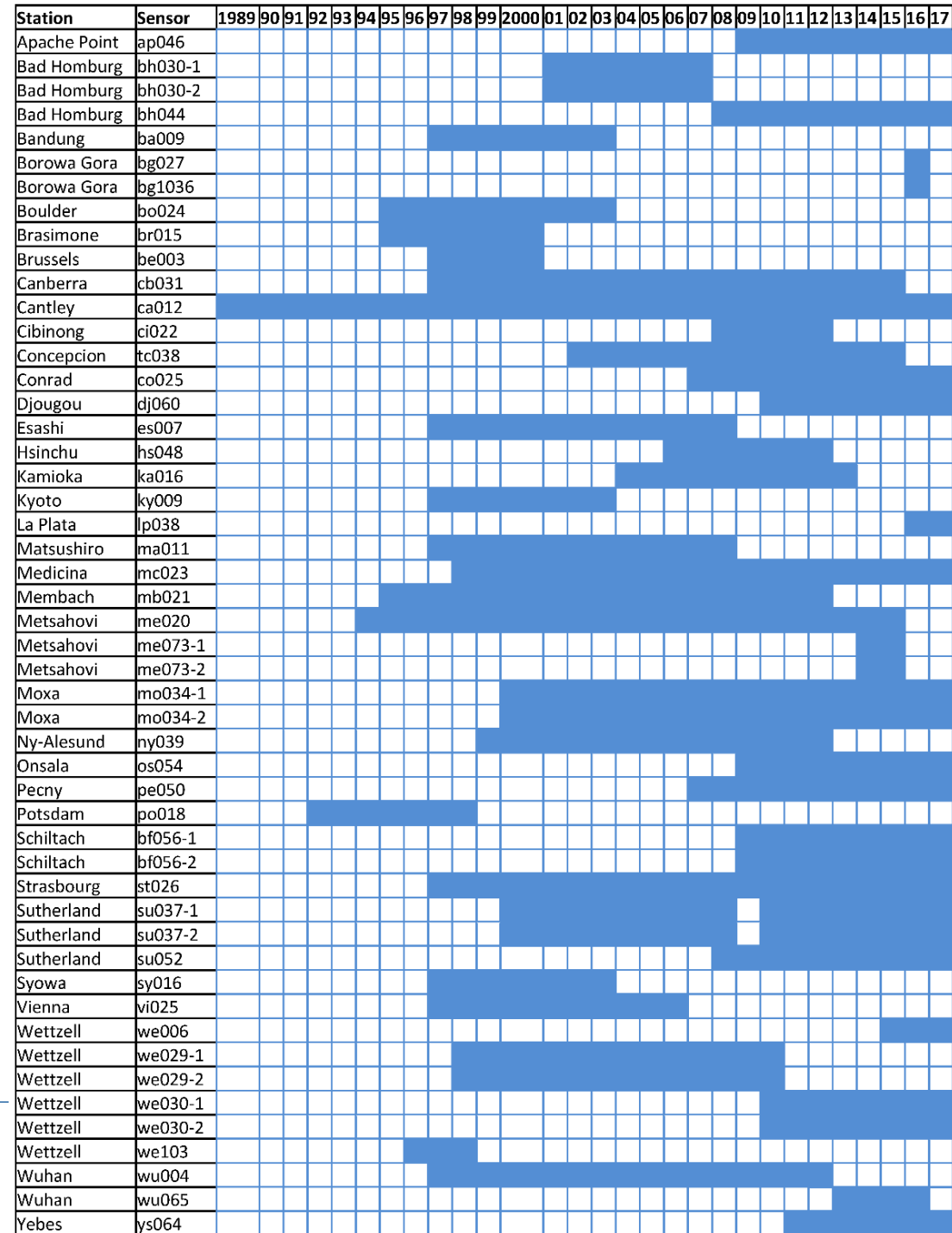
SG038 at La Plata



iGrav027 at Borowa Gora

# Temporal coverage

- 35 stations
- 50 sensors
- time spans of 20 years and more (Cantley)



# Data products

- Level 1:
  - raw data as recorded without preprocessing and downsampled to 1 min resolution,
  - after filling gaps or spikes shorter than 10 seconds by linear interpolation,
  - provided by the station operators.
- Level 2:
  - pre-processed data, i.e. elimination of gaps, spikes, steps and earthquakes,
  - ready for tidal analysis
  - provided by the station operators or by the University of French Polynesia (or by both).
- Level 3 (*new product in progress*):
  - residual gravity data after reducing Level 2 gravity data for modeled tidal and non-tidal gravity variations,
  - tidal models specific for each station covering the effects of solid Earth tides and ocean loading effects, obtained from harmonic analysis of the level 2 records,
  - Earth rotation effects (polar motion and length-of-day variations) based on the EOP C04 series of IERS,
  - non-tidal loading effects due to atmospheric, oceanic and hydrological mass-redistributions reduced according to the products provided by EOST Loading Service and Atmospheric Attraction Computation Service (ATMACS).

# New data sets

Level	Files	Content
1	GGP	1 s gravity and pressure data (Apache Point, Djougou, Strasbourg, Sutherland and Yebes)
1	CAL	One calibration file for each sensor according to IGETS conventions (Apache Point, Conrad and Sutherland)

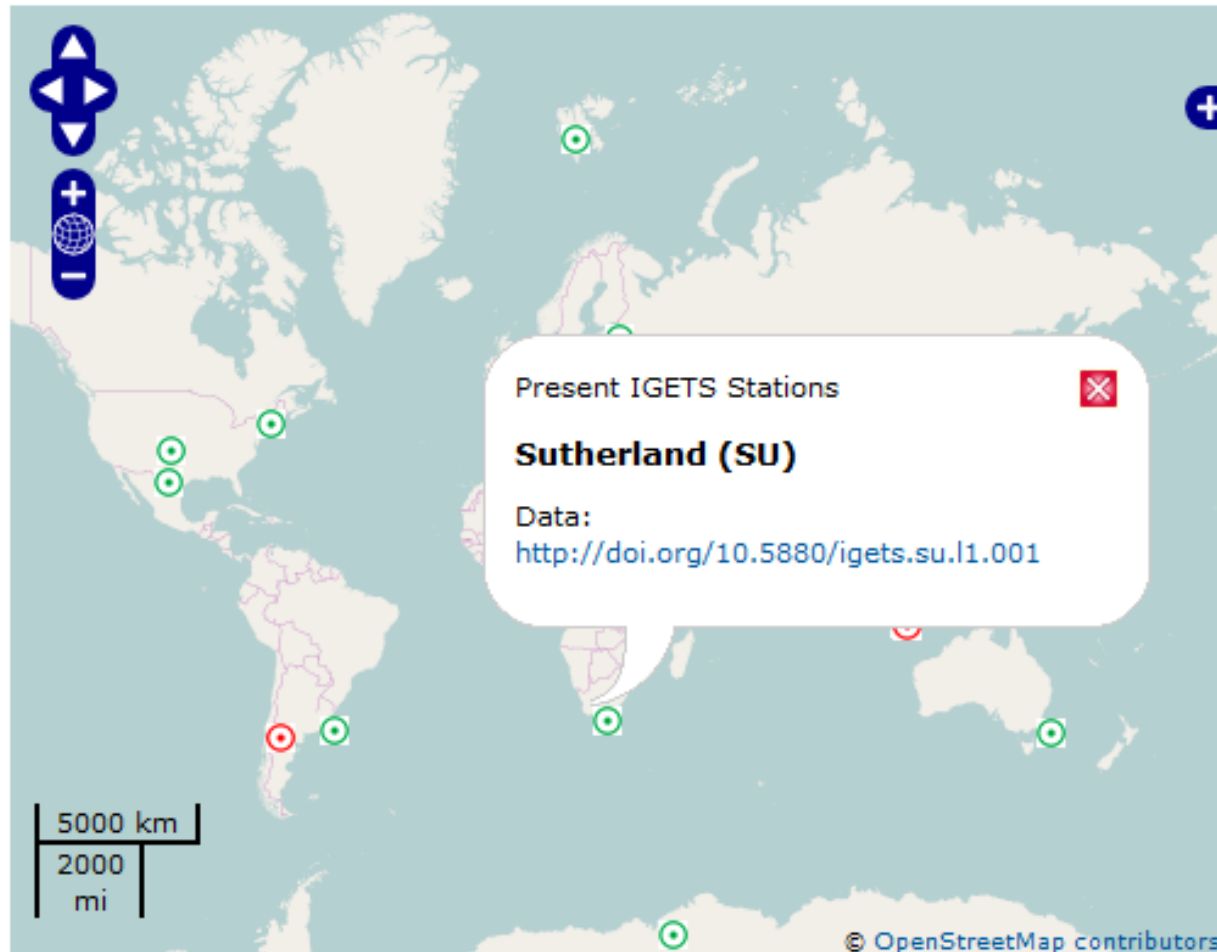
# Data Publication and Citation with DOIs

DOI (Digital Object Identifier) assignments already established for the Level 1 data sets of BKG, EOST and GFZ:

- BKG: Bad Homburg <http://doi.org/10.5880/igets.bh.l1.001>  
Concepcion <http://doi.org/10.5880/igets.tc.l1.001>  
La Plata <http://doi.org/10.5880/igets.lp.l1.001>  
Medicina <http://doi.org/10.5880/igets.mc.l1.001>  
Wettzell <http://doi.org/10.5880/igets.we.l1.001>
- EOST: Djougou <http://doi.org/10.5880/igets.dj.l1.001>  
Strasbourg <http://doi.org/10.5880/igets.st.l1.001>
- GFZ: Potsdam <http://doi.org/10.5880/igets.po.l1.001>  
Sutherland <http://doi.org/10.5880/igets.su.l1.001>  
GFZ@Wettzell <http://doi.org/10.5880/igets.we.gfz.l1.001>

# Data Publication and Citation with DOIs

<http://igets.gfz-potsdam.de>





# DOI landing page for Sutherland

- data download
- link to data base report
- reference to related publications
- introduction
- contact
- official keywords and meta data
- geographical position



**Dataset**

Cite as:  
 Förste, Christoph; Voigt, Christian; Abe, Maiko; Kroner, Corinna; Neumeyer, Jürgen; Pflug, Hartmut; Fourie, Piet (2016): Superconducting Gravimeter Data from Sutherland - Level 1. V. 001. GFZ Data Services. <http://doi.org/10.5880/igets.sul1.001>

Copy citation to clipboard

**Data Files**

Data download via <ftp://igetsftp.gfz-potsdam.de> (registration required)  
 IGETS Website

License: CC BY 4.0

**Abstract**

An International Geodynamics and Earth Tide Service (IGETS) was established in 2015 by the International Association of Geodesy IAG. IGETS continues the activities of the Global Geodynamics Project (GGP) between 1997 and 2015 to provide support to geodetic and geophysical research activities using superconducting gravimeter (SG) data within the context of an international network. As part of this network, the South African Geodynamic Observatory Sutherland (SAGOS) was established by the GFZ German Research Centre for Geosciences during the years 1998 and 2000 based on an Agreement on Cooperative Activities between the National Research Foundation (NRF) and GFZ signed in August 1998. Continuous time-varying gravity and atmospheric pressure data from the SGs at SAGOS are integrated in the IGETS data base hosted by GFZ.

The SAGOS observatory is located at the site of the South African Astronomical Observatory (SAAO) approximately 350 km northeast of Cape Town (longitude: 20.81 E, latitude: 32.38 S, height above MSL: 1755 m). The operation and maintenance of the SAGOS instrumentation is jointly done by staff of SAAO and GFZ. The shortest distance to the South Atlantic coastline is approximately 200 km. The area is located in a tectonically quiet zone far away from the African rift. Geologically, the setting is a huge dolerite plateau with a several kilometres thick layer of dolerite. This bedrock allows a good coupling of the SG pillars to the ground. The environment is a remote area with no industry and low seismicity. The climate at this place is determined by the difference between summer and winter rainfall zones so that temperature fluctuations are not too rough. The observatory is built into the ground to protect it against environmental effects like strong winds and temperature changes. All rooms are thermally insulated. An air-conditioning system controls the temperature inside the measurement chamber, which is equipped with three concrete pillars embedded into the dolerite bedrock. Two of the pillars are constructed for SGs or other geophysical instruments. The third pillar is dedicated for absolute gravimeters for the calibration of the SGs. In the vicinity of the observatory four further pillars were set up for various other geodetic antennas and instrumentation.

SAGOS is a high precision geodynamic observatory comprising space techniques and ground instruments. Presently, the observatory is equipped with two SGs manufactured by GWR Instruments (SG D037 and SG 052). The time series of gravity and barometric pressure from the dual sensor gravimeter SG D037 starts in February 2000 and is interrupted from July 2008 to November 2009 due to an upgrade of the electronics package. The time series of SG 052 begins in August 2008 without interruption. Both SGs are active and the time series are kept up to date regularly with a time delay of a few months. The time sampling of the raw gravity and barometric pressure data of IGETS Level 1 is 1 minute. Starting in January 2016, raw data with a time sampling of 1 second is provided additionally. For a detailed description of the IGETS data base and the provided files see Voigt et al. (2016, <http://doi.org/10.2312/GFZ.D103-16087>). In addition, SAGOS is equipped with auxiliary data supporting the interpretation of the SG measurements, which is, however, not provided in the IGETS data base due to their complexity. These are a local network of hydrological and meteorological sensors as well as a permanent GNSS (Global Navigation Satellite Systems) station as a core station of the International GNSS Service (IGS) with the ID SUTM.

**Data Description**

Voigt, Christian; Förste, C.; Wziontek, Hartmut; Crossley, David; Meurers, Bruno; Pálinkás, Vojtěch; Hinders, Jacques; Boy, Jean-Paul; Barriot, Jean-Pierre; Sun, Heping; (2016): Report on the Data Base of the International Geodynamics and Earth Tide Service (IGETS); GFZ German Research Centre for Geosciences. <https://doi.org/10.2312/GFZ.D103-16087>

**Related Work**

Referenced by

Kroner, C., Werth, S., Pflug, H., Güntner, A., Creutzfeldt, B., Thomas, M., ... Charles, P. (2011): Signals of Mass Redistribution at the South African Gravimetric SAGOS. International Association of Geodesy Symposia, 305-313. doi:10.1007/978-3-642-20338-1\_37

Kroner, C., Thomas, M., Dobslaw, H., Abe, M., & Weise, A. (2009). Seasonal effects of non-tidal oceanic mass shifts in observations with superconducting gravimeters. Journal of Geodynamics, 48(3-5), 354-359. doi:10.1016/j.jog.2009.09.020

Chen, X., Kroner, C., Sun, H., Abe, M., Zhou, J., Yan, H., & Wziontek, H. (2009). Determination of gravimetric parameters of the gravity pole tide using observations recorded with superconducting gravimeters. Journal of Geodynamics, 48(3-5), 348-353. doi:10.1016/j.jog.2009.09.020

Rosat, S., & Wziontek, H. (2011). Noise Levels of Superconducting Gravimeters: Updated Comparison and Time Stability. Bulletin of the Seismological Society of America, 101(3), 1233-1241. doi:10.1785/0120100217

Neumeyer, J. (2010). Superconducting Gravimetry. Sciences of Geodesy - I, 339-413. doi:10.1007/978-3-642-11741-1\_10

**Dataset Contact**

Voigt, Christian; GFZ German Research Centre for Geosciences, Potsdam, Germany; [christian.voigt@\\_gfz-potsdam.de](mailto:christian.voigt@_gfz-potsdam.de)

**Keywords**

Superconducting gravimetry, Earth tides, Geodynamics, IGETS, International Geodynamics and Earth Tide Service, geophysics, geodesy, hydrology

**GCMD Science Keywords**

EARTH SCIENCE > SOLID EARTH > GRAVITY/GRAVITATIONAL FIELD > GRAVITY

**More Metadata**

iso19115: view inline / download xml  
 dataset: view inline / download xml  
 df: view inline / download xml  
 escidoc: view inline / download xml

**Location**

Click/hover over markers or bounding boxes to see related details. Click/hover over details to see related marker or bounding box.



**Find More Research Data**

<http://bib.telegrafenberg.de/finden/datenbank/forschungsdaten/>

# Documentation



**Introduction**  
The International Geodynamics and Earth Tide Service (IGETS) was established in 2015 by the International Association of Geodesy (IAG). IGETS continues the activities of the **Global Geodynamics Project** (GGP, 1987-2015) to provide support to geodesic and geophysical research activities using superconducting gravimeter data within the context of an international network. The objectives of IGETS are:

- to provide a service for continuous ground based measurements
- to monitor temporal variations of the Earth's gravity field and deformation of the Earth's surface by long term records
- using ground gravimeters, tiltmeters, strainmeters and other geodynamic sensors.

IGETS also continues the activities of the International Center for Earth Tides (ICET), in particular, in collecting, archiving and distributing Earth tide records from long series of the various geodynamic sensors.

## Stations and Sensors

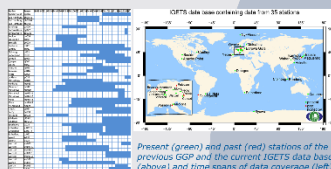
The IGETS data base is accessible via GFZ Potsdam end is accessible via

<http://igets.gfz-potsdam.de>

## Currently

- Data from 35 stations are available, globally distributed
- Provided by 26 producers
- Covering a time span of up to 20 years

Records from superconducting gravimeters made by GWR of compact (CT) and observatory (OSG) type are predominant. However, recently data from two transportable superconducting gravimeters GWR iGrav and one LaCoste & Romberg spring gravimeter were added. Furthermore, there are some more operators of iGrav and other gravimeters who are willing to send their data to the IGETS data base in the near future.



## How to become a producer for the IGETS data base?

Interested operators of geodynamic sensors should send an initial e-mail to the IGETS support team at [GFZ\\_igets-support@gfz-potsdam.de](mailto:GFZ_igets-support@gfz-potsdam.de)

All former GGP producers can use their existing GGP accounts to send their data to the FTP server of the IGETS data base: <ftp://igetsftp.gfz-potsdam.de>

[www.gfz-potsdam.de](http://www.gfz-potsdam.de)

## The Data Base of the International Geodynamics and Earth Tide Service (IGETS)

Christian Voigt (1), Christoph Förste (1), Hartmut Wziontek (2), David Crossley (3), Bruno Meurers (4), Vojtech Pálinkáš (5), Jacques Hinderer (6), Jean-Paul Boy (6), Jean-Pierre Barriot (7), and Heping Sun (8)

(1) GFZ German Research Centre for Geosciences, Potsdam, Germany (christian.voigt@gfz-potsdam.de); (2) DLR Federal Agency for Aeronautics and Space, Institute of Space and Astronautical Sciences, Berlin, Germany (hartmut.wziontek@dlr.de); (3) Department of Earth and Atmospheric Sciences, St. Louis University, St. Louis, MO, USA (david.crossley@slu.edu); (4) Department of Meteorology and Geoclimatology, University of Vienna, Vienna, Austria (bruno.meurers@univie.ac.at); (5) Centre for Geodesy, University of Vienna, Vienna, Austria (vojtech.palinkas@univie.ac.at); (6) Institut für Geodäsie und Geophysik, Universität zu Köln, Köln, Germany (jacques.hinderer@uni-koeln.de); (7) Geodetic Observatory Wettzell, Wettzell, Germany (jean-paul.boy@univie.ac.at); (8) Institute of Geodesy and Geophysics, Chinese Academy of Sciences, Wuhan, China



## Data Products

Gravity and atmospheric pressure data are usually recorded with 1s sample rate. Different product levels are derived from these data:

### Level 1:

Raw data as recorded without preprocessing and downsampled to 1 min resolution, after filling gaps or spikes shorter than 10 seconds by linear interpolation. Records with 1s samples are already provided for some stations.

### Level 2:

Pre-processed data, i.e. elimination of gaps, spikes, steps and earthquakes. These data sets are ready for tidal analysis and are provided by the station operators or by the University of French Polynesia (or by both).

### Level 3: A new product in progress

Residual gravity data after reducing Level 2 gravity data for modeled tidal and non-tidal gravity variations.

**Tidal models** are specific for each station and cover the effects of solid Earth tides and ocean loading effects and are obtained from harmonic analysis of the level 2 records.

**Earth rotation effects** (polar motion and length-of-day variations) are corrected based on the IOP-04 series of IERS.

**Non-tidal loading effects** due to atmospheric, oceanic and hydrological mass redistributions are reduced according to the products provided by EOST Loading Service.

Atmospheric Attraction Computation Service ATMACS

Repar codes introduced by GGP are adopted and extended by IGETS and are part of the file name conventions and indicate the pre-processing strategies and processing levels.

Corrections of the **SG instrumental drift** based on absolute gravity measurements (Level 4 products) are planned for the future by linking IGETS with the International Database for Absolute Gravity Observations **AGraw**. IGETS stations will play an important role to establish a Global Absolute Gravity Reference System (IAG Resolution No. 2 of 2015).

In addition, IGETS established individual **calibration files** for the stations providing a systematic review of the calibration changes formerly given in the GGP file headers. These include the full history of amplitude calibration values for gravity and pressure as well as the phase calibration (time delay) for the sensors.

## Data Availability and Access

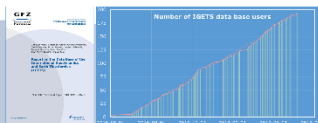
The IGETS data sets are stored on a **FTP server** and are freely available after user registration. The number IGETS users has been rapidly increasing since the launch in summer 2016.

All relevant information are compiled in the scientific technical report

<http://doi.org/10.21203/rs.3.rs-10087>

## How to become a user of the IGETS data base?

The user access for browsing and downloading data from the FTP server of the IGETS data base <ftp://igetsftp.gfz-potsdam.de> requires a username and a password obtained by a registration procedure presupposing a valid e-mail address. The registration form can be found on the IGETS data base website <http://igets.gfz-potsdam.de>.



Scientific technical report on the IGETS data base (left) and the increasing number of IGETS data base users since the launch in summer 2016.

## Data Publication and Citation - DOI

IGETS established the provision of digital object identifiers (DOI) for the data sets of every station. DOIs are unique and persistent identifiers used to reference and link the individual data sets. The advantages are:

- clear reference to data sets,
- enable to link scientific results with associated publications,
- standard feature in science when publishing scientific articles,
- improve access to scientific data, enhances the visibility of research data, encourage new research to be conducted, and foster scientific cooperation.

**Level 1 data:** DOI assigned for each station, i.e. one for all sensors of a station referencing the station operators. The DOIs of the Level 1 data sets resolve to DOI landing pages with an overview of the station and the data. The first DOI assigned data sets are the Level 1 data sets from GFZ (Sutherland and Potsdam), EOST (Strasbourg and Djougou) and BKG (Bad Homburg, Conspicuum, La Plata, Medicina, Wettzell) in the original DOI version (01), e.g. Sutherland:

Förste, C., Voigt, C., Abo, M., Kroner, C., Neumeyer, J., Pflug, H., Fournier, P. (2016) Superconducting Gravimeter Data from Sutherland - Level 1. GFZ Data Services. <http://doi.org/10.5880/gfz.su.11.001>

**Level 2 and Level 3 data:** DOI are assigned for all IGETS stations in total, i.e. one DOI for all data sets.

## Outlook and Discussion

At the IGETS business meeting at the IAG-IASPEI Joint Scientific Assembly 2017 on

Thursday, 03 August 2017, from 18:00 to 20:00, Room 504+505,

information about IGETS and the IGETS data base is given. Several aspects of IGETS are discussed. One important issue is activating operators of superconducting gravimeters and other geodynamical sensors sending data to IGETS in order to further strengthen the worldwide network. All interested IAG-IASPEI participants are welcome.

## You are invited!

Are you operating ground gravimeters, tiltmeters or strainmeters? You are cordially invited to join IGETS! Major benefits are a long term storage, an increased visibility and use of your data as well as a proper data citation by DOI assignments of each data sets!



HELMHOLTZ CENTRE POTSDAM  
GFZ GERMAN RESEARCH CENTRE FOR GEOSCIENCES

Christian Voigt, Christoph Förste, Hartmut Wziontek, David Crossley, Bruno Meurers, Vojtech Pálinkáš, Jacques Hinderer, Jean-Paul Boy, Jean-Pierre Barriot, Heping Sun

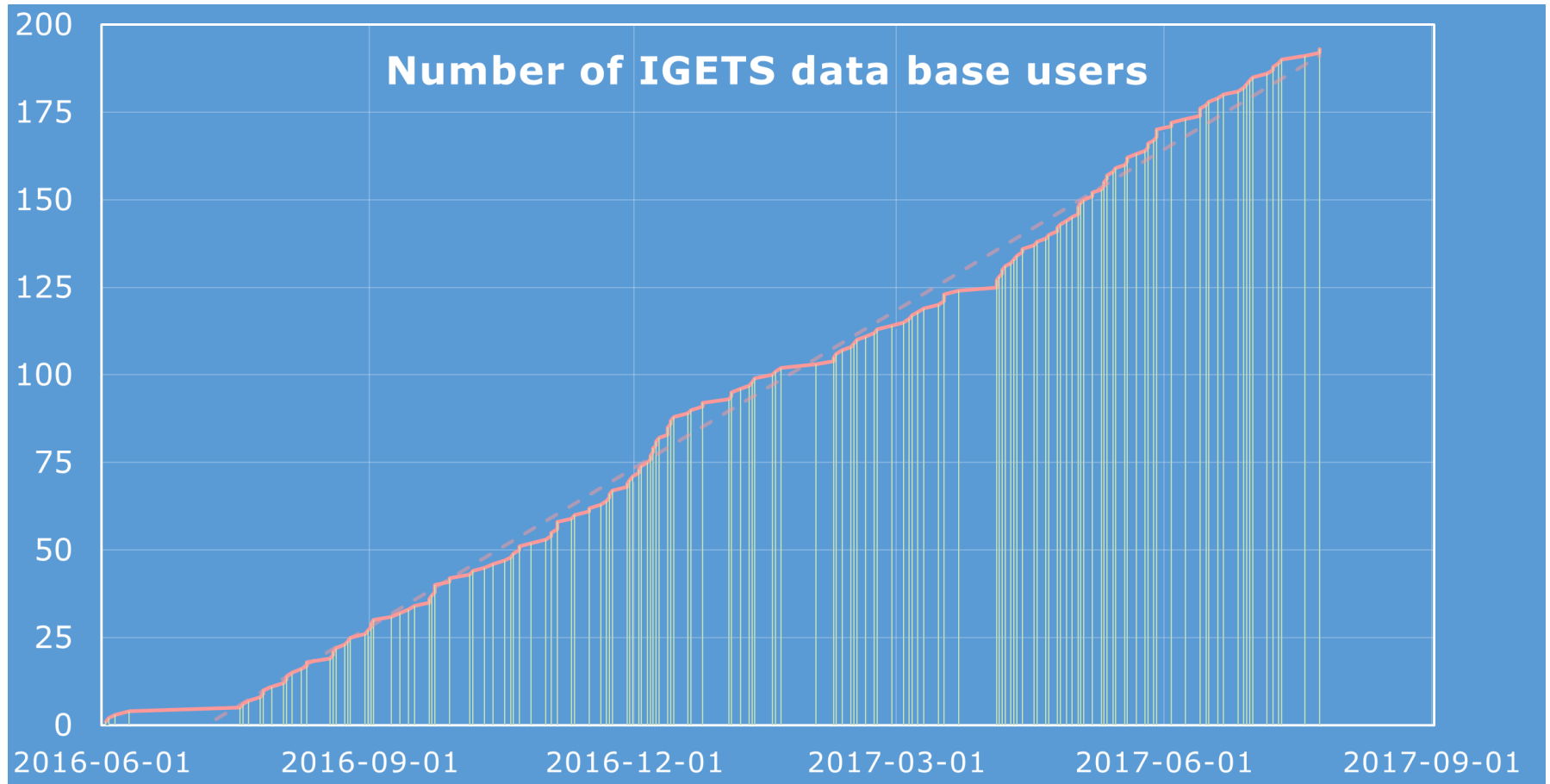
## Report on the Data Base of the International Geodynamics and Earth Tide Service (IGETS)

Scientific Technical Report STR16/08 – Data

[www.gfz-potsdam.de](http://www.gfz-potsdam.de)



# User statistics



193 users at 2017-07-24 (1 user registration every 2 days)

# Missing data

- Former GGP stations  
(*to be reactivated*)
  - Canberra (Australia, Japan)
  - Cibinong (Indonesia)
  - Esashi (Japan)
  - Hsinchu (Taiwan)
  - Kamioka (Japan)
  - Matsushiro (Japan)
  - Ny-Alesund (Norway, Japan)
  - Syowa (Antarctica, Japan)
- Further stations  
(*to be added*)
  - Ghuttu (India)
  - Gujarat (India)
  - Jangbogo (Antarctica, South Korea)
  - Lhasa (China)
  - Lijiang (China)
  - MunGyung (South Korea)

Station	Sensor	1989	90	91	92	93	94	95	96	97	98	99	2000	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
Apache Point	ap046																													
Bad Homburg	bh030-1																													
Bad Homburg	bh030-2																													
Bad Homburg	bh044																													
Bandung	ba009																													
Borowa Gora	bg027																													
Borowa Gora	bg1036																													
Boulder	bo024																													
Brasimone	br015																													
Brussels	be003																													
Canberra	cb031																													
Cantley	ca012																													
Cibinong	ci022																													
Concepcion	tc038																													
Conrad	co025																													
Djougou	dj060																													
Esashi	es007																													
Hsinchu	hs048																													
Kamioka	ka016																													
Kyoto	ky009																													
La Plata	lp038																													
Matsushiro	ma011																													
Medicina	mc023																													
Membach	mb021																													
Metsahovi	me020																													
Metsahovi	me073-1																													
Metsahovi	me073-2																													
Moxa	mo034-1																													
Moxa	mo034-2																													
Ny-Alesund	ny039																													
Onsala	os054																													
Pecny	pe050																													
Potsdam	po018																													
Schiltach	bf056-1																													
Schiltach	bf056-2																													
Strasbourg	st026																													
Sutherland	su037-1																													
Sutherland	su037-2																													
Sutherland	su052																													
Syowa	sy016																													
Vienna	vi025																													
Wettzell	we006																													
Wettzell	we029-1																													
Wettzell	we029-2																													
Wettzell	we030-1																													
Wettzell	we030-2																													
Wettzell	we103																													
Wuhan	wu004																													
Wuhan	wu065																													
Yebes	ys064																													

# Participation

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