



## INTRODUCTION

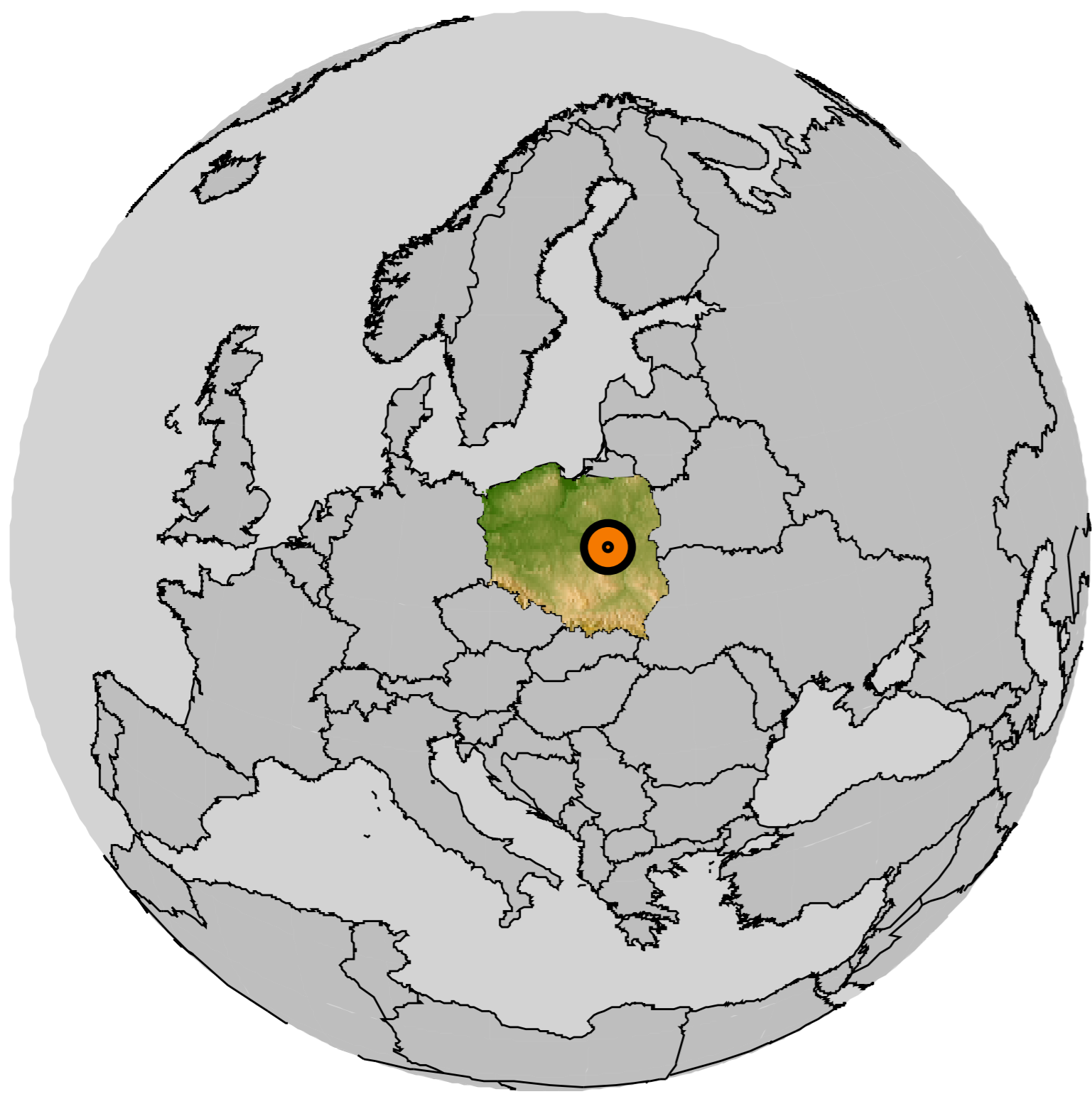


Figure 1: Location of Józefosław Observatory

- The Astro-Geodetic Observatory of Warsaw University of Technology is located in Warsaw suburb area
- Beginning of history in 1950's
- A part of newly created network of geodetic observatories in Poland
- For more details see <http://joze.pw.edu.pl>

## EQUIPMENT

### GPS

- The long period of observation
- No antenna change since 1993!
- Trimble 4000 SSI (SSE 2009) receiver
- Atmospheric pressure loading removed using Petrov's service
- IGS repro1 solution used in this study

### Absolute gravimeter

- FG5 no. 230 gravimeter
- Measurements since 2005, once a month
- Standard procedures of processing and models
- Tides, ocean tidal loading and pole gravity effect removed
- Pressure effect eliminated using local barometric measurements and admittance factor determined on the basis of tidal gravity measurements

### Additional measurements

- Two others GPS installed
- Tidal gravity measurements with spring LC&R ET 26 gravimeter
- Monitoring of meteorological parameters (two near-by station within 40 meters)
- Monitoring of groundwater level (manually)
- Microgravity measurement with relative gravimeters

## HYDROLOGY LOADING

This effect was estimated using Green's function formalism on the basis of two data source:

### GRACE

- Total Water Equivalent (TWE) from Groupe de Recherche en Géodésie Spatiale (GRGS)
- 1° spatial resolution both in longitude and latitude
- Ten days temporal resolution

### Hydrology model

- WaterGAP Hydrology Model
- 0.5° spatial resolution both in longitude and latitude
- Monthly temporal resolution
- TWE – all surface water and snow, subsurface and soil water components added

## GRAVITY RESULTS

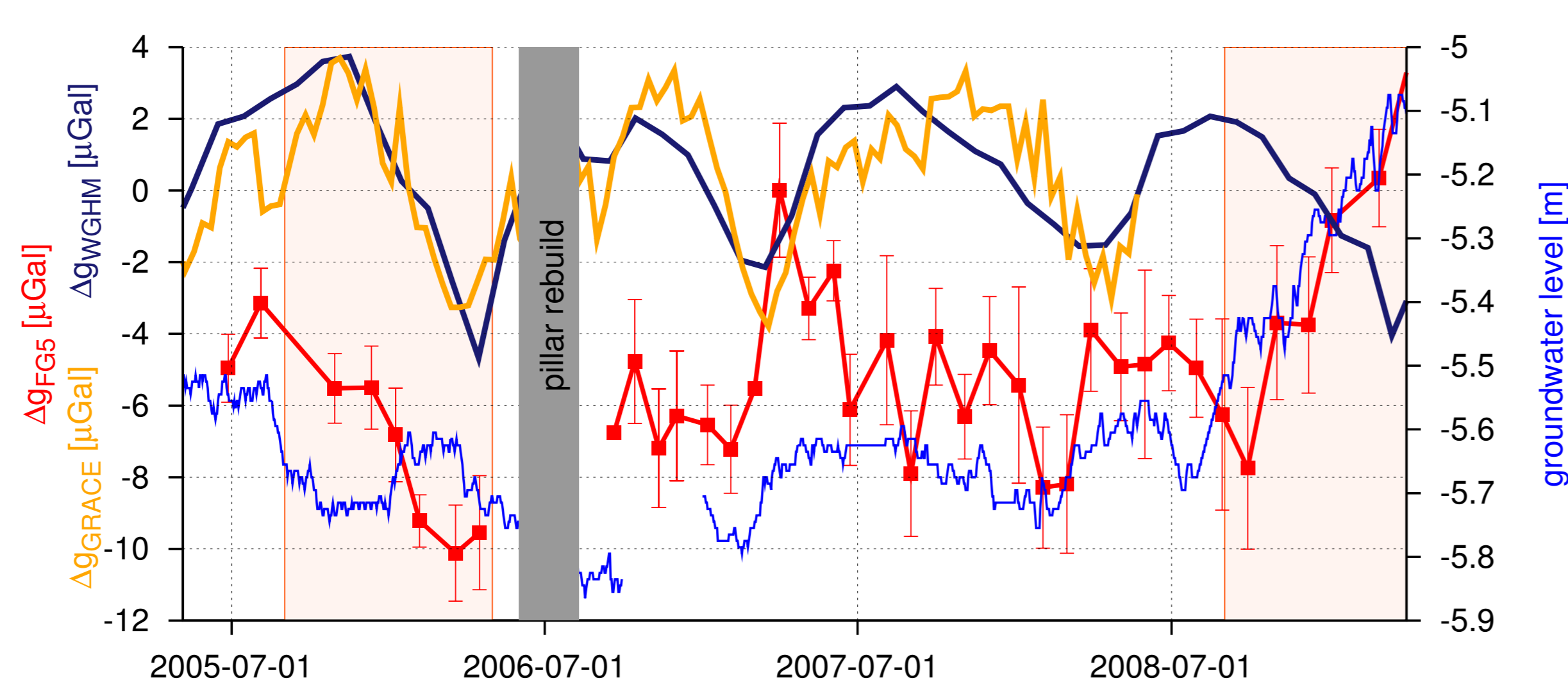


Figure 2: The observed gravity changes with FG5 gravimeter (red) along with modelled gravity changes on the basis of Total Water Equivalent from GRACE (orange) and WGHM (dark blue). The groundwater level means the distance from gravimeter site to groundwater surface.

## GPS RESULTS

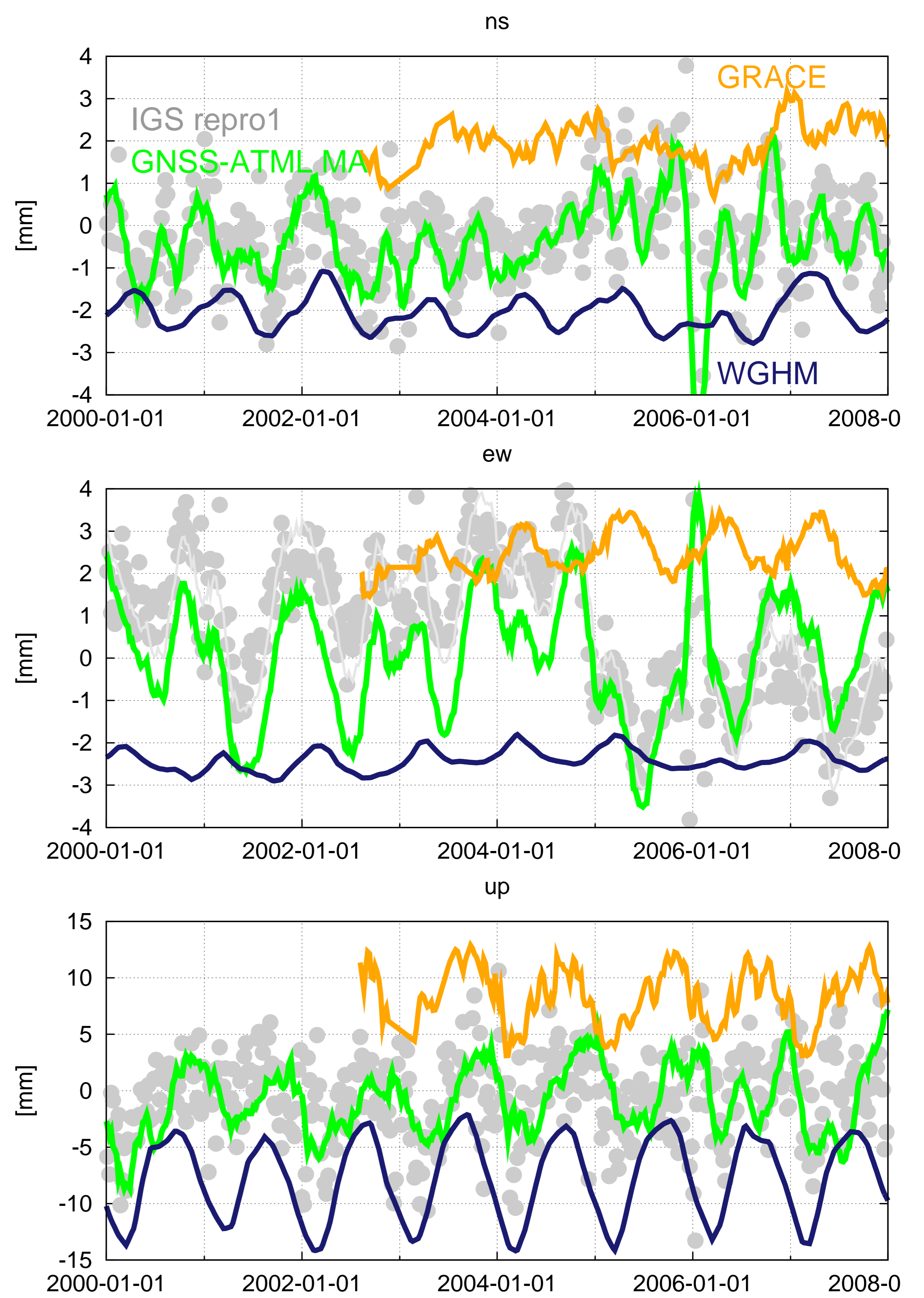


Figure 3: The time series of observed position variation in Józefosław (IGS repro1 weekly solution, gray dots) and the same data after atmospheric loading correction and smoothing with window length of 9 weeks (green). Modelled variation due to loading on the basis of GRACE and WGHM data (orange and dark blue color respectively).

## CONCLUSIONS

- The hydrology loading is clearly visible in GPS results for vertical component. Both amplitude and phase agree well with modelled deformation from GRACE and WGHM data. The WGHM gives slightly overestimated amplitudes
- For horizontal components the conclusion are ambiguous. There are likely several reasons of poor fit – small amplitude of signal (hence small SNR), atmospheric loading models, land-sea distribution, local environmental effects
- The computation of this quantity from water storage is much more complicated. The gravimeter site is located 6 m below ground level therefore the global hydrology cycle influence (from GRACE and WGHM model respectively) has opposite sign (and slightly modified amplitudes) as the main part of water storage take place in soil, thus the masses are above gravimeter. On the other hand local hydrology could have significant impact on observed gravity change. The level of groundwater table is below gravity site.
- The complex hydrology situation is reflected in Fig. 2. Two periods are marked with rectangle. In first period we observe a very good agreement with global hydrology effect while second period shows good correlation with local hydrology (groundwater level)
- The FG5 and GPS data are consecutively collected therefore more comprehensive analysis, qualitative and quantitative evaluation of hydrology loading influence on position and gravity will be undertaken

## REFERENCES AND ACKNOWLEDGMENTS

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