



European Gravity Service for Improved Emergency Management

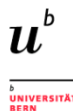
# European Gravity Service for Improved Emergency Management - Status and project highlights

**Torsten Mayer-Guerr**, Jäggi Adrian, Ulrich Meyer, Yoomin Jean, Andreja Susnik, Matthias Weigelt, Tonie van Dam, Frank Flechtner, Christian Gruber, Andreas Güntner, Ben Gouweleeuw, Andreas Kvas, Beate Klinger, Jakob Flury, Sean Bruinsma, Jean-Michel Lemoine, Hendrik Zwenzner, Stephane Bourgogne, and Tamara Bandikova

EGU General Assembly 2016

Vienna, April 20<sup>th</sup>

source: <http://boris.unibe.ch/85146/> downloaded: 13.3.2017

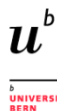


# EGSIEM

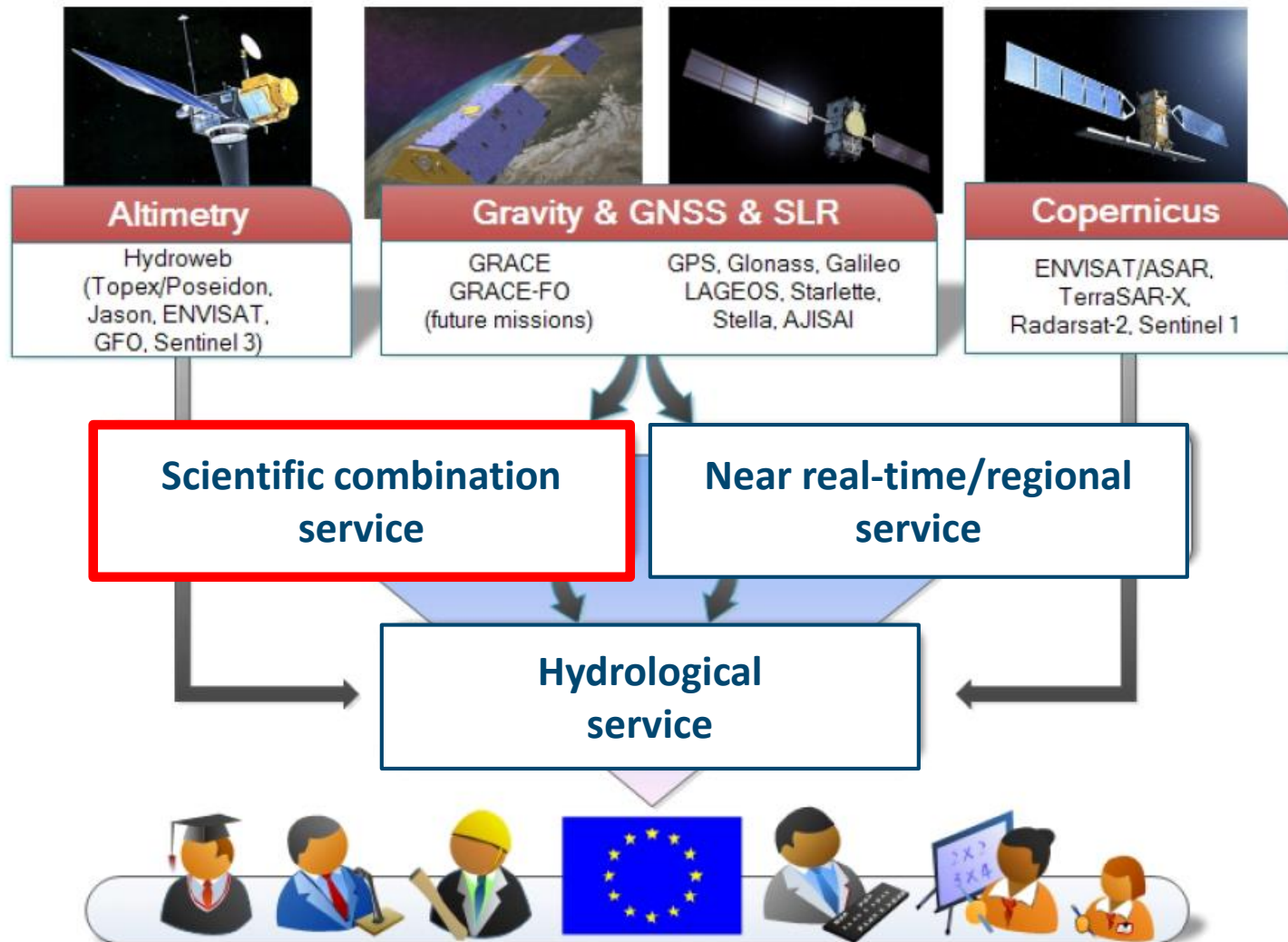
European Gravity Service for Improved Emergency Management

## European Gravity Service for Improved Emergency Management - Status and project highlights

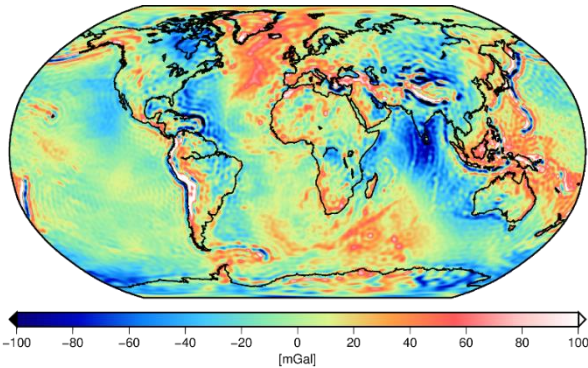
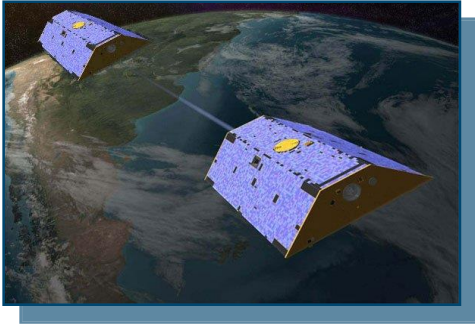
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# EGSIEM Project - Three services shall be established



# Scientific service

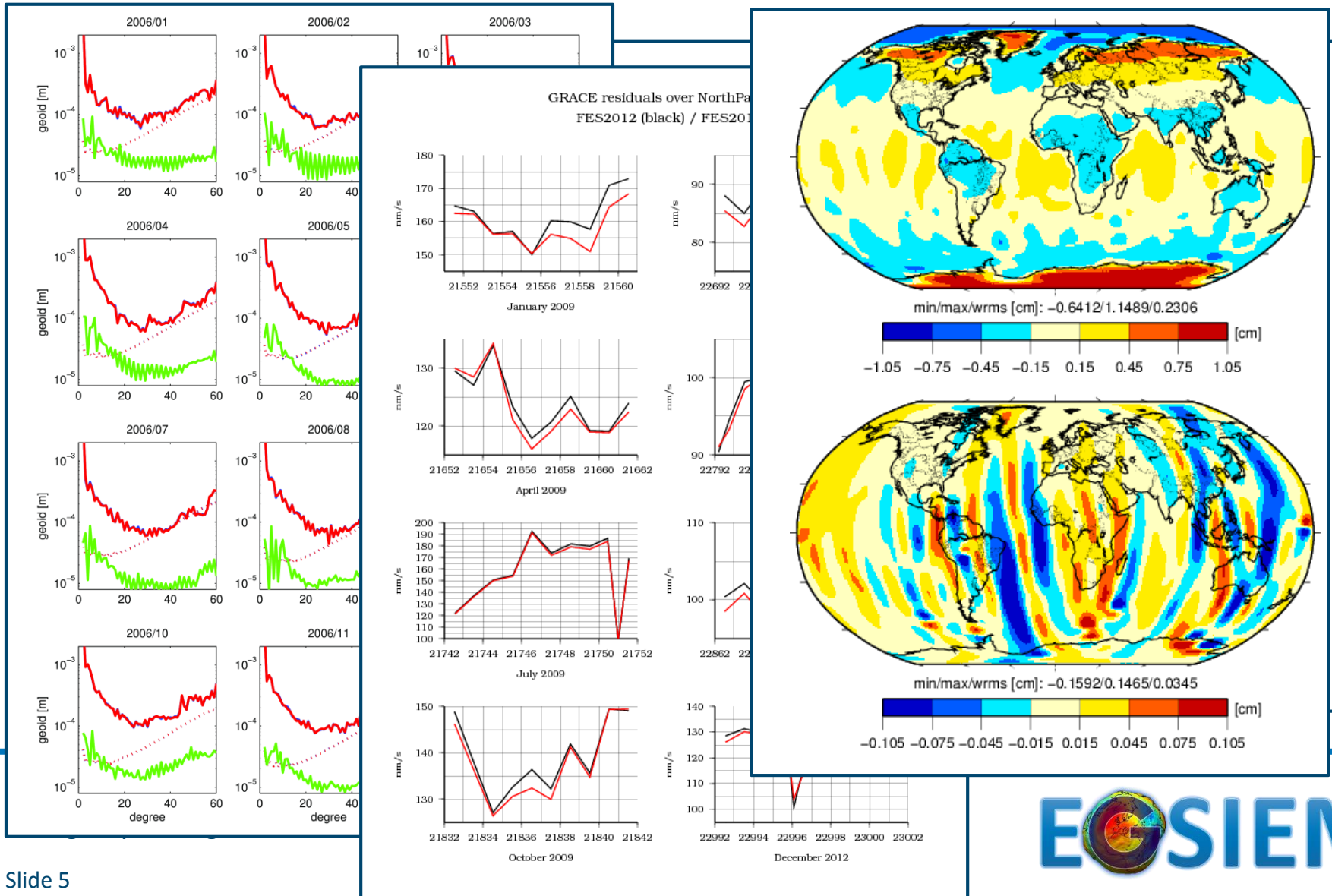


EGSIEM Analysis Centers (ACs):

- **GFZ**
  - **CNES**
  - **AIUB**
  - **TUG - ITSG**
  - **University of Luxembourg**
  - More in the future ...
1. Improvements of the processing
  2. Integration of complementary data
  3. Harmonization of processing standards
  4. Combination of the solutions

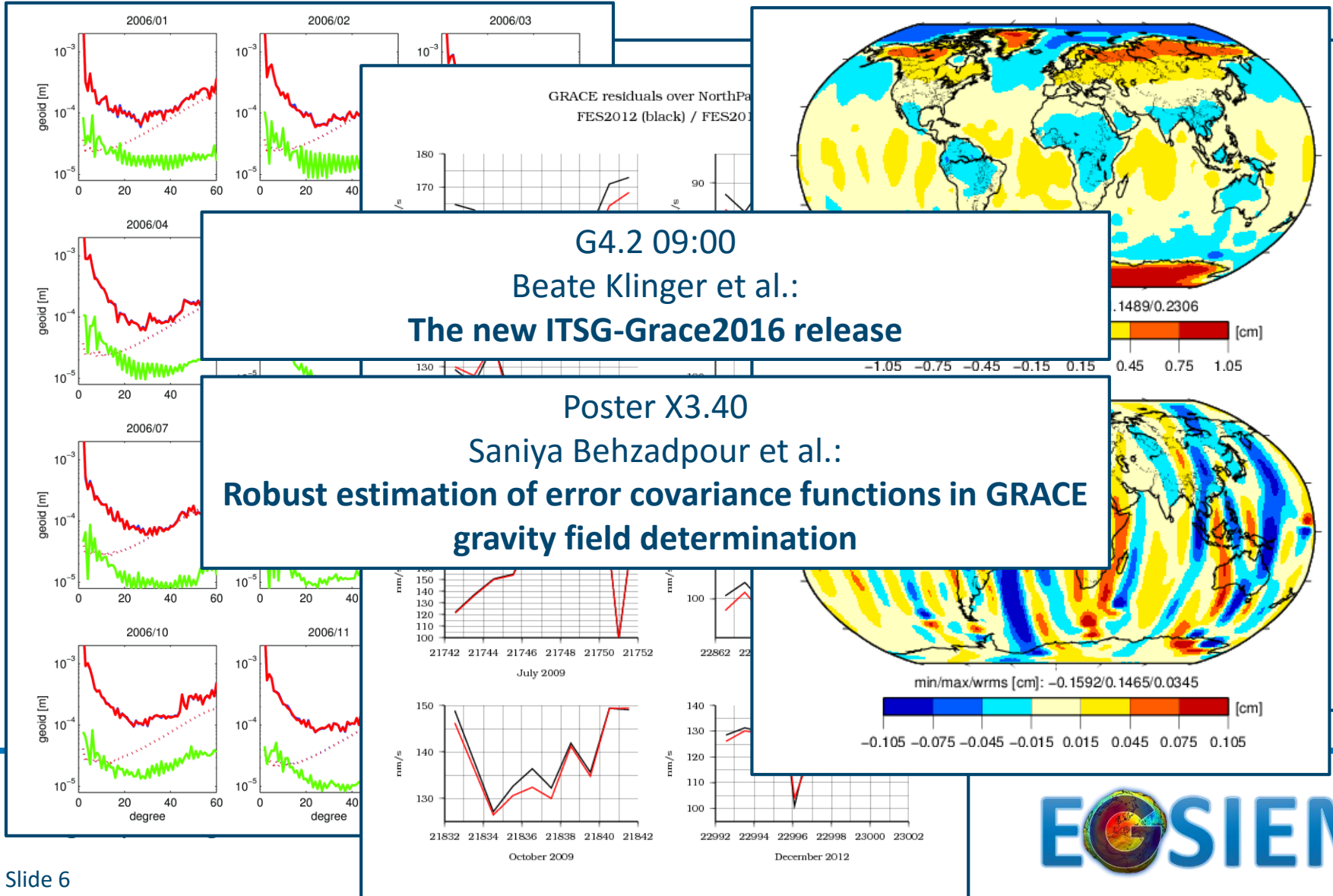
# 1. Improvements of the processing

A lot of tests, comparisons, discussions: instruments, calibration, background models



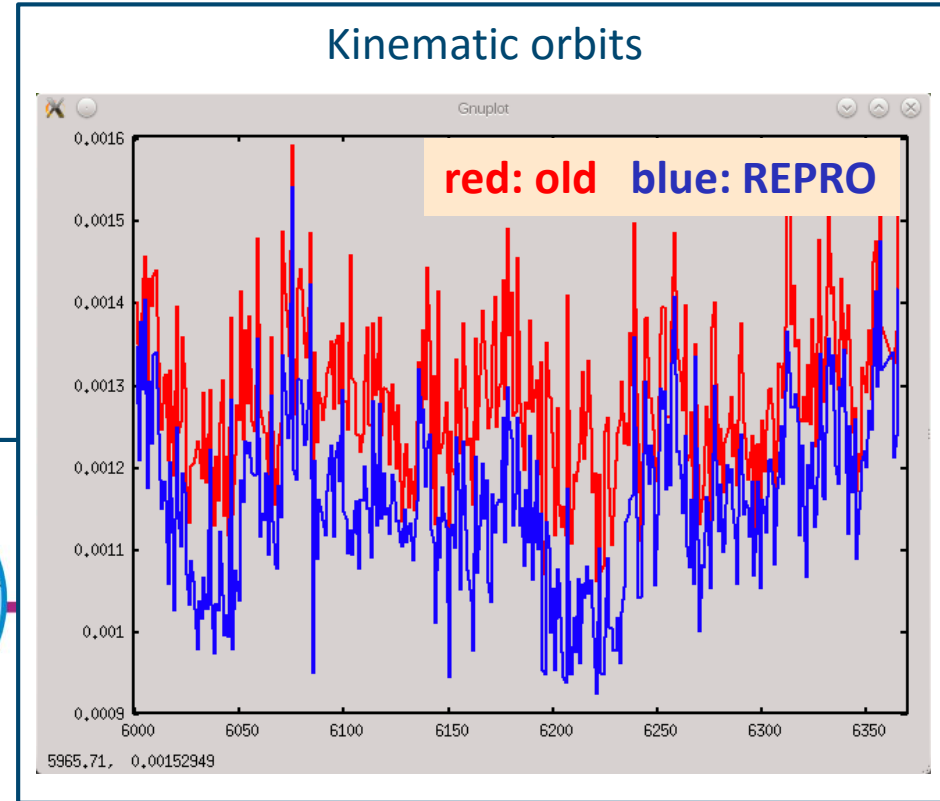
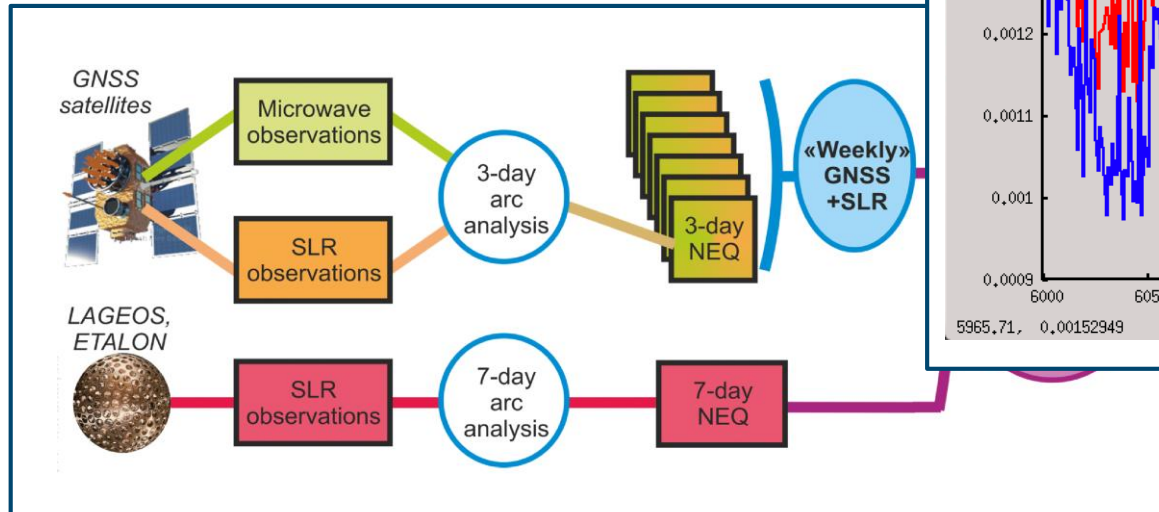
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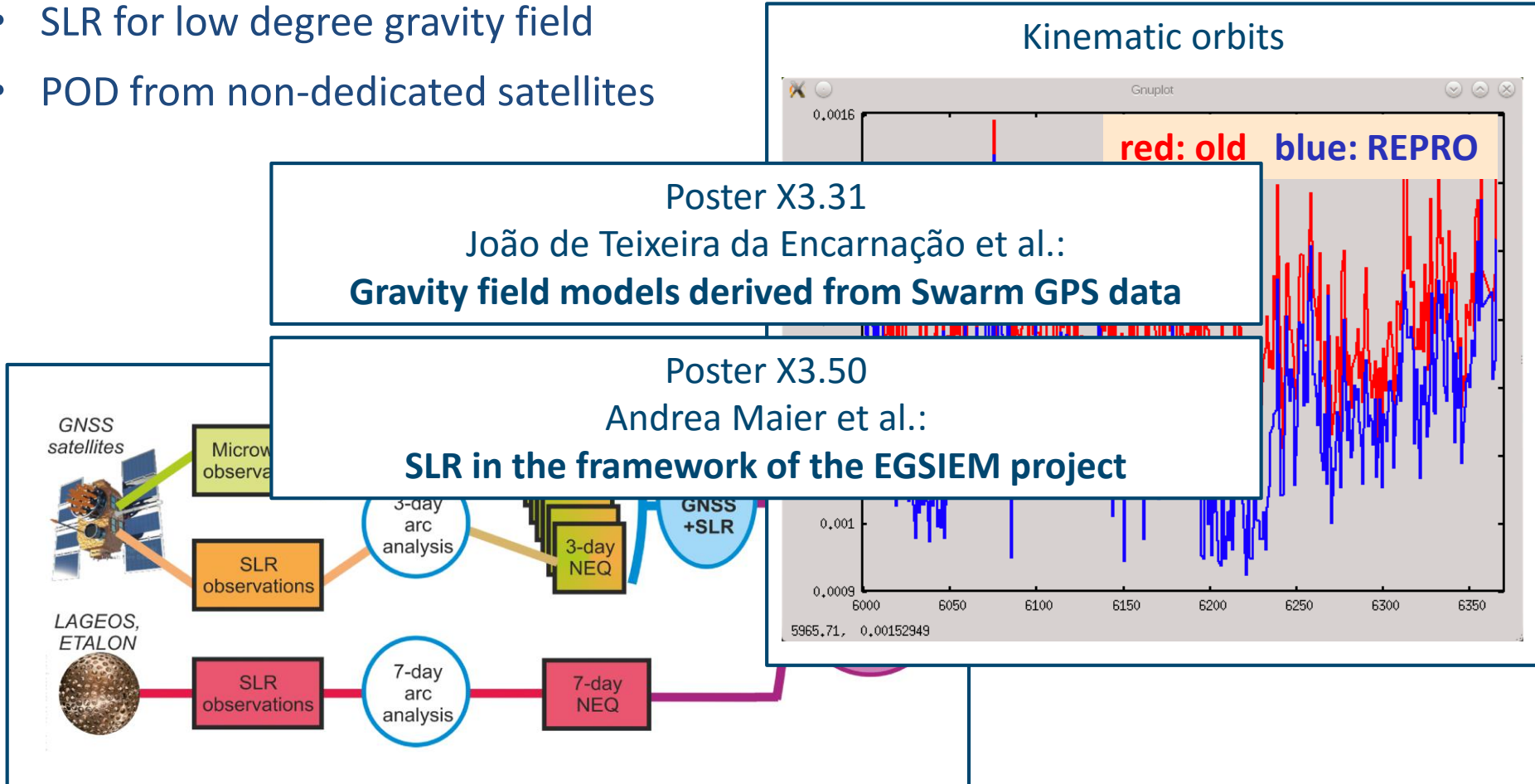
## 2. Integration of complementary data

- Reprocessed GPS orbits and clock corrections
- SLR for low degree gravity field
- POD from non-dedicated satellites



## 2. Integration of complementary data

- Reprocessed GPS orbits and clock corrections
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- POD from non-dedicated satellites





# 3. Harmonization of processing standards

- Common reference frame and GPS orbit constellation
- Ensemble of different background models
- Distribution of solutions at normal equation level in standard SINEX format

```
%=SNX 2.02  
+FILE/REFERENCE  
+FILE/COMMENT  
+SOLUTION/STATISTICS  
+SOLUTION/NORMAL_EQUATION_VECTOR  
+SOLUTION/NORMAL_EQUATION_MATRIX U  
+SOLUTION/ESTIMATE  
+SOLUTION/APRIORI  
%ENDSNX
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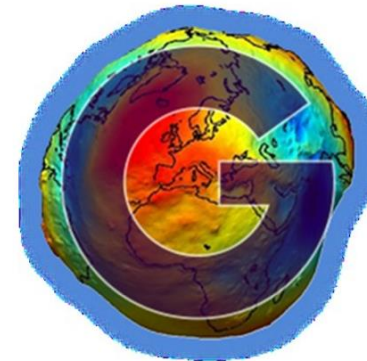


*EO-1-2014: New ideas for Earth-relevant space applications  
Research and Innovation Action*

Action Acronym: **EGSiEM**  
Action full title: European Gravity Service for improved Emergency Management  
Grant agreement no: 637010

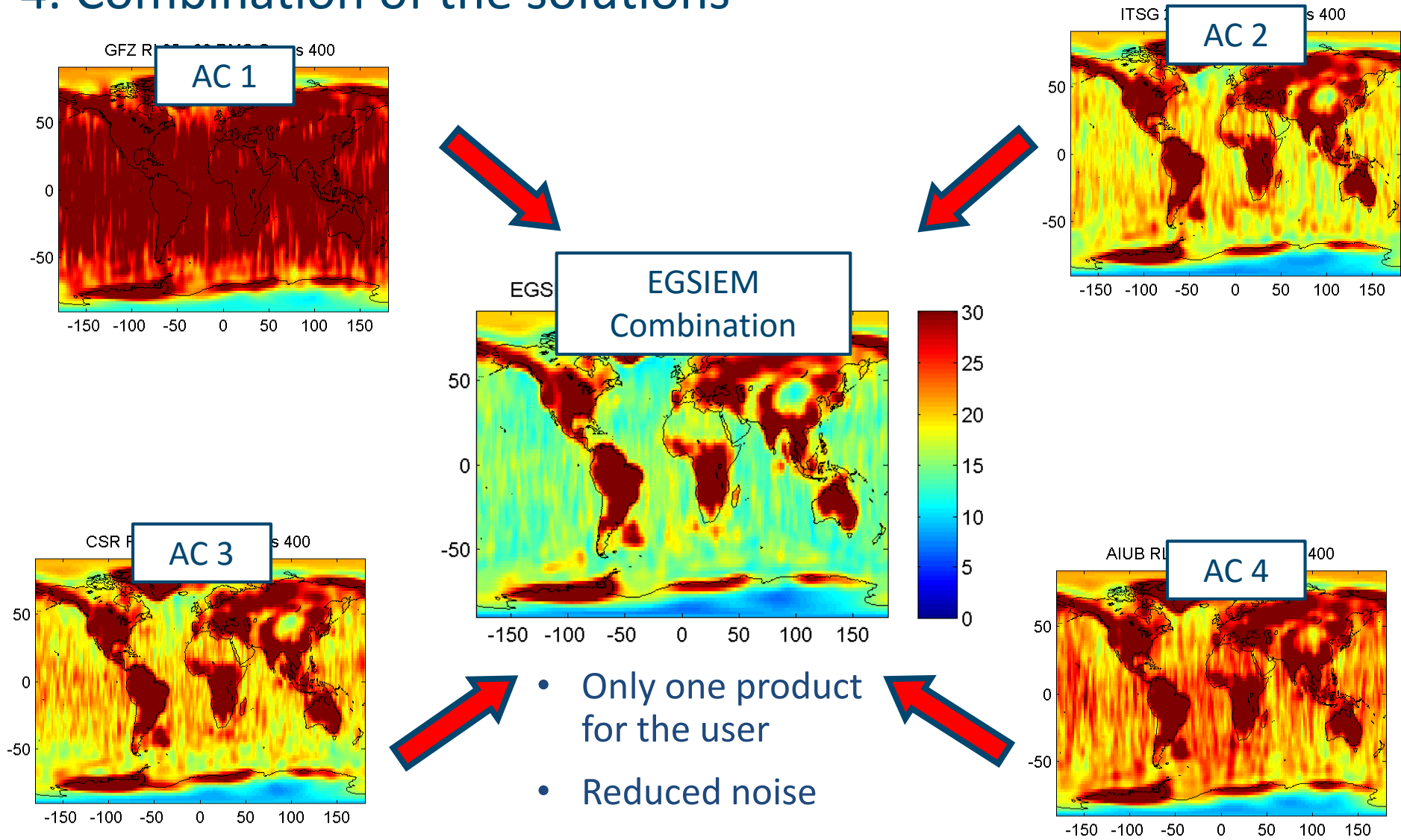
Deliverable 2.1:  
Processing Standards

Date: 02/03/2015

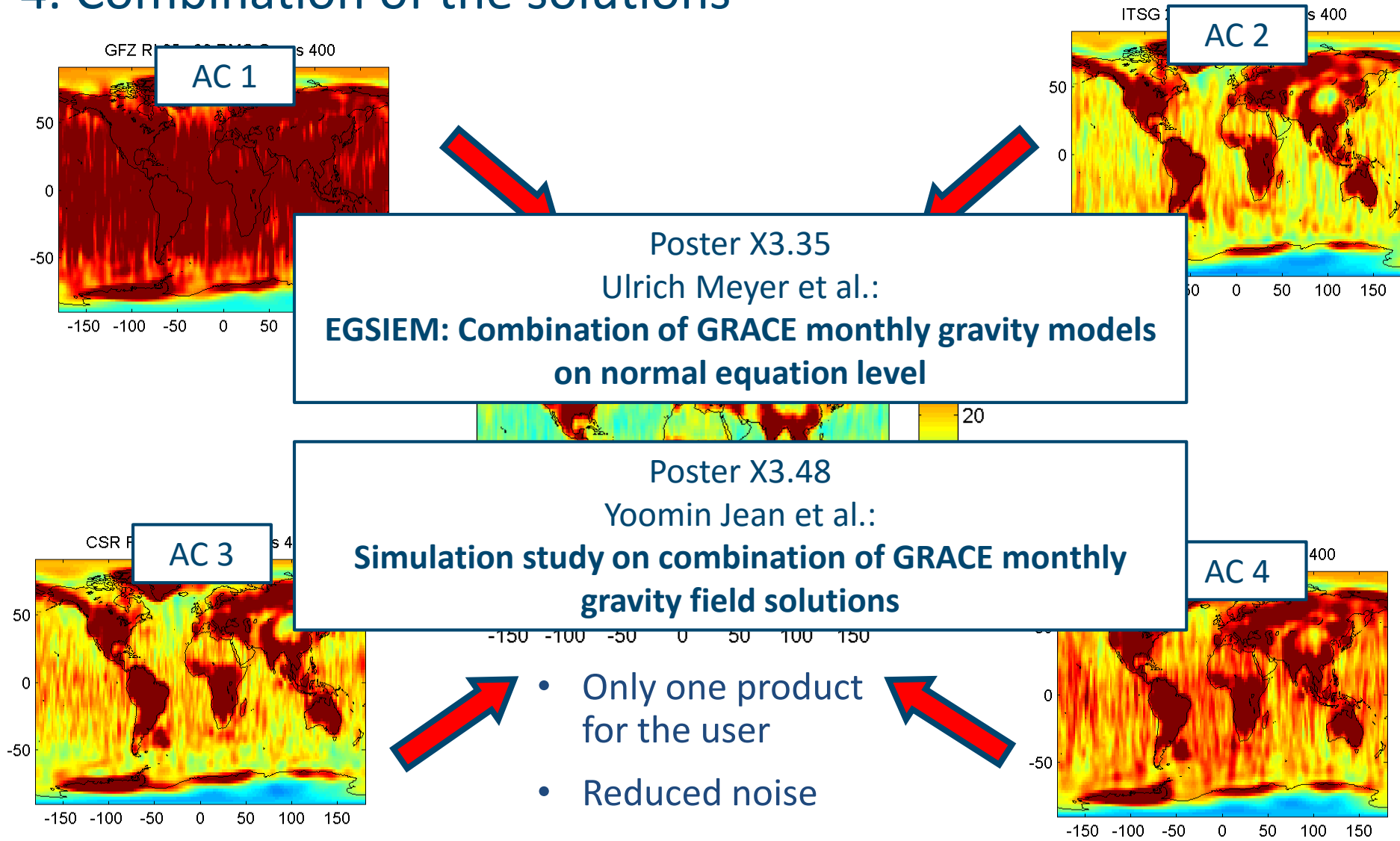


Prepared by: U. Meyer

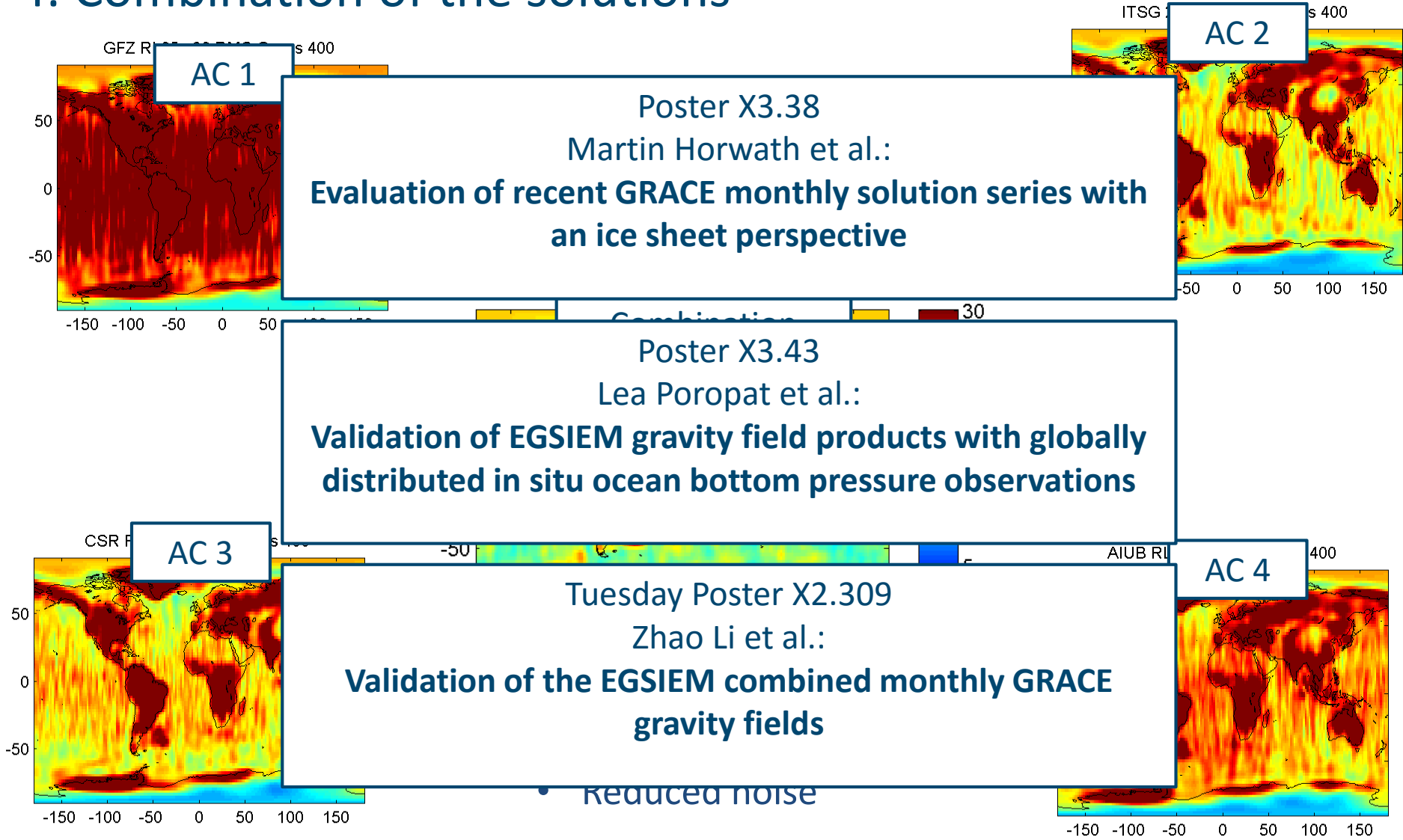
# 4. Combination of the solutions



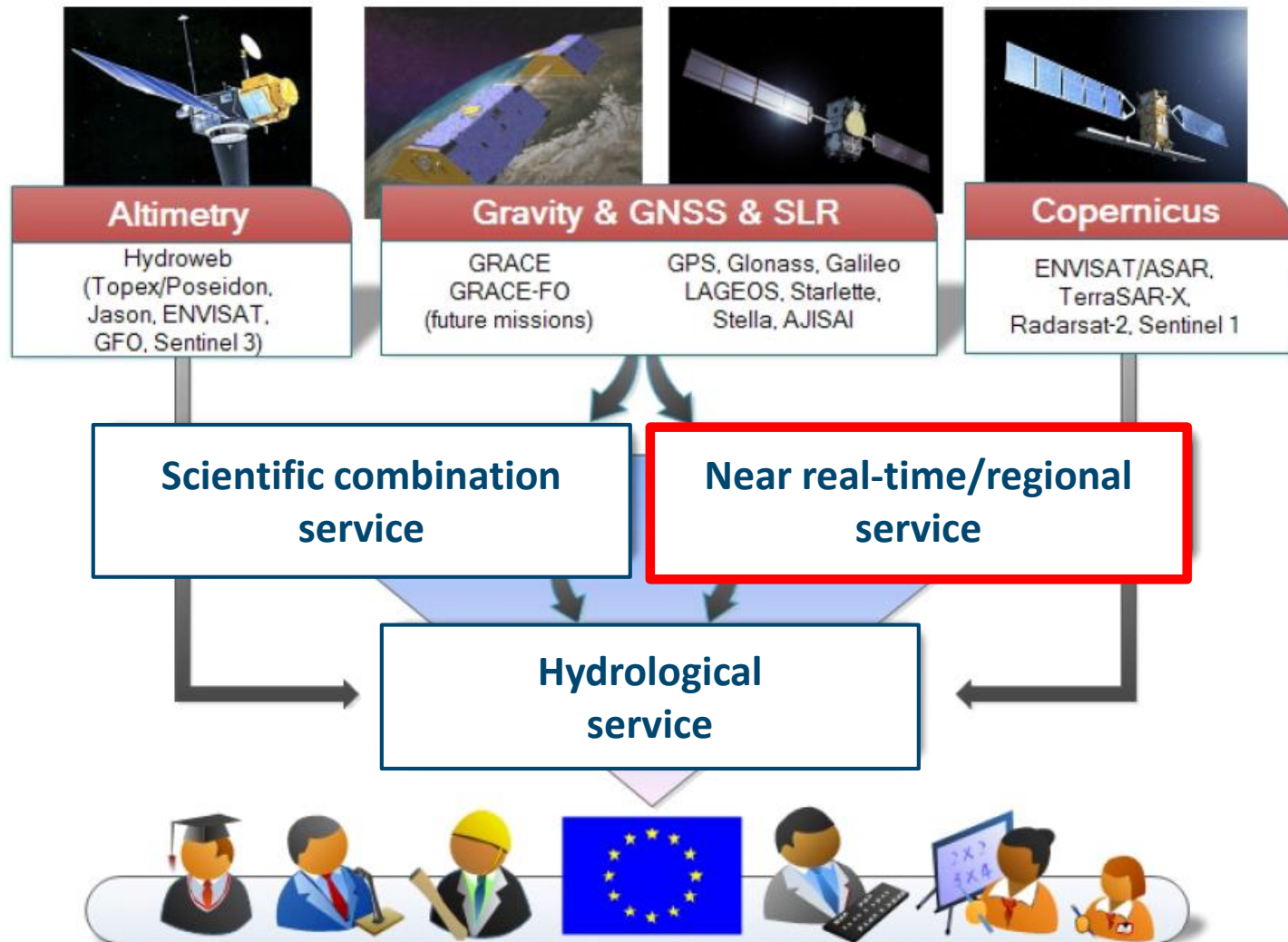
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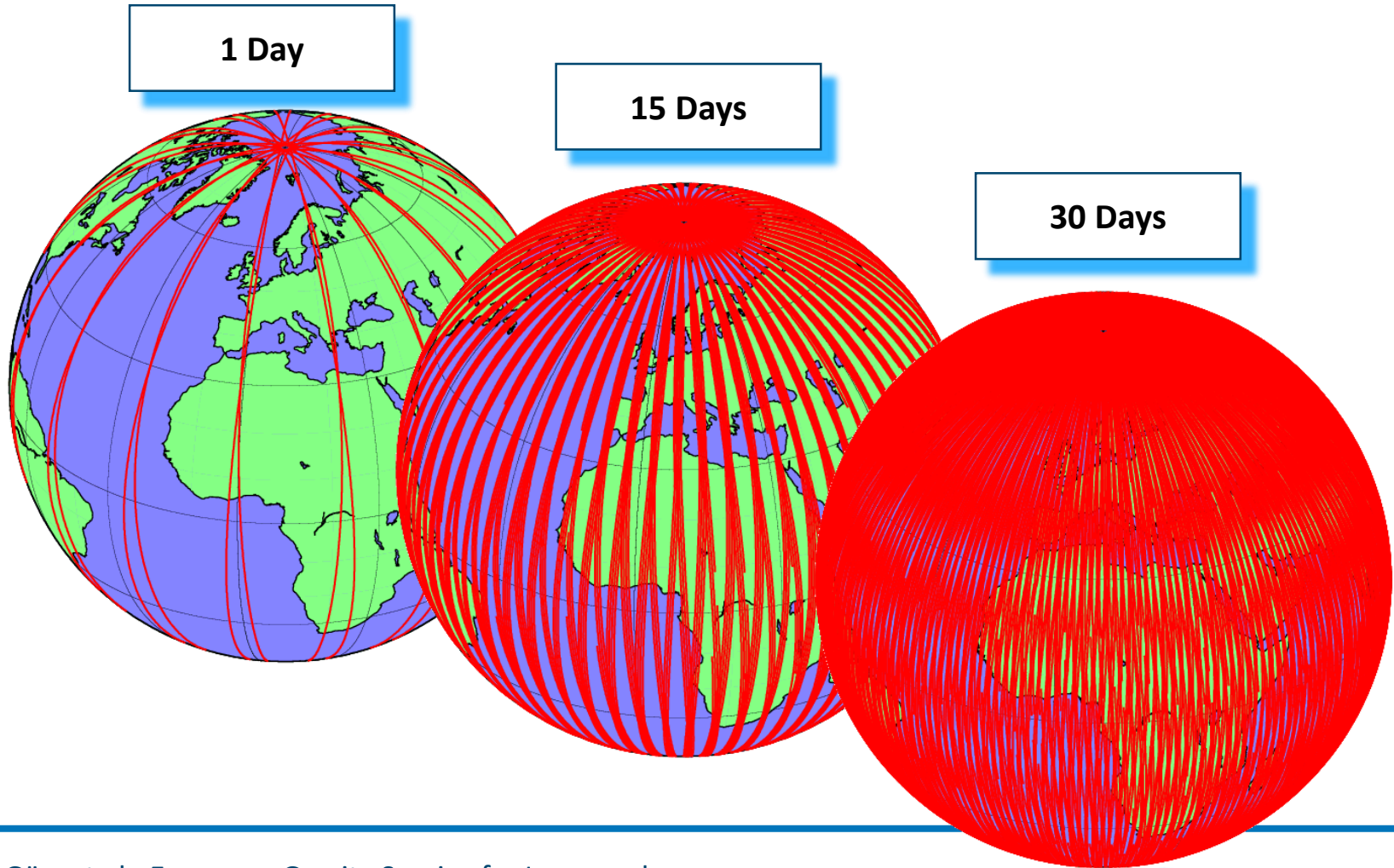


# EGSIEM Project



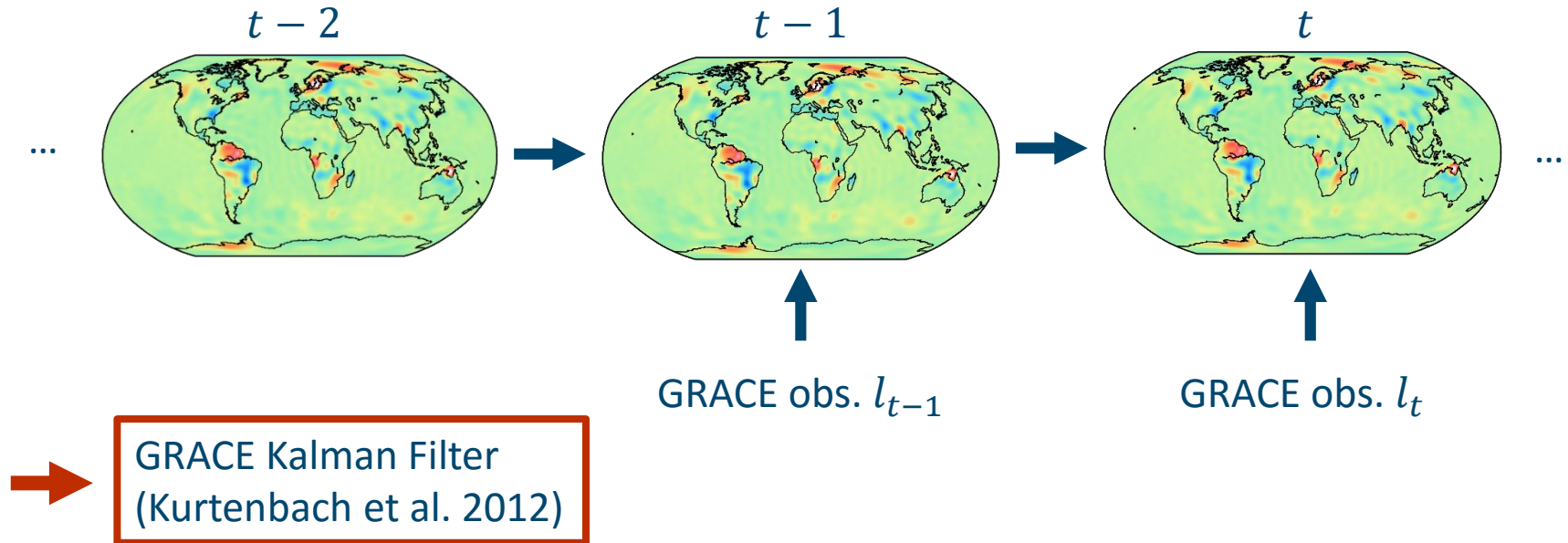
# Daily updated gravity field solutions from GRACE

- Data distribution is a challenge

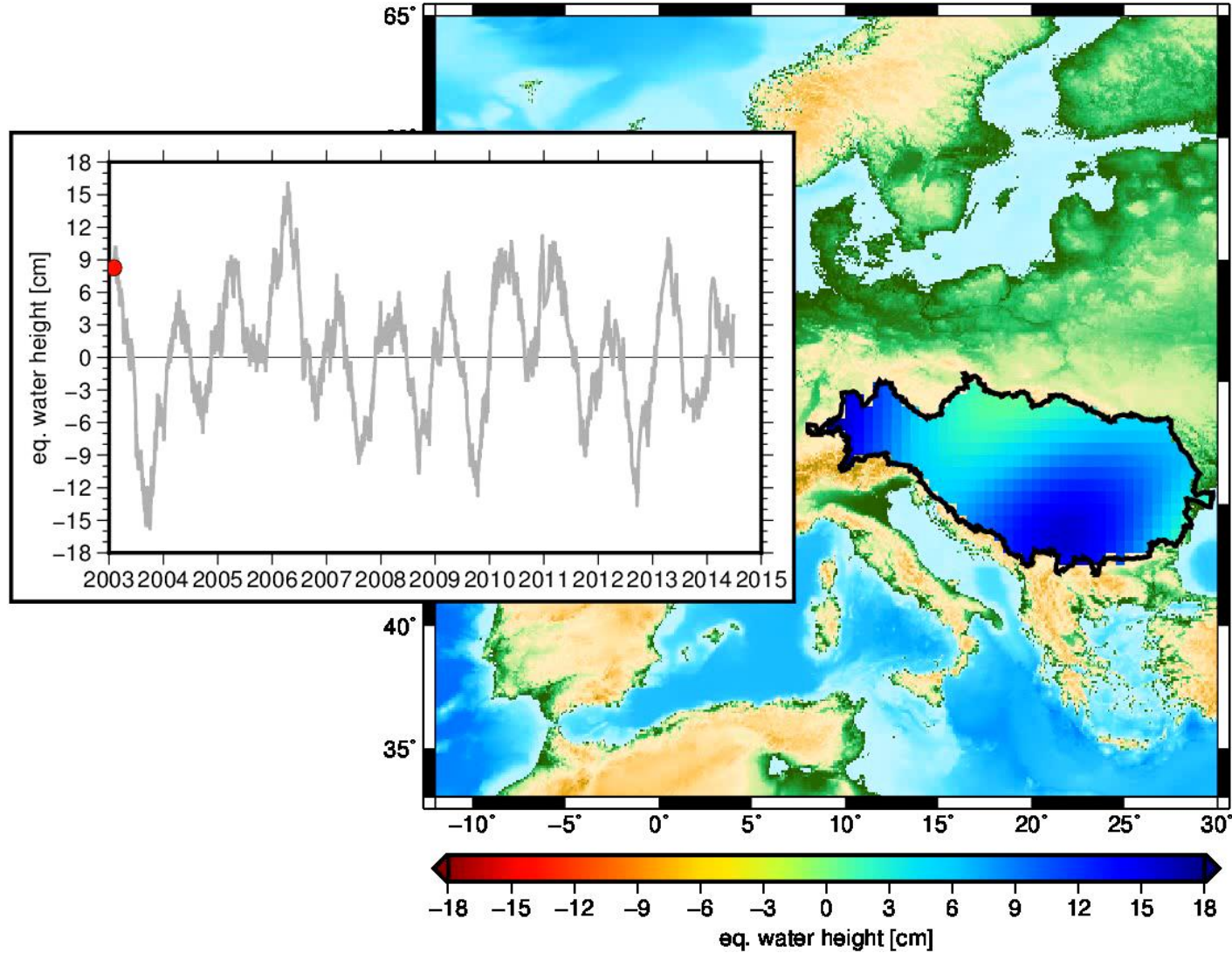


# Daily updated gravity field solutions from GRACE

- Data distribution is a challenge
- Additional information is introduced in form of a **process model**
  - Prediction based on spatio-temporal correlations from geophysical models
  - Solution is weighted mean between GRACE observations and prediction

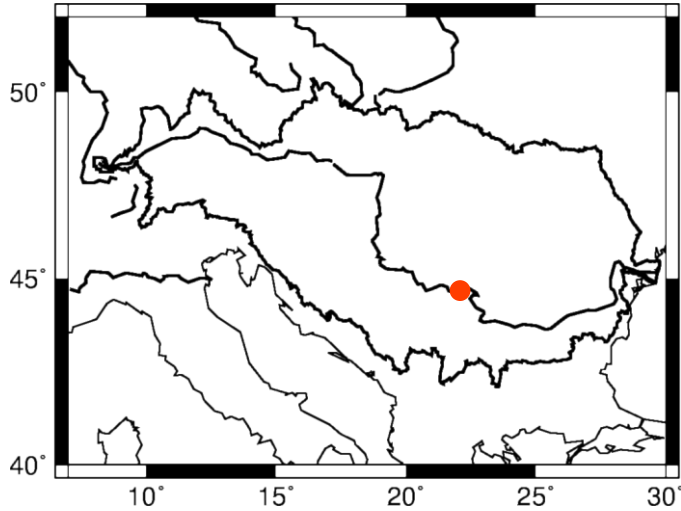


# Example: The Danube basin

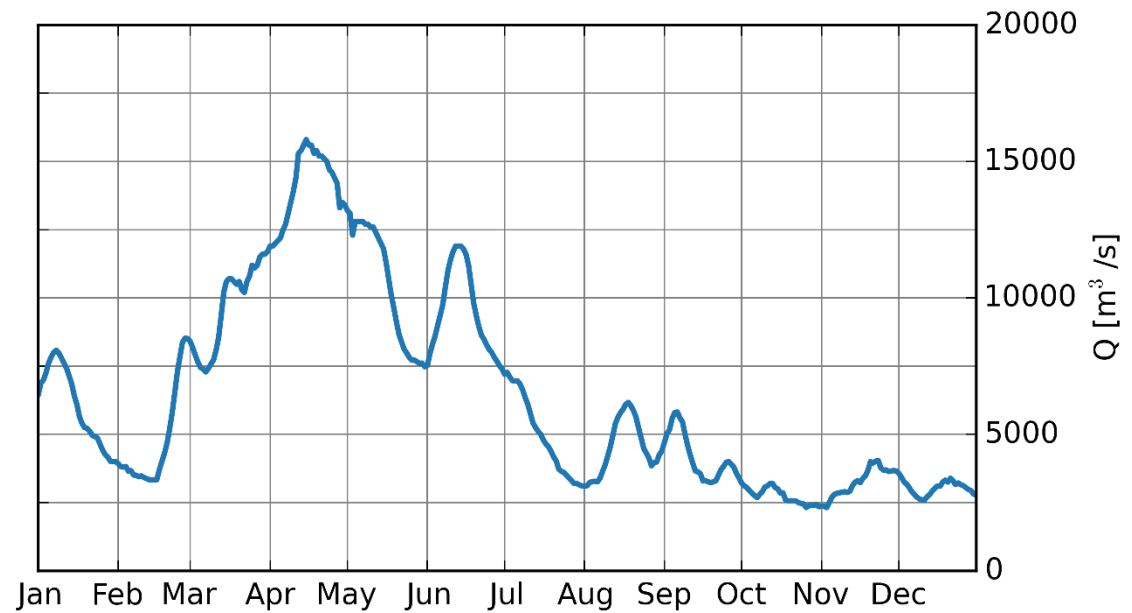




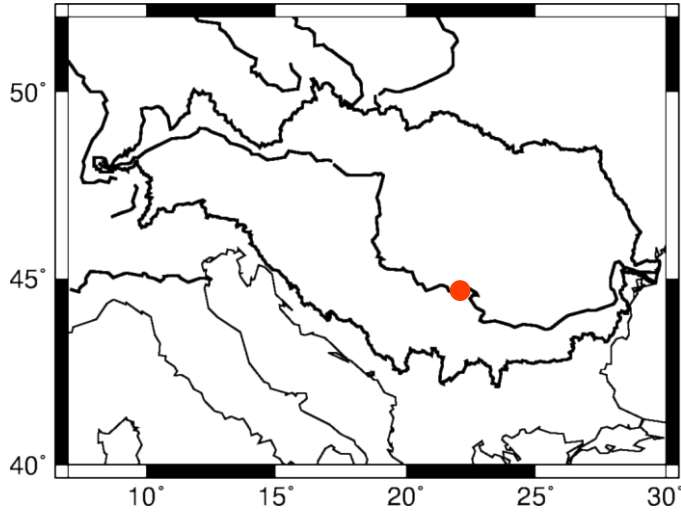
# Example: The Danube basin



River discharge at Bazias, 2006

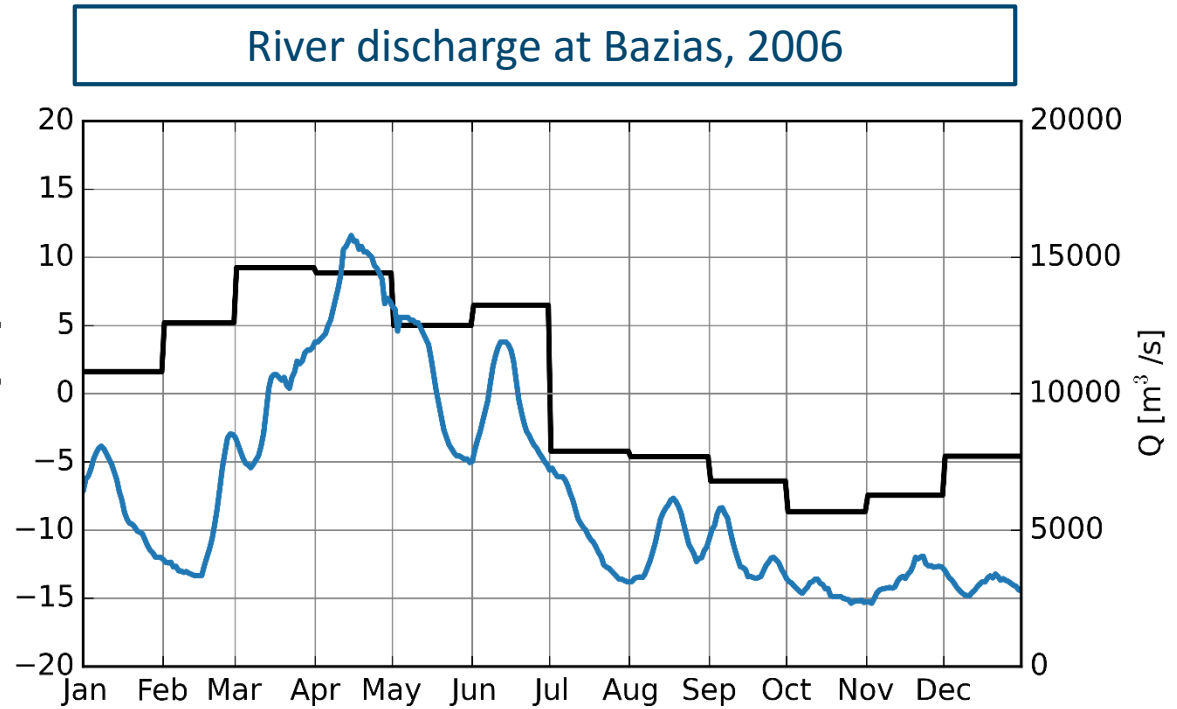


# Example: The Danube basin



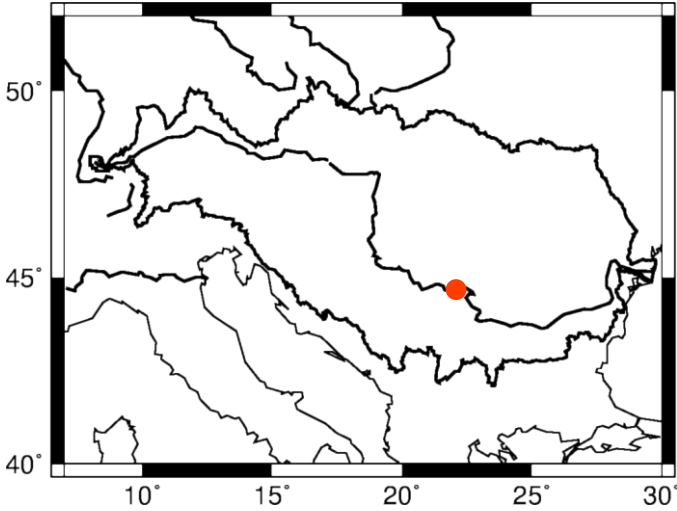
Water storage:  
GRACE monthly solutions

EWH [cm]



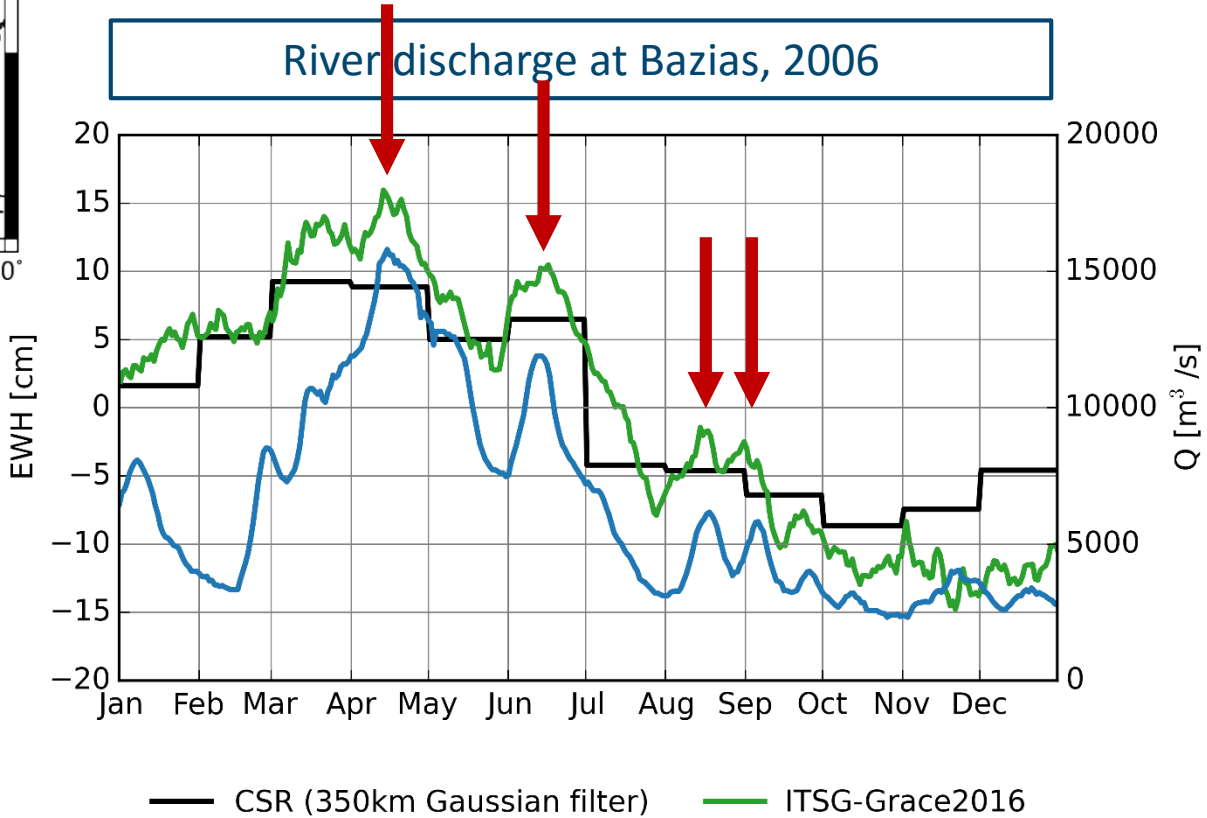
— CSR (350km Gaussian filter)

# Example: The Danube basin

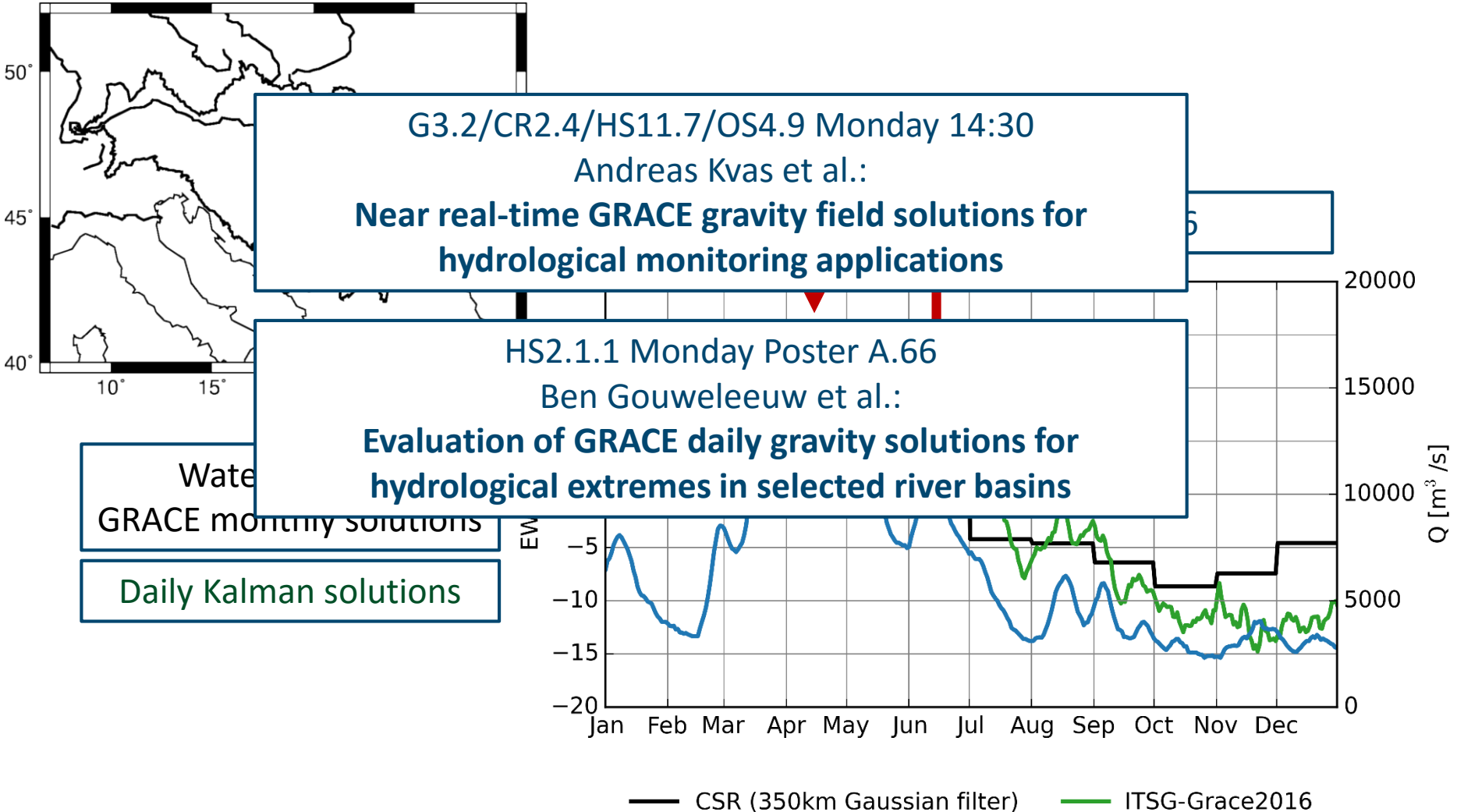


Water storage:  
GRACE monthly solutions

Daily Kalman solutions

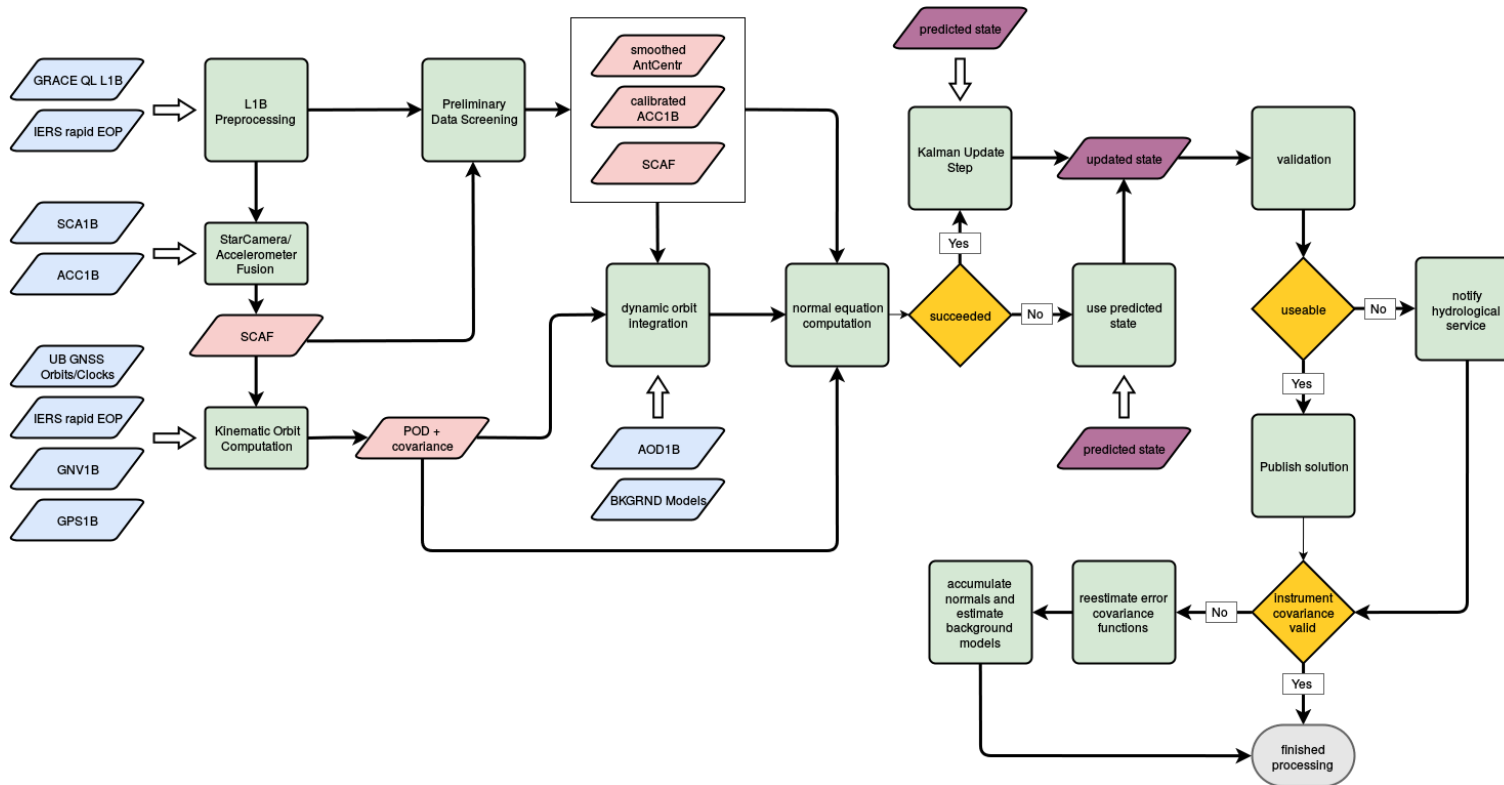


# Example: The Danube basin

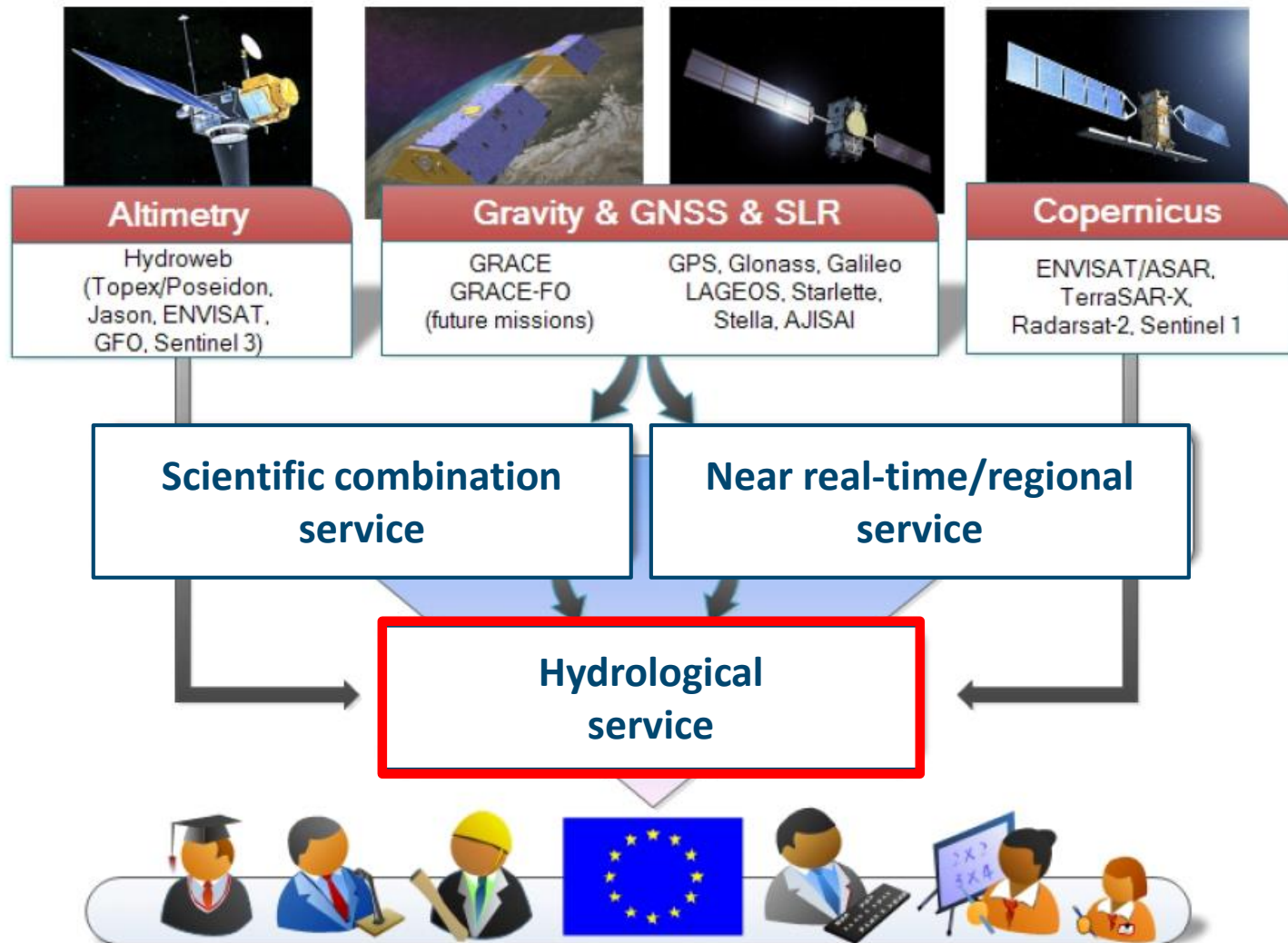


# Near real time (max. 5 days delay)

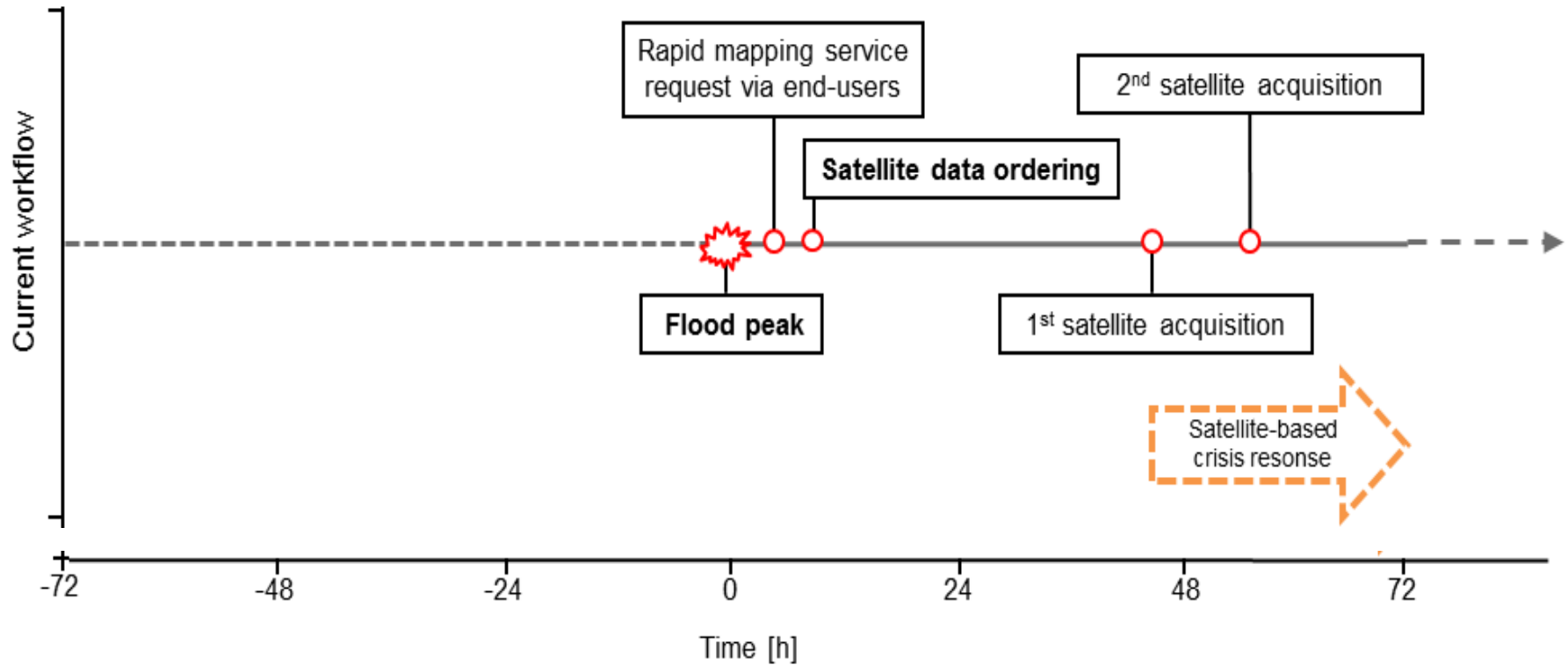
- Adapted daily gravity field processing scheme:
  - Rapid GNSS constellation and Earth orientation
  - forward only filtering → increased high frequency noise



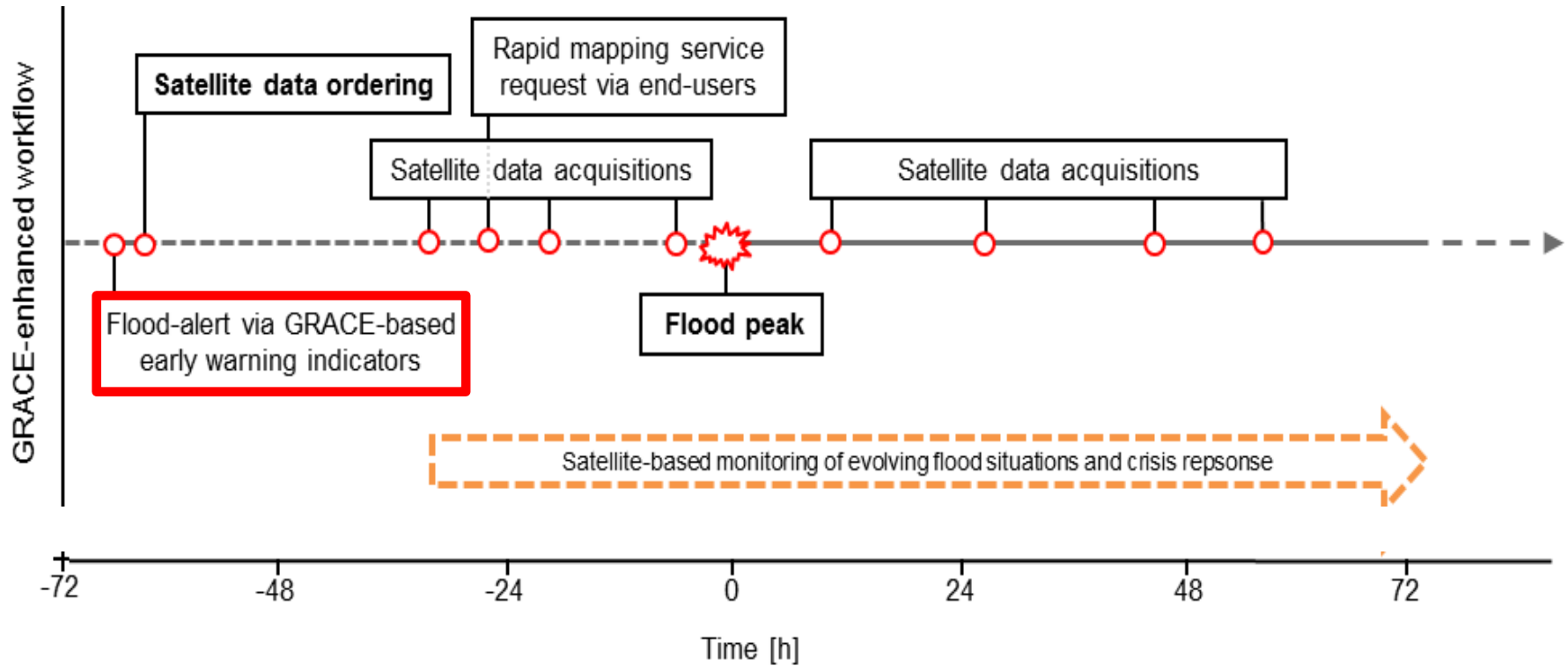
# EGSIEM Project



# Integration into automatic flood emergency management services

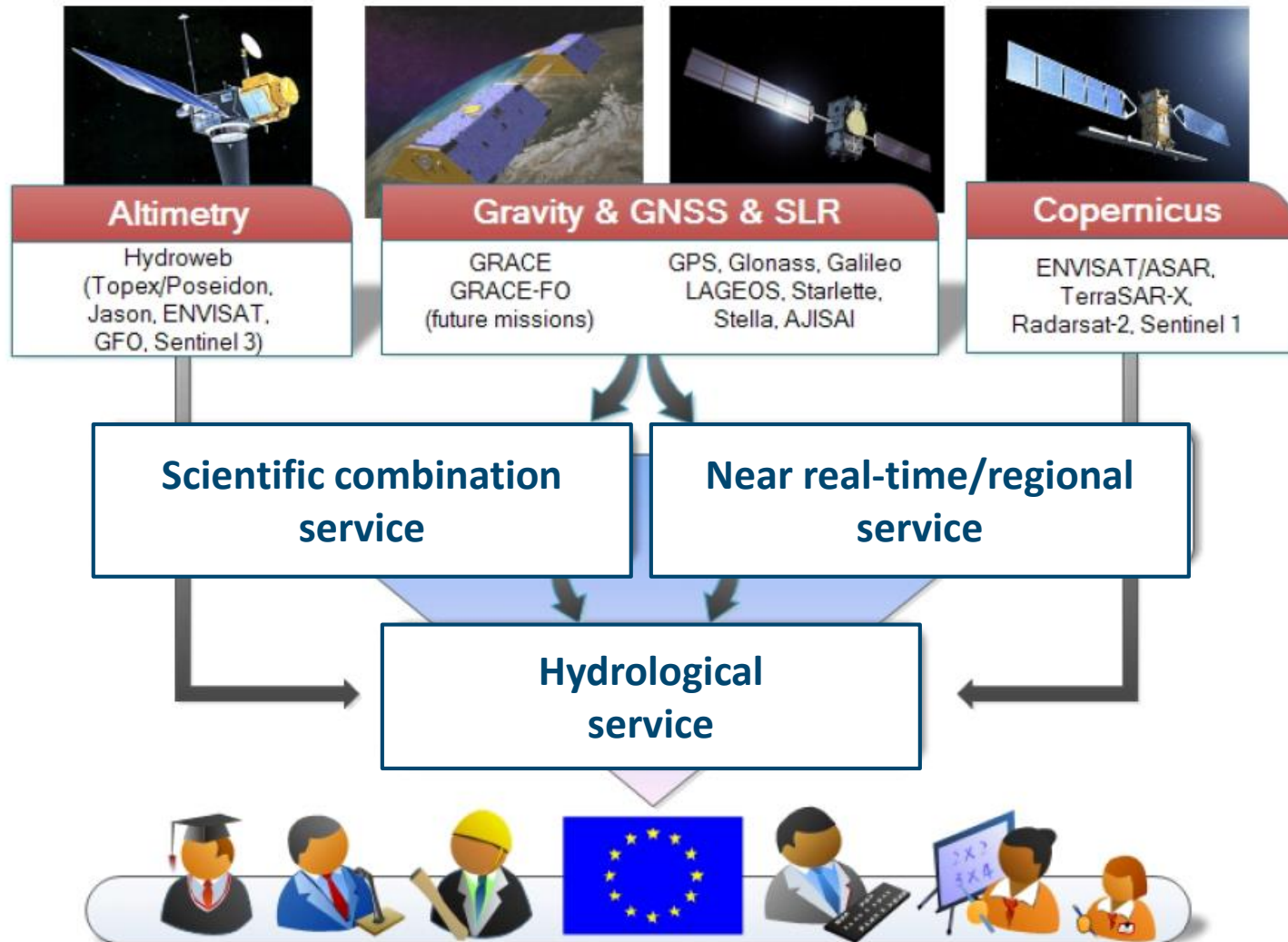


# Integration into automatic flood emergency management services





# Summary (1/2)



# Summary (2/2)

- Much effort is going on

# Summary (2/2)

- Much effort is going into

Poster X3.35  
Ulrich Meyer et al.:  
**EGSIEM: Combination of GRACE monthly gravity models on normal equation level**

11.7/OS4.9 Monday 14:30

reas Kvas et al.:

**Near real-time GRACE gravity field solutions for**

lications

Beate Klinger et al.:  
**The new ITSG-Grace2016 release**

Poster X3.48

Yoomin Jean et al.:

**Simulation study on combination of GRACE monthly gravity field solutions**

56

Poster X3.40

Saniya Behzadpour et al.:

**Robust estimation of error covariance functions in GRACE gravity field determination**

Ben Gouweleeuw et al.:

**EGSIEM daily gravity solutions for rivers in selected river basins**

Poster X2.309

Zhao Li et al.:

**Validation of the EGSIEM combined monthly gravity fields**

Poster X3.31

João de Teixeira da Encarnação et al.:  
**Gravity field models derived from Swarm data**

Poster X3.43

Lea Poropat et al.:

**Validation of EGSIEM gravity field products with globally distributed in situ ocean bottom pressure observations**

Poster X3.50

Andrea Maier et al.:

**SLR in the framework of the EGSIEM project**

Poster X3.38

Martin Horwath et al.:

**Evaluation of recent GRACE monthly solution series with an ice sheet perspective**

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# Keep in touch



## Inside this issue:

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## WELCOME TO EGSIEM

The **European Gravity Service for Improved Emergency Management (EGSIEM)** project, which is funded by the Horizon2020 Framework Program for Research and Innovation of the European Union, aims at using gravity field analysis for forecasting and mapping of hydrological extremes like large-scale droughts and flood events. The project is funded for three years, from 2015 to 2017. The leader of the project is the Astronomical Institute of the University of Bern.

### EGSIEM CONSORTIUM

- Universität Bern, Switzerland
- Université du Luxembourg, Luxembourg
- Helmholtz-Zentrum Potsdam Deutsches GeoForschungszentrum, Germany
- Technische Universität Graz, Austria
- Leibniz Universität Hannover, Germany
- Centre National d'Études Spatiales, France
- Deutsches Zentrum für Luft- und Raumfahrt e.V., Germany
- Géode & Cie, France



### Goals and Ambitions

At the heart of the EGSIEM project is the idea that *better knowledge yields better decision-making*. Towards this idea the 8 consortium members of EGSIEM aim to derive improved products from the **Gravity Recovery and Climate Experiment (GRACE)** satellite mission. The current latency and complex nature of the data derived from the GRACE mission (a dual satellite mission of NASA and the German Aerospace Center, which has been making detailed measurements of Earth's gravity field variations since March 2002) makes the data of limited value for monitoring and forecasting applications. Currently Geodesists need to wait approximately 2 months from observation by GRACE until the data is processed for access and examination. EGSIEM will improve the data latency, will perform the complex processing, and will provide a simple to use web interface (based on the **EGSIEM plotter** provided by Géode & Cie). The data will be freely available for users.

### The impact of EGSIEM

The main goal of the project is to improve the availability of data for users, especially in terms of better drought and flood forecasting. EGSIEM will reduce the timeframe to 5 days. As the data is going to be made freely available (via our project website [egsiem.eu](http://egsiem.eu)), the users may use them also for other applications as well. EGSIEM aims to improve existing monitoring products. The improvement in flood and drought monitoring will benefit Europe and also other countries. For example the impact of the 2009 flood in Namibia which claimed 131 lives and displaced 445,000 people could have been better anticipated by the existence of concise warning products.

News and updates will be regularly published on various media, e.g., by the quarterly EGSIEM Newsletter.

[www.egsiem.eu](http://www.egsiem.eu)

EGSIEM is also present on social media:

<https://twitter.com/EGSIEM>

[www.facebook.com/egsiem](http://www.facebook.com/egsiem)

<https://egsiem.wordpress.com>



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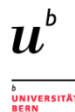


# EGSIEM

European Gravity Service for Improved Emergency Management



This project is funded by the Horizon 2020 Framework Programme of the European Union under grant agreement No 637010.



Leibniz  
Universität  
Hannover

