No. 2
July 2015

Newsletter

EGSIEM

European Gravity Service for Improved Emergency Management

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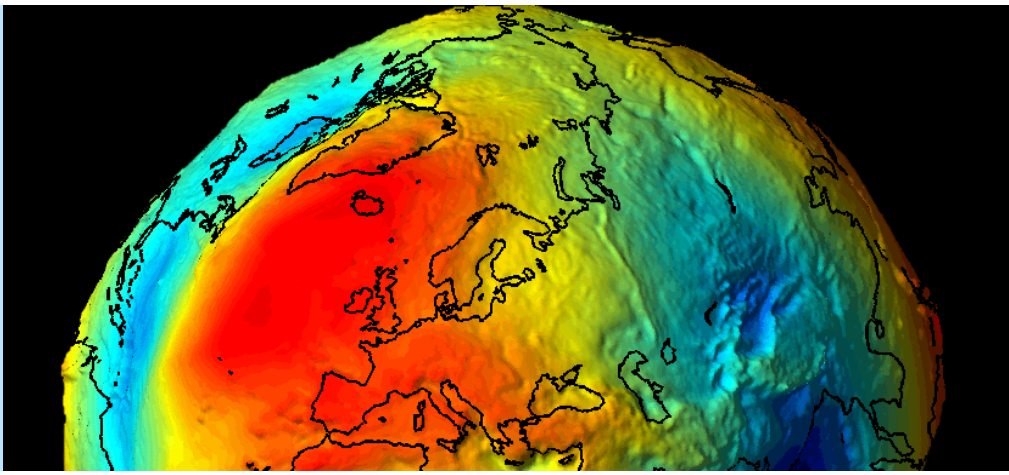


EGSIEM SCIENTIFIC SERVICES

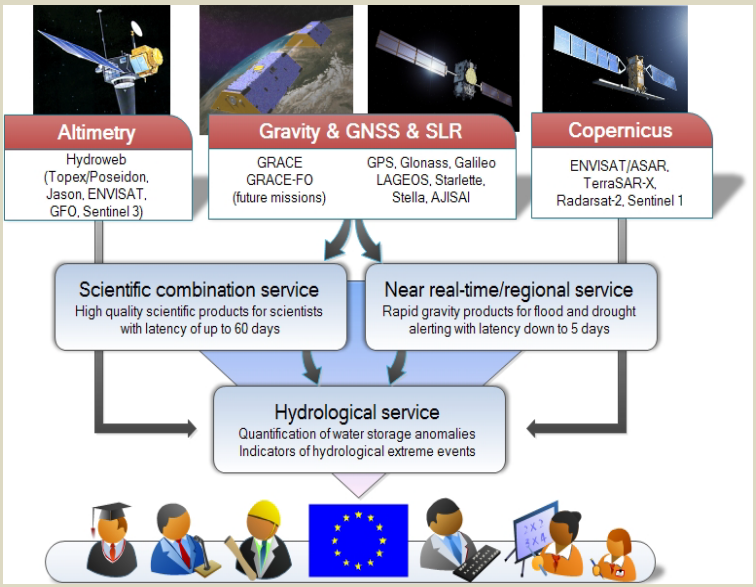
Today a number of Analysis Centers (ACs) within and outside of the GRACE science data system perform first level data processing. They do not adopt uniform processing standards and the end user is left with the difficult choice of deciding which results from which AC to use. It takes approximately two months from the time that the actual observation is made to the time when scientists can access and examine the data. Temporal resolution of gravity field solutions currently is at best 7-10 days.

EGSIEM will implement three scientific services:

❖ A **scientific combination service** which will combine the results obtained from different ACs of the EGSIEM consortium, each of which will perform independent analysis methods but will employ consistent processing standards. The quality, robustness and reliability of these datasets will significantly increase.

❖ A **near real-time (NRT) / regional service** improving the temporal resolution to one day and providing full gravity field information within five days. This will translate into tremendous added value for warning and forecasting the onset of natural hazards.

❖ A **hydrological/early warning service** providing adequate data products and indicators to support operational satellite-based flood information services.

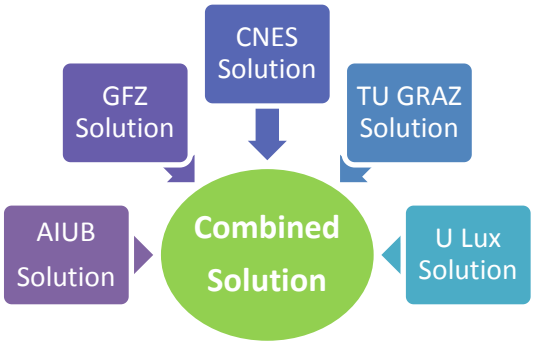


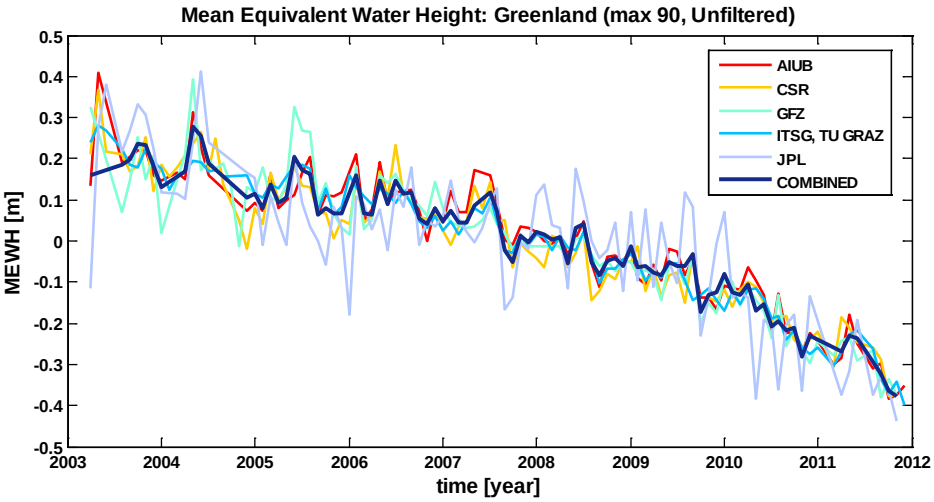
*General concept of the EGSIEM: Satellite data from **Altimetry**, **Gravity**, **GNSS**, **SLR** and **Copernicus** missions will be used to create these three services, all tailored to the needs of governments, scientists, decision makers, stakeholders and engineers.*

In this issue we introduce the first service, the scientific combination service, see page 2. The other two services will be presented in the following issues of our newsletter.

SCIENTIFIC COMBINATION SERVICE

The **scientific combination service** is the first service in the EGSIEM project and combines the global monthly gravity models derived from GRACE data from the individual ACs. By the combination systematic errors inherent to the individual processing strategies will be reduced. It will enable hydrologists, glaciologists, oceanographers, geodesists or geophysicists to take full advantage of one **dedicated, calibrated, and validated monthly solution.** The combined models including associated error estimates will be released within the framework of dedicated and user-oriented data centers. All models can be visualized on the **EGSIEM plotter**.

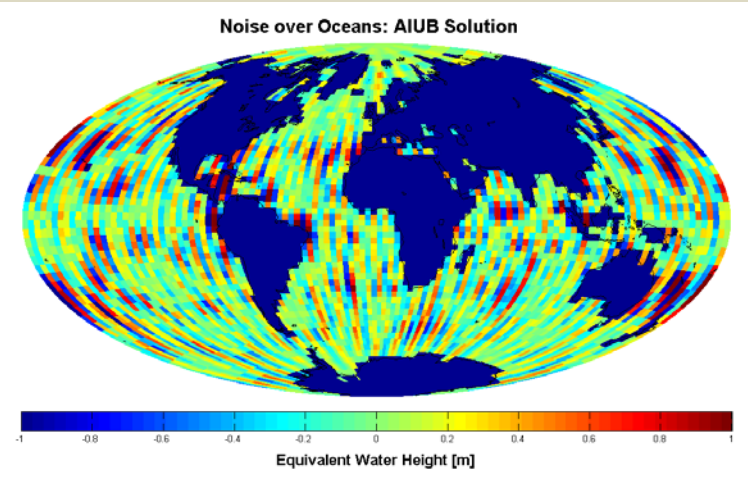


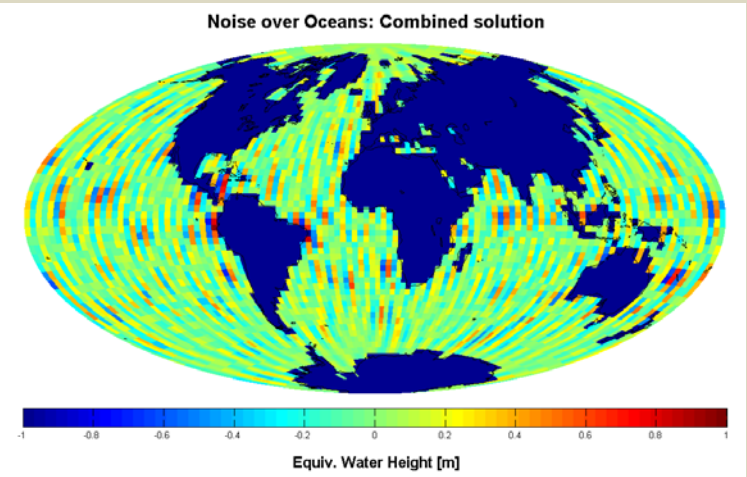


As such a service for gravity data does not currently exist the user must select between various gravity solutions for their individual analysis. Depending on this choice s/he might derive (for example) different annual or trend signals. A visualization of ice mass loss in Greenland illustrates the range of differences between currently available unfiltered solutions, and the potential noise reduction offered by a combination.

Fig.1: Evolution of ice mass (in terms of equivalent water height) in Greenland from 2003 to 2012, plottet relative to its 9 year mean. The combined solution represents the arithmetic mean of the monthly solutions of 5 different ACs.

The Astronomical Institute of the University of Bern (AIUB) is in charge of the scientific combination service. Several combination strategies will be investigated in the frame of the EGSIEM project, e.g., on the level of normal equations, taking the correlations between gravity field and orbit specific parameters into account. To ensure combinability, i.e., un-biasedness of the contributions of the different ACs, the individual solutions will be carefully analyzed prior to combination. Combination strategies on the solution level will be investigated as well. Solution specific weights may be derived from comparisons between the individual solutions and a weighted arithmetic mean of all solutions may be computed. Already the arithmetic mean of available (not standardized) monthly gravity fields leads to a significant reduction in 'noise'.





Figs. 2+3: Noise of a single monthly gravity field solution (left) and of a combined solution (right) computed as the arithmetic mean of 5 individual solutions (see Fig. 1). The errors (noise) are approximated by the unfiltered variations over the oceans, where no time variable gravity signal is expected.

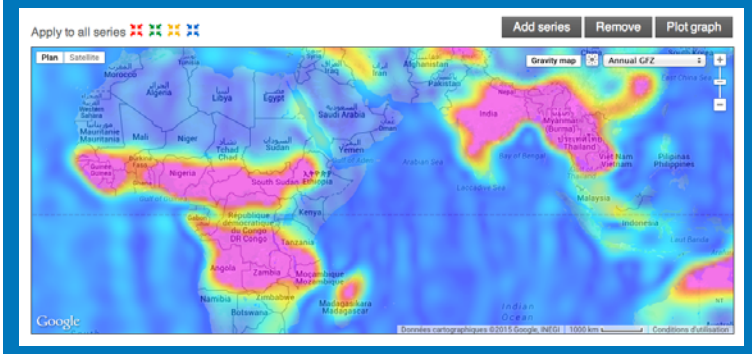
NEW RELEASE OF THE EGSIEM PLOTTER

The EGSIEM Plotter development team is delighted to announce some **brand new features** which have been added to at http://plot.egsiem.eu , these include:

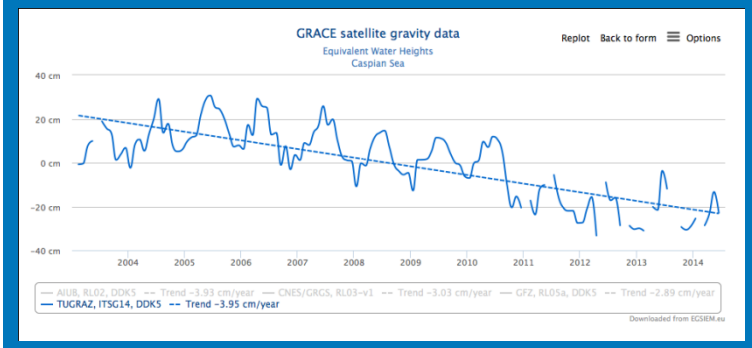
- GRACE monthly gravity data has been incorporated from Universität Bern (AIUB), Centre national d'études Spatiales (CNES), Center for Space Research, The University of Texas at Austin (CSR), German Research Center for Geosciences (GFZ), Jet Propulsion Laboratory (JPL) and Technische Universität Graz (TUG)
- Geoid height and spherical harmonic coefficients time-series, in addition equivalent water heights
- Extractions can be made from various points or customizable geometrical areas, plus over 200 predefined hydrological basins
- Gravity background maps of trend, annual & semi-annual signals are available from each group
- Full numerical details and statistics can be downloaded with one simple click
- Application of bias and scale on the time-series for easier comparisons
- Various regressions: linear, parabolic, polynomial, periodic (linear component + annual cosine/sine + semi-annual cosine/sine), and "advanced", a very special feature that takes into account the modulation of annual and semiannual phase and amplitude over the years. It is also possible to display the different components of the adjusted model to compare time-series!
- Automatic smart graph titles (or fully customizable)
- Improved user interface

Easy to use, lightweight and fast, the EGSIEM Plotter is an efficient and instant tool for comparing gravity time-series and is available to everyone!

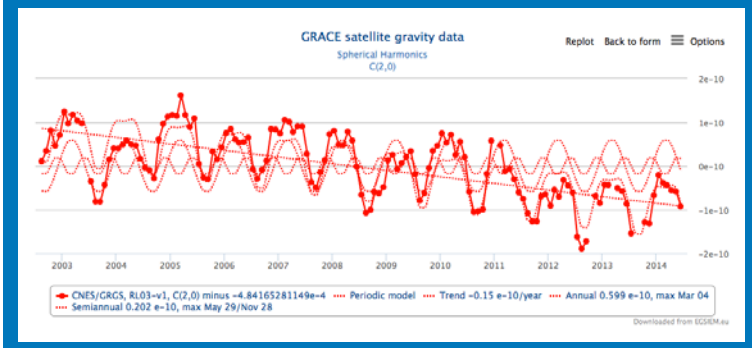
Visit us at http://plot.egsiem.eu !



Map of annual amplitude from GRACE (Equivalent Water Heights)



Linear regression on time-series (-3.95 cm/year trend over Caspian Sea)



C20 time-series and periodic regression (total model + individual components).

EGSIEM MEETS STUDENTS

On June 5 2015, Luxembourg high school students attended a special event celebrating **World Environment Day, 2015**. Prof. T. van Dam was invited to speak to the students about water and the changing water cycle. Among other things, she discussed the goals of the EGSIEM project. Other panelists included a member of the Luxembourg Government and a Member of the U.S. State department. Students attending the event received a tree and were encouraged to plant it to offset the increase in atmospheric carbon dioxide.

World Environment Day (WED) is the United Nations' principal vehicle for encouraging worldwide awareness and action for the environment to protect nature and the planet Earth.

http://www.unep.org/wed/wed2015/about.asp

EGSIEM CONSORTIUM INTRODUCES ITSELF

Prof. Dr. Tonie van Dam

1 - My main interest in Geodesy is its application to understanding how environmental mass is changing in response to global warming. In particular, my research focuses on using geodesy to investigate mass change on the Greenland Ice Sheet and changes in the water cycle.

2 - My role in EGSIEM cannot be defined in isolation. I will work with Matthias Weigelt and Zhao Li to set up a validation of the gravity/mass products using GNSS surface displacements. We will also contribute to estimating the scatter in hydrological models.

3 - The main aspect of EGSIEM that interests me is the science. We cannot develop a new product without improving and understanding what goes into the product. This means that we will have improved products for science as well as for flood and drought monitoring/ prediction.

University of Luxembourg
http://www.uni.lu
Research Unit in Engineering Science
http://wwwen.uni.lu/recherche/fstc/geophysics

Dr. Matthias Weigelt

1 - Geodesy is a unique engineering and science field. No other field is covering so many aspects such as instrument design and development, observation techniques, adjustment theory and interpretation of results. In any application geodetic aspects can be seen as a ticking clock and only if every little piece of it is designed well, the time (i.e. the result) is right. This is the challenge about the work but at the same time also its fascination.

2 - ULux is one of the analysis centers (AC) of EGSIEM and is providing a GRACE solution based on the acceleration approach. I am developing the approach and the code to calculate the required normal matrices as well as the gravity field solutions. Additionally I am also the exploitation manager of the project whose task is to promote the products of EGSIEM and extend the range of applications during and beyond the time of the project.

3 - There is not just one but many aspects such as the anticipated improvement in the GRACE solutions by the combination or the hydrological interpretations. If I have to choose one then I would pick the near-realtime service which opens up a completely new area of application for geodesists.

Interview questions:
1 - What interests you about Geodesy?
2 - Describe your role in EGSIEM?
3 - What is the one aspect of EGSIEM you are most interested in?

Dr. Zhao Li

1 - I have been studying Geodesy since 2002 when I was an undergraduate. I have a background of GPS data processing, time series analysis and environmental load modeling. To me, the most interesting part of Geodesy is that we could understand the Earth's geometric shape together with its variation with time through different kinds of geodetic observation techniques. Thanks to Geodesy, we could have a clear picture of our dynamic Earth.

2 - I am mainly involved in GNSS loading validation with the output Gravity products from EGSIEM. This allows to ensure the quality of the EGSIEM products. Another important role is to assist Dr. Matthias Weigelt to derive the Earth's gravity field using the refined acceleration approach. Since I'm just a beginner in the field of Gravity, this is a real challenge for me, but it would bring many benefits to my future career.

3 - What interests me most is that the EGSIEM would provide a combined gravity solution by taking advantages of different methods from different analysis centers. From the experience of GNSS combination for the ITRF establishment, I am expecting that the EGSIEM combined gravity field will be serve as a standard gravity product within the geodetic community.

MEET EGSIEM

Hydrospace 2015, Frascati, Italy
September 15th-17th, 2015
GRACE Science Team Meeting, Austin, TX
September 21st-23rd, 2015
Earth Observation Open Science 2.0, Frascati, Italy
October 12th-14th, 2015

KEEP IN TOUCH

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