European Gravity Service for Improved Emergency Management
a new Horizon2020 project to serve the international community
and improve the accessibility to gravity field products

A. Jäggi¹, M. Weigelt², F. Flechtner³, A. Güntner³, T. Mayer–Gürr⁴, S. Martinis⁵, S. Bruinsma⁶, J. Flury⁷, S. Bourgogne⁸

¹Astronomical Institute, University of Bern, Switzerland
²Geophysics Laboratory, University of Luxembourg, Luxembourg
³German Research Centre for Geosciences, Potsdam, Germany
⁴Institute of Theoretical Geodesy and Satellite Geodesy, Technical University of Graz, Austria
⁵Deutsches Zentrum für Luft- und Raumfahrt
⁶Groupe de Recherche de Géodesie Spatiale, Toulouse, France
⁷Institute of Geodesy, University of Hannover, Germany
⁸Géode & Cie, Toulouse, France

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Introduction

A 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.
EGSIEM project overview (1)

The Grant Preparation with the European Commission has been successfully completed last year and EGSIEM has officially started on January 1, 2015.

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

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.
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)

<table>
<thead>
<tr>
<th>Data</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNSS</td>
<td>Reference frame</td>
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<tr>
<td>SLR</td>
<td>Reference frame + gravity</td>
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<td>GNSS loading</td>
<td>Validation</td>
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<td>Ocean bottom pressure</td>
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<tr>
<td>Altimetry data (lake and river levels)</td>
<td>Integration into hydrological service (and validation)</td>
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<tr>
<td>GIA models</td>
<td>Separation of GIA–related trend from hydrological trend (where necessary)</td>
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<tr>
<td>Historical flood situations</td>
<td>Validation of GRACE derived flood and drought indices</td>
</tr>
</tbody>
</table>
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
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 will be coordinated by AIUB, it 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
Solution comparison and combination:

For more details, see poster G348 by Jean et al.
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)
Gravity-based flood and drought indicators as descriptors of the integral wetness status of river basins → early warning for hydrological extreme events

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: Hydrological Service (2)

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

Disaster-cycle phase:
- Early warning
- Crisis
- Response
- Recovery

Slide 13
Astronomical Institute University of Bern

Adrian Jäggi et al.: European Gravity Service for Improved Emergency Management, EGU General Assembly, G4.2, 14 April 2015
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:

www.egsiem.eu

A central component of the EGSIEM dissemination activities will be the EGSIEM plotter, which allows easy data access and visualization.
WP7: Dissemination and Exploitation (2)

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

Data selection
- center, type, version...

Multiple possibilities for extraction areas, custom or predefined

Interactive plots

<table>
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<th>Series title</th>
<th>Data center</th>
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EGSIEM Visualization Tool: Interactive, fast and user-friendly visualization of results for scientific evaluation.
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.**
Keep in touch

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

The first issue can already be accessed at

www.egsiem.eu

EGSIEM is also present on social media:

https://twitter.com/EGSIEM
www.facebook.com/egsiem
https://egsiem.wordpress.com
Keep in touch

Thanks a lot for your attention!

The EGSIEM consortium is looking forward to your feedback