EGSIEM

Title: EGSIEM project overview & Advisory Board Introduction

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Affiliation: University of Bern

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University of Bern
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Introduction

The proposal for the project

EGSIEM European Gravity Service for Improved Emergency Management

has been submitted last spring to the EO-1 Space Call of the Horizon 2020 Framework Program for Research and Innovation

LANTMÄTERIET

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
JOINT RESEARCH CENTRE
Directorate H - Institute for Environment and Sustainability
Climate Risk Management

EGSIEM project overview (1)

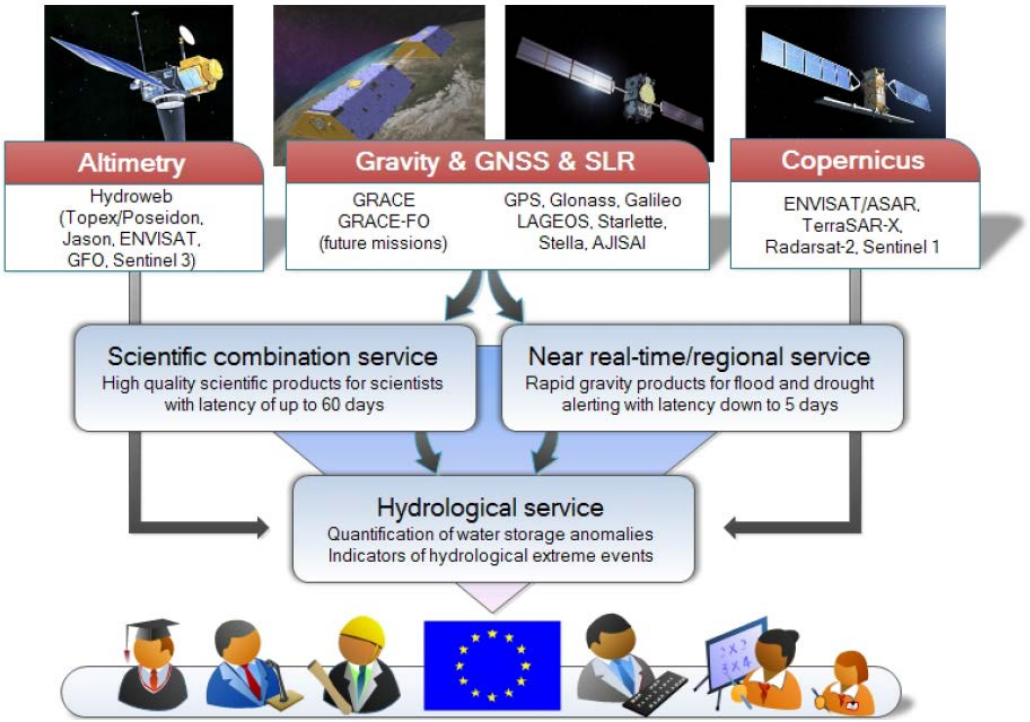
EGSIEM has officially started on January 1, 2015 and will last for three years.

The three main objectives of EGSIEM are to

- Deliver the best gravity products for applications in Earth and environmental science research
- Reduce the latency and increase the temporal resolution of the gravity and therefore mass redistribution products
- Develop gravity-based indicators for extreme hydrological events and demonstrate their value for flood and drought forecasting and monitoring services

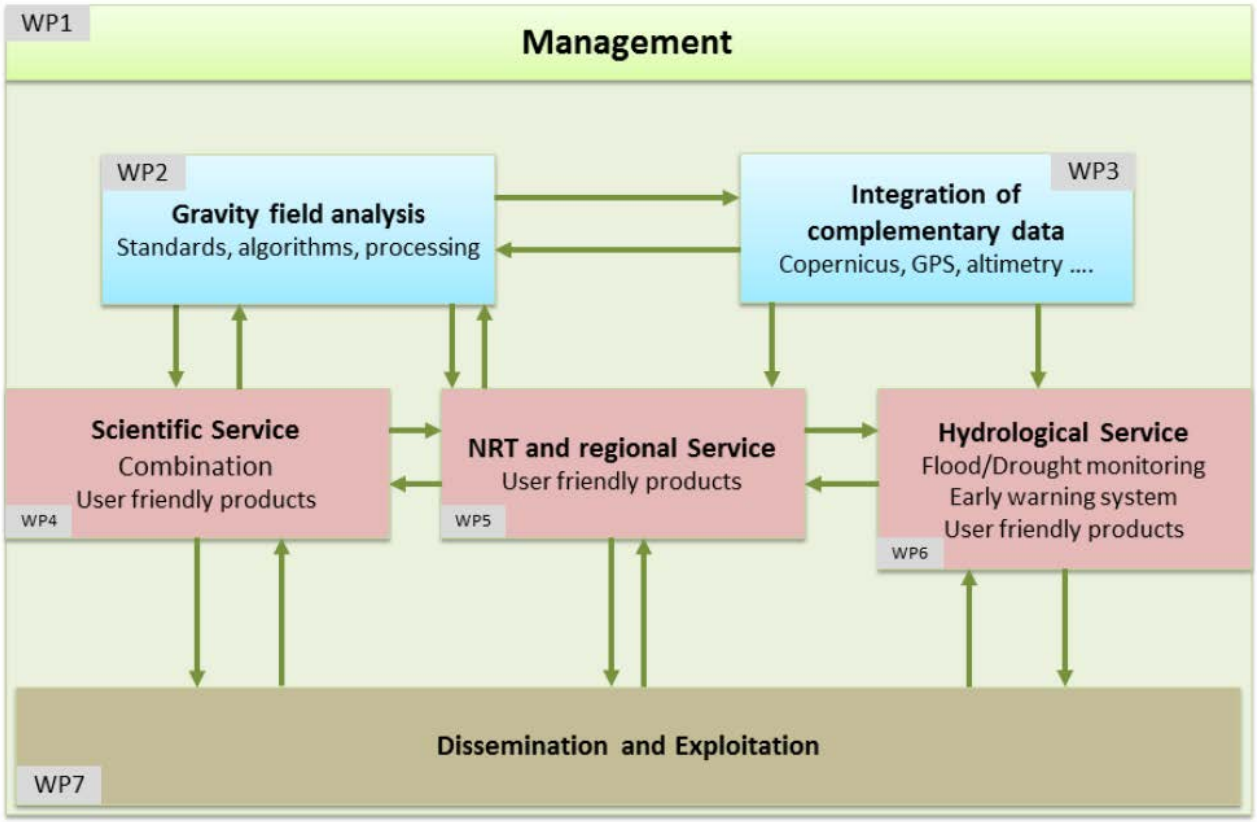
EGSIEM project overview (2)

- Three dedicated services shall be established



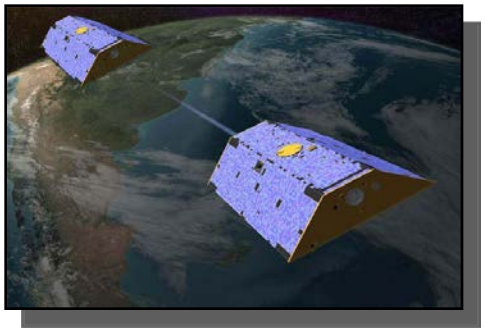
The Services will be tailored to the needs of governments, scientists, decision makers, stakeholders and engineers. Special visualisation tools will be used to inform, update, and attract also the large public.

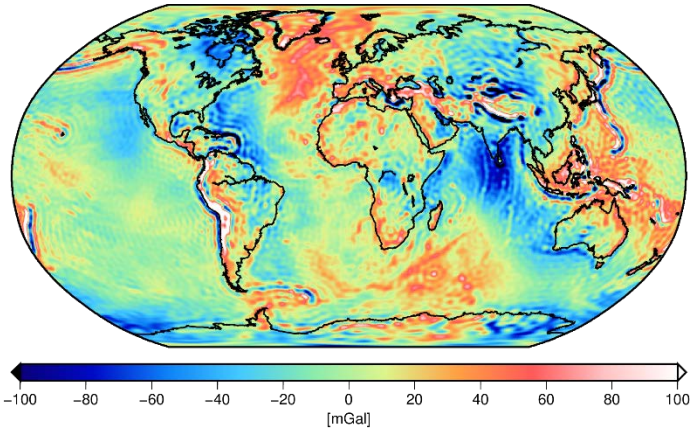
EGSIEM project overview (3)



The used input data sources and the anticipated services that shall be established are reflected in the EGSIEM WP structure.

WP2: Gravity Field Analysis





- Improved gravity field solutions by:
  - Harmonization of processing standards
  - Improvements of analysis methods
  - Error analysis with End-to-End simulator
- EGSIEM Analysis Centers (ACs):
  - GFZ (Direct Approach)
  - CNES (Direct Approach)
  - AIUB (Celestial Mechanics Approach)
  - ITSG (Short-Arc Approach)
  - University of Luxembourg (Acc. Approach)
  - More in the future …

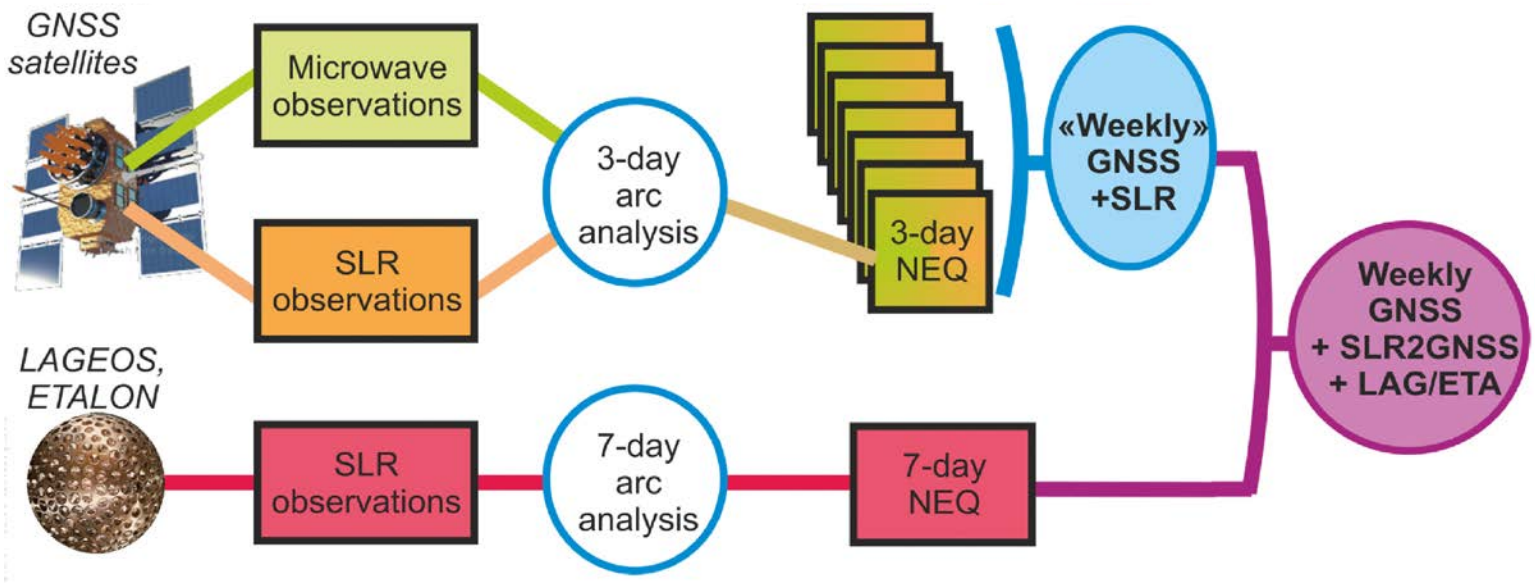
==> Provide different solutions for the combination in WP 4

WP3: Integration of complementary data (1)

Data	Application
GNSS	Reference frame
SLR	Reference frame + gravity
GNSS loading	Validation
Ocean bottom pressure	
Altimetry data (lake and river levels)	Integration into hydrological service (and validation)
GIA models	Separation of GIA-related trend from hydrological trend (where necessary)
Historical flood situations	Validation of GRACE derived flood and drought indices

WP3: Integration of complementary data (2)

- Consistent reference frame for all products
- Linking geometry (GNSS) and gravity (SLR)
- Degree 1 coefficients from SLR directly incorporated
- NRT service requires NRT reference frame



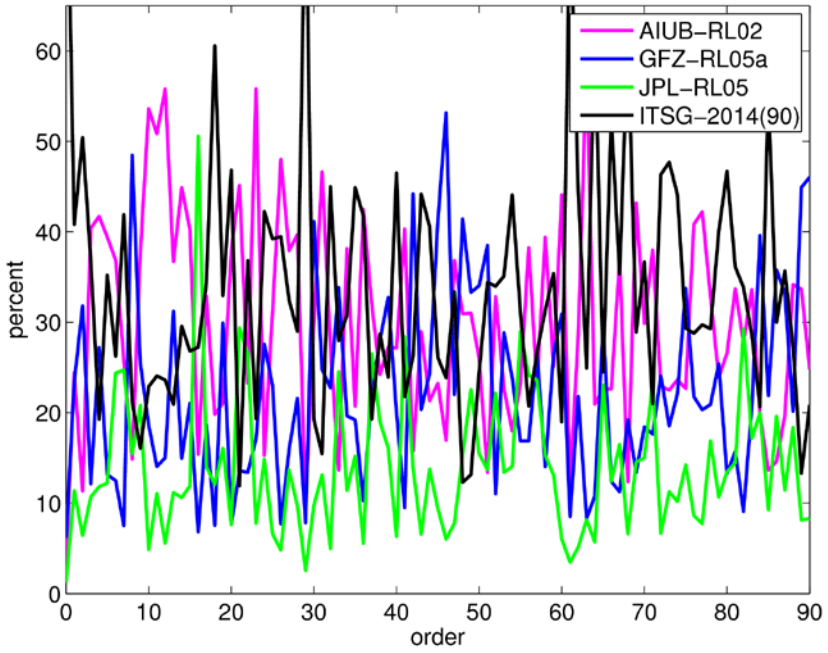
WP4: Scientific Service (1)

Adopting rigorous and independent processing approaches, each AC will deliver consistent gravity field solutions. For the first time, a meaningful combination by the Analysis Center Coordinator (ACC) will be possible. This task includes

- Comparison of the AC solutions, identification of gross errors
- Pair-wise comparison of gravity solutions to approximate empirical weights for the individual ACs
- Combination of all AC solutions to generate combined solutions using the following two schemes
  - Calculate weighted averages based on the empirical weights
  - Determine the combined solution based on a combination of normal equations (NEQ) generated by the individual Acs
- Provide suitable products for hydrological and geophysical applications from the combined and individual AC products

WP4: Scientific Service (2)

Contribution per order



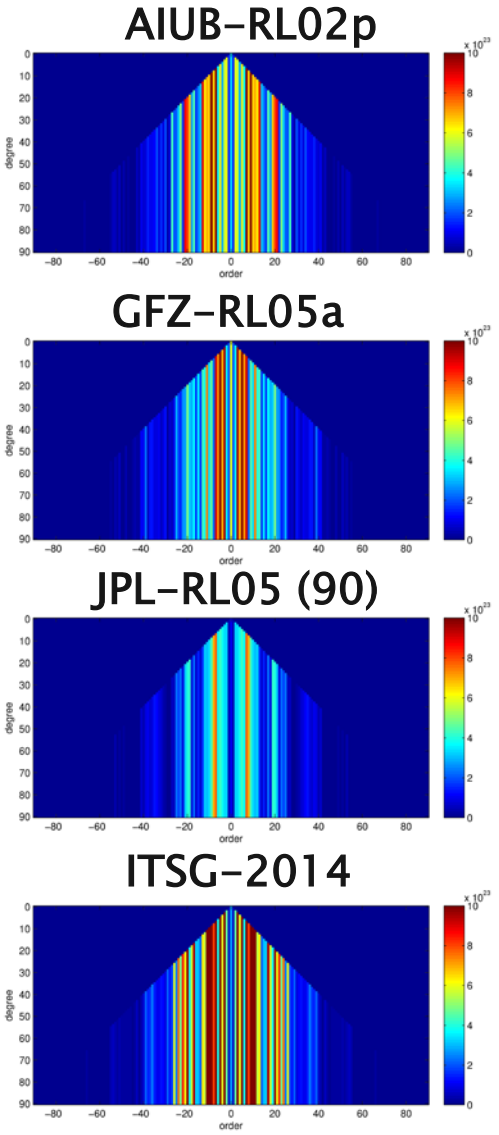
Mean:

AIUB: 30 %

GFZ: 22 %

JPL: 14 %

ITSG: 34 %



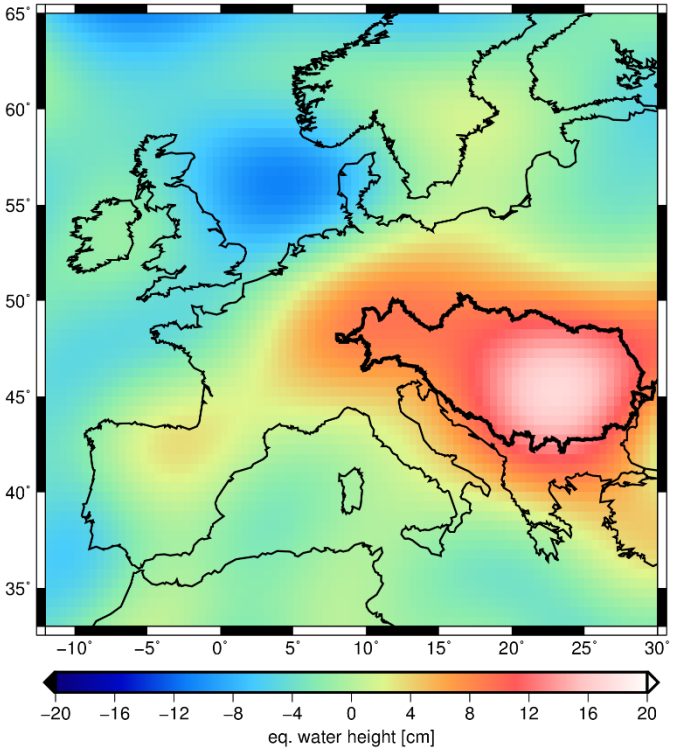
Percent: $100\% * w_i/(w_1+w_2+w_3)$

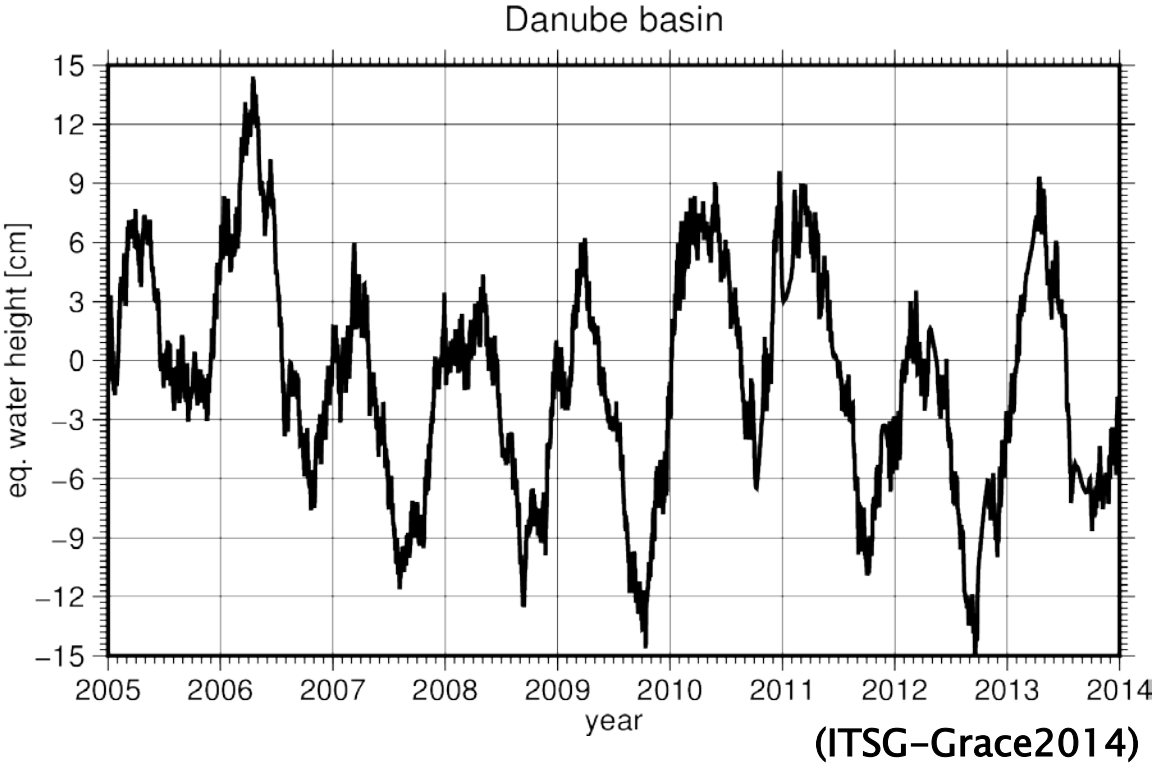
Weight matrix: $1/RMS^2$ per order

WP5: Near real-time and regional service

Daily updated solution (Near real-time with max. 5 days delay)

- ITSG: Kalman filtered solutions
- GFZ: Alternative representations (e.g., radial basis functions)

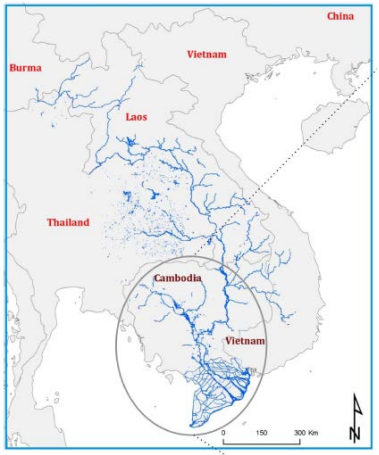


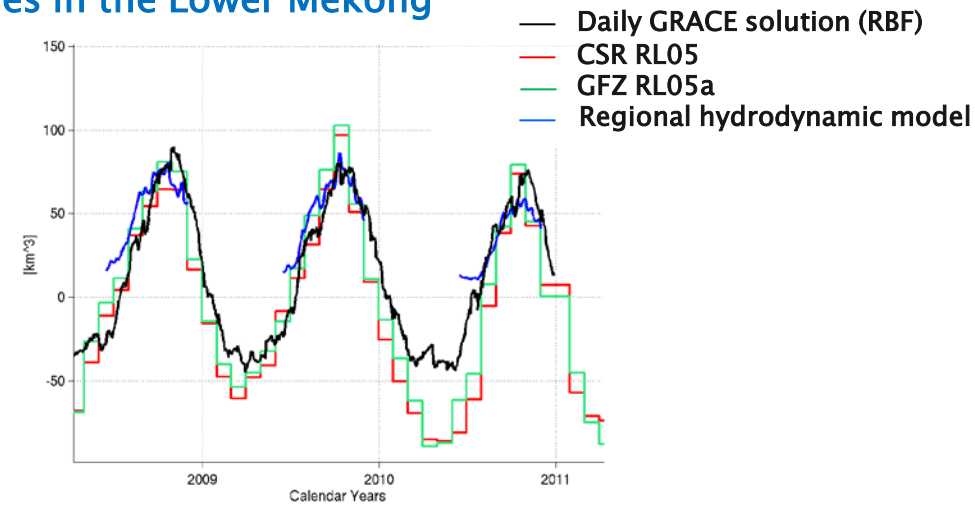


WP6: Hyrdological Service (1)

- Gravity-based flood and drought indicators as descriptors of the integral wetness status of river basins
  → early warning for hydrological extreme events

Flood volumes in the Lower Mekong





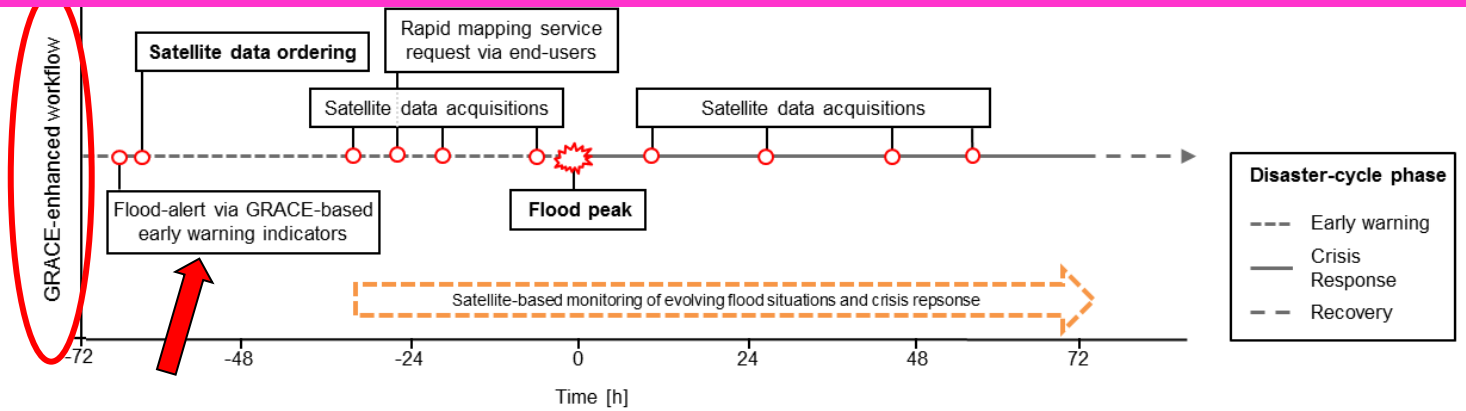
- Testing the added value of gravity-based indicators at different lead times (several months to near real time)
  - via assimilation into flood forecasting models
  - in statistical forecasting approaches

WP6: Hyrdological Service (2)

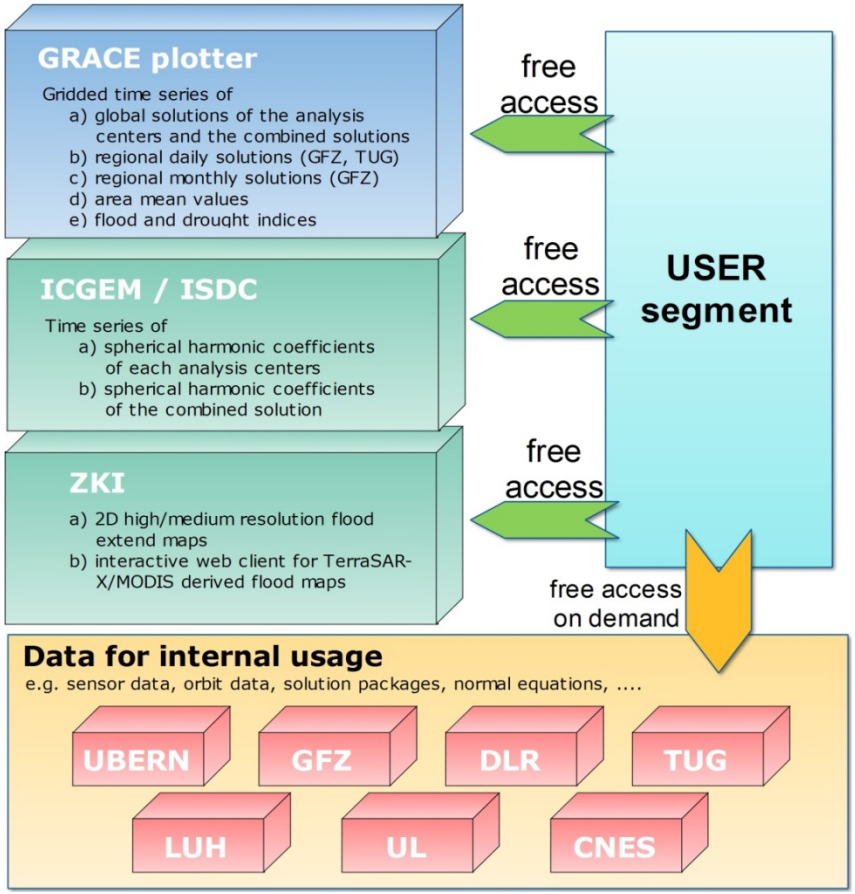
- Improved rapid mapping by on-demand programming of satellite
- Integration into automatic flood emergency management services

The performance of the NRT service will be tested using historical hydrological extreme events.

An operational test run of half a year is foreseen in the frame of DLR's Center for Satellite Based Crisis Information.



WP7: Dissemination and Exploitation (1)



- EGSIEM will have an open data policy with respect to all data generated within the project. Accessibility to all levels will be guaranteed via the project website.
- A central component of the EGSIEM dissemination activities will be the GRACE plotter, which allows easy data access and visualization.

WP7: Dissemination and Exploitation (2)

géode&cie

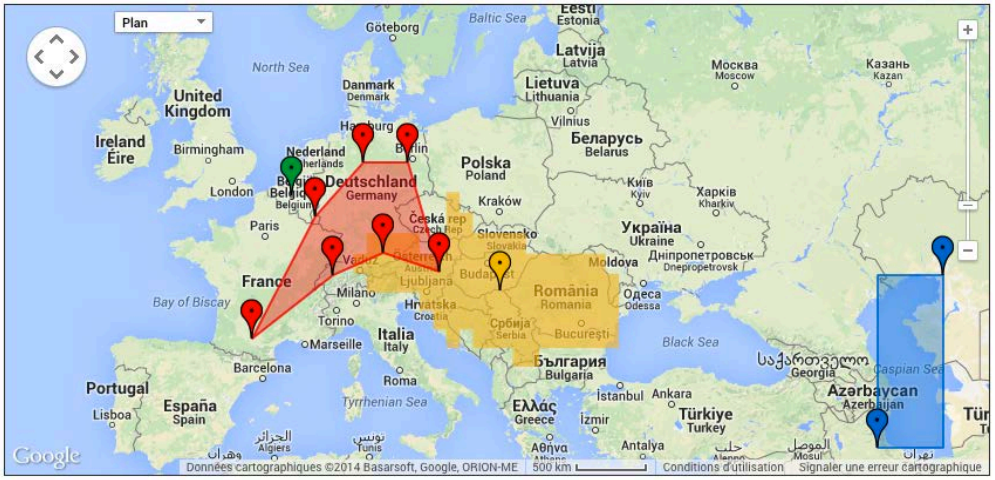
EGSIEM Visualization Tool: Extension of The GRACE Plotter, developped by Géode & Cie for CNES.

Data selection center, type, version…

Multiple possibilities for extraction areas, custom or predefined

Interactive plots

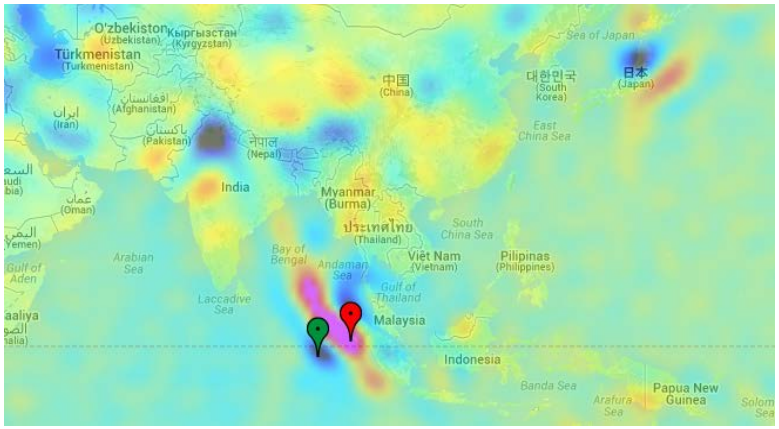
Series title	Data center	Version	Area	Address	Latitude	Longitude	Apply
Series 1	CNES/GRGS	RL03-v1	7-Heptagon	Bern, Switzerland	46.947922	7.444608	All
				Oberpfaffenhofen, Germa	48.074400	11.262200	
				Graz, Austria	47.070714	15.439504	
				Potsdam, Germany	52.390569	13.064473	
				Hannover, Germany	52.375892	9.732010	
				Luxembourg	49.815273	6.129583	
				Toulouse, France	43.604652	1.444209	
Series 2	GFZ	RL05-DDK5	Point	Brussels, European Comn	50.842317	4.370471	All
Series 3	CSR	RL05-DDK5	Danube	Danube basin	46.121053	19.994737	All
Series 4	JPL	RL05-DDK5	Rectangle	Iran, Province d'Ardabil	37.385404	48.373454	All
				Kazakhstan, District de Jy	46.937235	53.227348	

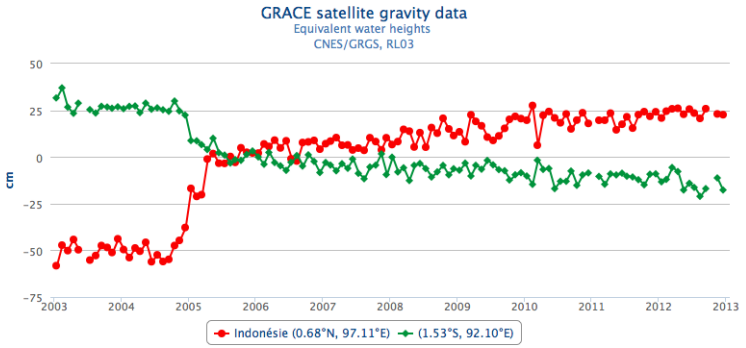


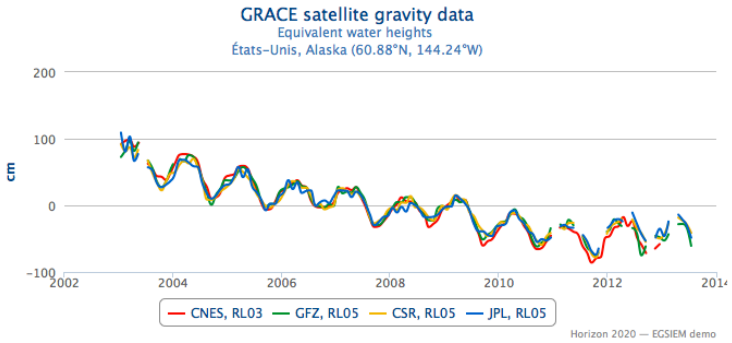
WP7: Dissemination and Exploitation (3)

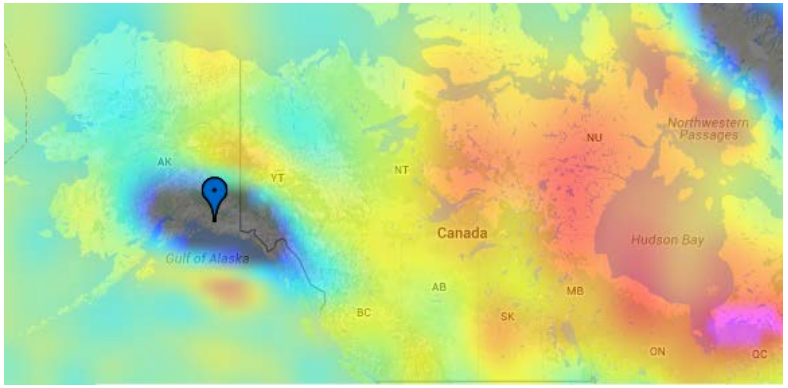
géode&cie

EGSIEM Visualization Tool: Interactive, fast and user-friendly visualization of results for scientific evaluation.

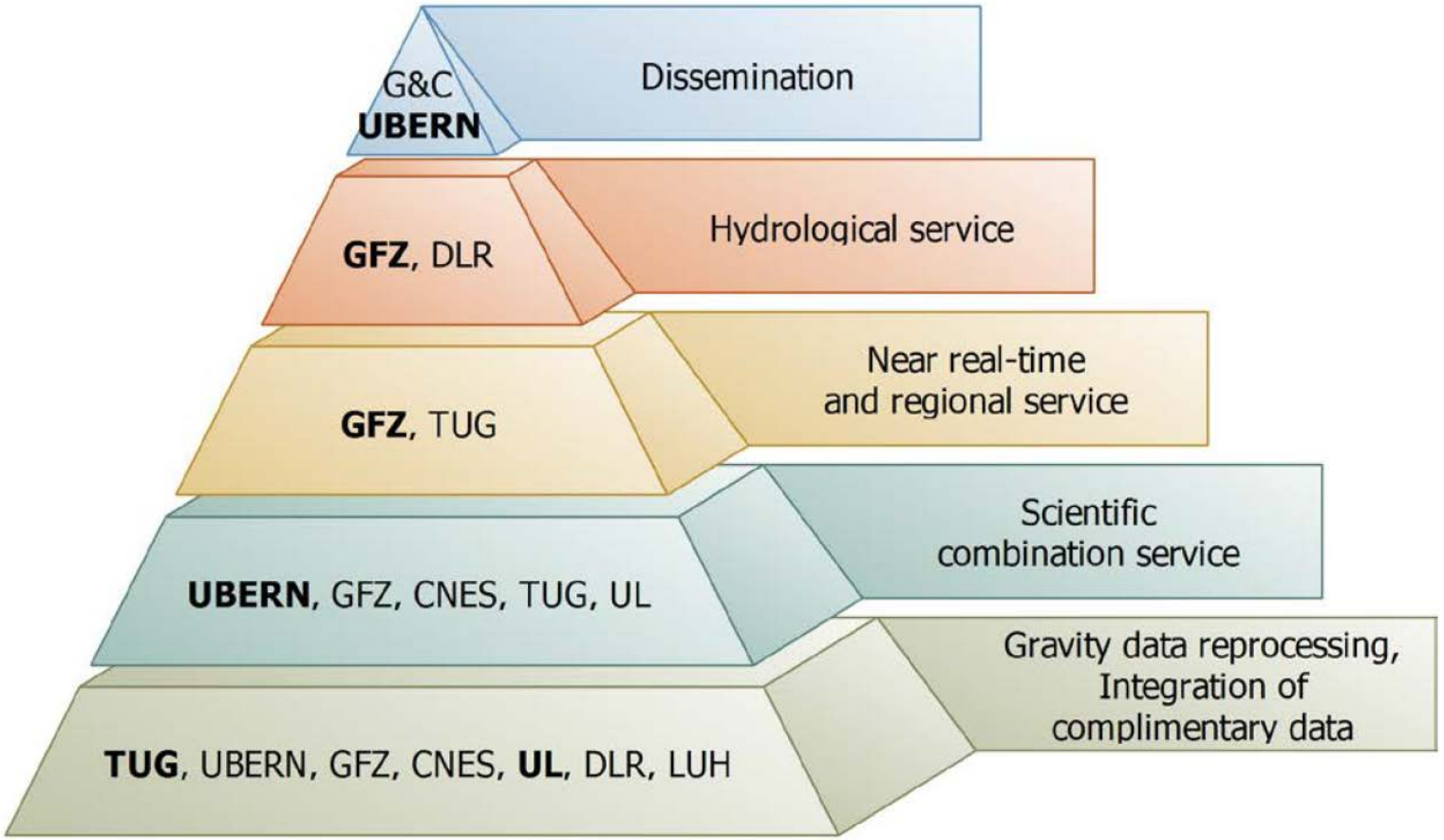








Summary


G&C
UBERN
Dissemination
GFZ, DLR
Hydrological service
GFZ, TUG
Near real-time
and regional service
UBERN, GFZ, CNES, TUG, UL
Scientific
combination service
TUG, UBERN, GFZ, CNES, UL, DLR, LUH
Gravity data reprocessing,
Integration of
complimentary data

Summary and Outlook

- EGSIEM will run for three years (2015-2017)
- Three different services shall be established:
  - a scientific combination service
  - a near real-time (NRT) / regional service
  - a hydrological/early warning service
- Future integration into the services of the International Association of Geodesy (IAG), e.g., under the umbrella of the International Gravity Field Service (IGFS), and into the Copernicus emergency service is envisaged
- EGSIEM will have an open data policy and is open for collaborations with further partners.

Advisory Board Introduction:

Srinivas Bettadpur is from the Center for Space Research (CSR), Austin, Texas, USA. CSR conducts coordinated research associated with orbit determination, space geodesy, the Earth and its environment. CSR acts as the official GRACE analysis centres on the US-side.

Srinivas Bettadpur is the **GRACE Science Operations Manager** and member of the Project Science Advisory Group for GRACE-FO. He will provide a close link between EGSIEM and the US, the leading space-faring nation.

Advisory Board Introduction:

Günter Blöschl is head of the Institute of Hydraulic Engineering at the Technical University of Vienna, Austria. **From 2013-2015 he is the President of the European Geosciences Union (EGU)**. He has published around 300 scientific articles in the area of hydrology and water resources and is Editor of Water Resources Research, and Hydrology and Earth Systems Sciences, and Associate Editor or Editorial Board member of the Journal of Hydrology, Hydrological Processes, Hydrology Research, and the International Journal of River Basin Management.

His support will guarantee that EGSIEM products will address the needs from the hydrological community.

Advisory Board Introduction:

Richard Gross is from the Jet Propulsion Laboratory (JPL), Pasadena, California, USA. JPL is a world leader in science and technology managed by the California Institute of Technology for NASA.

Richard Gross is **the president of IAG's Commission on Earth Rotation and Geodynamics and the chair of the GGOS science panel**. GGOS is the Observing System of the IAG and works with the IAG components to provide the geodetic infrastructure necessary for monitoring the Earth system and for global change research. His support will guarantee that EGSIEM developments will be in line with the GGOS goals.

Advisory Board Introduction:

Urs Marti is from swisstopo, Wabern, Switzerland. The Federal Office of Topography (swisstopo) is the centre of competence for the Swiss Confederation responsible for geographical reference data.

Urs Marti is **the president of IAG's Commission on Gravity Field**. His support will guarantee that our planned services might eventually be put under the umbrella of IAG's International Gravity Field Service (IGFS).

Advisory Board Introduction:

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
JOINT RESEARCH CENTRE
Directorate H - Institute for Environment and Sustainability
Climate Risk Management

Peter Salomon is from the Institute for Environment and Sustainability at the Joint Research Centre (JRC) of the European Commission where his main task is to provide policy support in the area of flood risk management at the European and Global level. **In 2013 he became project leader of the development of the European and Global Flood Awareness Systems (EFAS and GloFAS)**.

His support will guarantee that the early warning indicators developed by EGSIEM will be highly valuable for the large scale early warning systems developed by the JRC and that they will eventually be integrated in the operational forecasting systems at the JRC.

Advisory Board Introduction:

Jürgen Kusche is Professor for Astronomical, Physical and Mathematical Geodesy at the Institute for Geodesy and Geoinformation of the University of Bonn, Germany. He is **speaker of the DFG Priority Programme SPP1257 "Mass Transport and Mass Distribution in the Earth System"** and member of the European GRACE-FO Science Team.

His support will guarantee that duplications may be avoided and new ideas may be taken up efficiently by both the EGSIEM and SPP1257 consortia.