Production of IGETS Level-3 data at EOST

J.-P. Boy

EOST/IPGS, Strasbourg, France

IPGS
Institut de Physique du Globe de Strasbourg

IGETS

Université de Strasbourg

“Official” IGETS products

Level-1

- Raw 1-min. (and 1-sec.) gravity and pressure.

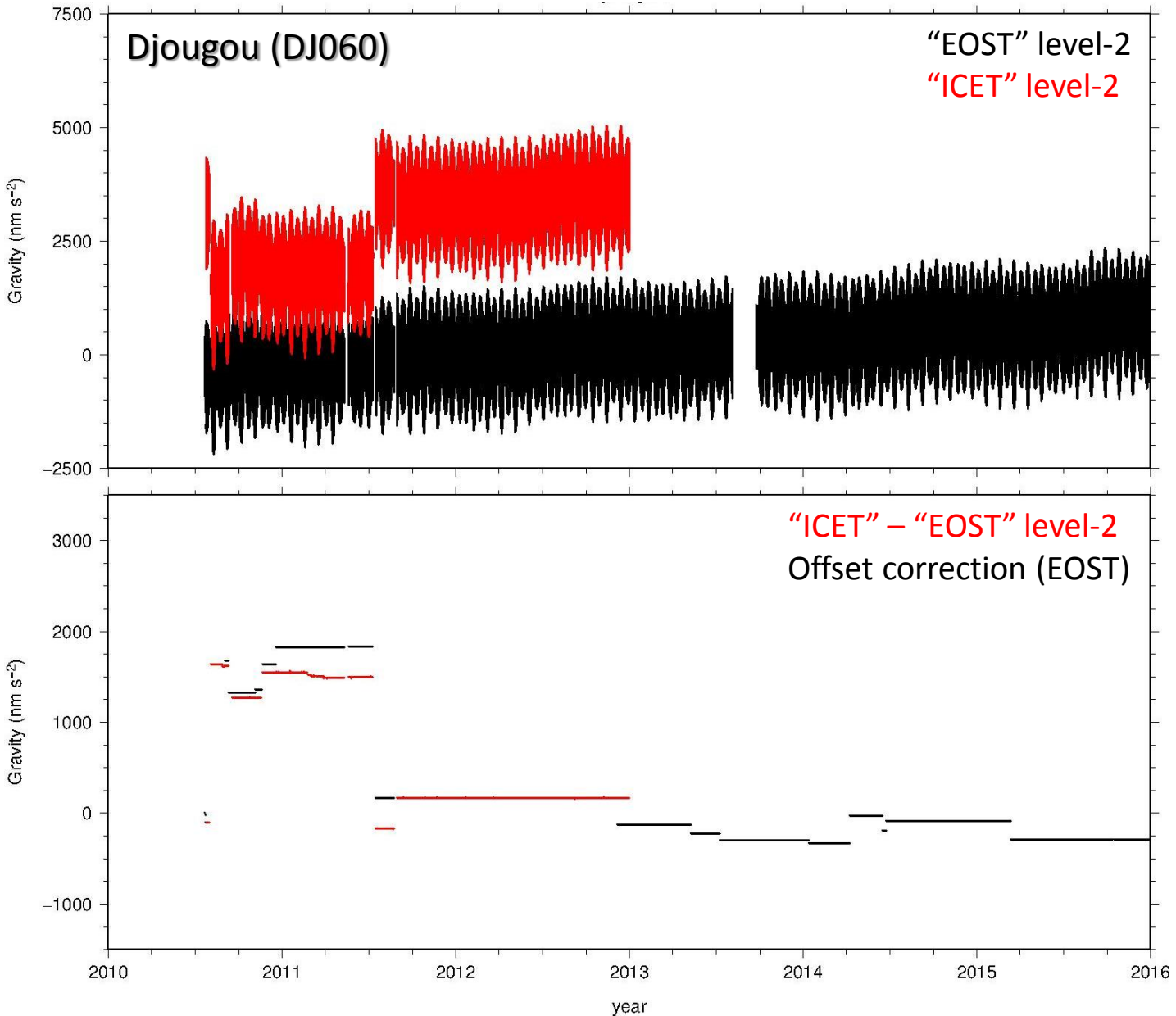
Level-2

- “Pre-processed” 1-min. gravity and pressure (ready for tidal analysis),
- Produced by University of French Polynesia (former ICET).

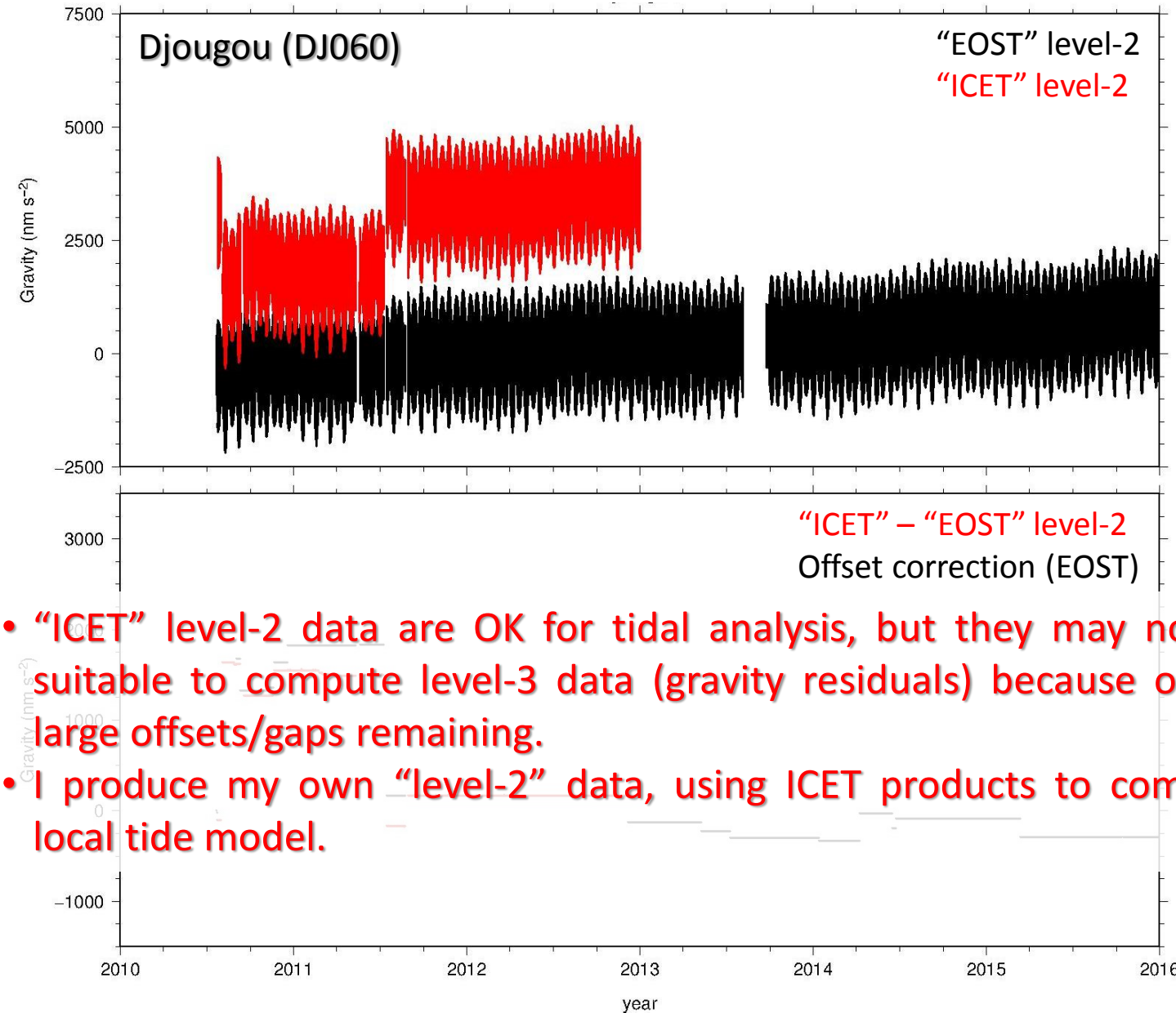
Level-3

- Gravity residuals, corrected for known signals (tides, polar motion, atmospheric loading) and instrumental drift.
- Produced (from Level-2 products) at EOST.

Some comments on the level-2 data



Some comments on the level-2 data



- "ICET" level-2 data are OK for tidal analysis, but they may not be suitable to compute level-3 data (gravity residuals) because of the large offsets/gaps remaining.
- I produce my own "level-2" data, using ICET products to compute local tide model.

Alternate level-2 product (YS054)

Units:

- nm s^{-2}
- hPa

Calibrations provided

6 colums

- Gravity (filled)
- Pressure (filled)
- Gravity (with gaps)
- Pressure (with gaps)
- Gravity offsets
- Pressure offsets

```
Filename      : YS1118mn.dat
Gravity unit  : nm s-2
Pressure unit : hPa
Calibration   :  -715.540 &     1.000 from 20111215 to 20180430
Prepocessing  : IGETS Central Bureau
Author        : jeanpaul.boy@unistra.fr
Corrections   : offsets, gaps and spikes
Gravity       : filled with local tides
Pressure      : filled with hourly MERRA2
yyyymmdd hhmmss     g_fil     p_fil   g_nofil   p_nofil  g_offset  p_offset
C*********************************************************************************
INSTR              1.0000    1.0000     0.000         3
77777777
20111215      0  -538.237   917.358  -538.237   917.358     0.000     0.000
20111215    100  -544.078   917.402  -544.078   917.402     0.000     0.000
20111215    200  -550.149   917.460  -550.149   917.460     0.000     0.000
20111215    300  -556.212   917.490  -556.212   917.490     0.000     0.000
20111215    400  -562.228   917.474  -562.228   917.474     0.000     0.000
20111215    500  -568.240   917.443  -568.240   917.443     0.000     0.000
20111215    600  -574.271   917.434  -574.271   917.434     0.000     0.000
20111215    700  -580.282   917.456  -580.282   917.456     0.000     0.000
20111215    800  -586.168   917.484  -586.168   917.484     0.000     0.000
20111215    900  -591.928   917.497  -591.928   917.497     0.000     0.000
20111215   1000  -597.653   917.505  -597.653   917.505     0.000     0.000
20111215   1100  -603.411   917.532  -603.411   917.532     0.000     0.000
20111215   1200  -609.244   917.583  -609.244   917.583     0.000     0.000
20111215   1300  -615.040   917.634  -615.040   917.634     0.000     0.000
20111215   1400  -620.703   917.664  -620.703   917.664     0.000     0.000
20111215   1500  -626.416   917.671  -626.416   917.671     0.000     0.000
20111215   1600  -632.311   917.672  -632.311   917.672     0.000     0.000
20111215   1700  -638.264   917.683  -638.264   917.683     0.000     0.000
20111215   1800  -644.025   917.713  -644.025   917.713     0.000     0.000
20111215   1900  -649.505   917.753  -649.505   917.753     0.000     0.000
20111215   2000  -654.881   917.784  -654.881   917.784     0.000     0.000
20111215   2100  -660.322   917.797  -660.322   917.797     0.000     0.000
20111215   2200  -665.880   917.795  -665.880   917.795     0.000     0.000
20111215   2300  -671.455   917.792  -671.455   917.792     0.000     0.000
20111215   2400  -676.914   917.796  -676.914   917.796     0.000     0.000
20111215   2500  -682.330   917.809  -682.330   917.809     0.000     0.000
20111215   2600  -687.864   917.834  -687.864   917.834     0.000     0.000
20111215   2700  -691.485   917.874 99999.999   917.874     0.000     0.000
20111215   2800  -697.124   917.912 99999.999   917.912     0.000     0.000
20111215   2900  -702.671   917.927 99999.999   917.927     0.000     0.000
20111215   3000  -708.108   917.914 99999.999   917.914     0.000     0.000
20111215   3100  -713.496   917.893 99999.999   917.893     0.000     0.000
20111215   3200  -718.903   917.887 99999.999   917.887     0.000     0.000
```

Alternate level-2 product (ST026)

Units:

- nm s^{-2}
- hPa

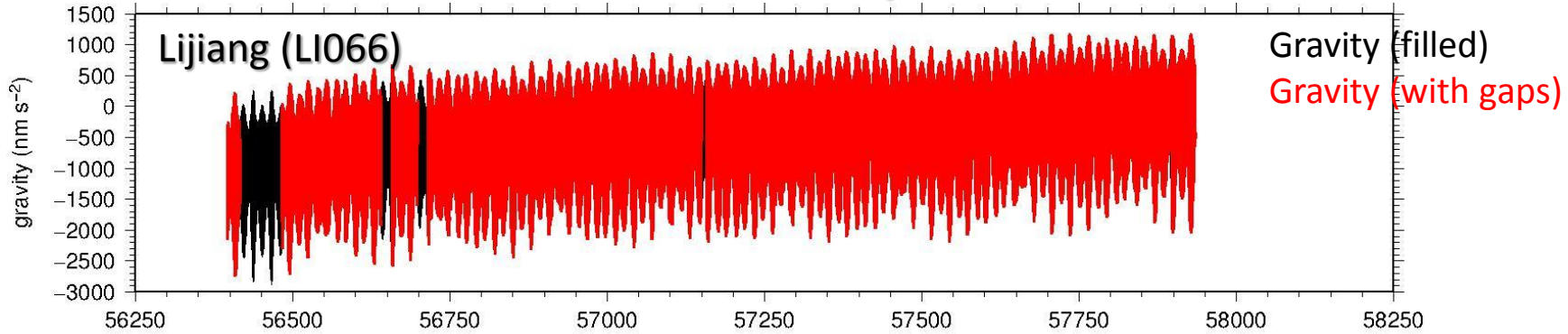
Calibrations provided

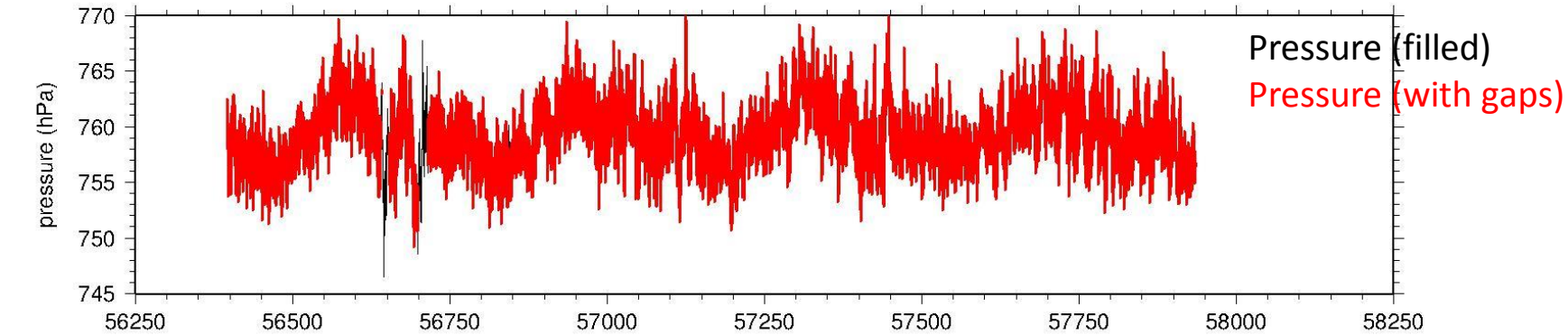
6 colums

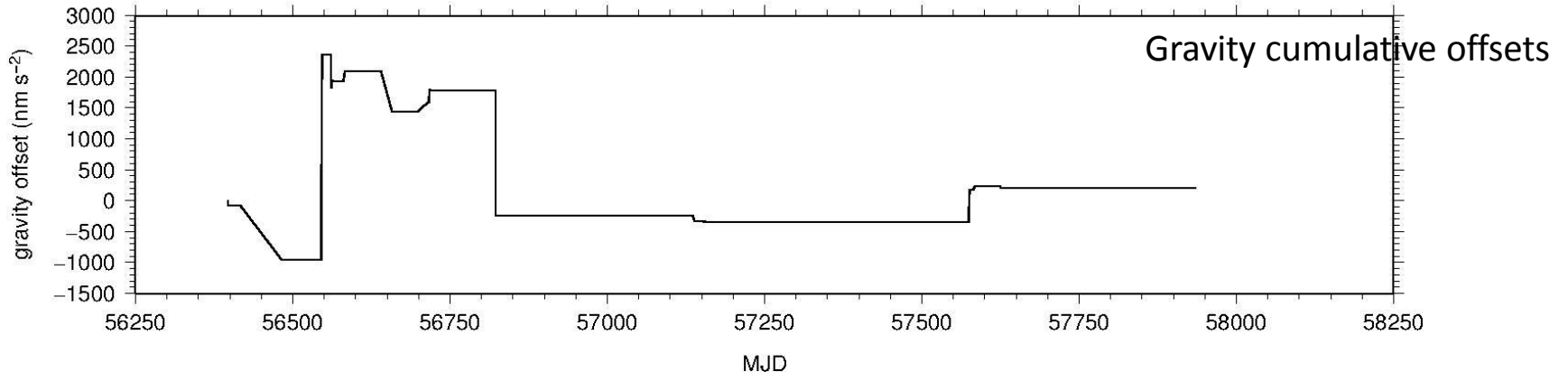
- Gravity (filled)
- Pressure (filled)
- Gravity (with gaps)
- Pressure (with gaps)
- Gravity offsets
- Pressure offsets

```
Filename      : ST9718mn.dat
Gravity unit  : nm s-2
Pressure unit : hPa
Calibration   :  -792.000 &   200.000 from 19970226 to 19990922
Calibration   :  -792.000 &    22.222 from 19990922 to 20080701
Calibration   :  -792.000 &     1.000 from 20080701 to 20180430
Prepocessing  : IGETS Central Bureau
Author        : jeanpaul.boy@unistra.fr
Corrections   : offsets, gaps and spikes
Gravity       : filled with local tides
Pressure      : filled with hourly MERRA2
yyyymmdd hhmmss     g_fil     p_fil   g_nofil   p_nofil  g_offset  p_offset
C*******************************************************************************
INSTR                1.0000    1.0000     0.000         3
77777777
19970226 153500  -415.046    81.644  -415.046    81.644     0.000     0.000
19970226 153600  -412.057    81.636  -412.057    81.636     0.000     0.000
19970226 153700  -409.110    81.632  -409.110    81.632     0.000     0.000
19970226 153800  -406.297    81.609  -406.297    81.609     0.000     0.000
19970226 153900  -403.160    81.585  -403.160    81.585     0.000     0.000
19970226 154000  -400.063    81.543  -400.063    81.543     0.000     0.000
19970226 154100  -397.167    81.486  -397.167    81.486     0.000     0.000
19970226 154200  -394.201    81.464  -394.201    81.464     0.000     0.000
19970226 154300  -391.127    81.462  -391.127    81.462     0.000     0.000
19970226 154400  -387.998    81.446  -387.998    81.446     0.000     0.000
19970226 154500  -385.028    81.429  -385.028    81.429     0.000     0.000
19970226 154600  -381.918    81.424  -381.918    81.424     0.000     0.000
19970226 154700  -378.544    81.417  -378.544    81.417     0.000     0.000
19970226 154800  -375.512    81.400  -375.512    81.400     0.000     0.000
19970226 154900  -372.545    81.385  -372.545    81.385     0.000     0.000
19970226 155000  -369.232    81.386  -369.232    81.386     0.000     0.000
19970226 155100  -366.165    81.390  -366.165    81.390     0.000     0.000
19970226 155200  -363.292    81.376  -363.292    81.376     0.000     0.000
19970226 155300  -360.045    81.367  -360.045    81.367     0.000     0.000
19970226 155400  -356.770    81.377  -356.770    81.377     0.000     0.000
19970226 155500  -353.740    81.382  -353.740    81.382     0.000     0.000
19970226 155600  -350.652    81.383  -350.652    81.383     0.000     0.000
19970226 155700  -347.418    81.386  -347.418    81.386     0.000     0.000
19970226 155800  -344.196    81.390  -344.196    81.390     0.000     0.000
19970226 155900  -341.118    81.372  -341.118    81.372     0.000     0.000
19970226 160000  -337.967    81.326  -337.967    81.326     0.000     0.000
19970226 160100  -334.533    81.331  -334.533    81.331     0.000     0.000
19970226 160200  -331.144    81.387  -331.144    81.387     0.000     0.000
19970226 160300  -327.928    81.408  -327.928    81.408     0.000     0.000
19970226 160400  -324.807    81.392  -324.807    81.392     0.000     0.000
19970226 160500  -321.603    81.386  -321.603    81.386     0.000     0.000
```

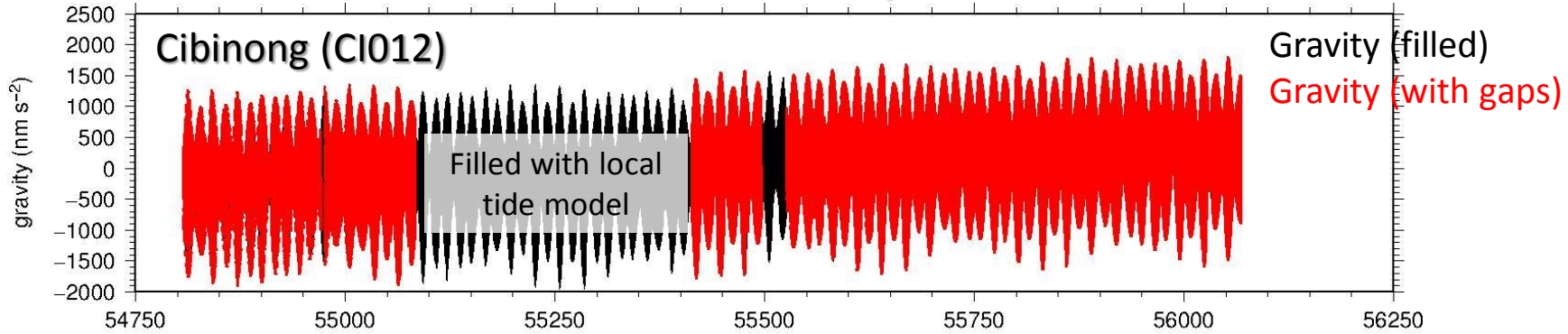
Alternate level-2 product

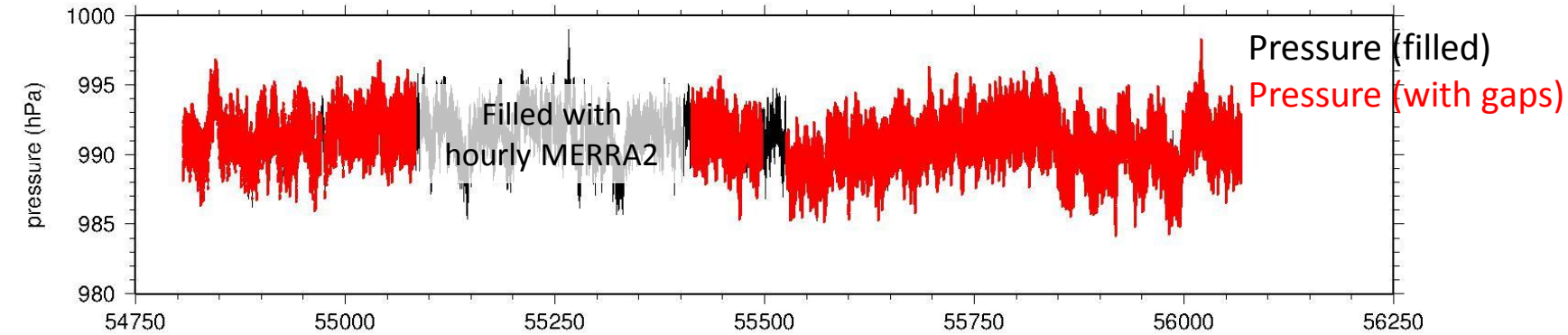


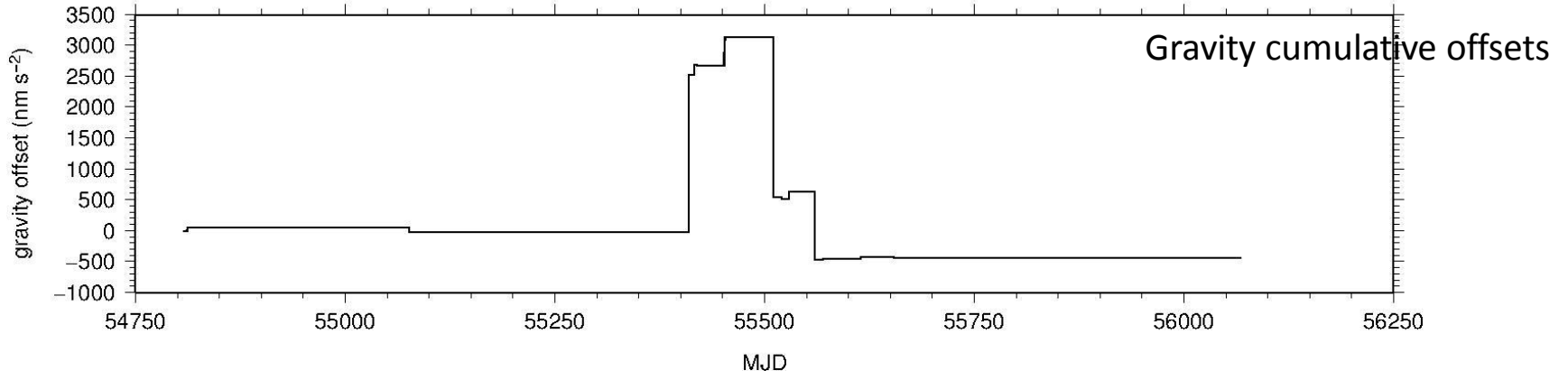




Alternate level-2 product



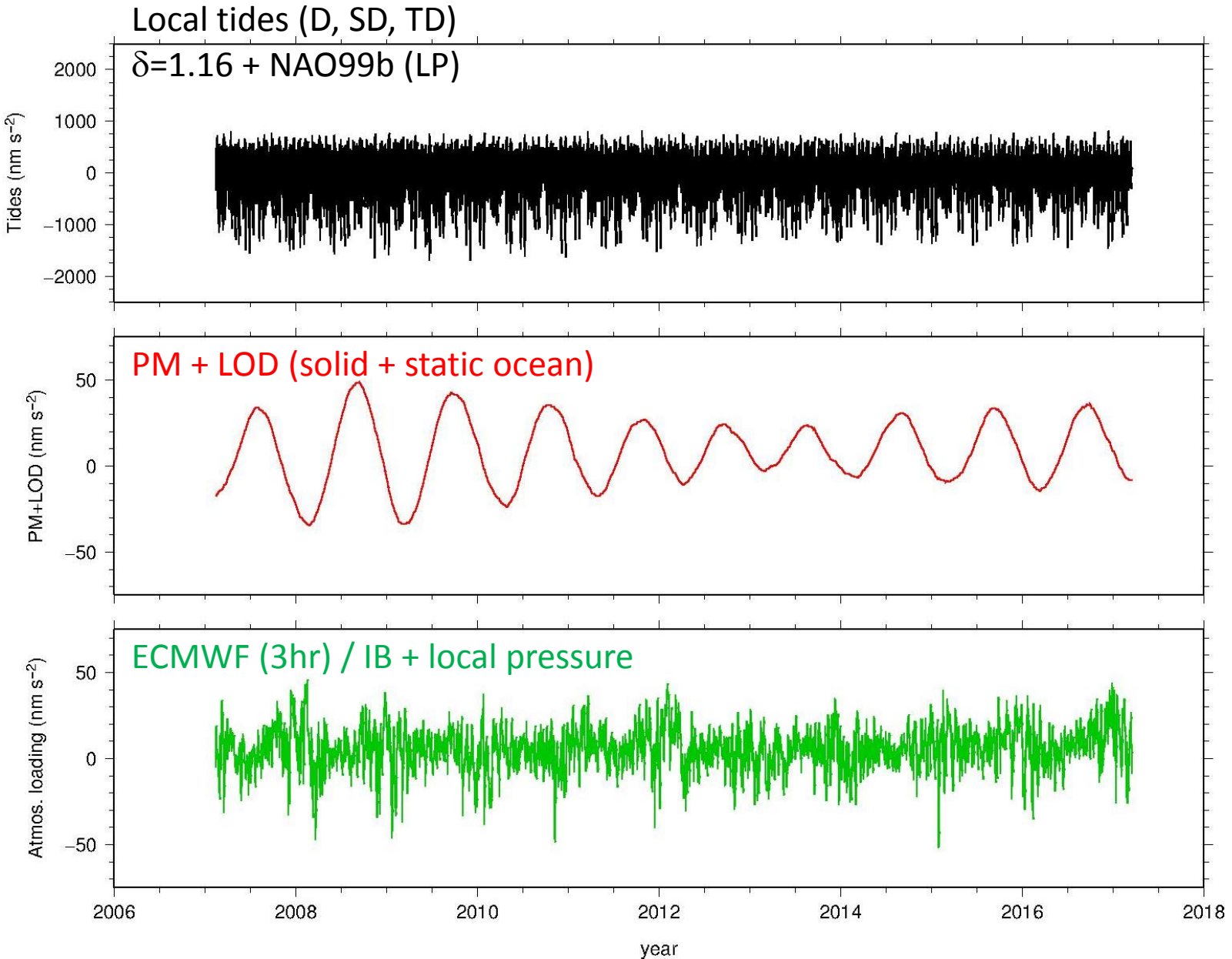




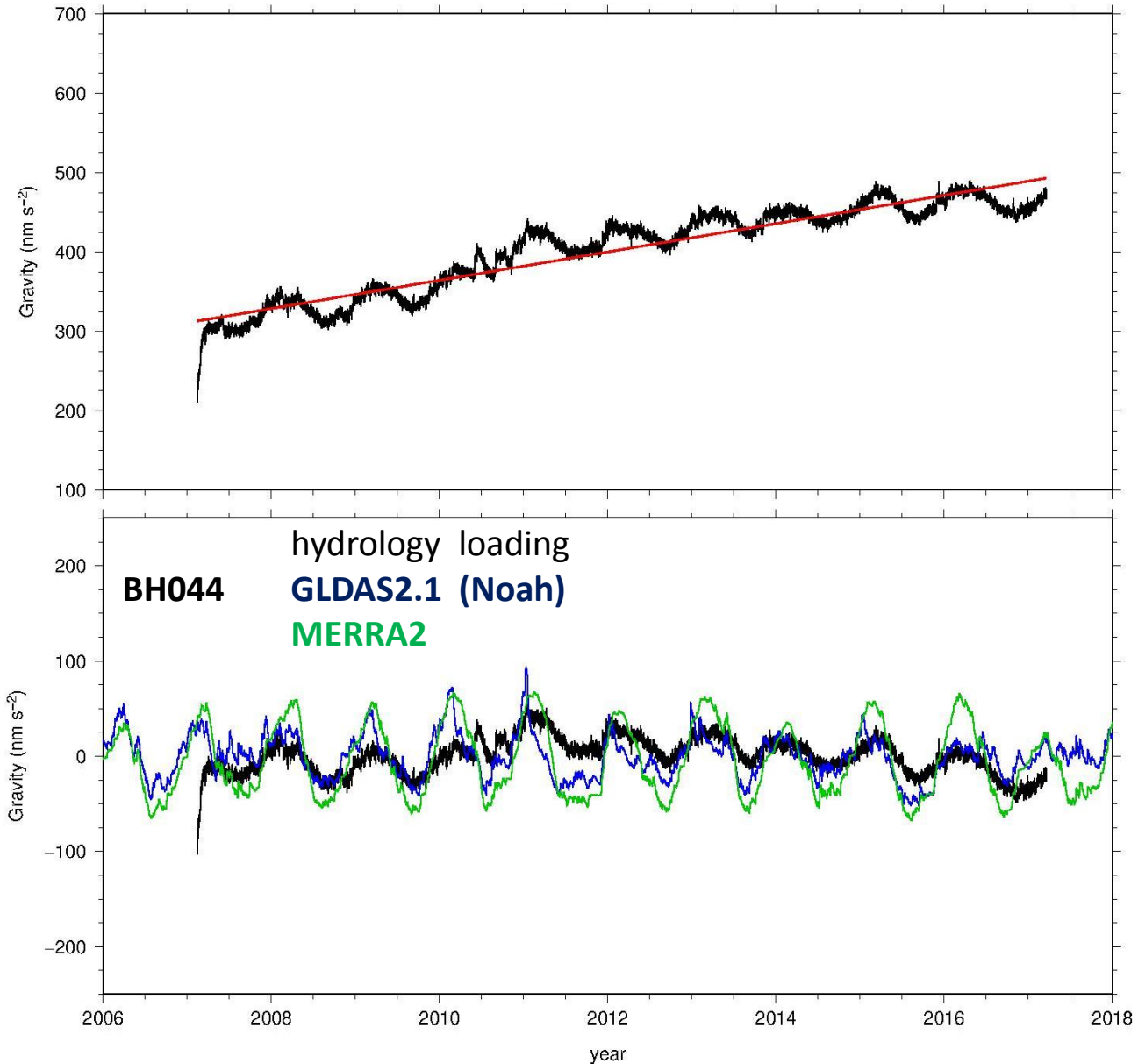
Level-3 data

- Current status (based on EOST level-2)
  - Modeling of solid & ocean tides (local model for short-period, nominal (δ=1.16) & NAO99b for long-period).
  - Modeling of polar motion + length-of-day (solid (δ=1.16) + static ocean).
  - Modeling of global atmospheric loading.
  - Adjustment of a polynomial drift (no AG data).
  - Based on EOST loading service (http://loading.-strasbg.fr).
- Possible improvements
  - Use of other models (FES2014, IERS convention, etc.).

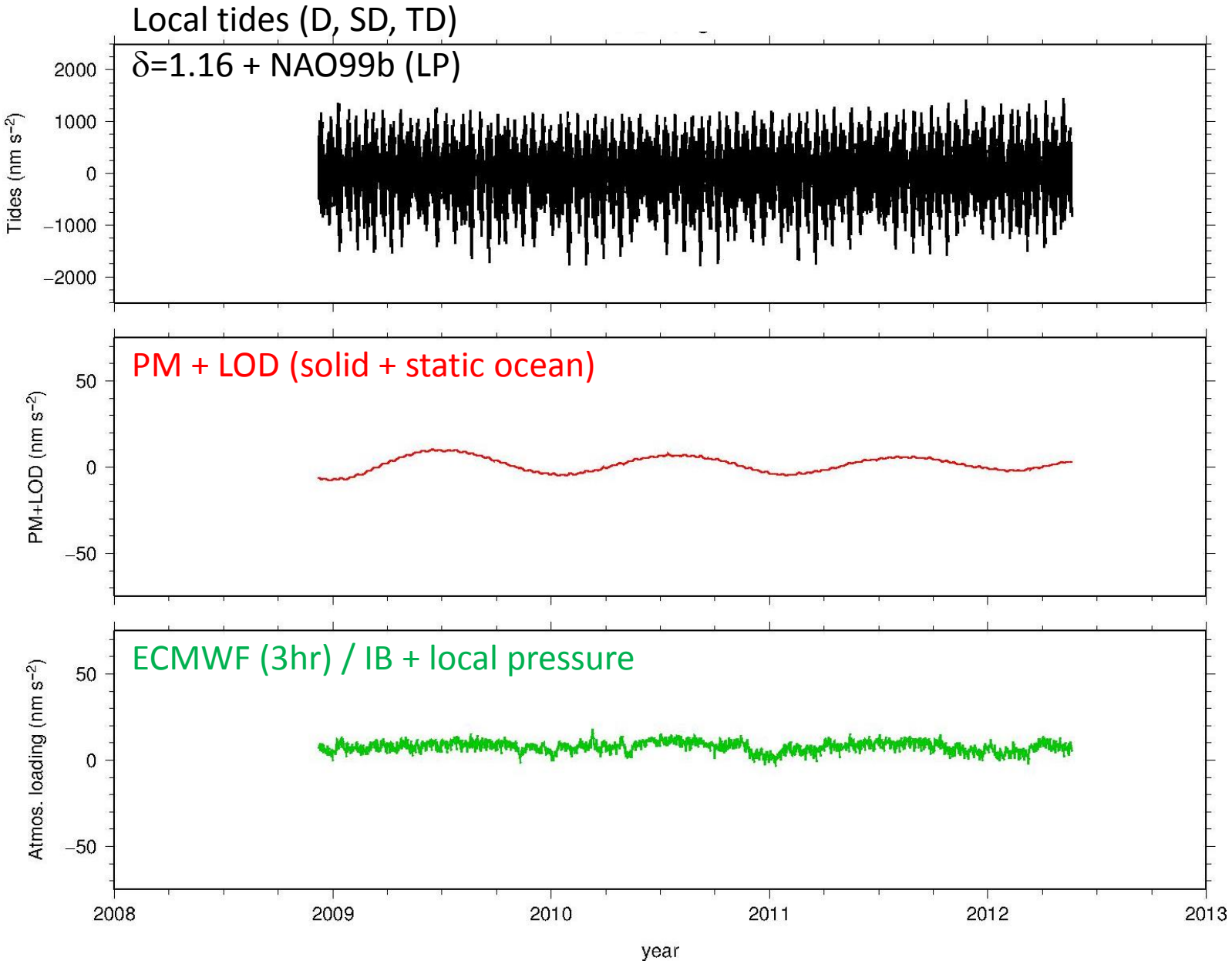
Bad-Homburg, Germany (BH044) – gravity models



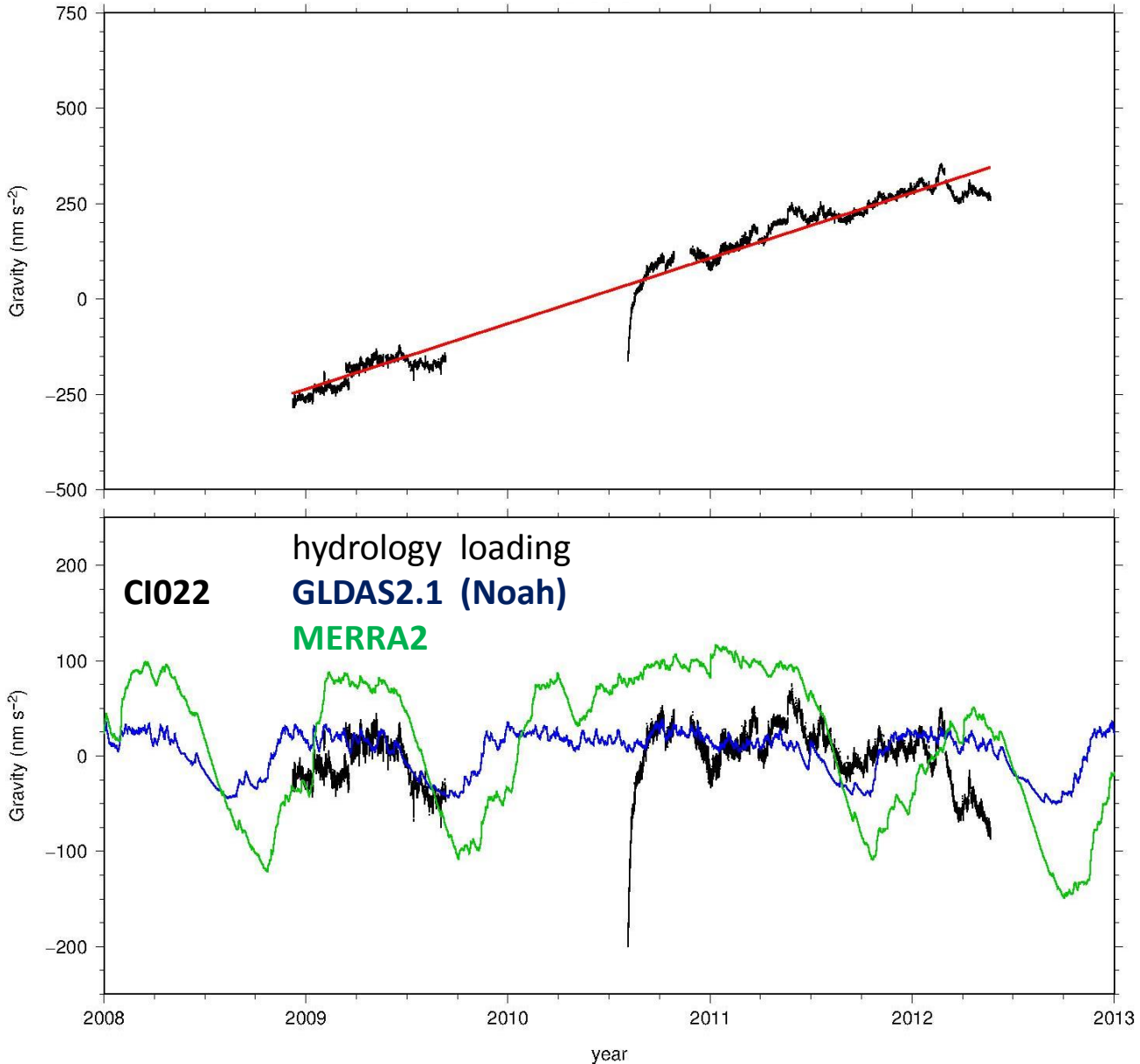
Bad-Homburg, Germany (BH044) – level-3



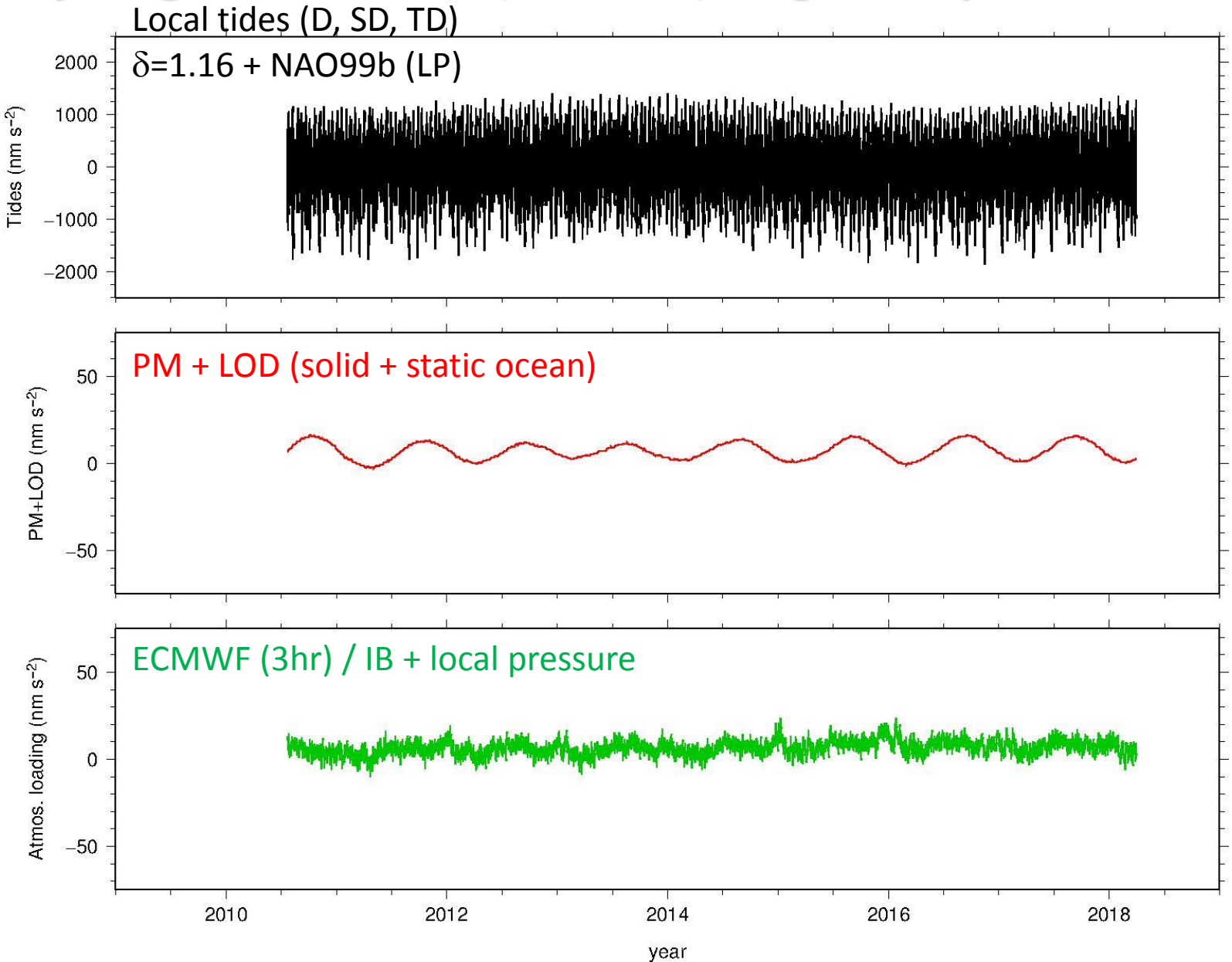
Cibinong, Indonesia (CI022) – gravity models



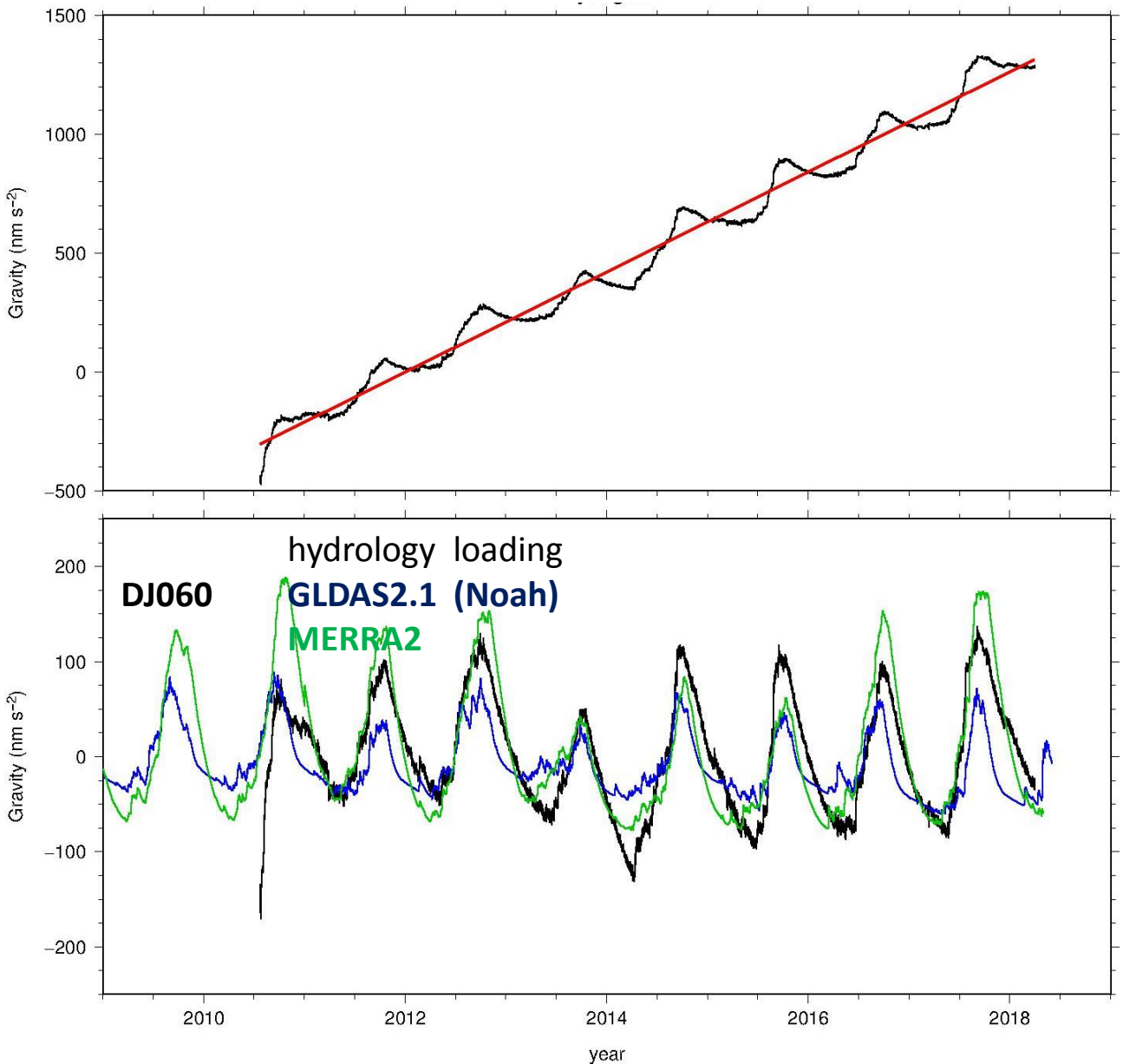
Cibinong, Indonesia (CI022) – level-3



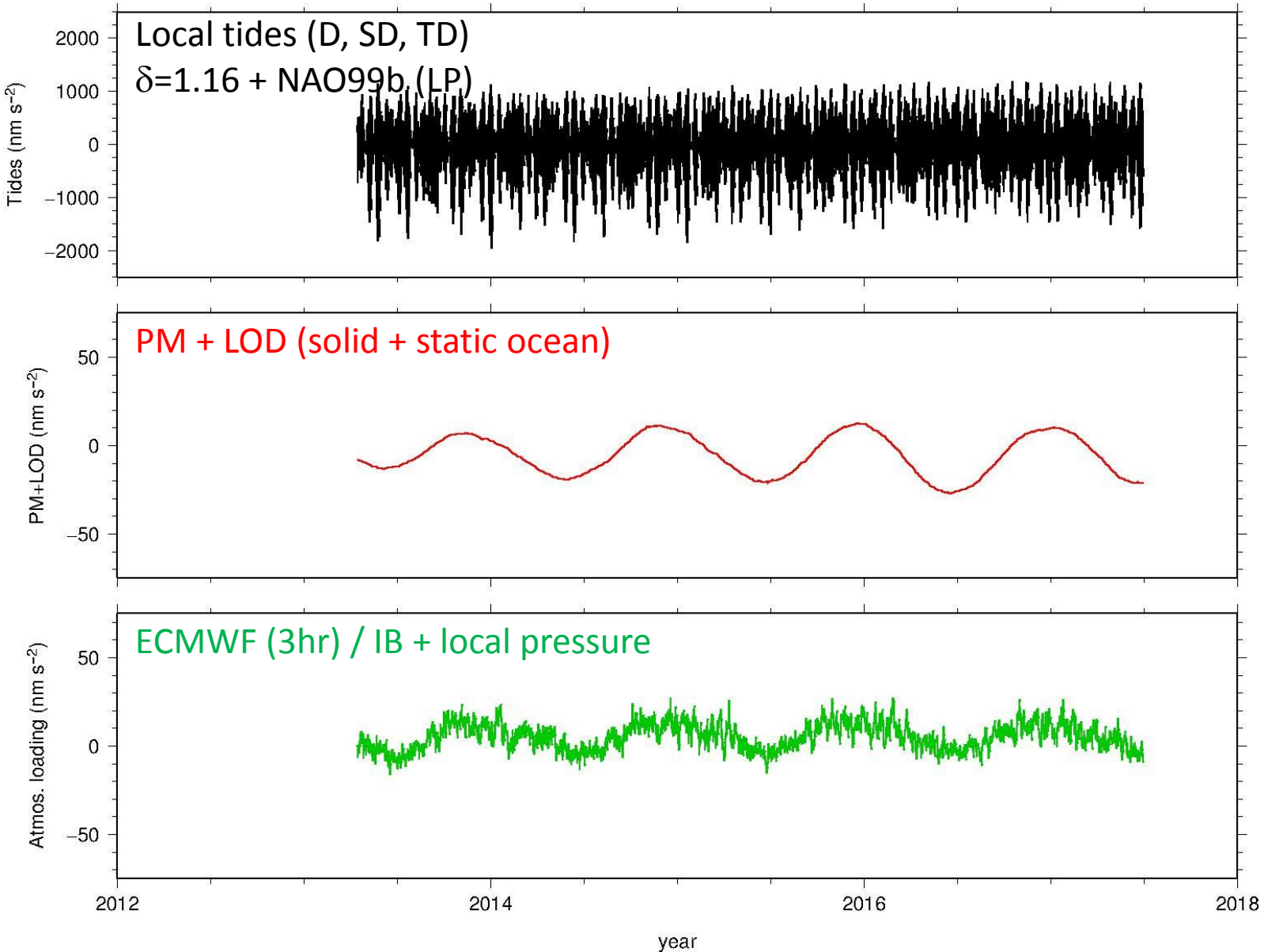
Djougou, Benin (DJ060) – gravity models



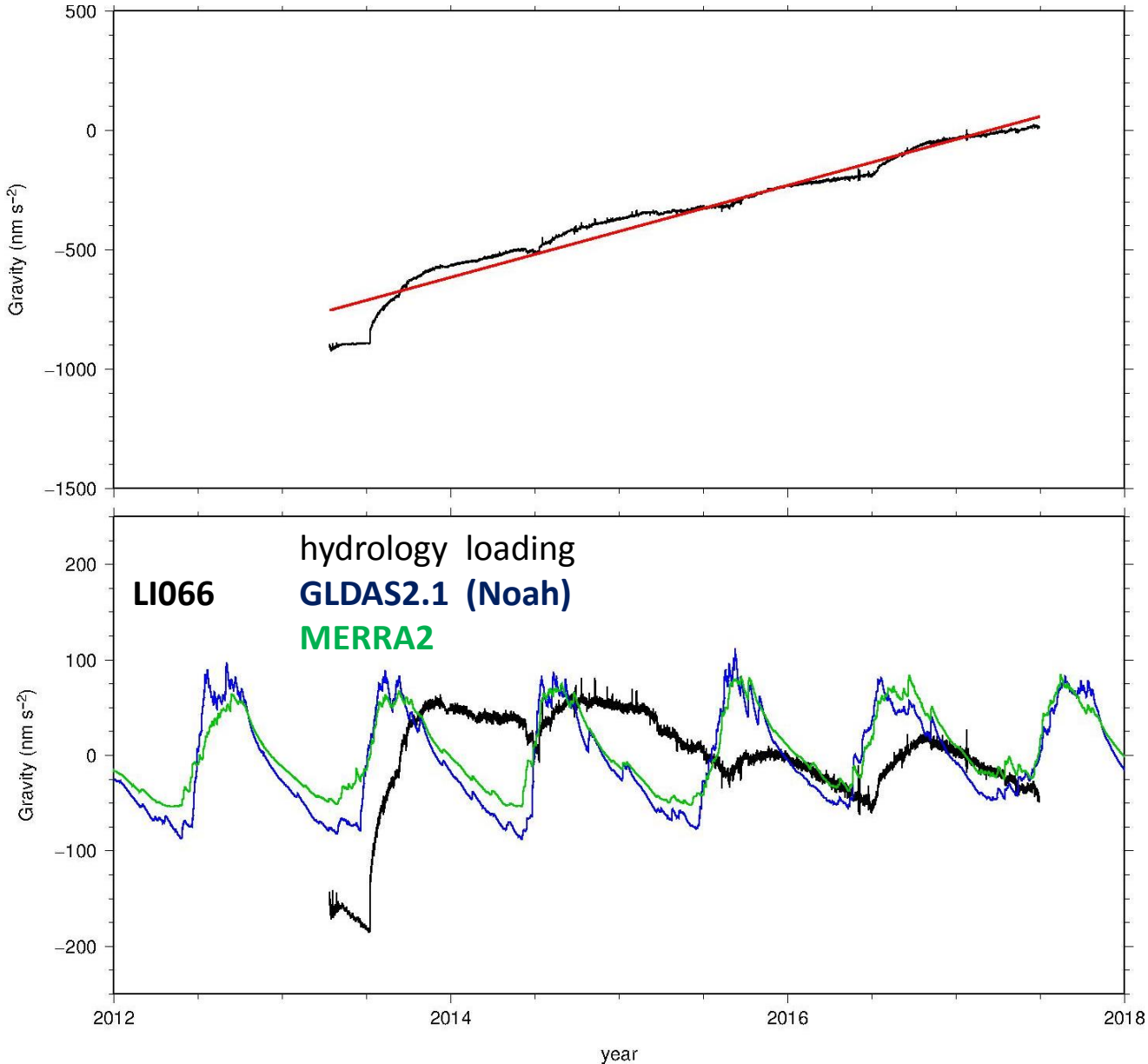
Djougou, Benin (DJ060) – level-3



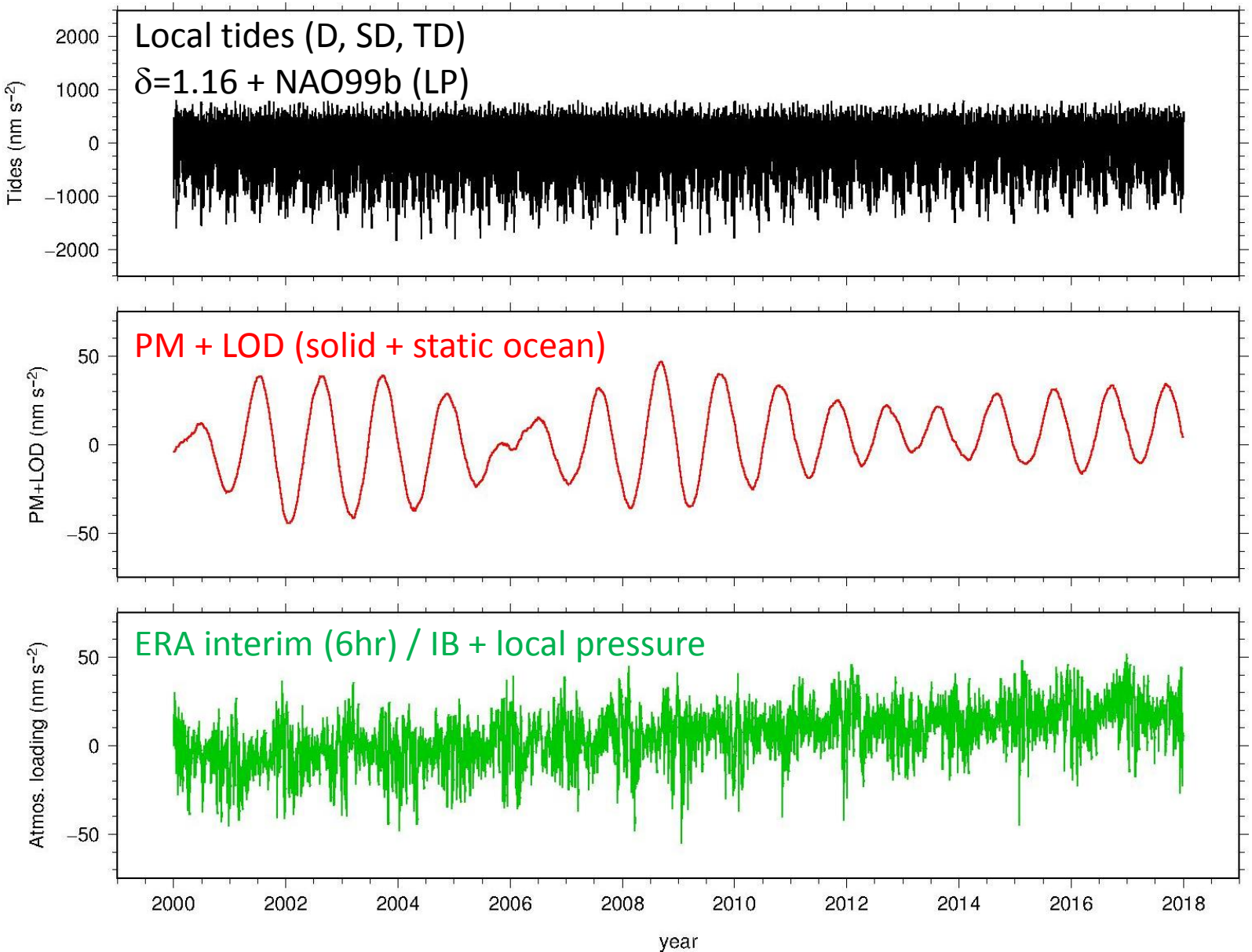
Lijiang, China (LI066) – gravity models



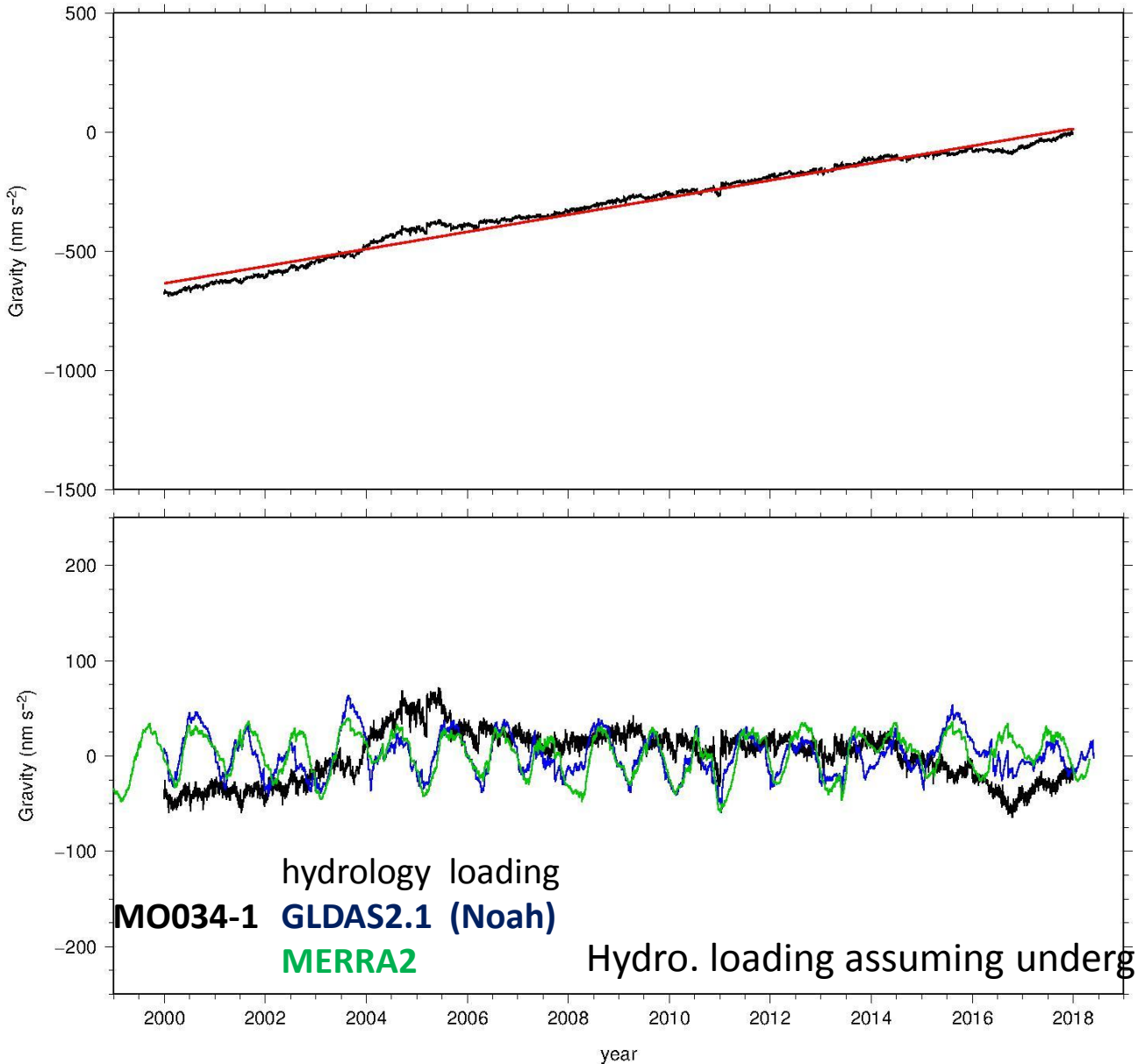
Lijiang, China (LI066) – level-3



Moxa, Germany (MO034-1) – gravity models

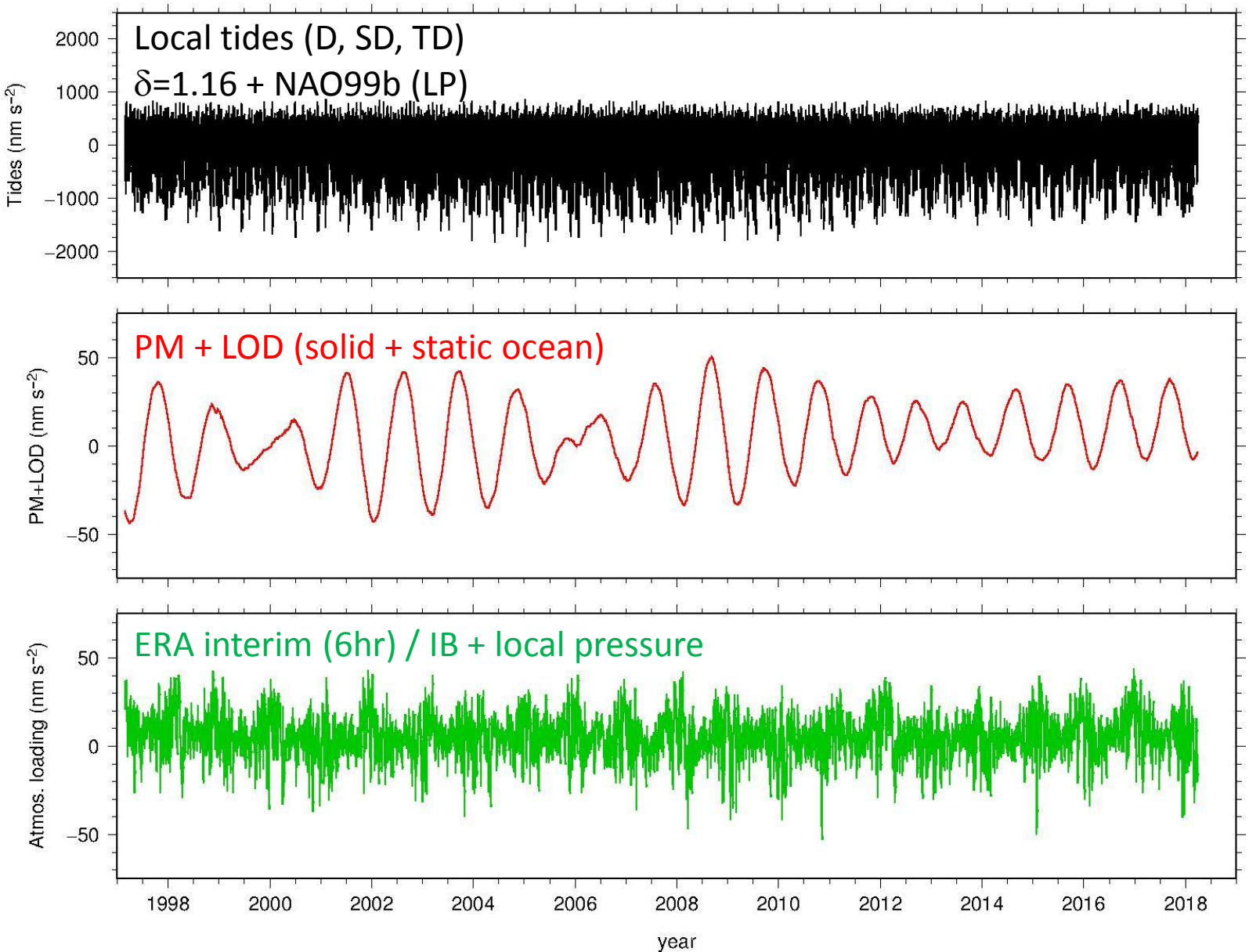


Moxa, Germany (MO034-1) – level-3

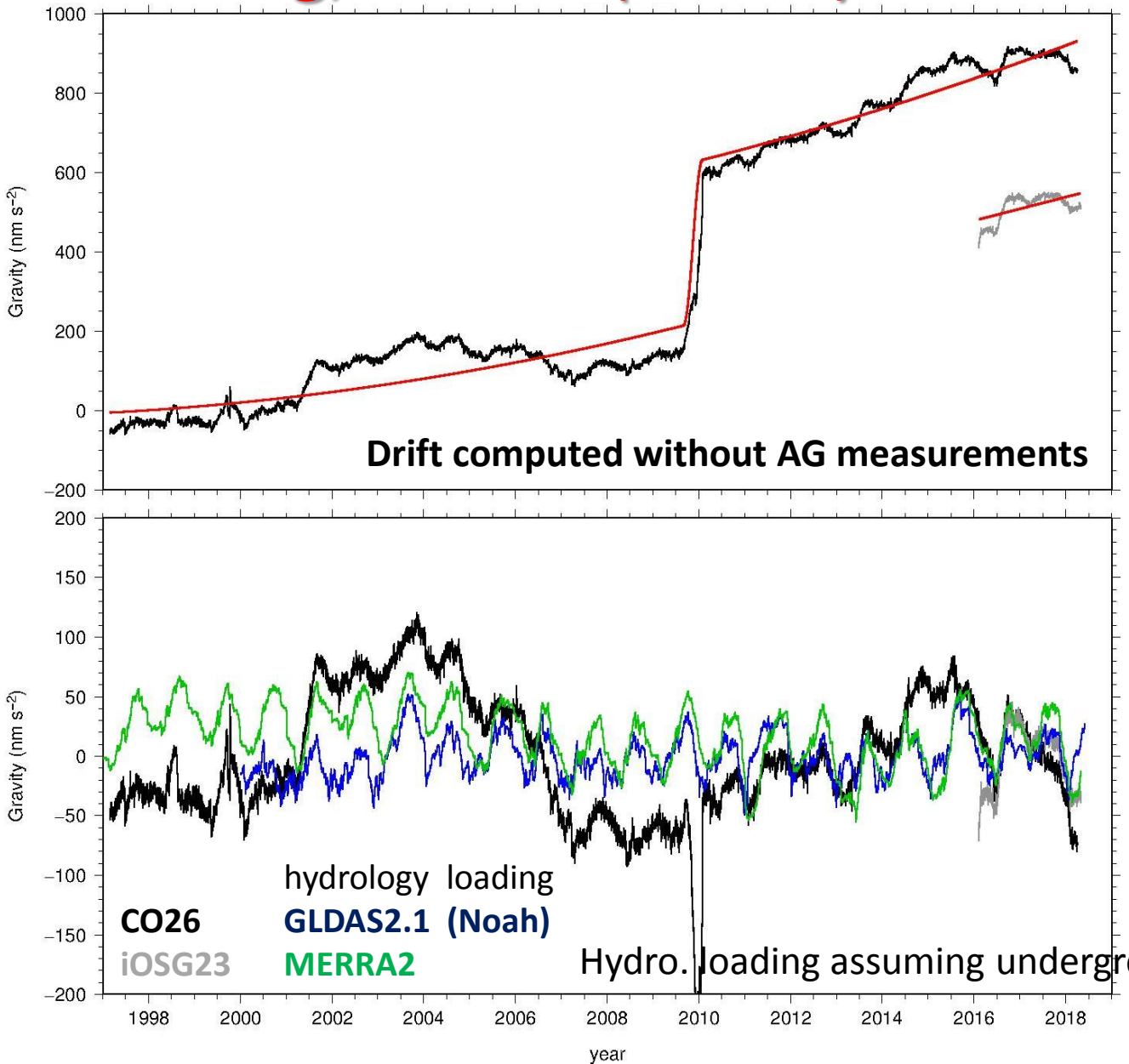


Hydro. loading assuming underground station.

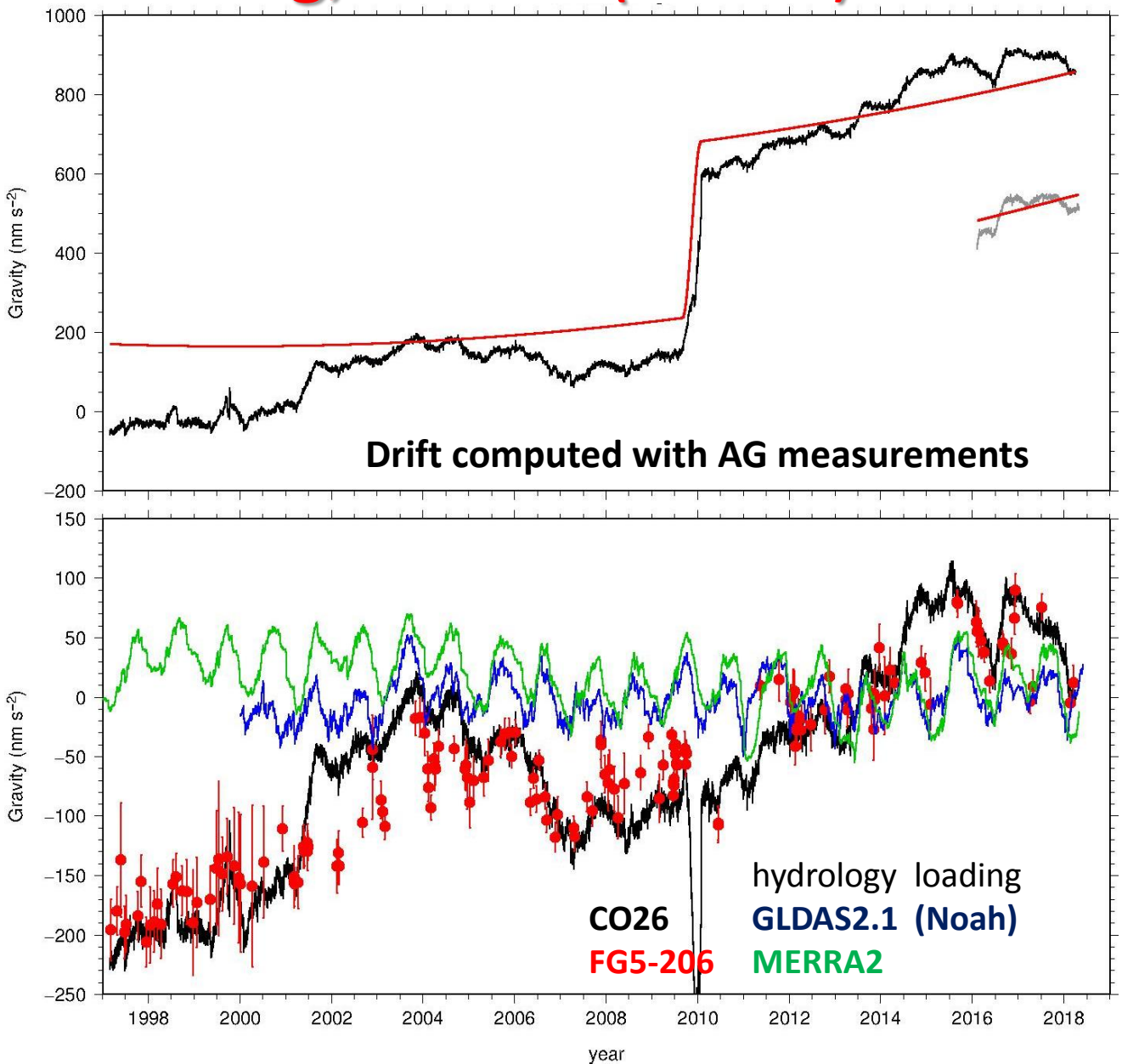
Strasbourg, France (ST026) – gravity models



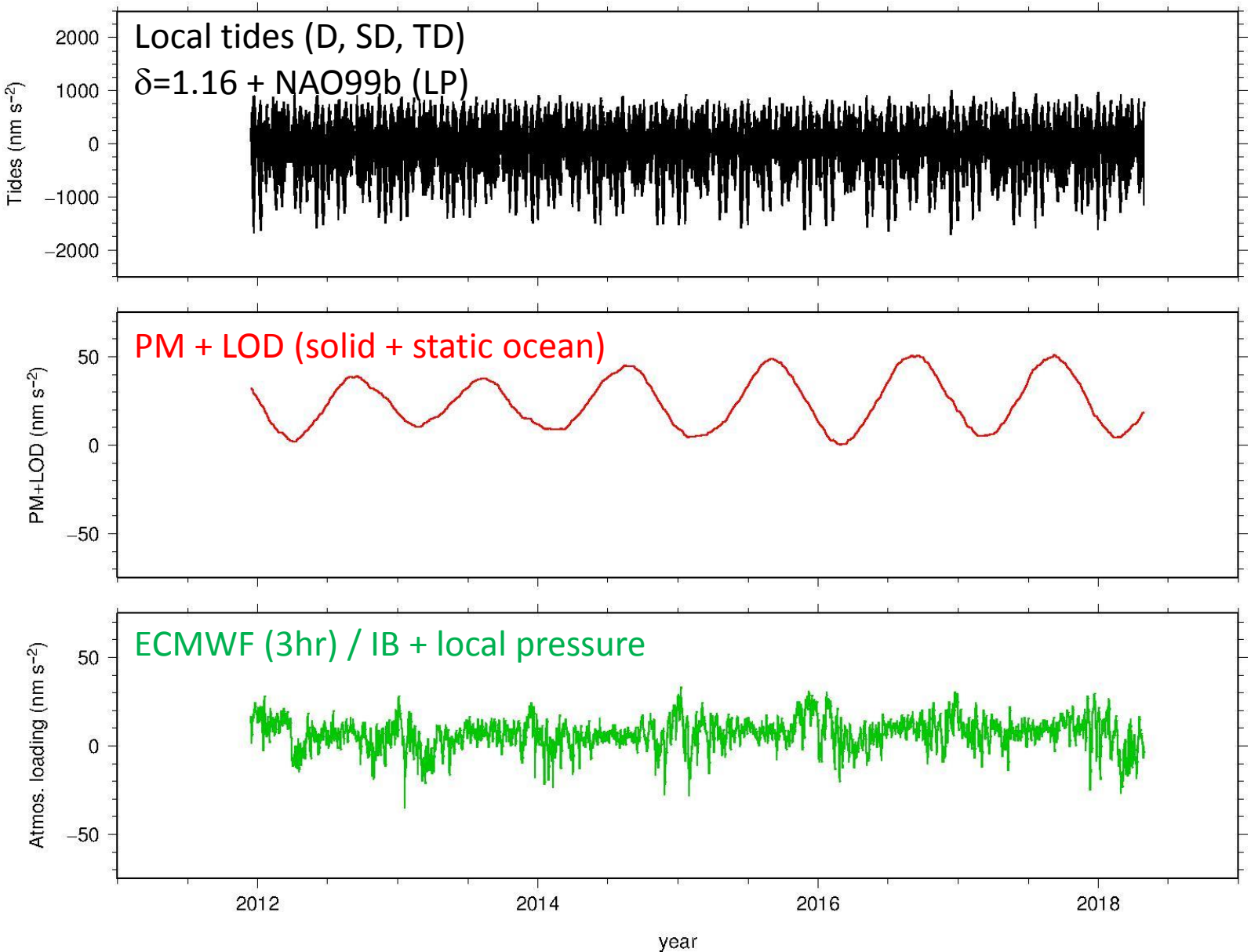
Strasbourg, France (ST026) – level-3



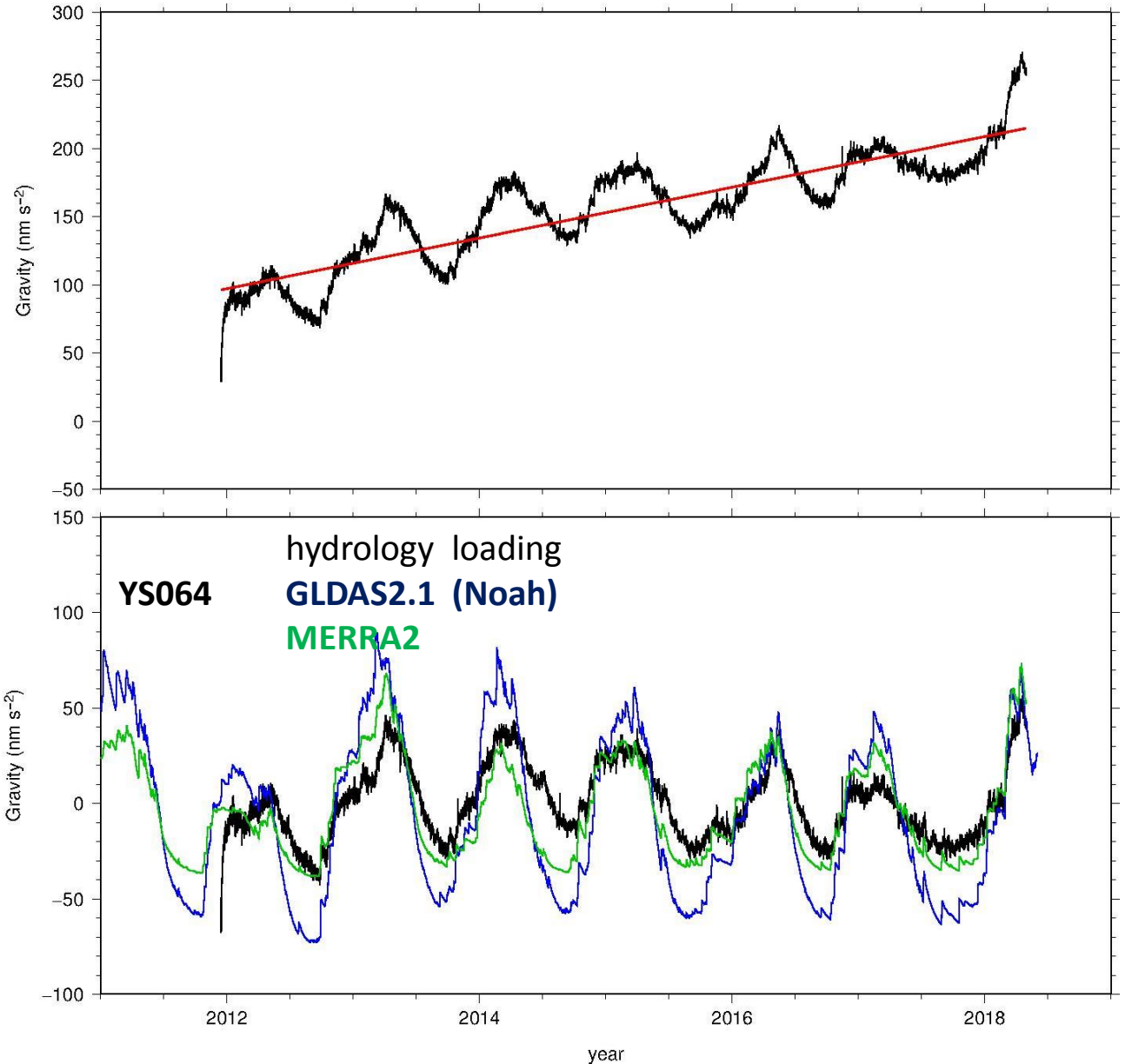
Strasbourg, France (ST026) – level-3



Yebes, Spain (YS064) – gravity models



Yebes, Spain (YS064) – level-3



List of processed stations/instruments

- AP046 2009/02 – 2017/12
- BF056 2009/10 – 2018/04
- BH030 2001/02 – 2007/04
- BH044 2007/02 – 2017/03
- CA012 1997/07 – 2017/06
- CB031 1997/07 – 2016/12
- CI022 2008/11 – 2012/05
- CO025 2007/11 – 2017/03
- DJ060 2010/07 – 2018/03
- HS048 2006/04 – 2012/08
- KA016 2004/10 – 2013/07
- LH057 2009/12 – 2017/06
- LI066 2013/03 – 2017/06
- MC023 1998/01 – 2017/12
- ME020 1994/08 – 2015/04
- MO034 2000/01 – 2017/12
- OS054 2009/06 – 2018/01
- PE050 2007/05 – 2018/03
- ST026 1997/02 – 2018/04
- SU037 2000/03 – 2017/09
- SU052 2008/09 – 2017/09
- TC038 2002/12 – 2015/04
- WE029 1998/11 – 2010/10
- WE030 2010/06 – 2017/12
- WE006 2015/03 – 2017/03
- WU065 2013/03 – 2017/06
- YS064 2011/12 – 2018/04

Conclusion & discussion

- Level-3 data (1-min.) are ready to be uploaded to the IGETS database. In addition to the residuals (with and without drift adjustment), all models (tides, Earth rotation, atmospheric loading) will be included.
  - Which level-2 data should be used ? Is it possible to have different level-2 data in the database (I can upload mine) ?
  - Are they any preferences regarding the gravity models (IERS Convention or DDW99 for solid tides, NAO99b or FES2014 for ocean tide , for example) ?
- Data can be provided as annual files, but will change through time, because of the drift adjustment. A production date should be included in the header.
- As shown for Strasbourg, the instrument drift computed using AG measurements may significantly differ from a simple polynomial fit.