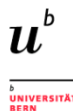# European Gravity Service for Improved Emergency Management - Status and project highlights

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 20th

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

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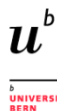
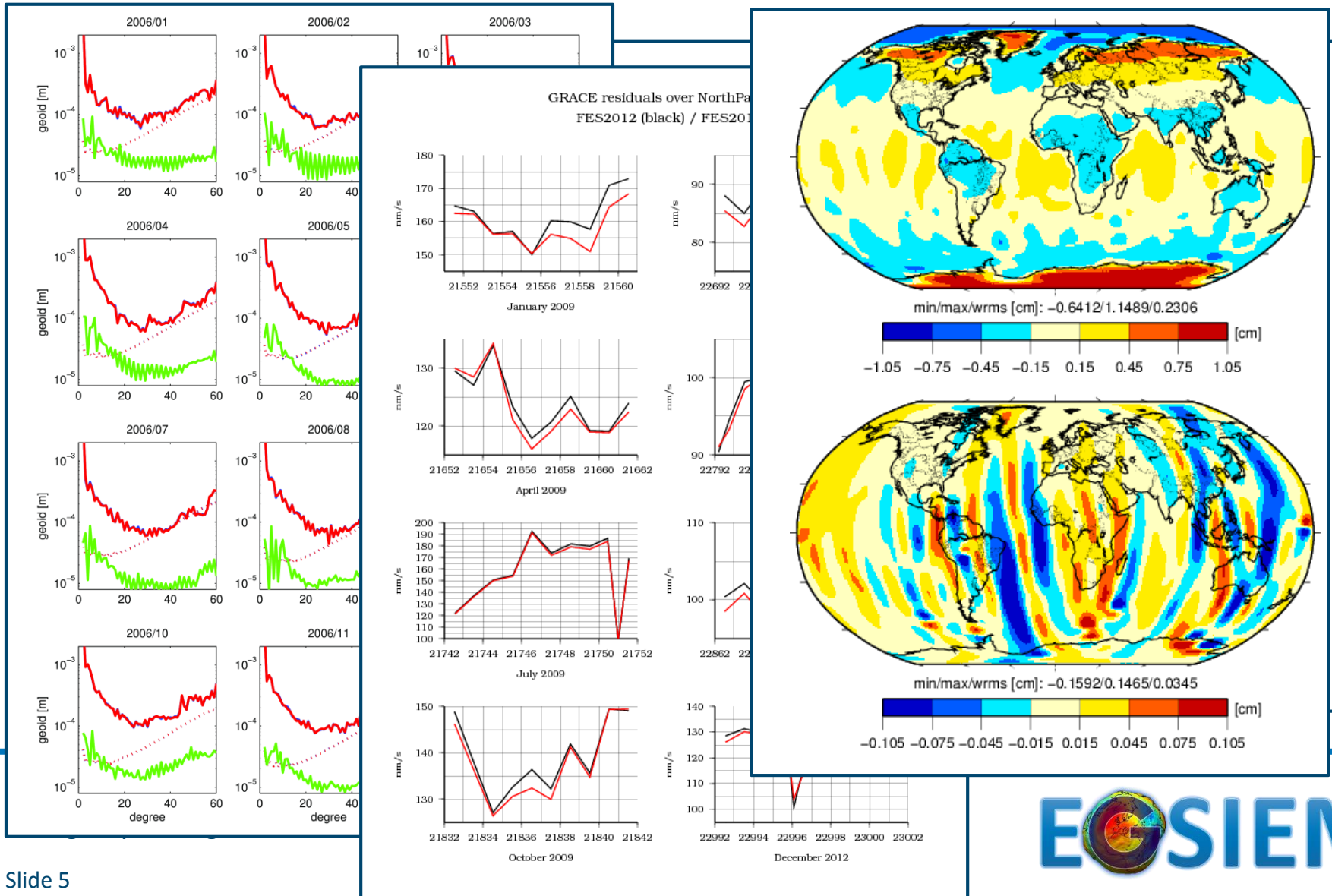# EGSIEM Project - Three services shall be established
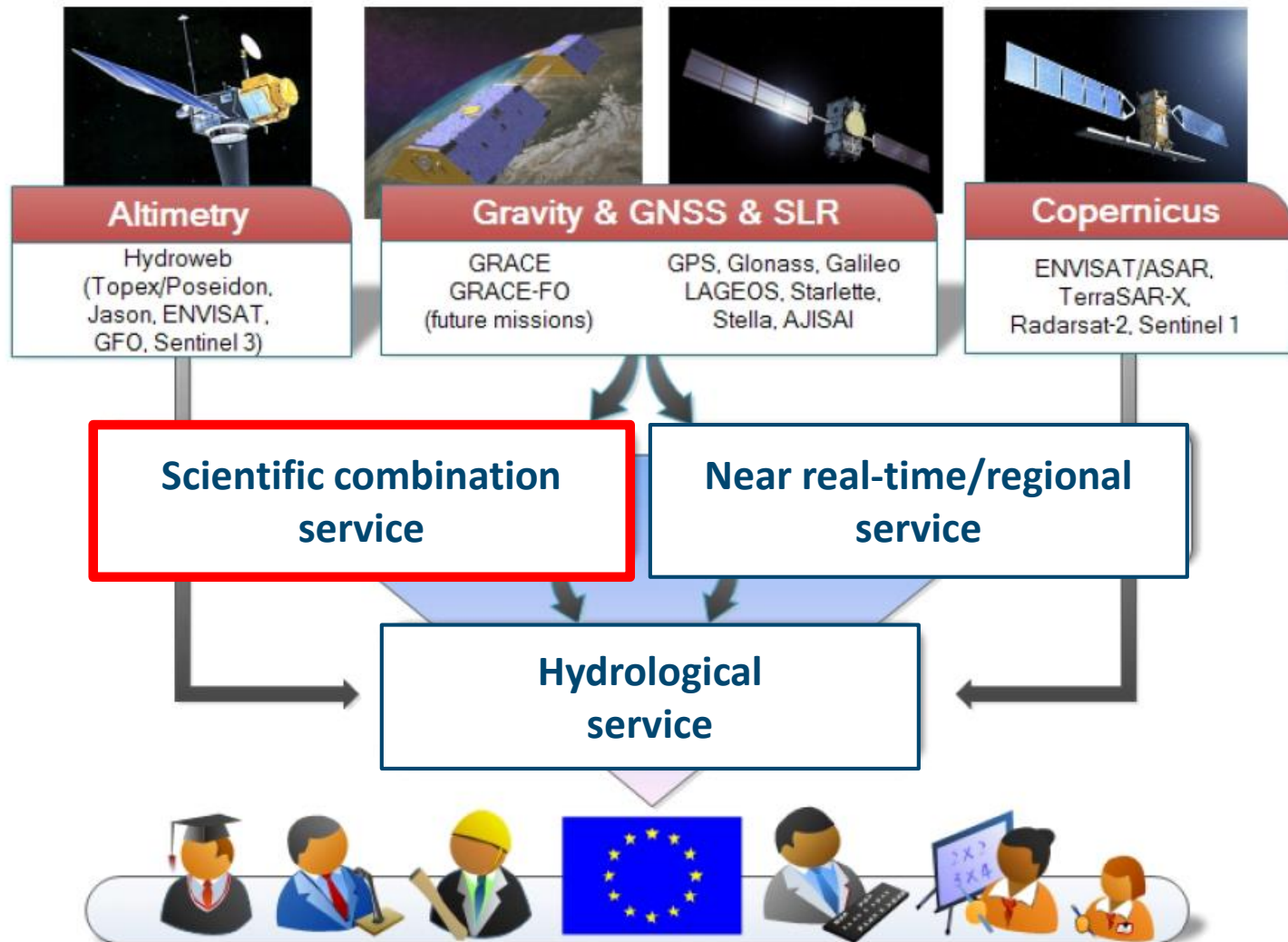
Scientific service
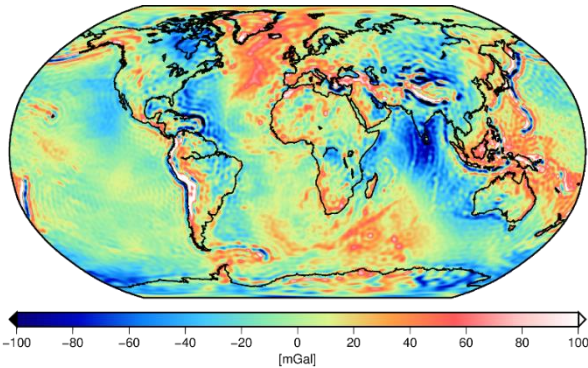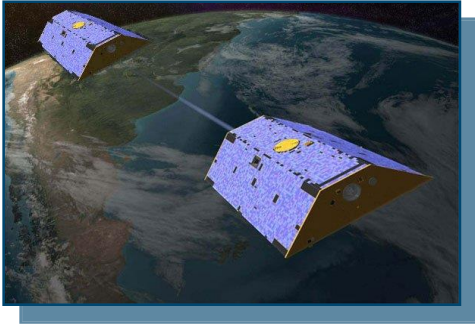
EGSIEM Analysis Centers (ACs):

- **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
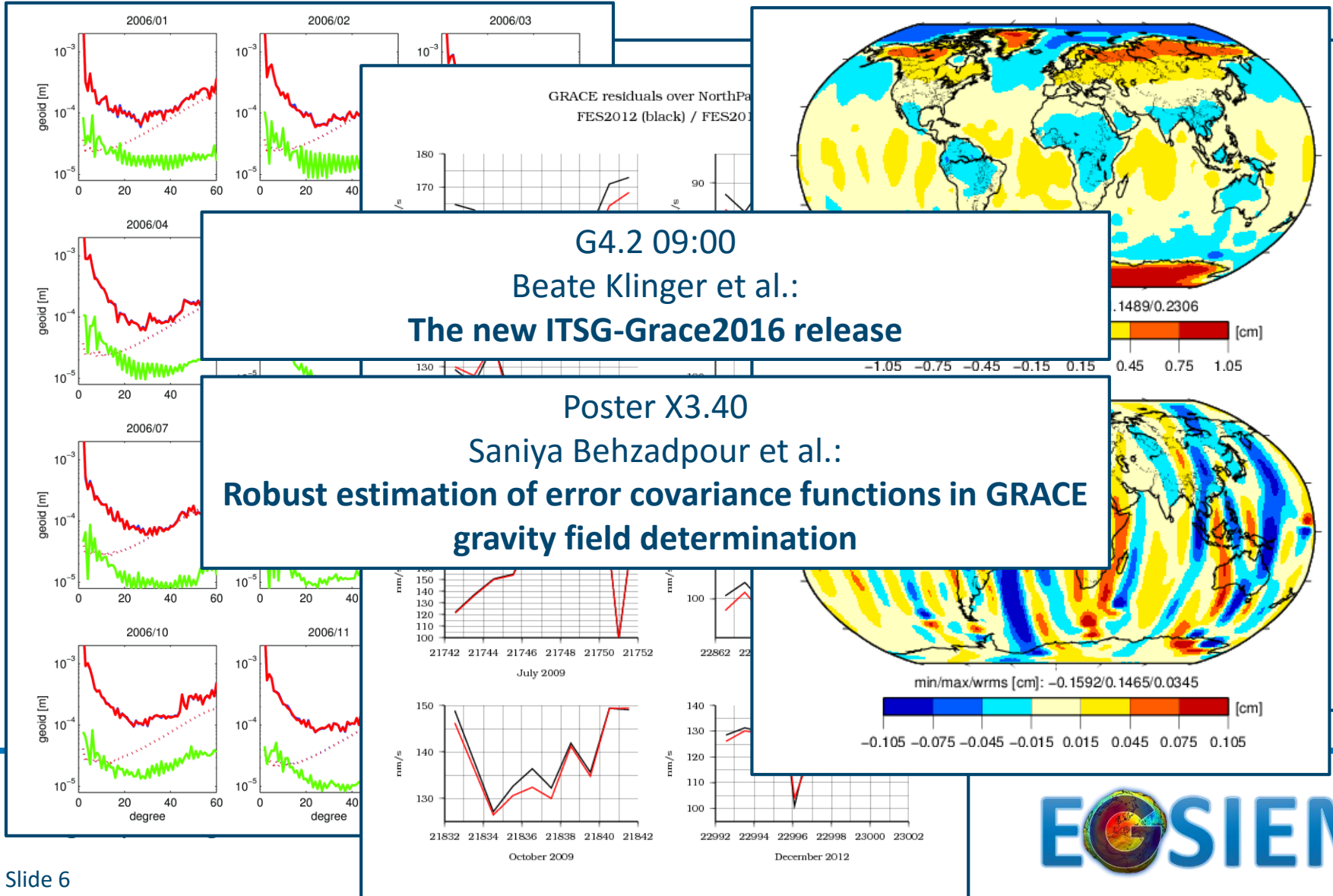4. Combination of the solutions

1. Improvements of the processing

A lot of tests, comparisons, discussions: instruments, calibration, background models
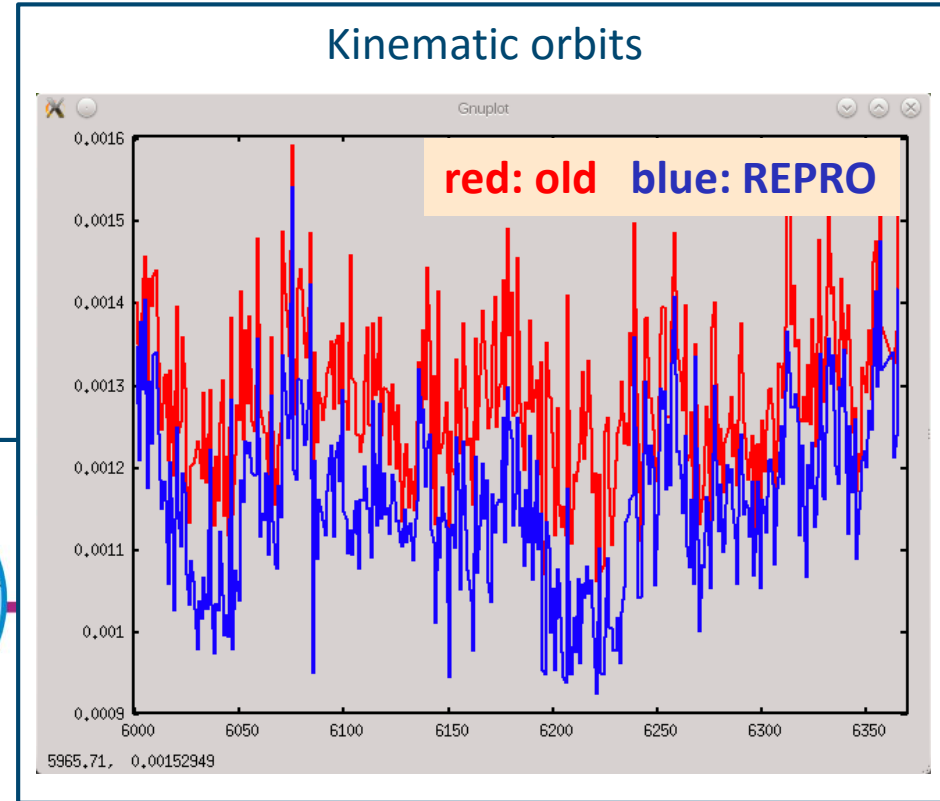
1. Improvements of the processing

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G4.2 09:00
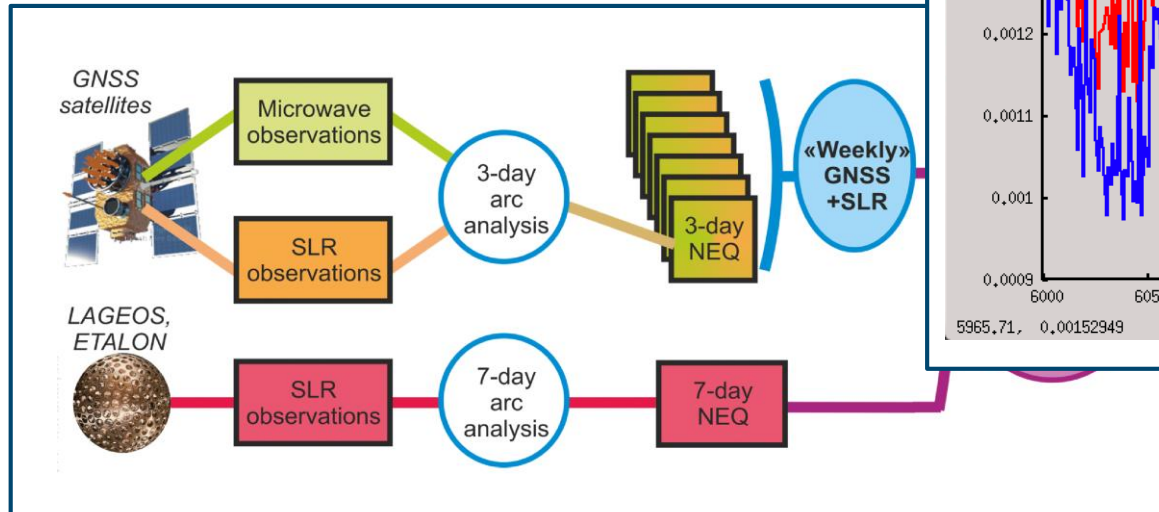Beate Klinger et al.:
The new ITSG-Grace2016 release

Poster X3.40
Saniya Behzadpour et al.:
Robust estimation of error covariance functions in GRACE gravity field determination

2. Integration of complementary data

- Reprocessed GPS orbits and clock corrections

- SLR for low degree gravity field

- POD from non-dedicated satellites
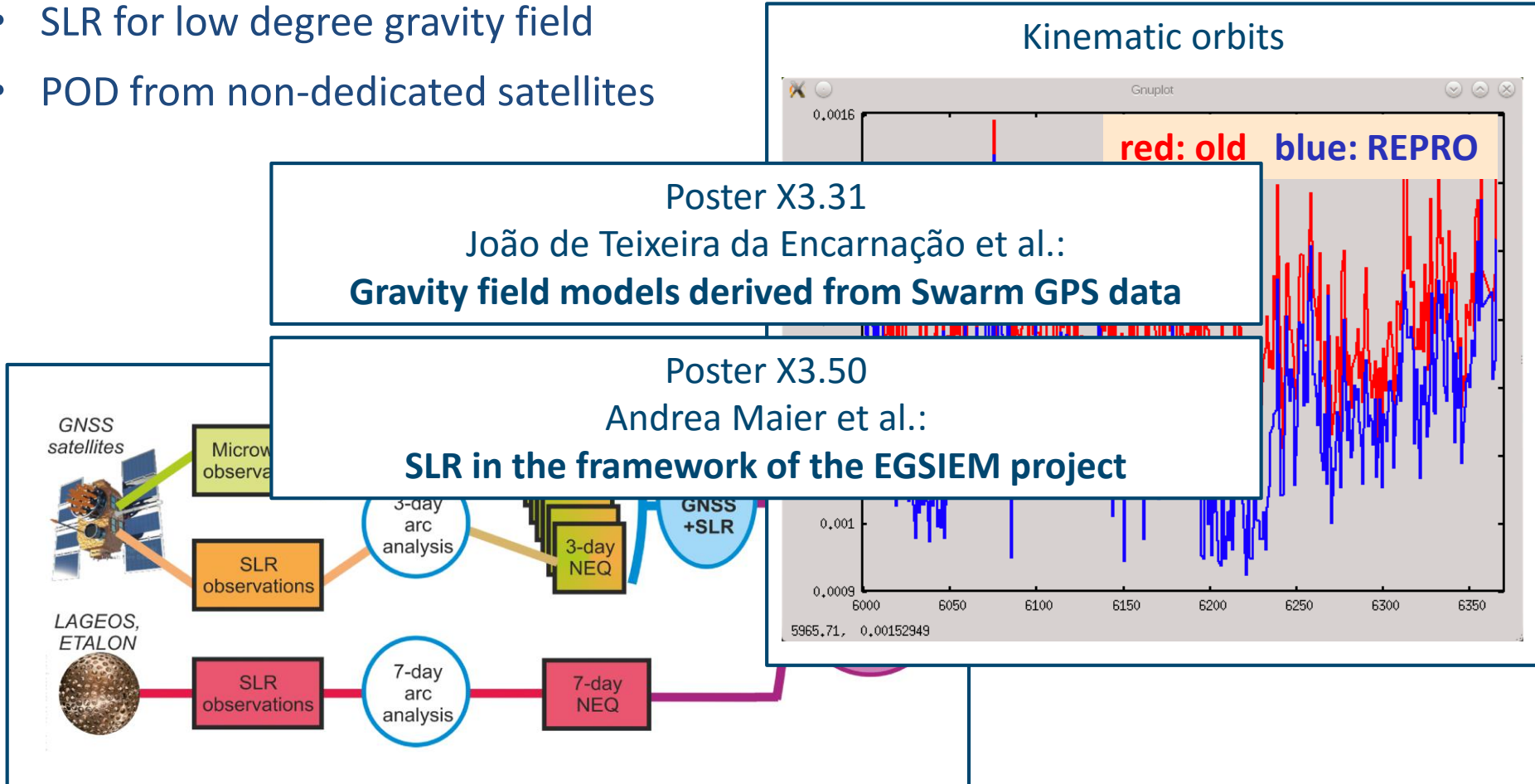
Kinematic orbits

red: old   blue: REPRO

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Poster X3.31
João de Teixeira da Encarnação et al.:
Gravity field models derived from Swarm GPS data

Poster X3.50
Andrea Maier et al.:
SLR in the framework of the EGSIEM project

GNSS satellites

Microw observa...

3-day arc analysis

3-day NEQ

GNSS +SLR

SLR observations

LAGEOS, ETALON

SLR observations

7-day arc analysis

7-day NEQ

EGSIEM

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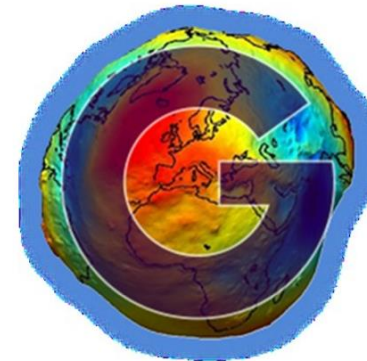
EO-1-2014: New ideas for Earth-relevant space applications
Research and Innoation Action

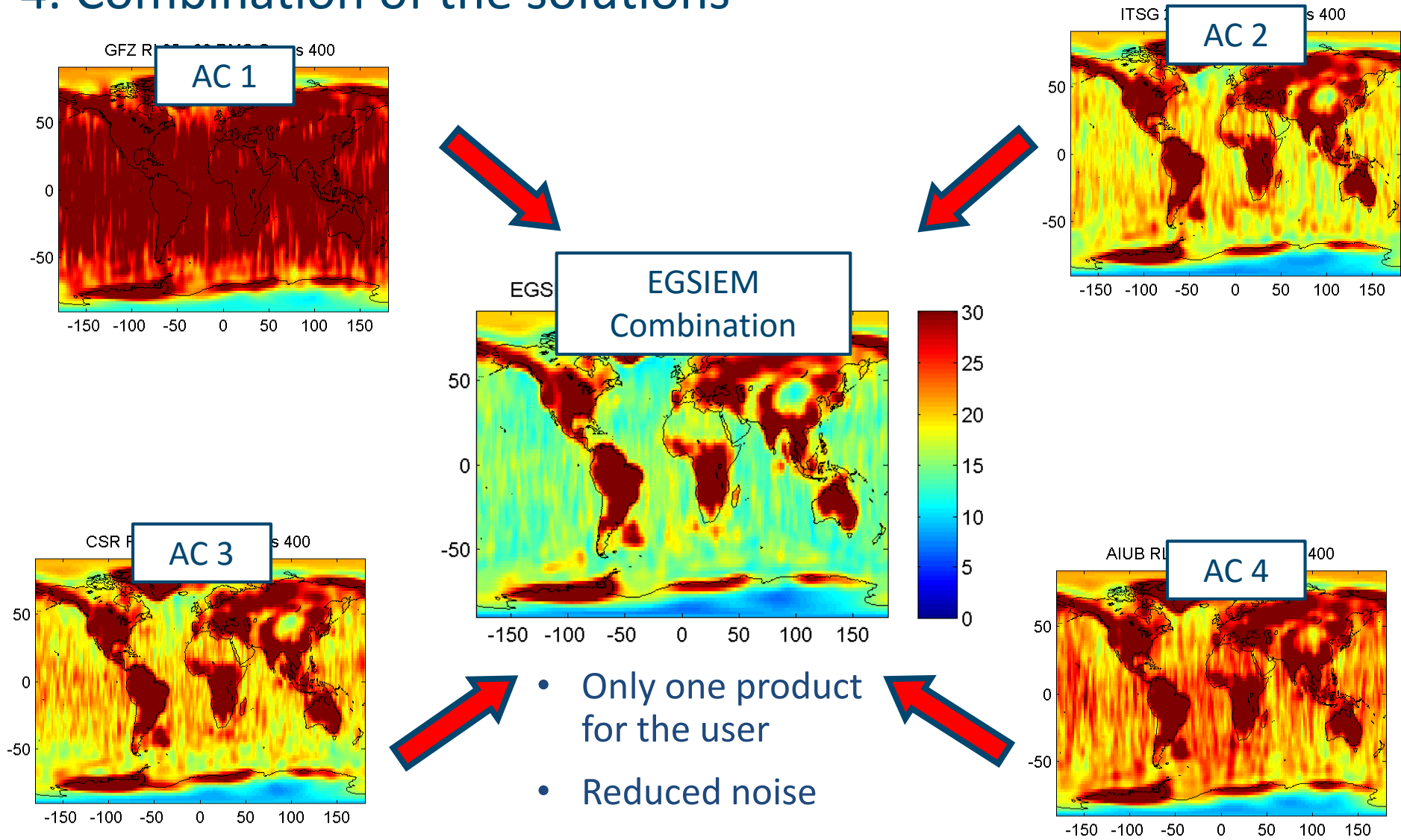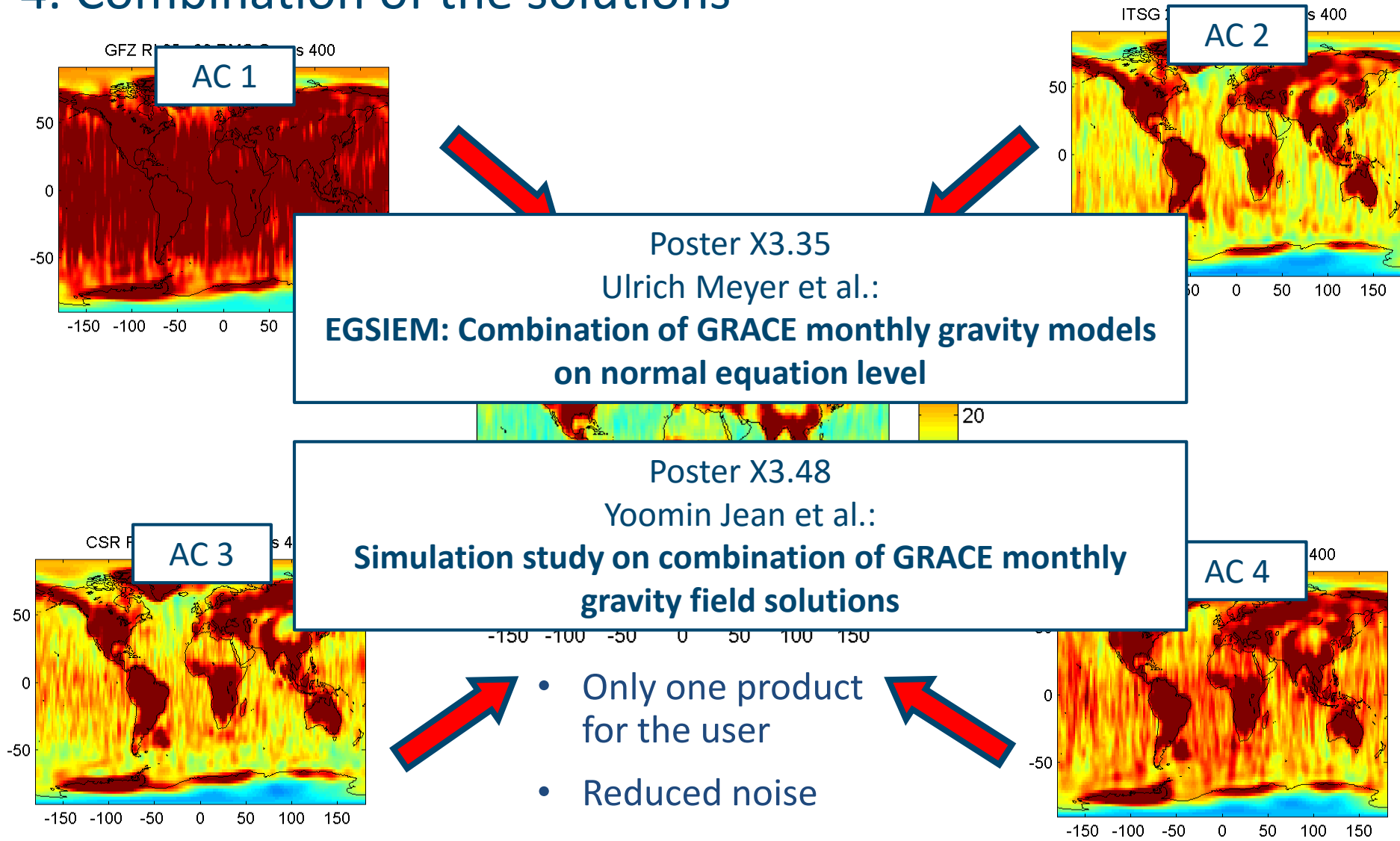|	
Action Acronym:	**EGSIEM**
Action full title:	European Gravity Service for improved Emergency Management
Grant agreement no:	637010

Deliverable 2.1:
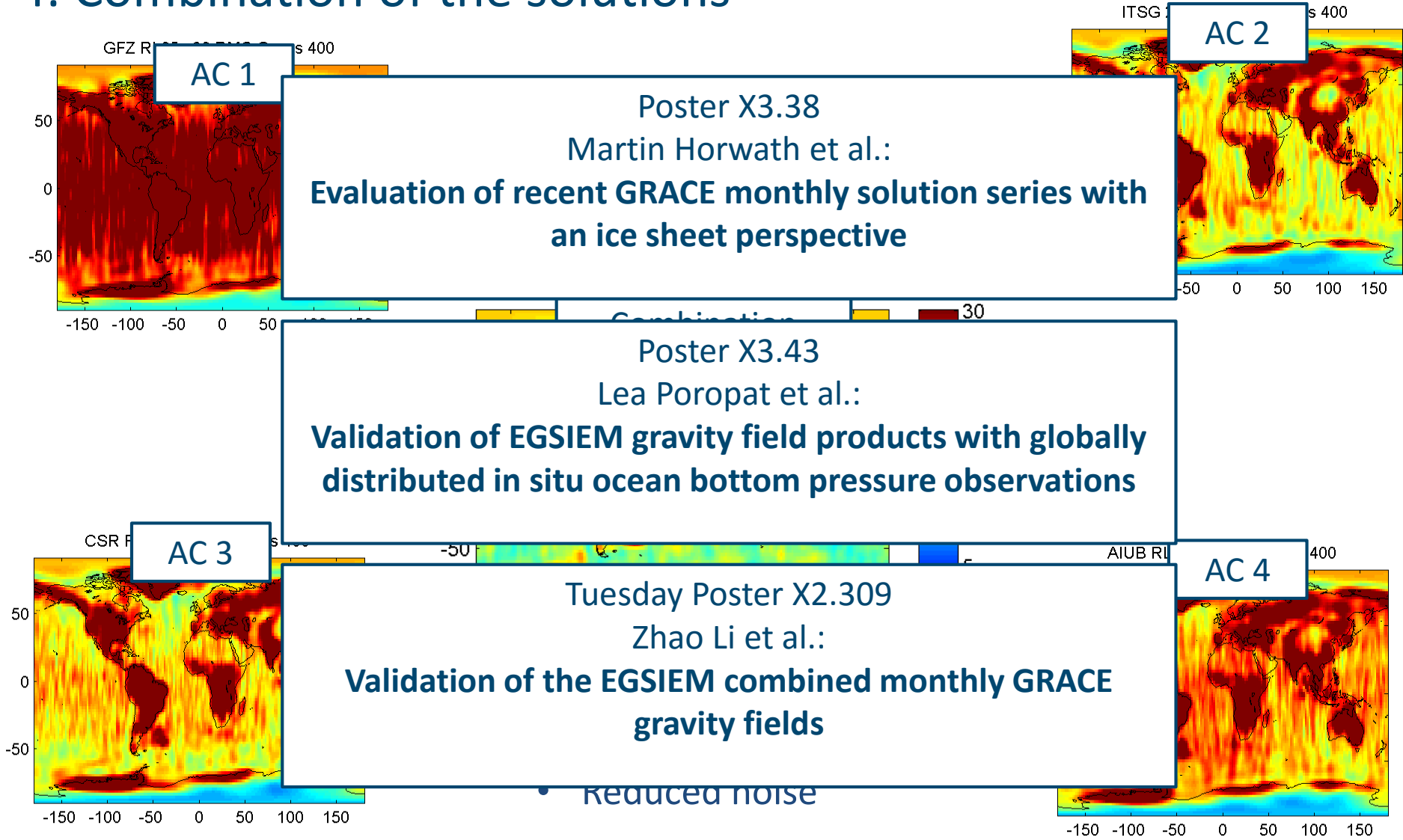Processing Standards

Date: 02/03/2015

Prepared by: U. Meyer

4. Combination of the solutions

AC 1

AC 2

AC 3

AC 4
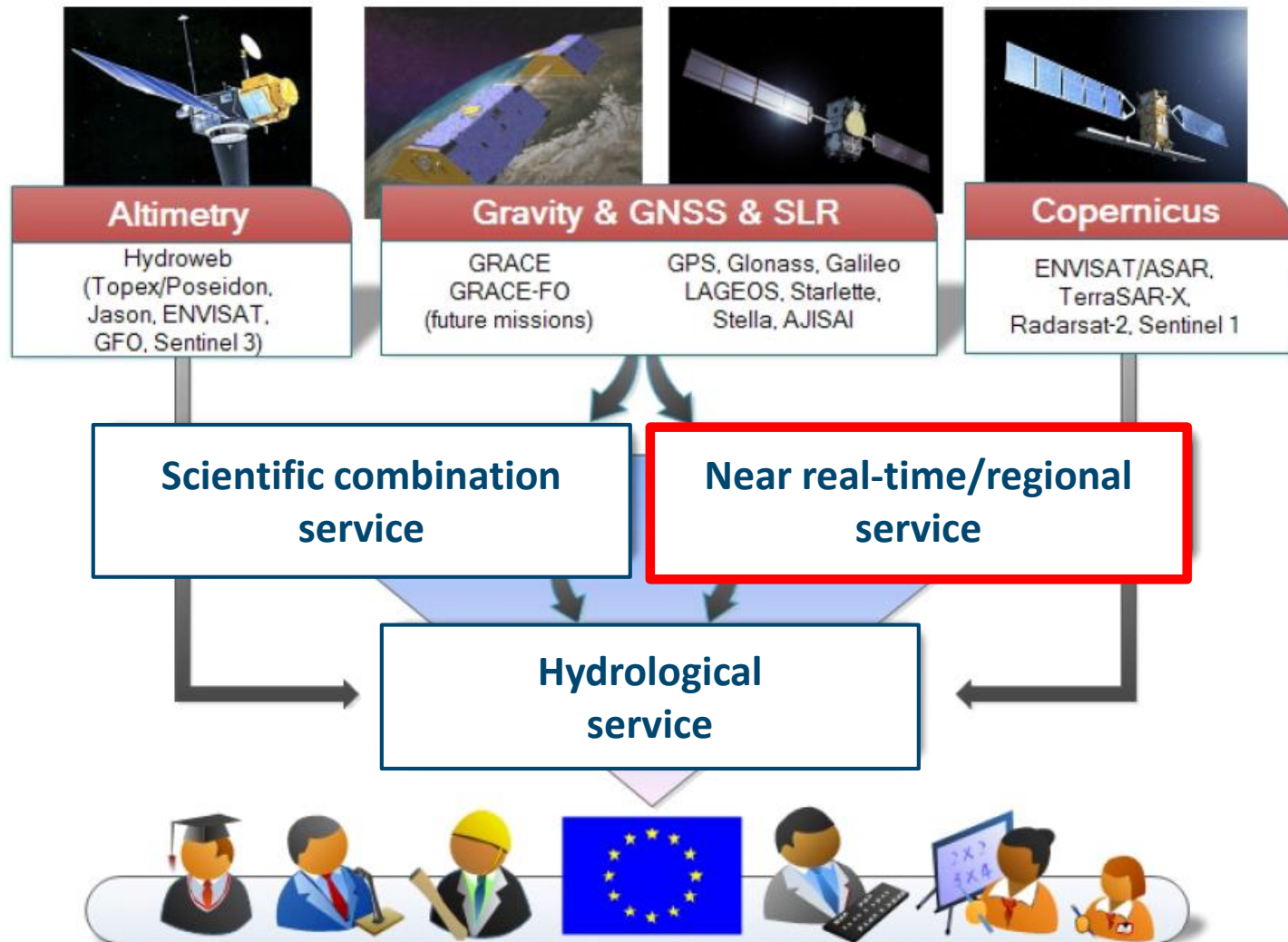
EGSIEM Combination

- Only one product for the user

- Reduced noise

4. Combination of the solutions

AC 1

AC 2

AC 3

AC 4

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

Poster X3.48
Yoomin Jean et al.:
Simulation study on combination of GRACE monthly gravity field solutions

- Only one product for the user

- Reduced noise

EGSIEM

4. Combination of the solutions

AC 1

AC 2

AC 3

AC 4

Poster X3.38

Martin Horwath et al.:

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

Poster X3.43

Lea Poropat et al.:

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

Tuesday Poster X2.309

Zhao Li et al.:

Validation of the EGSIEM combined monthly GRACE gravity fields

EGSIEM Project

Daily updated gravity field solutions from GRACE

- Data distribution is a challenge
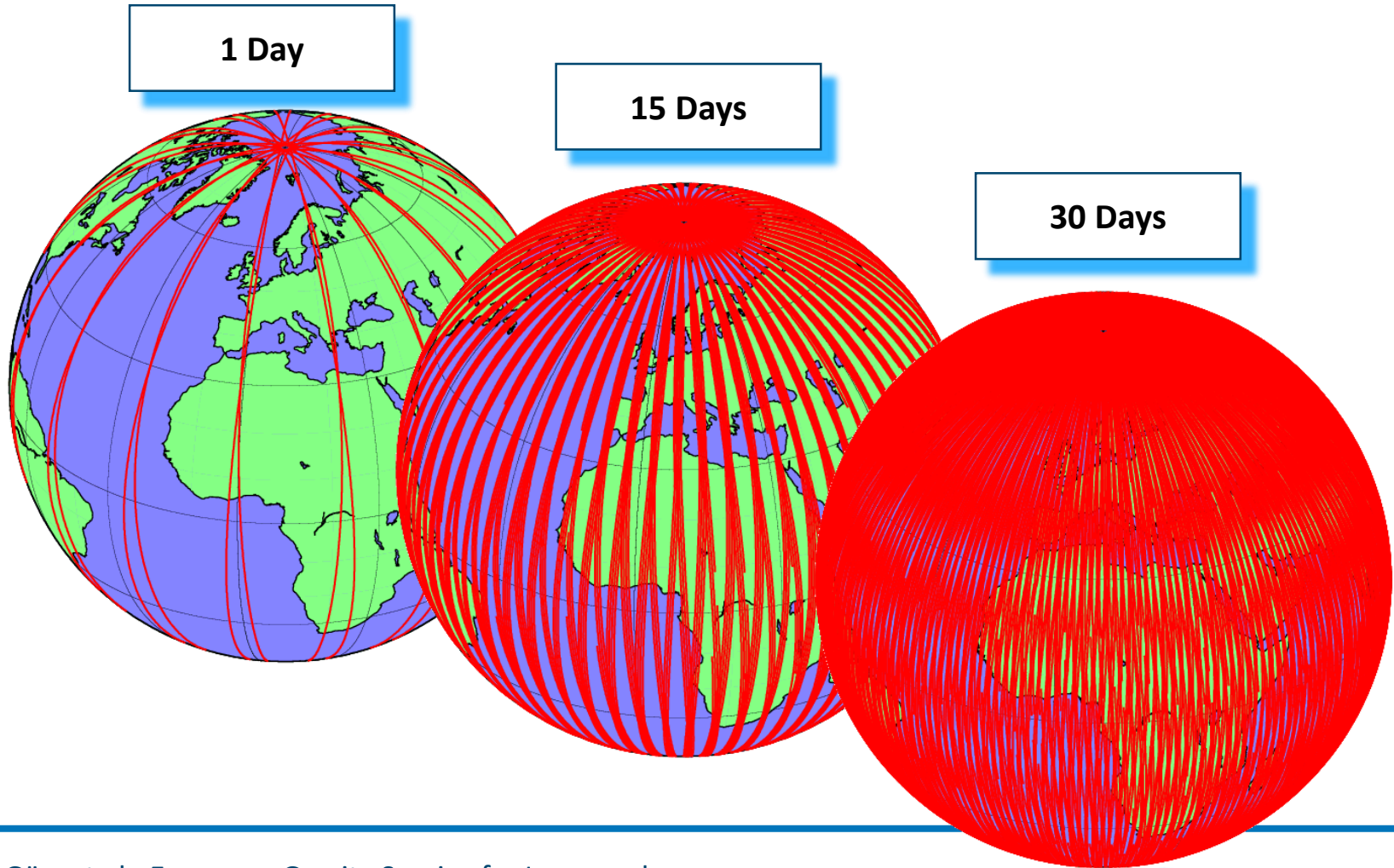
Daily updated gravity field solutions from GRACE

- 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
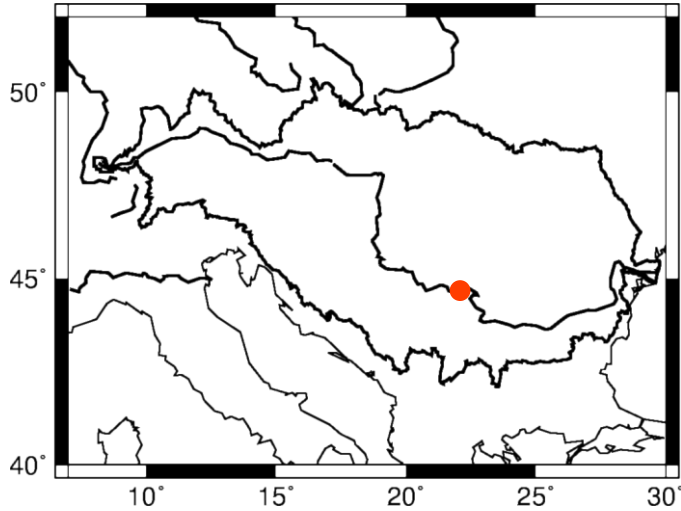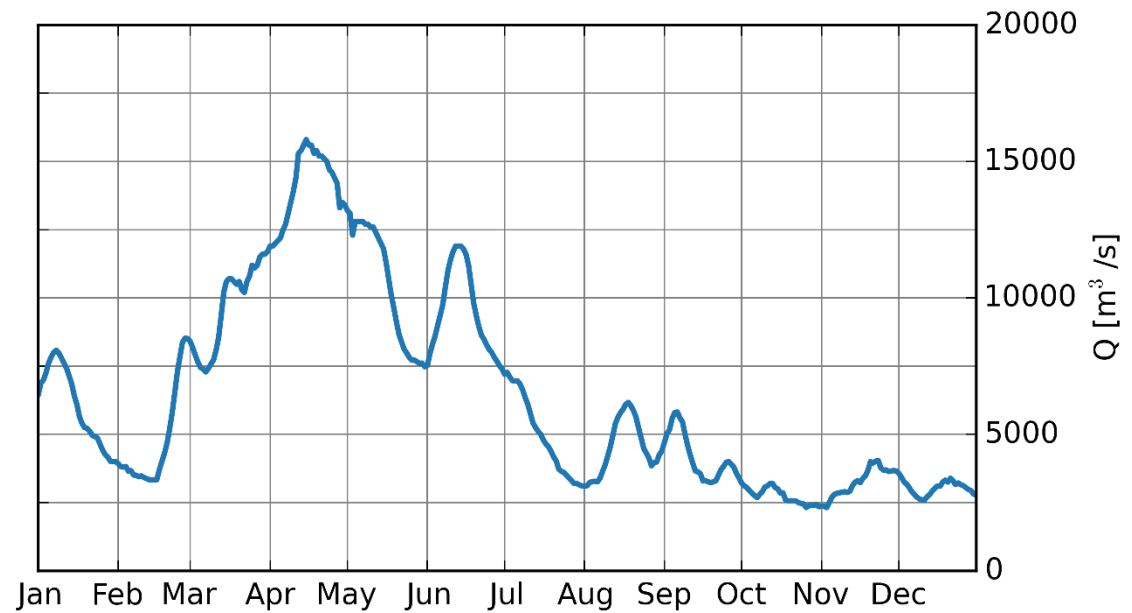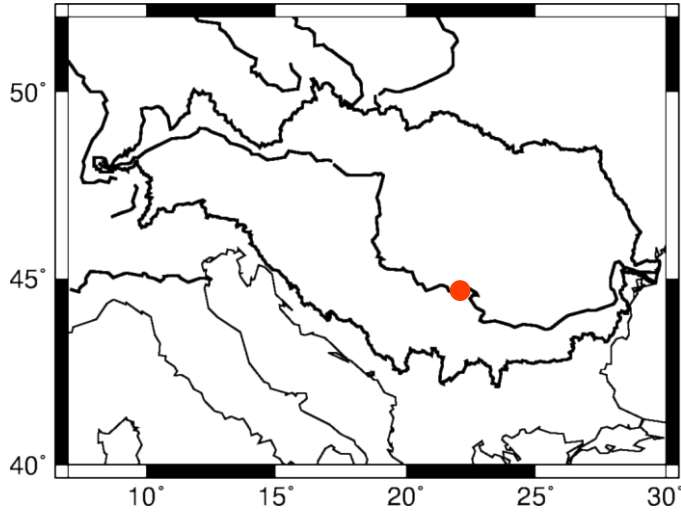

GRACE Kalman Filter
(Kurtenbach et al. 2012)
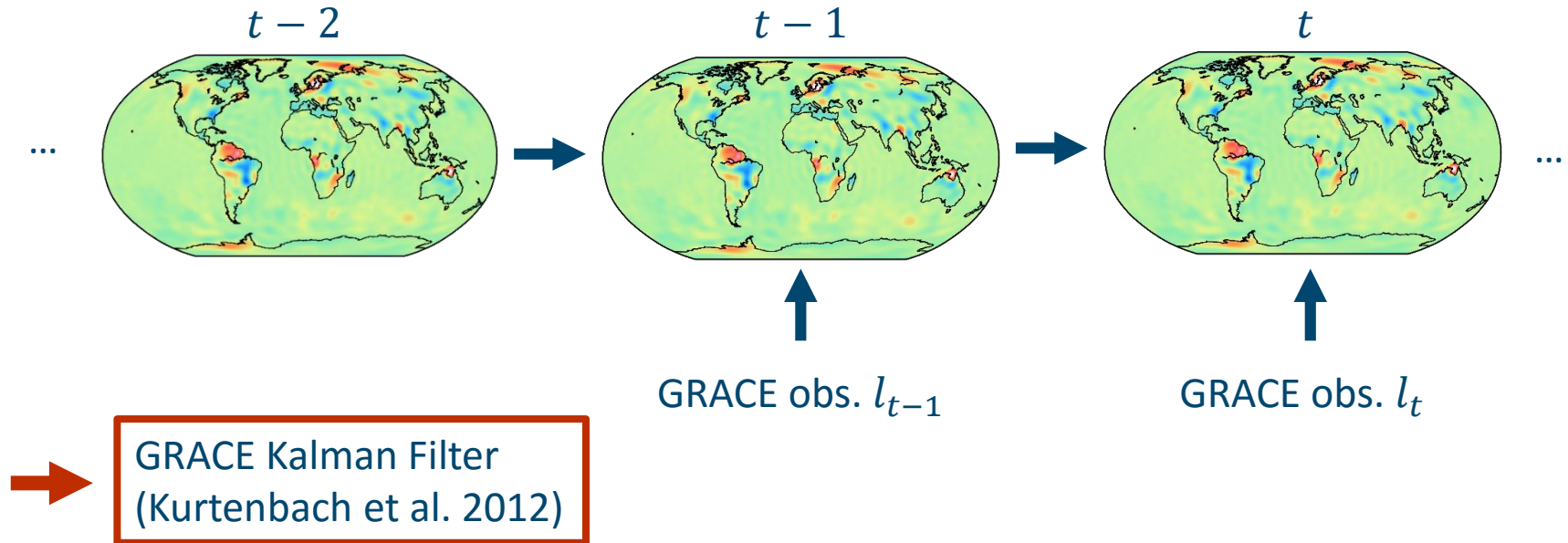
Example: The Danube basin
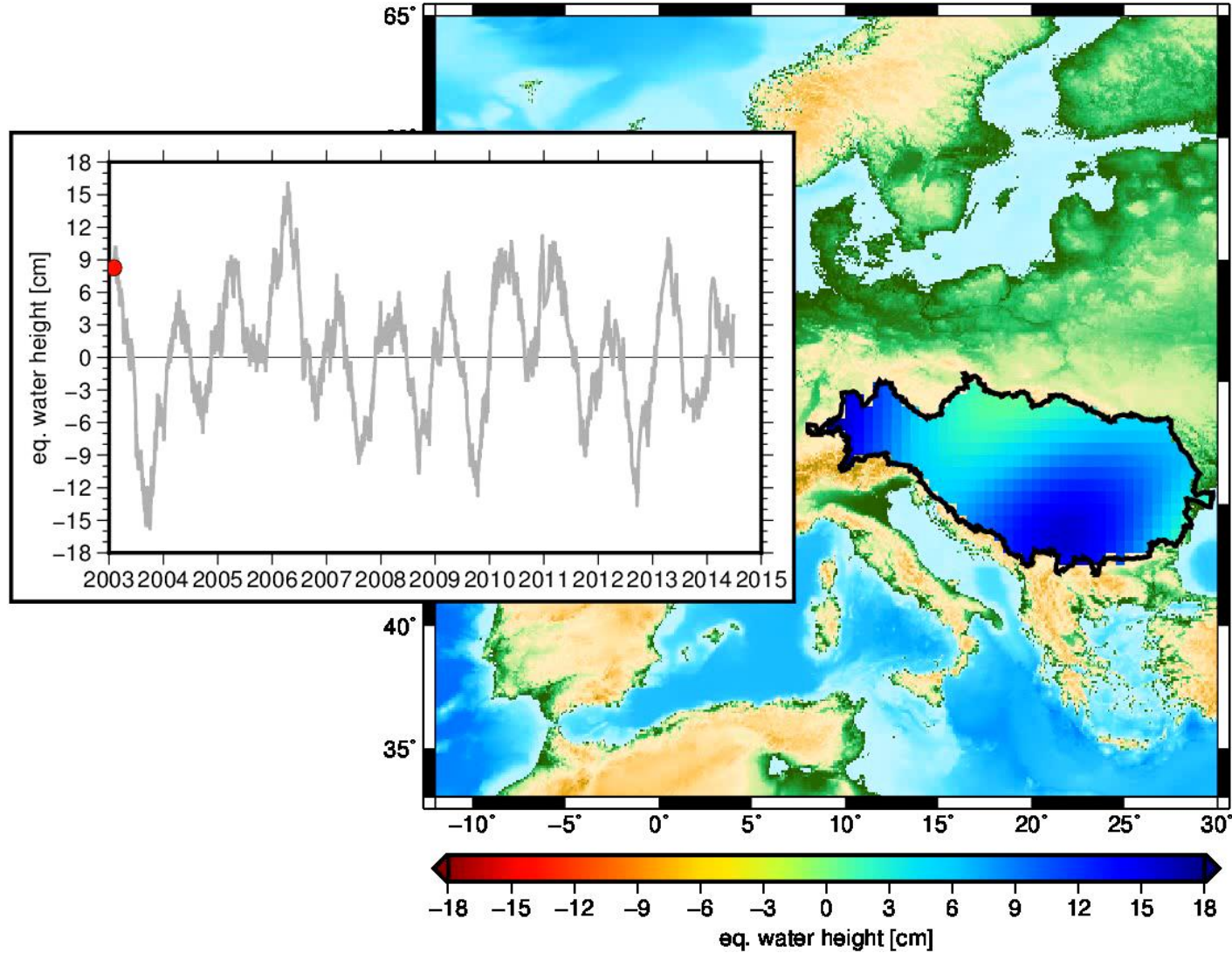
Example: The Danube basin

River discharge at Bazias, 2006

Example: The Danube basin

Water storage:
GRACE monthly solutions

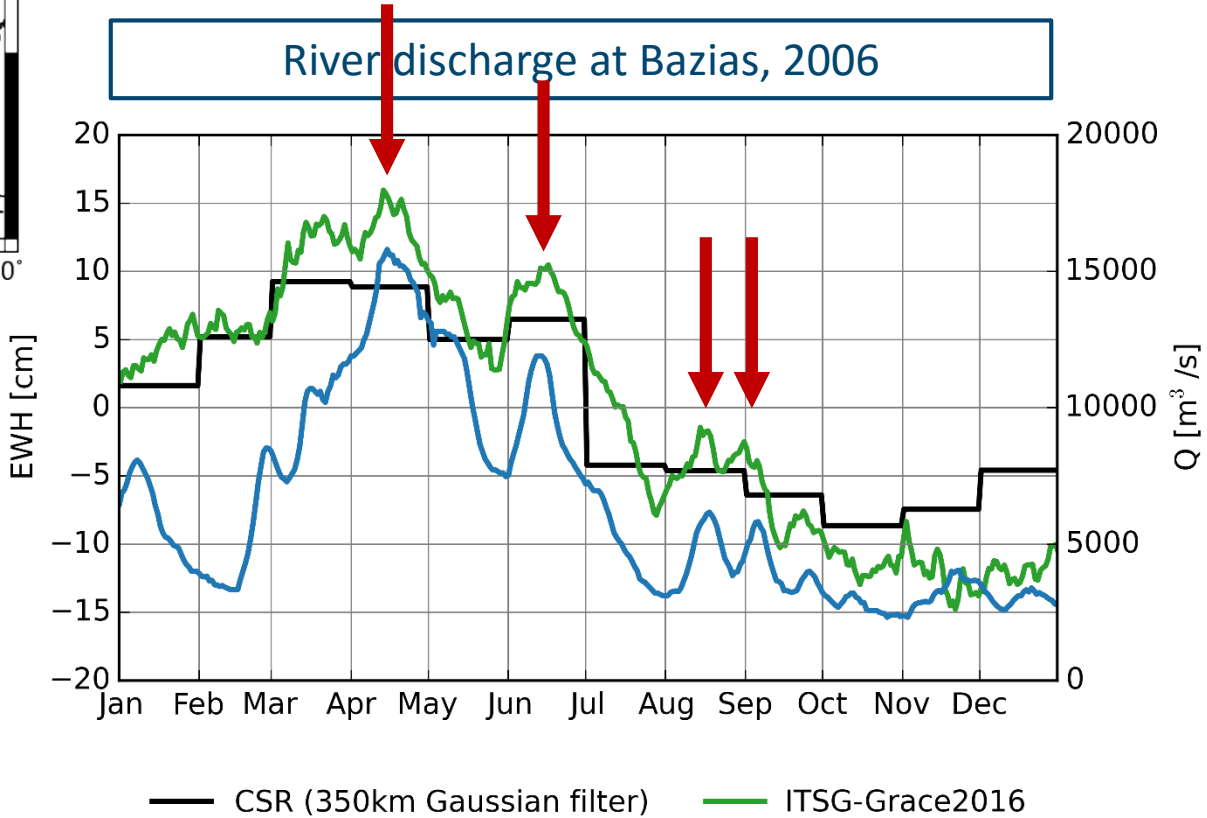River discharge at Bazias, 2006
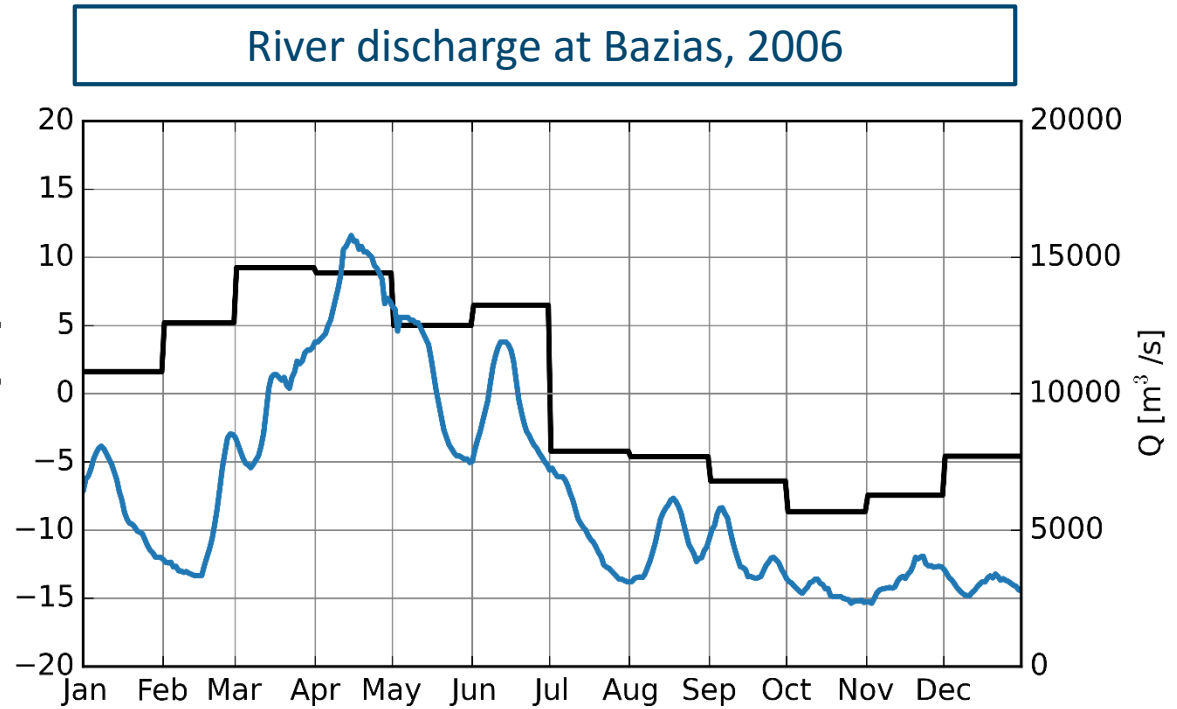
— CSR (350km Gaussian filter)

Example: The Danube basin

River discharge at Bazias, 2006

Water storage:
GRACE monthly solutions

Daily Kalman solutions

—— CSR (350km Gaussian filter)   —— ITSG-Grace2016

EGSIEM

Example: The Danube basin

G3.2/CR2.4/HS11.7/OS4.9 Monday 14:30
Andreas Kvas et al.:
Near real-time GRACE gravity field solutions for hydrological monitoring applications

HS2.1.1 Monday Poster A.66
Ben Gouweleeuw et al.:
Evaluation of GRACE daily gravity solutions for hydrological extremes in selected river basins

Wate[...] GRACE monthly solutions

Daily Kalman solutions

CSR (350km Gaussian filter) —— ITSG-Grace2016

Near real time (max. 5 days delay)

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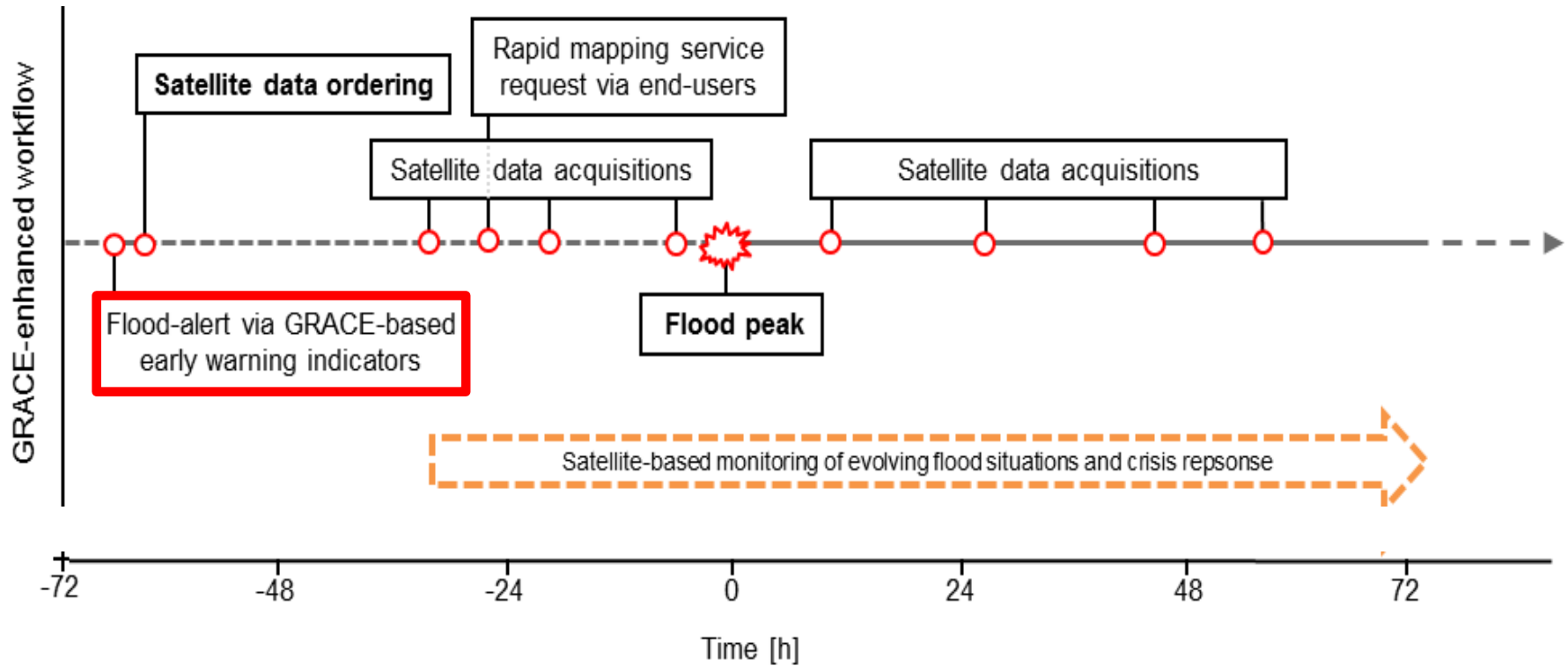 - forward only filtering → increased high frequency noise

EGSIEM Project

Altimetry	Gravity & GNSS & SLR		Copernicus
Hydroweb (Topex/Poseidon, Jason, ENVISAT, GFO, Sentinel 3)	GRACE GRACE-FO (future missions)	GPS, Glonass, Galileo LAGEOS, Starlette, Stella, AJISAI	ENVISAT/ASAR, TerraSAR-X, Radarsat-2, Sentinel 1

Scientific combination service

Near real-time/regional service

Hydrological service
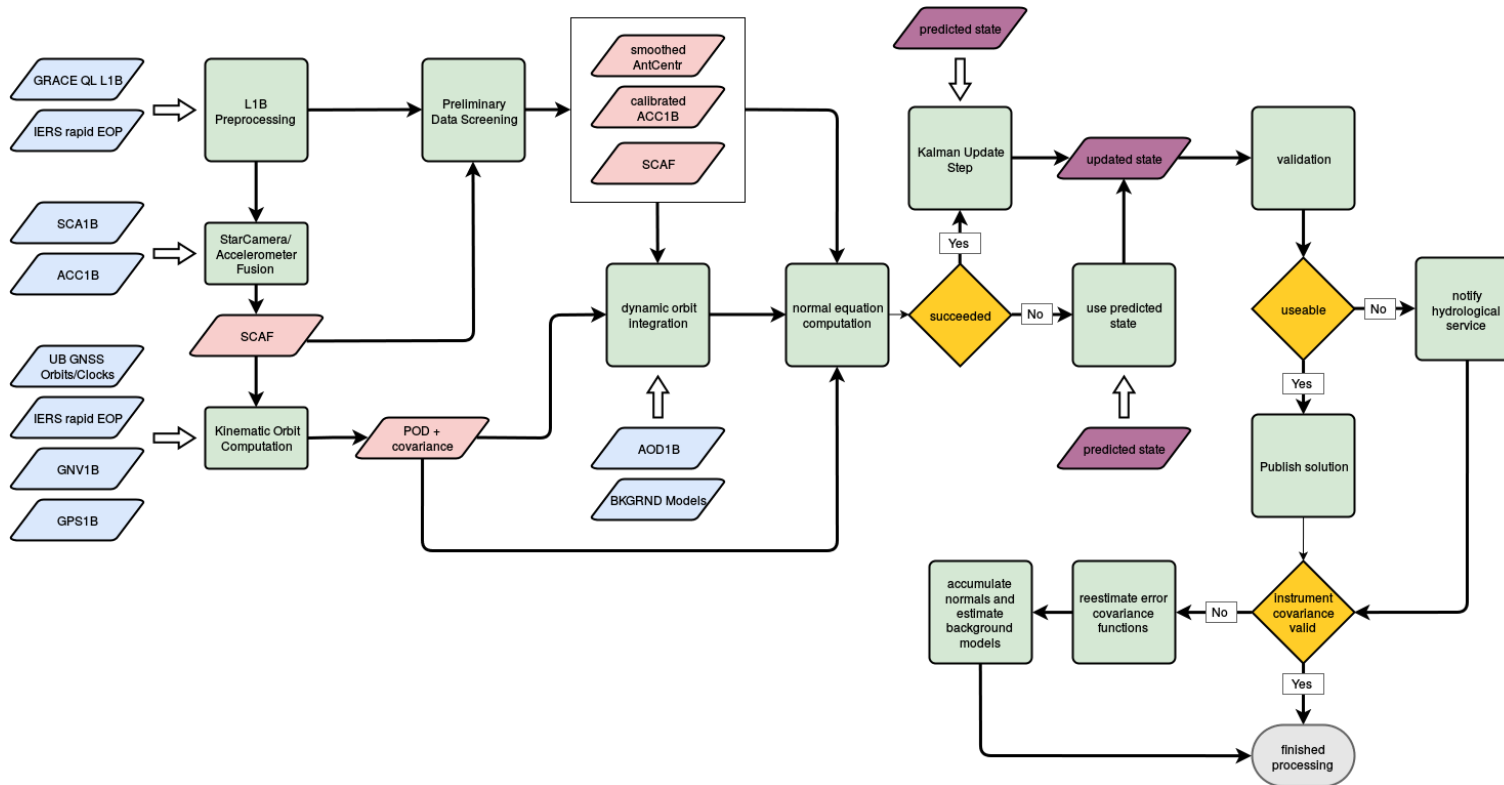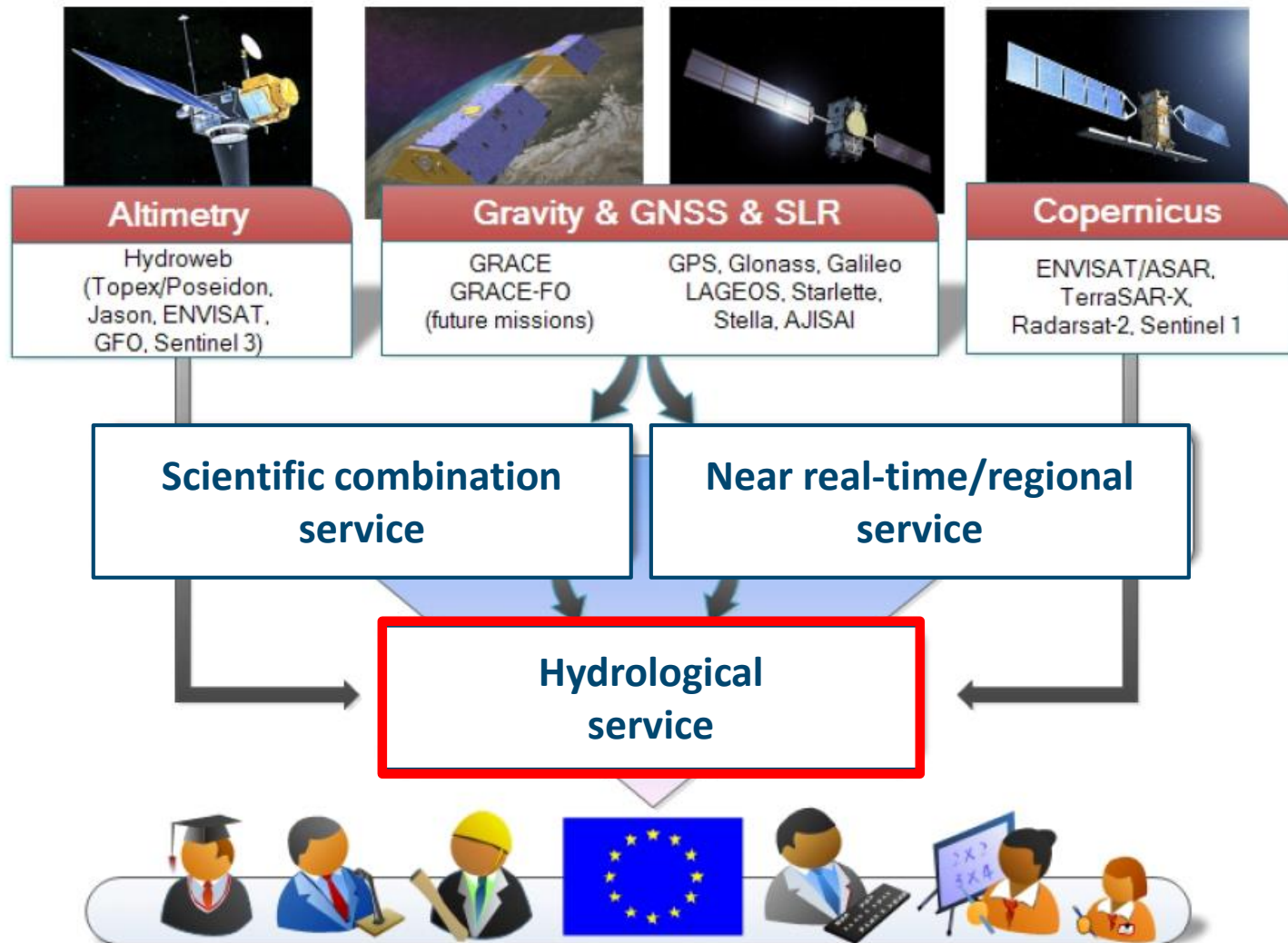
Integration into automatic flood emergency management services
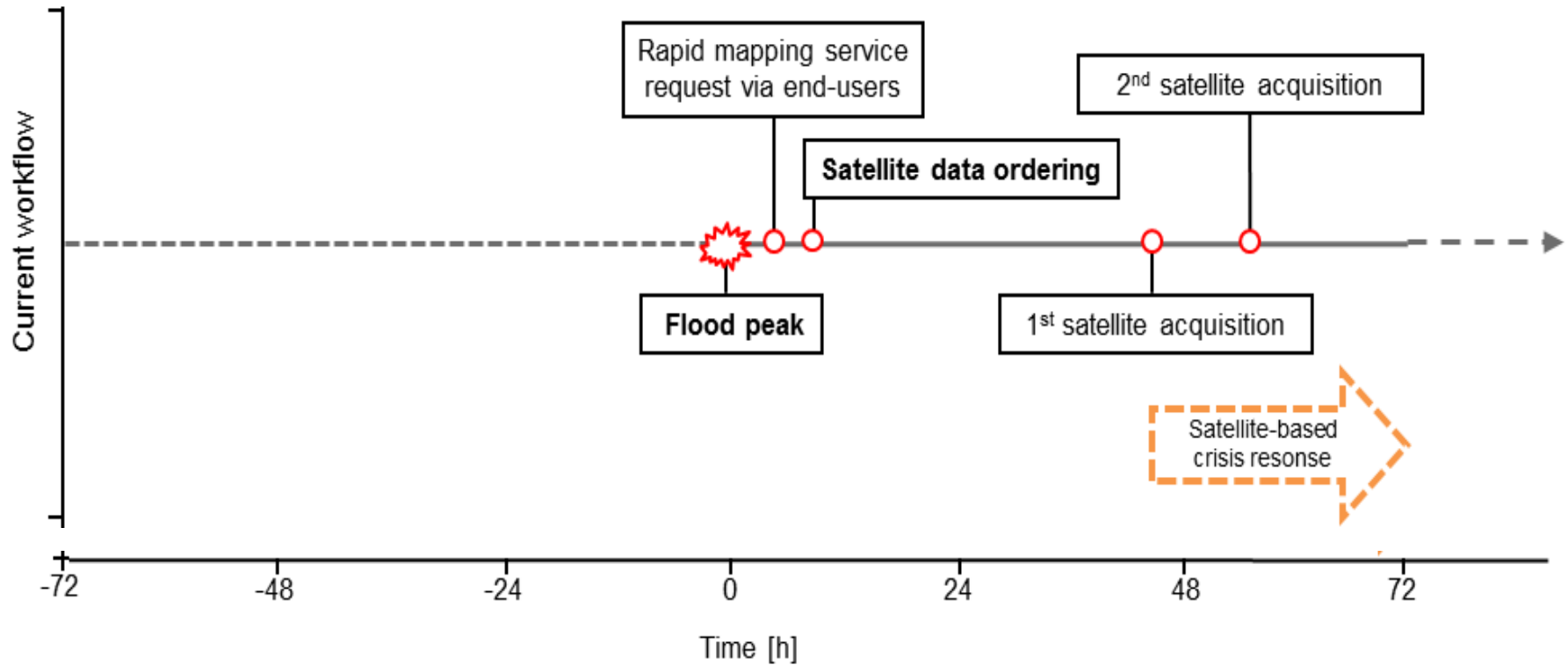
Integration into automatic flood emergency management services

Summary (1/2)

Altimetry
Hydroweb
(Topex/Poseidon,
Jason, ENVISAT,
GFO, Sentinel 3)

Gravity & GNSS & SLR
GRACE
GRACE-FO
(future missions)

GPS, Glonass, Galileo
LAGEOS, Starlette,
Stella, AJISAI

Copernicus
ENVISAT/ASAR,
TerraSAR-X,
Radarsat-2, Sentinel 1

Scientific combination service

Near real-time/regional service

Hydrological service
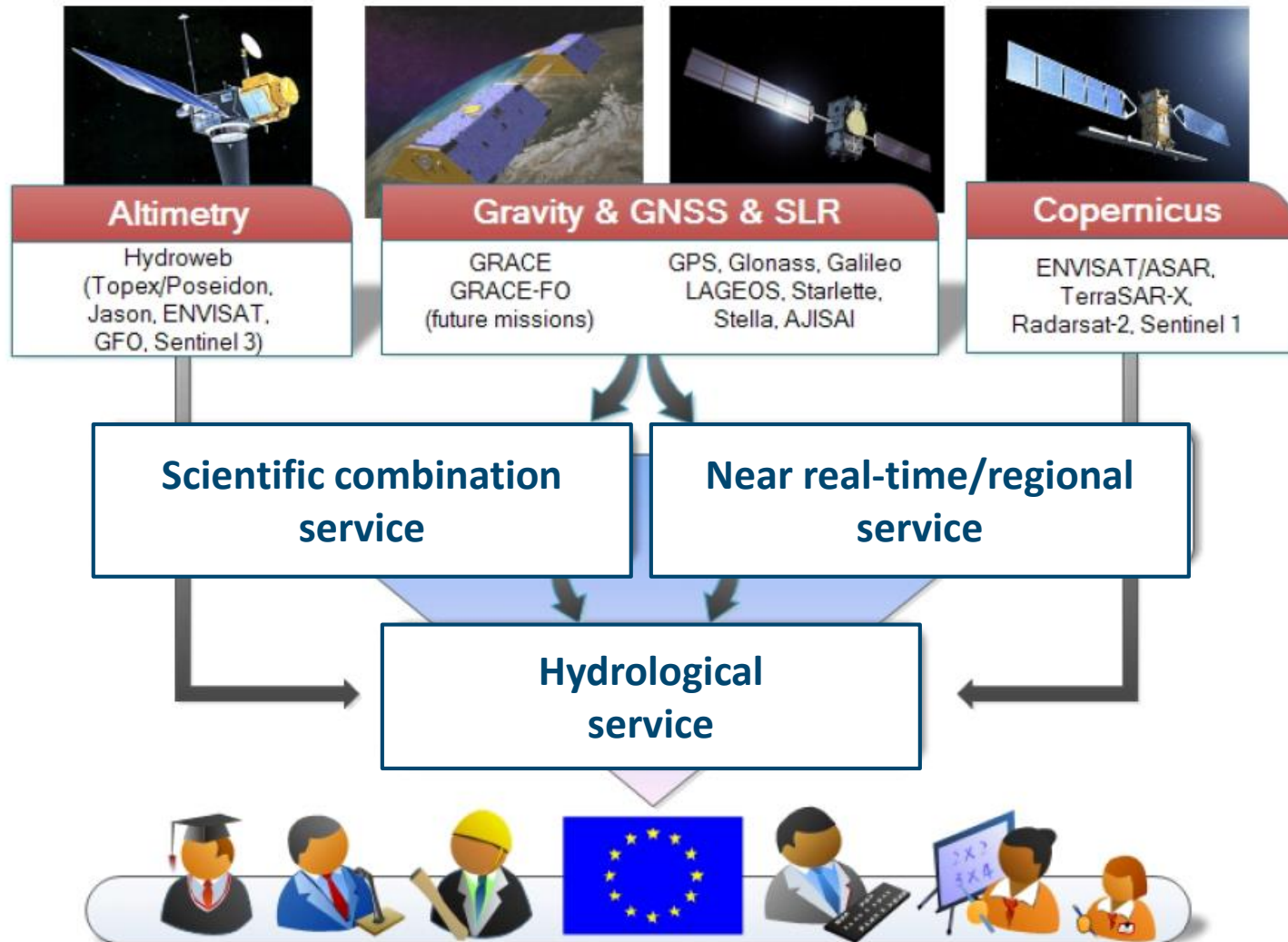
Summary (2/2)

- Much effort is going on

Summary (2/2)

- Much effort is g

Poster X3.35
Ulrich Meyer et al.:
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G4.2
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Mayer-Gürr et al.: European Gravity Service for Improved Emergency Management - Status and project highlights

Keep in touch

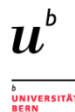News and updates will be regularly published on various media, e.g., by the quarterly EGSIEM Newsletter. www.egsiem.eu

EGSIEM is also present on social media:
https://twitter.com/EGSIEM
www.facebook.com/egsiem
https://egsiem.wordpress.com

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