

Near real-time GRACE gravity field solutions for hydrological monitoring applications

Andreas Kvas¹, Ben Gouweleeuw², Torsten Mayer-Gürr¹, Andreas Güntner²

EGU General Assembly 2016

Vienna, April 18th

¹Graz University of Technology

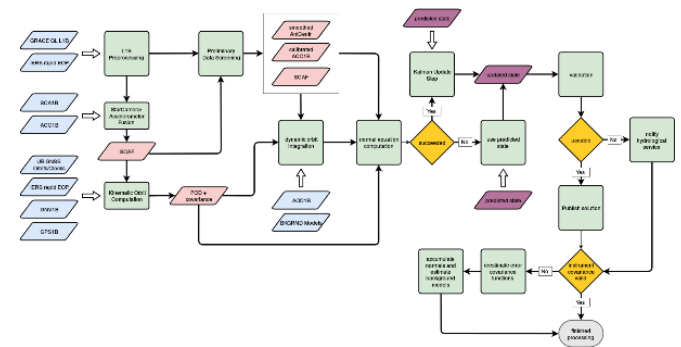
²GFZ - German Research Centre for Geosciences

Outline

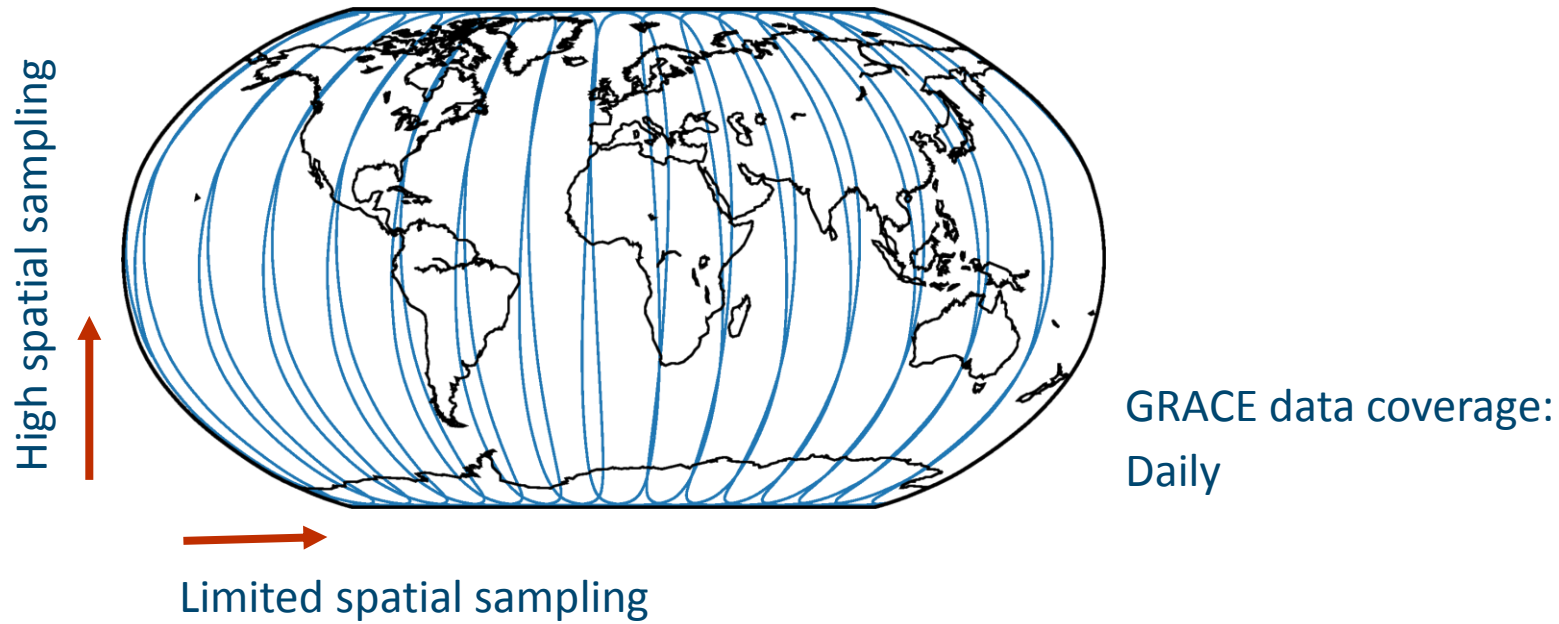
- EGSIEM near real-time gravity field service
- Daily gravity field processing strategy
- Post-processing results
- Conclusions and outlook

EGSIEM near real-time (NRT) service

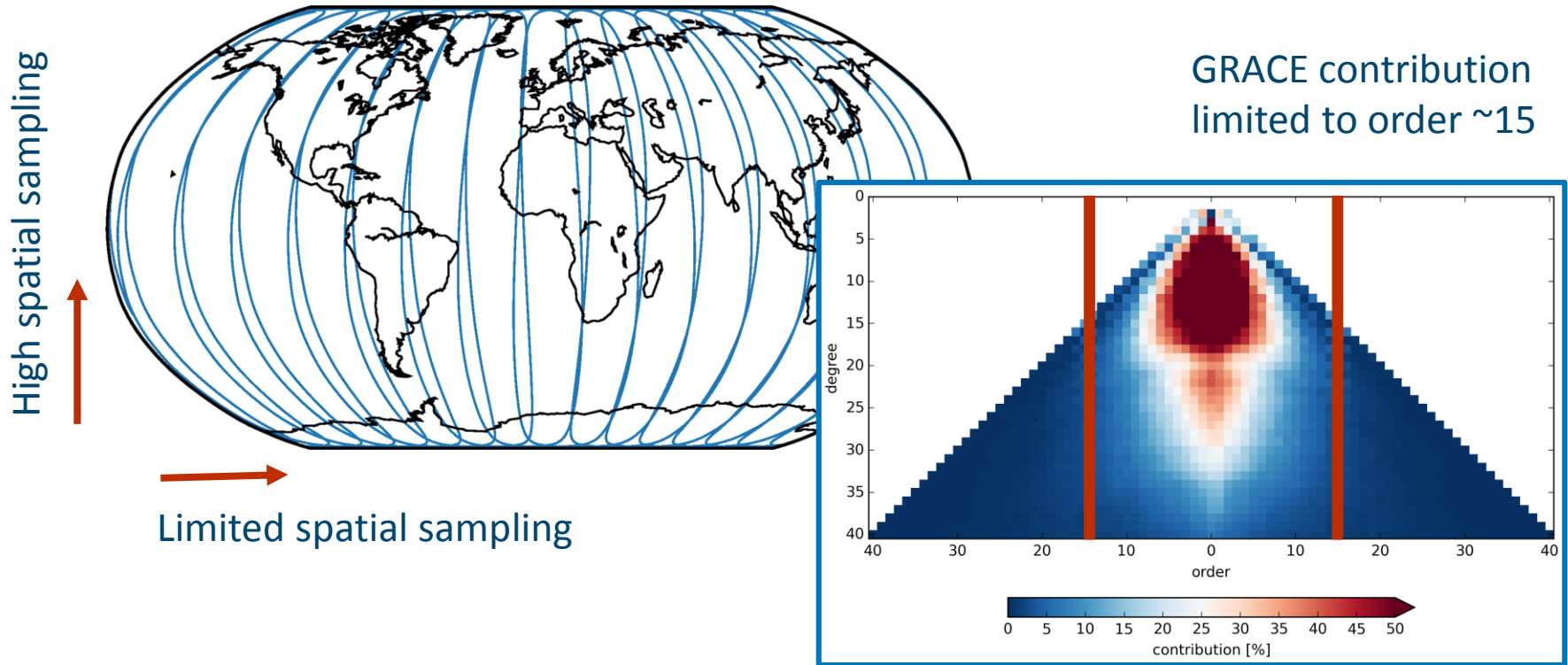
- As part of the EGSIEM project a tech demonstrator for near real-time gravity products will be established
- Operations will be run at GFZ and Graz University of Technology
 - Evaluation with GNSS loading at University of Luxembourg
- Scope: daily GRACE gravity field solutions with five day delay
- Two independently computed solutions
 - Global: spherical harmonic representation
 - Regional: radial basis functions



Processing strategy



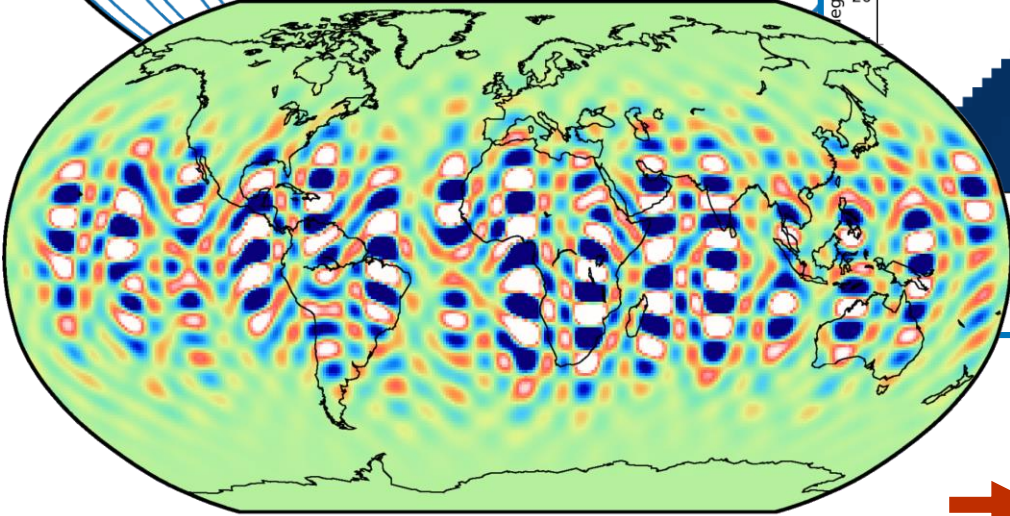
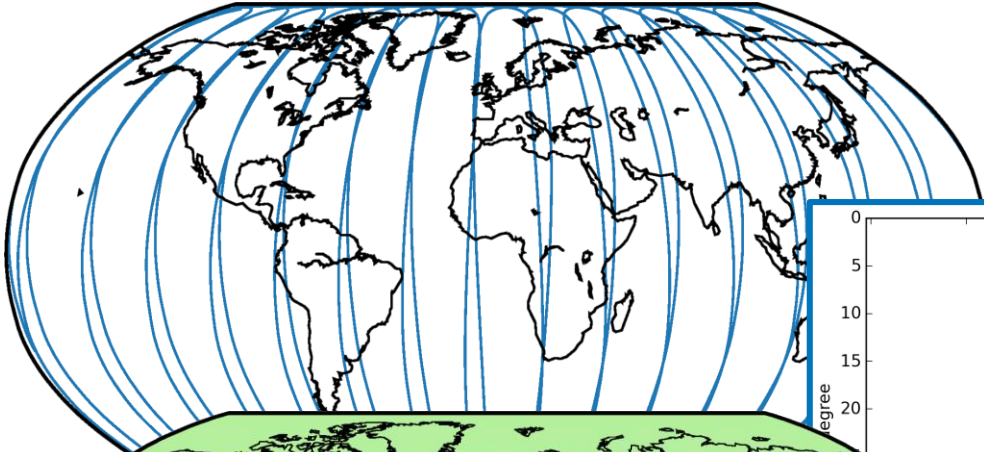
Processing strategy



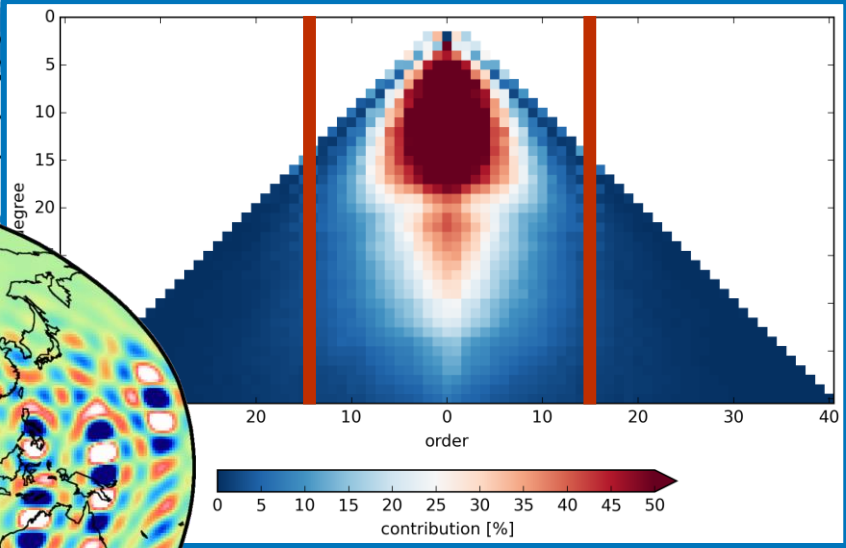
Kvas et al.: Near real-time GRACE gravity field solutions for hydrological monitoring applications

Processing strategy

High spatial sampling



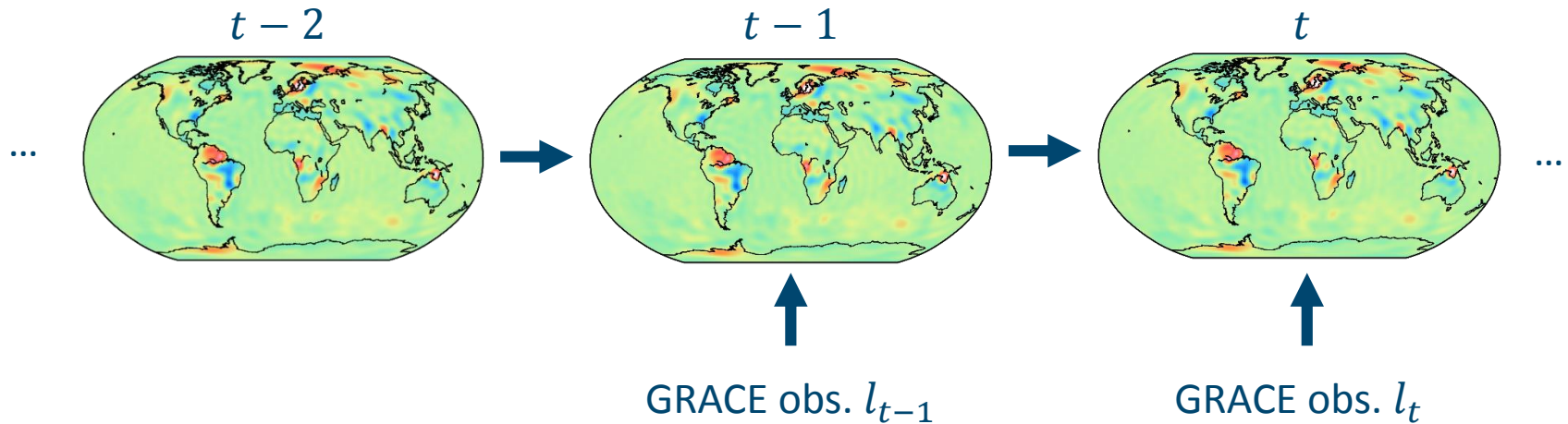
GRACE contribution limited to order ~15



GRACE alone cannot observe the full gravity field signal

Processing strategy

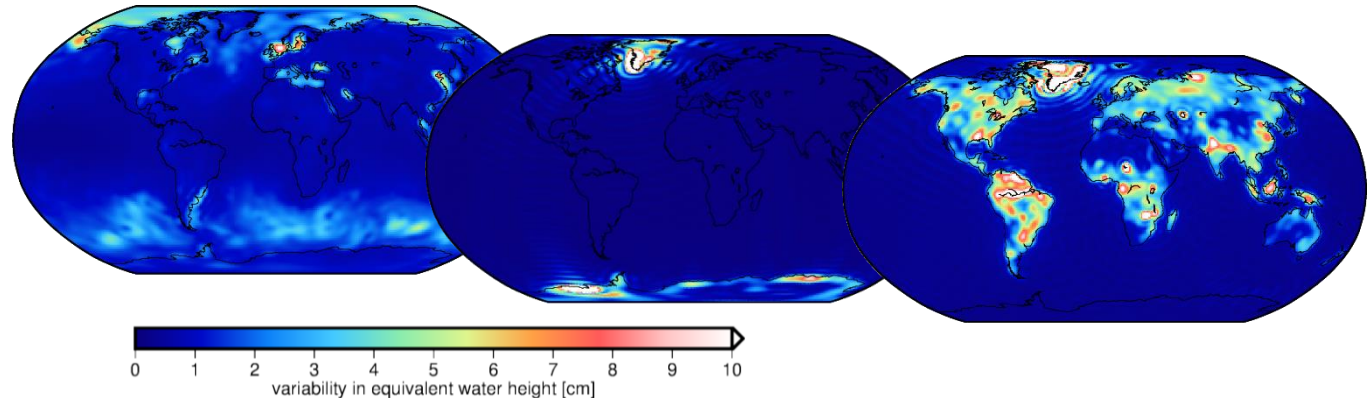
- Additional information is introduced in form of a **process model**
 - Prediction based on spatio-temporal correlations from geophysical models
 - Solution is weighted mean between GRACE observations and prediction



GRACE Kalman Filter
(Kurtenbach et al. 2012)

Post processing results – ITSG-Grace2016

- GRACE time series (2002 to 2016) processed and continually updated
 - 5053 daily solutions (4258 days with GRACE contribution)
- Process model derived from WGHM (hydrosphere) and ESA ESM (cryosphere, residual atmosphere/ocean)



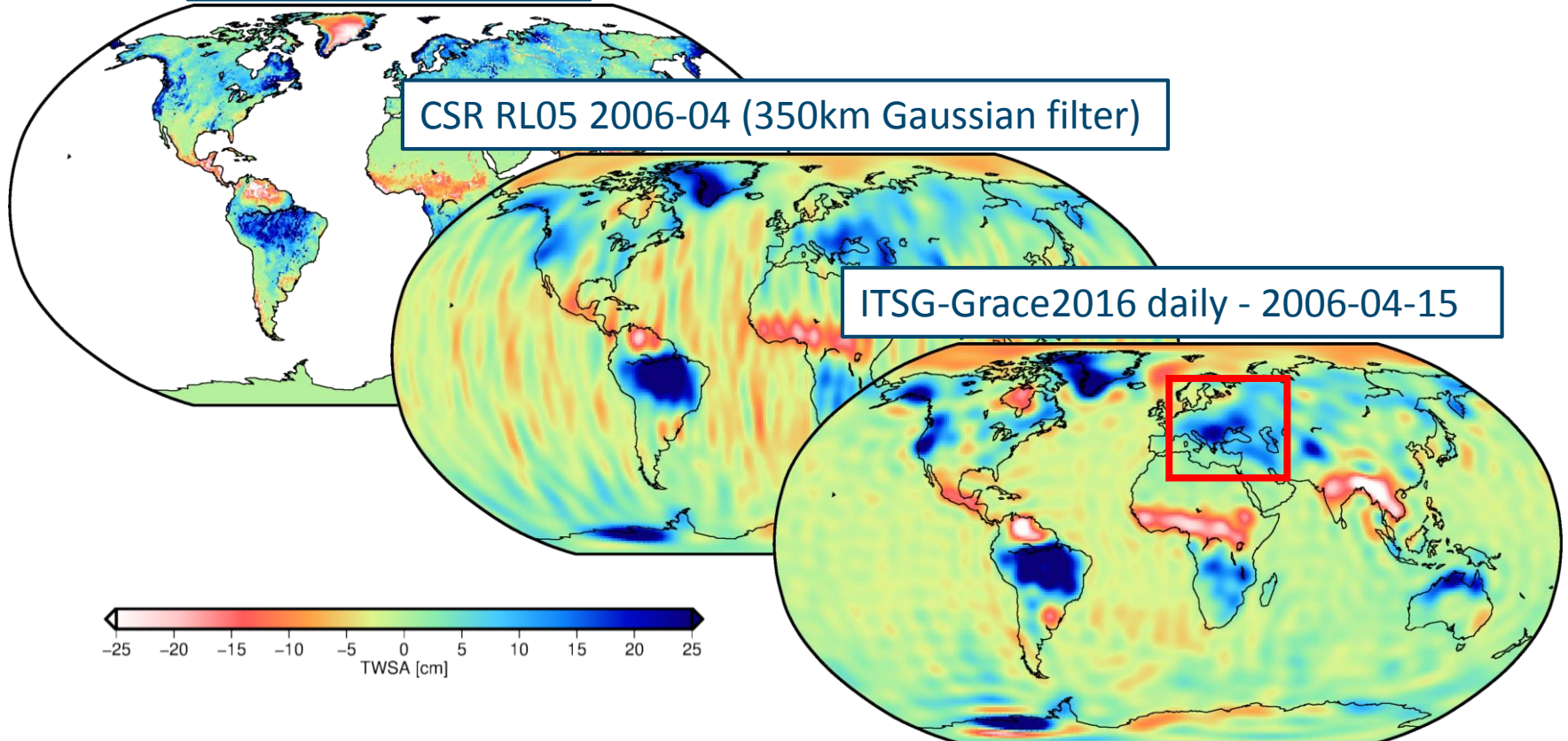
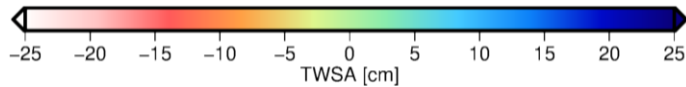
- GRACE processing details: Klinger et al. - Towards a new ITSG-Grace release: improvements within the processing chain, Session G4.2 - Wednesday, 9am

Post processing results – ITSG-Grace2016

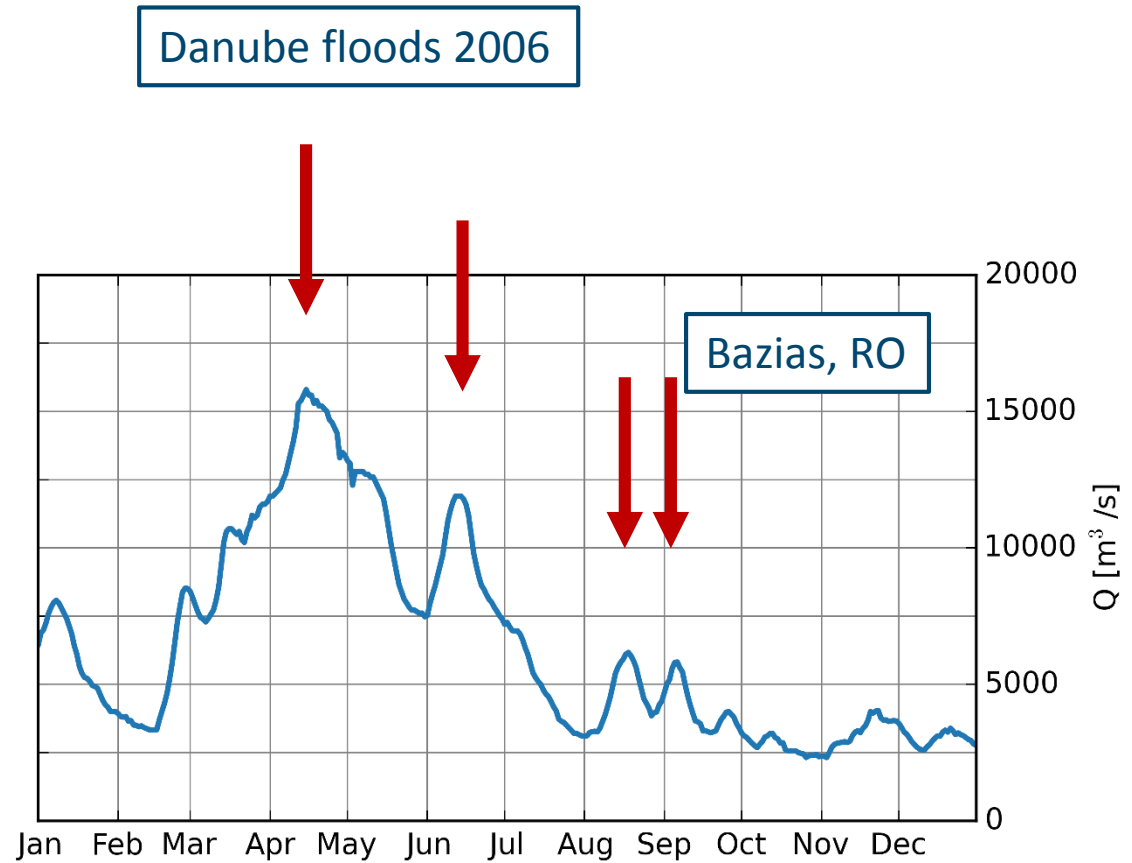
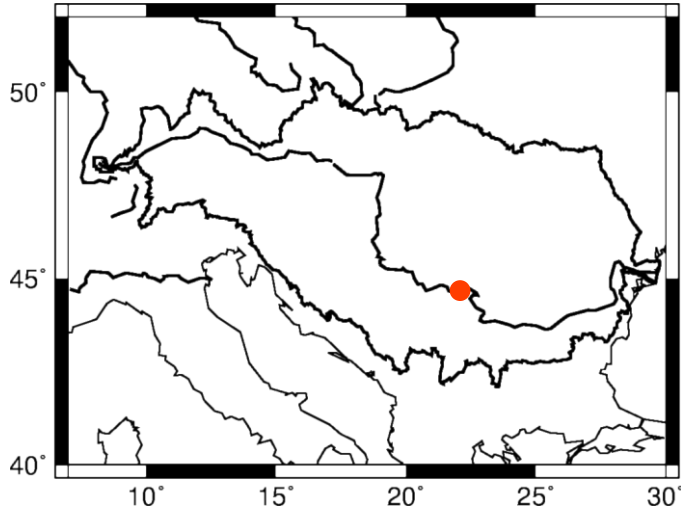
WGHM - 2006-04-15

CSR RL05 2006-04 (350km Gaussian filter)

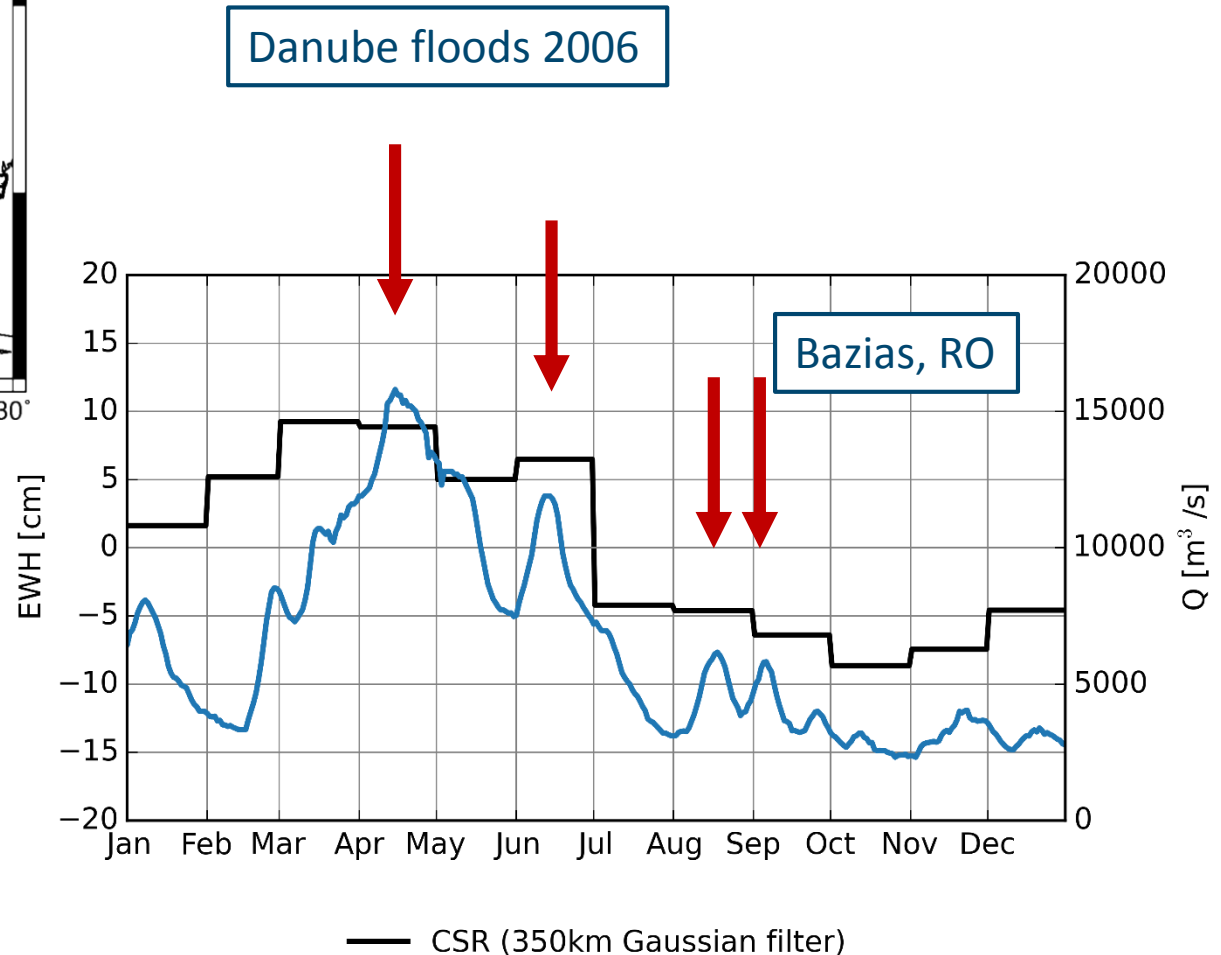
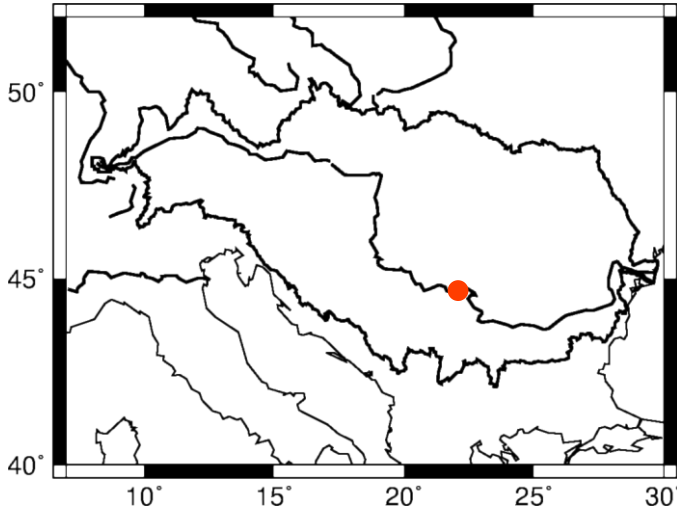
ITSG-Grace2016 daily - 2006-04-15



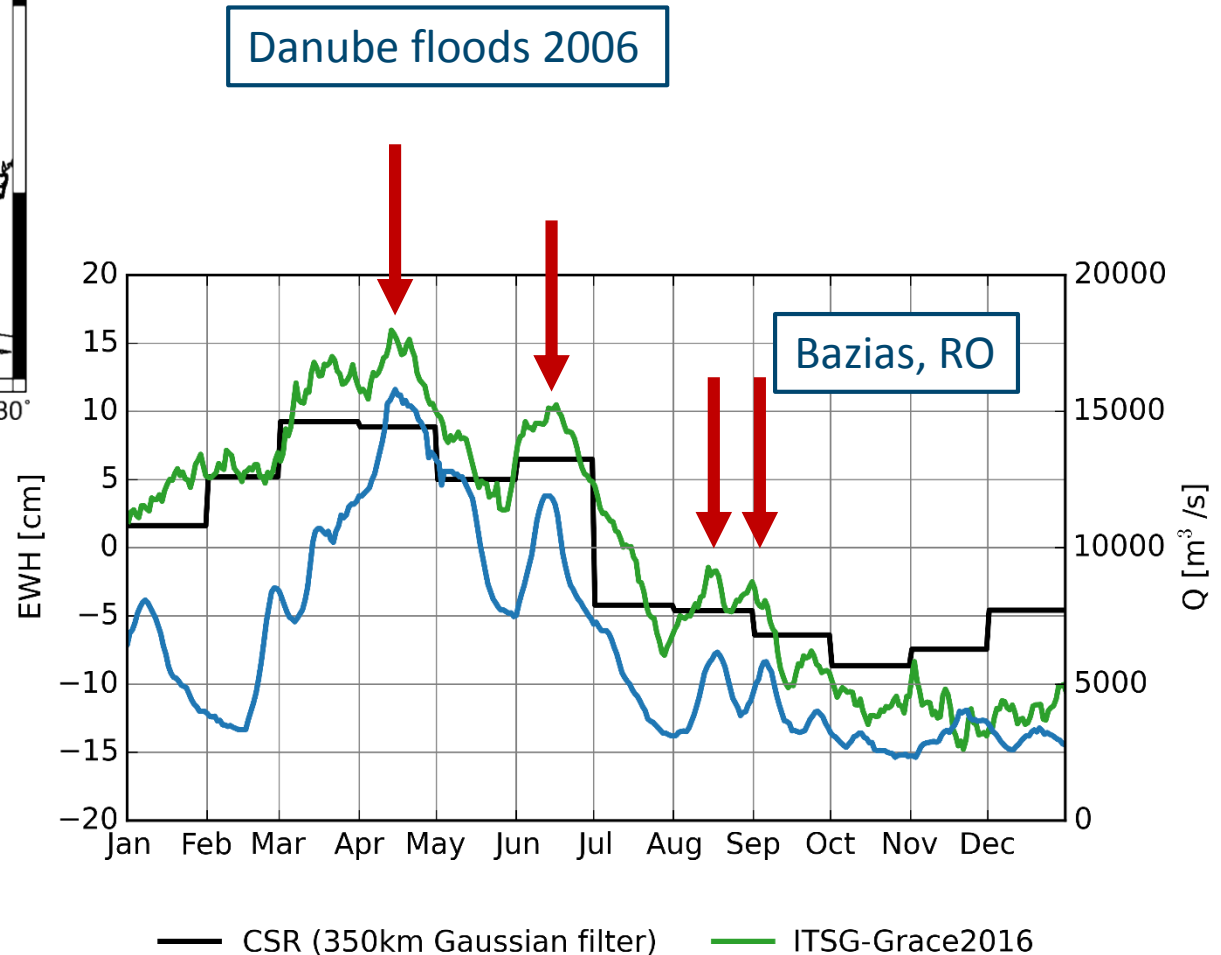
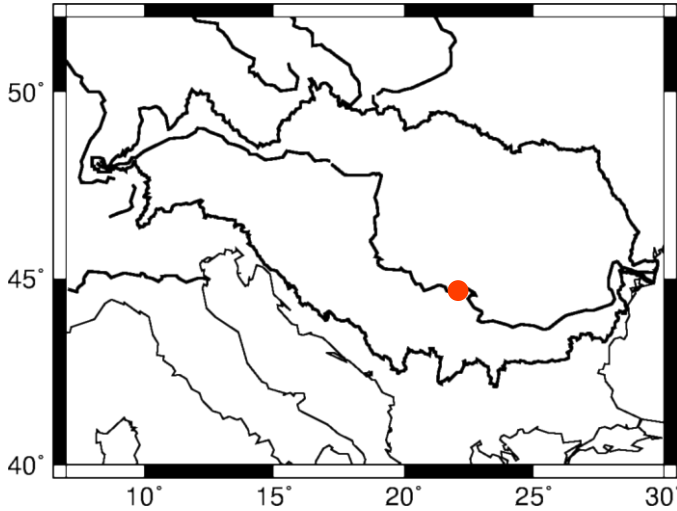
Post processing results – ITSG-Grace2016



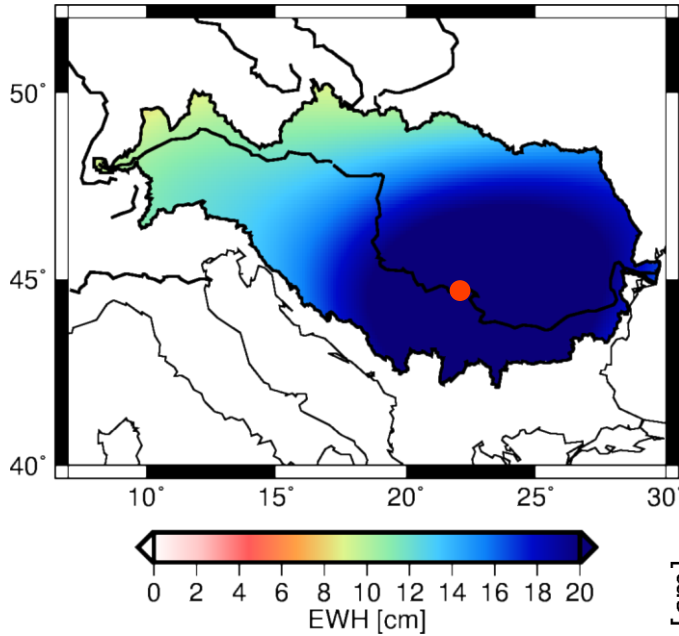
Post processing results – ITSG-Grace2016



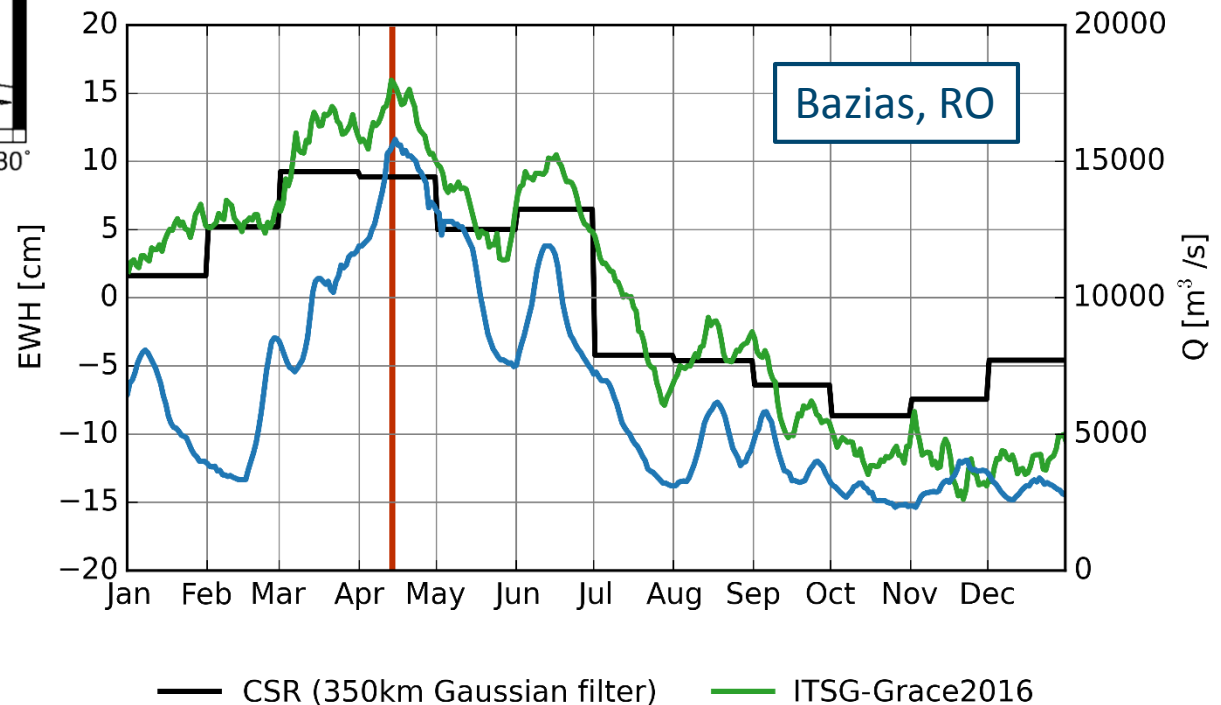
Post processing results – ITSG-Grace2016



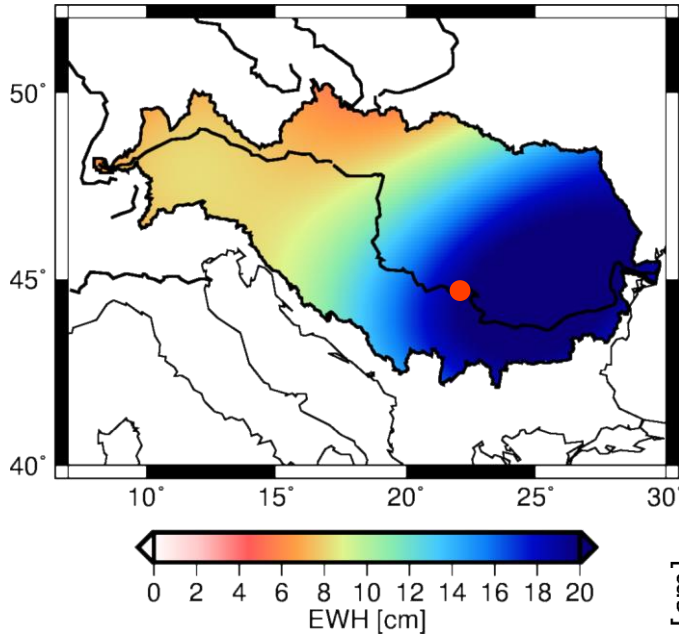
Post processing results – ITSG-Grace2016



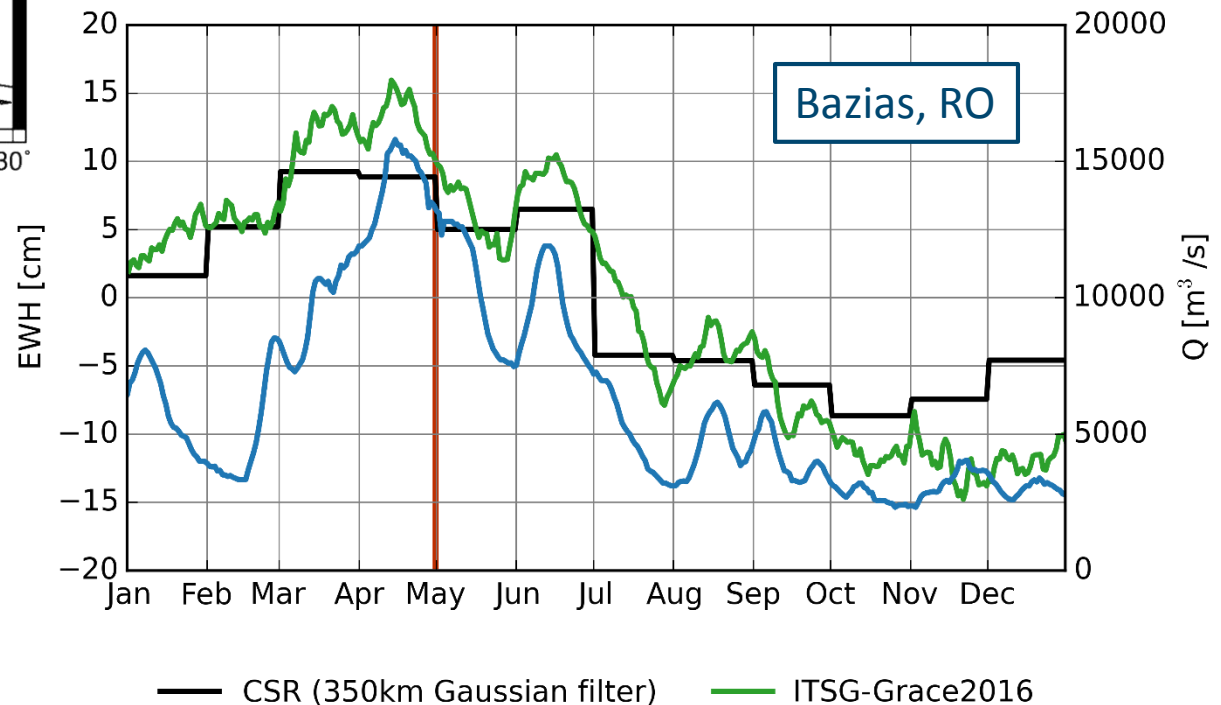
Danube floods 2006



Post processing results – ITSG-Grace2016

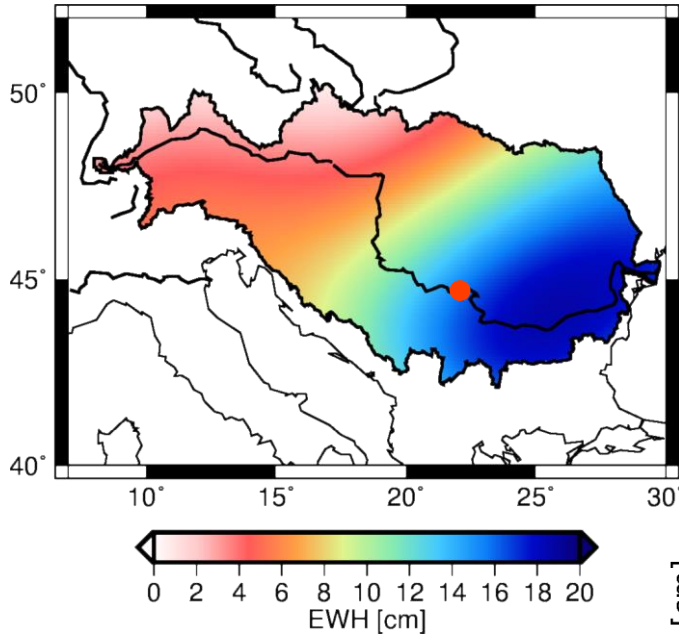


Danube floods 2006

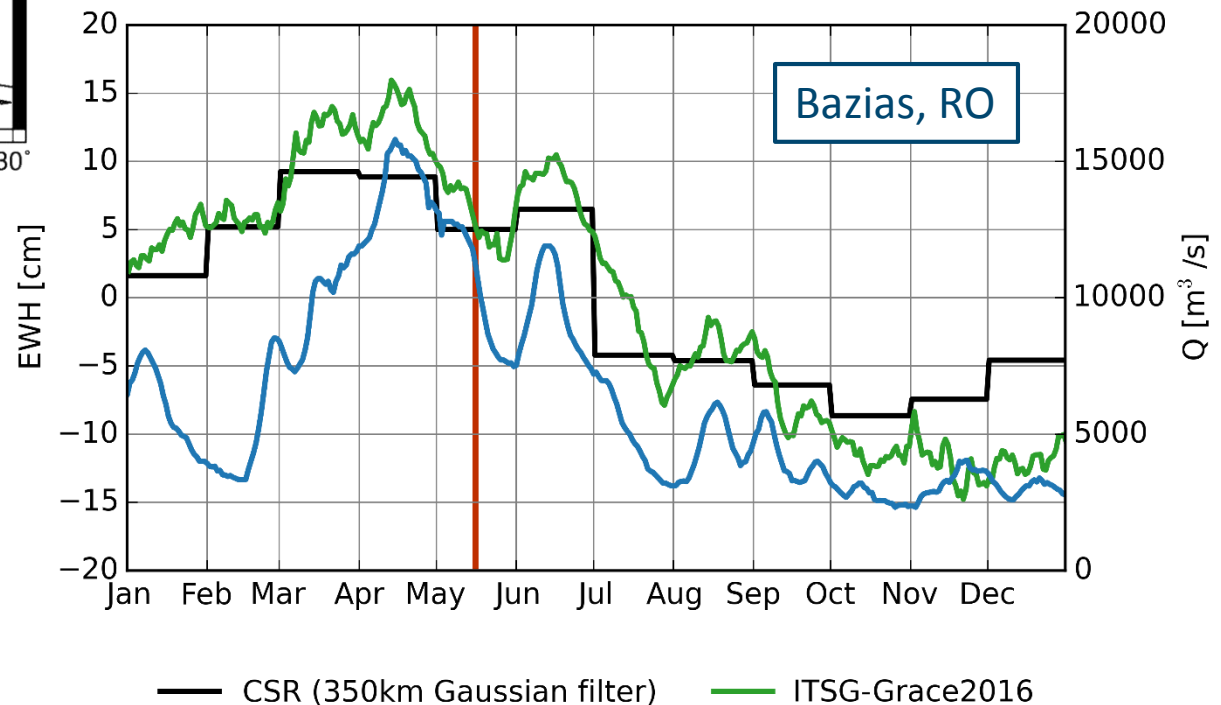


Bazias, RO

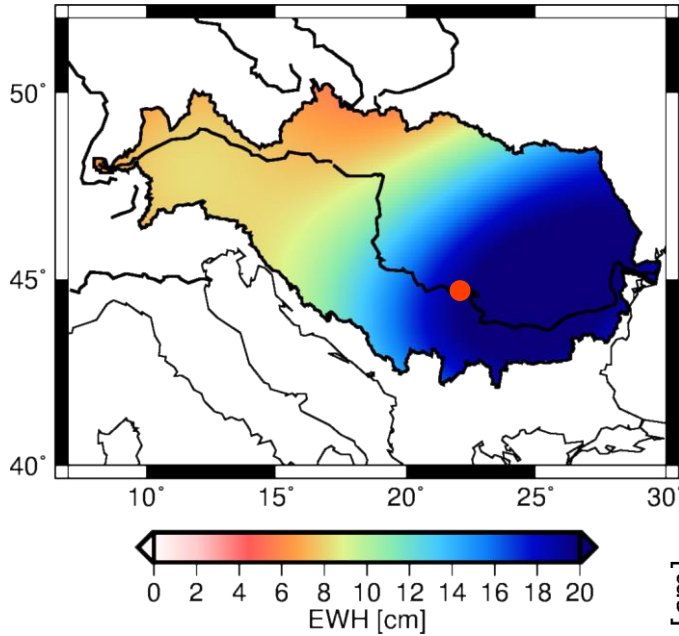
Post processing results – ITSG-Grace2016



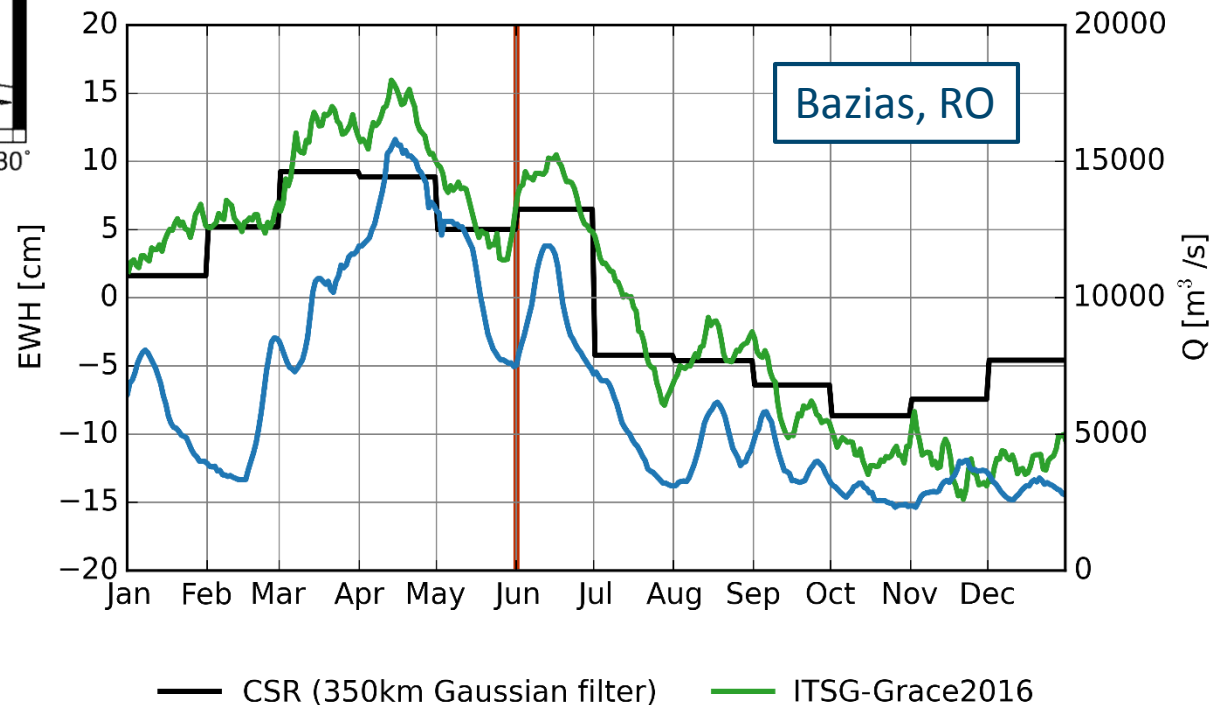
Danube floods 2006



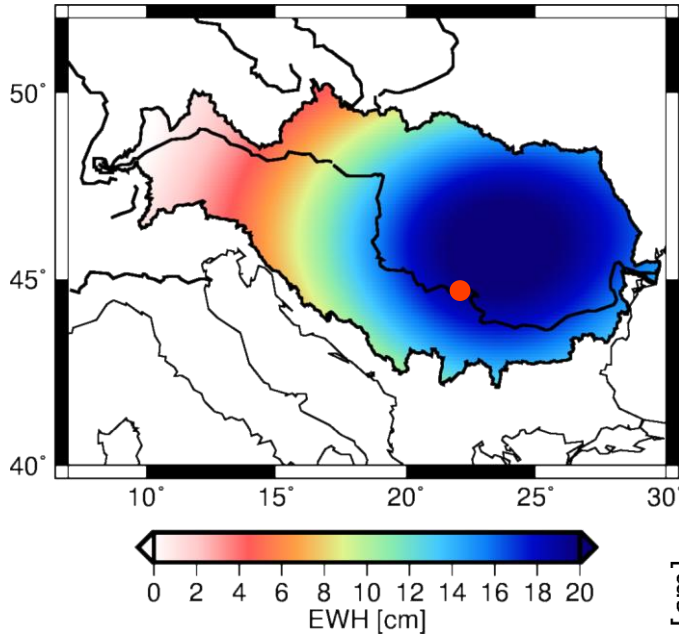
Post processing results – ITSG-Grace2016



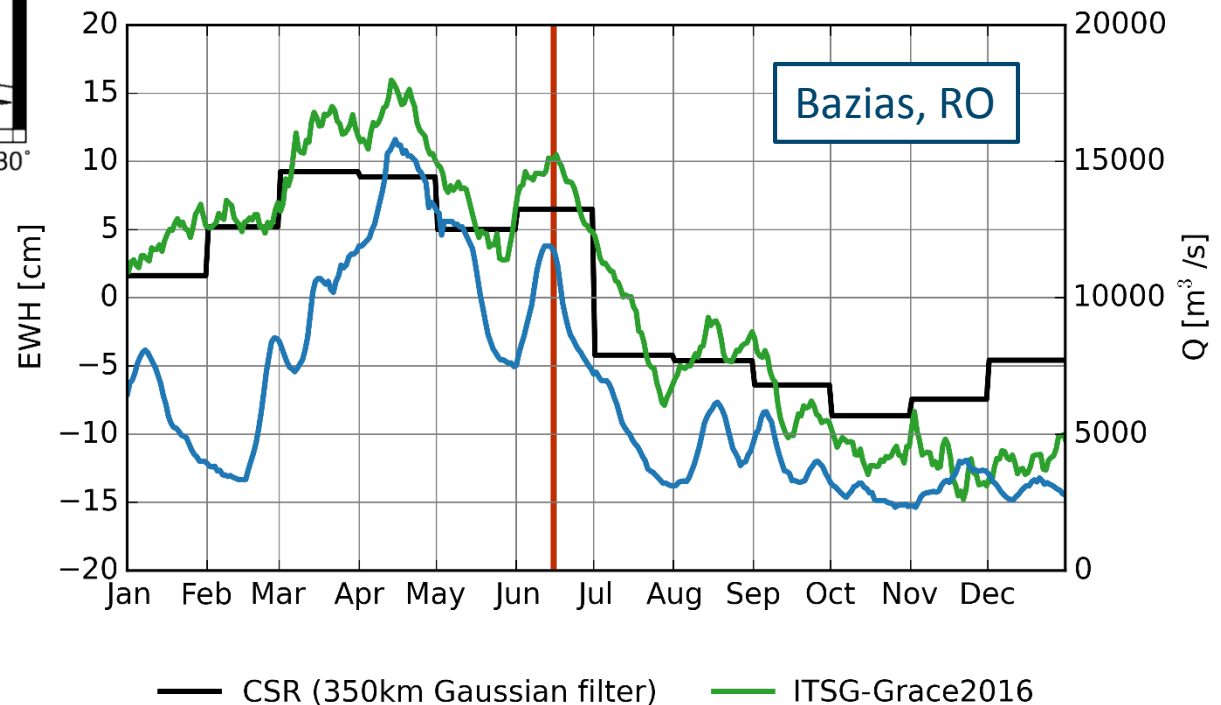
Danube floods 2006



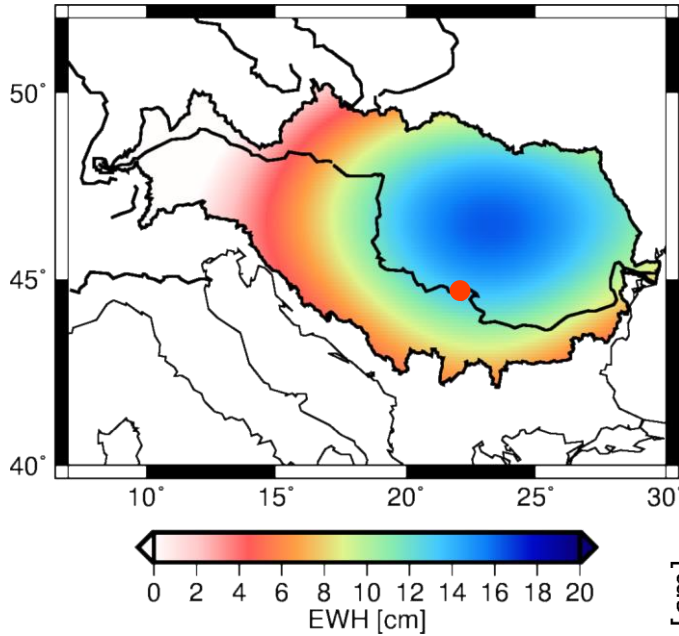
Post processing results – ITSG-Grace2016



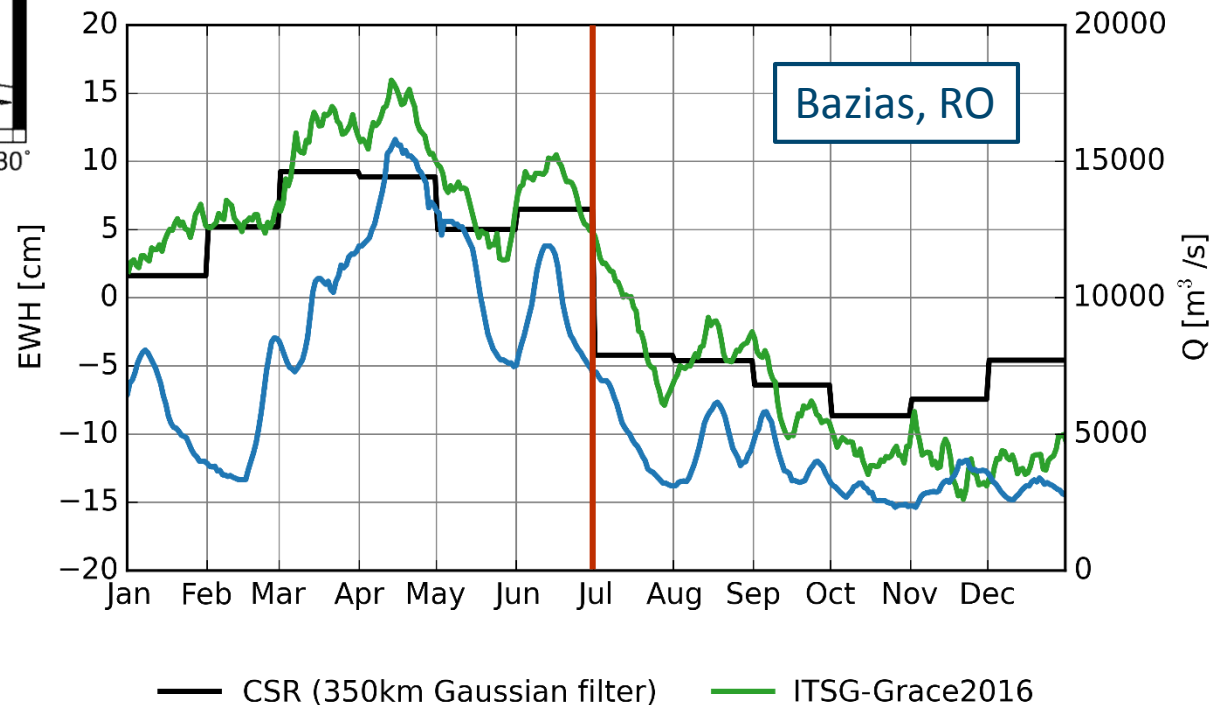
Danube floods 2006



Post processing results – ITSG-Grace2016

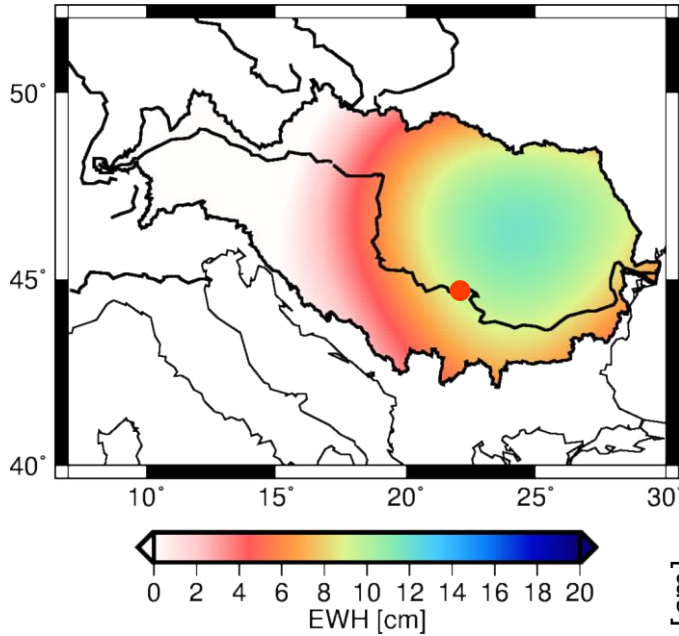


Danube floods 2006

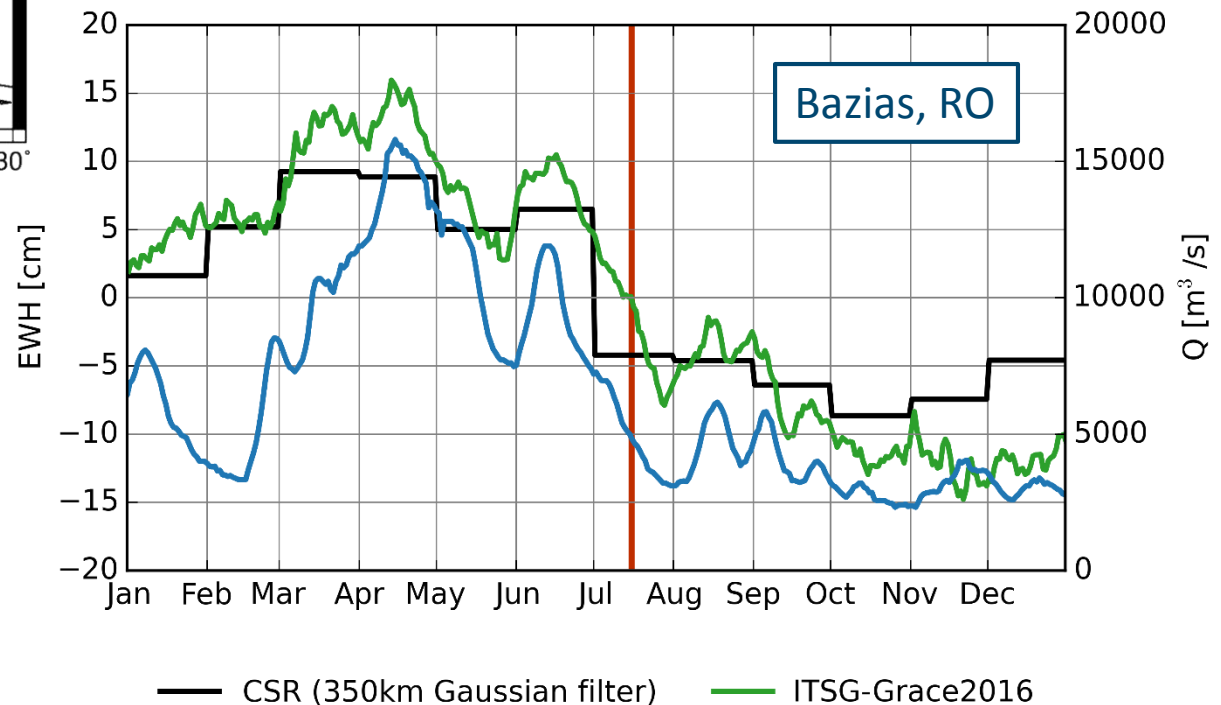


Bazias, RO

Post processing results – ITSG-Grace2016



Danube floods 2006

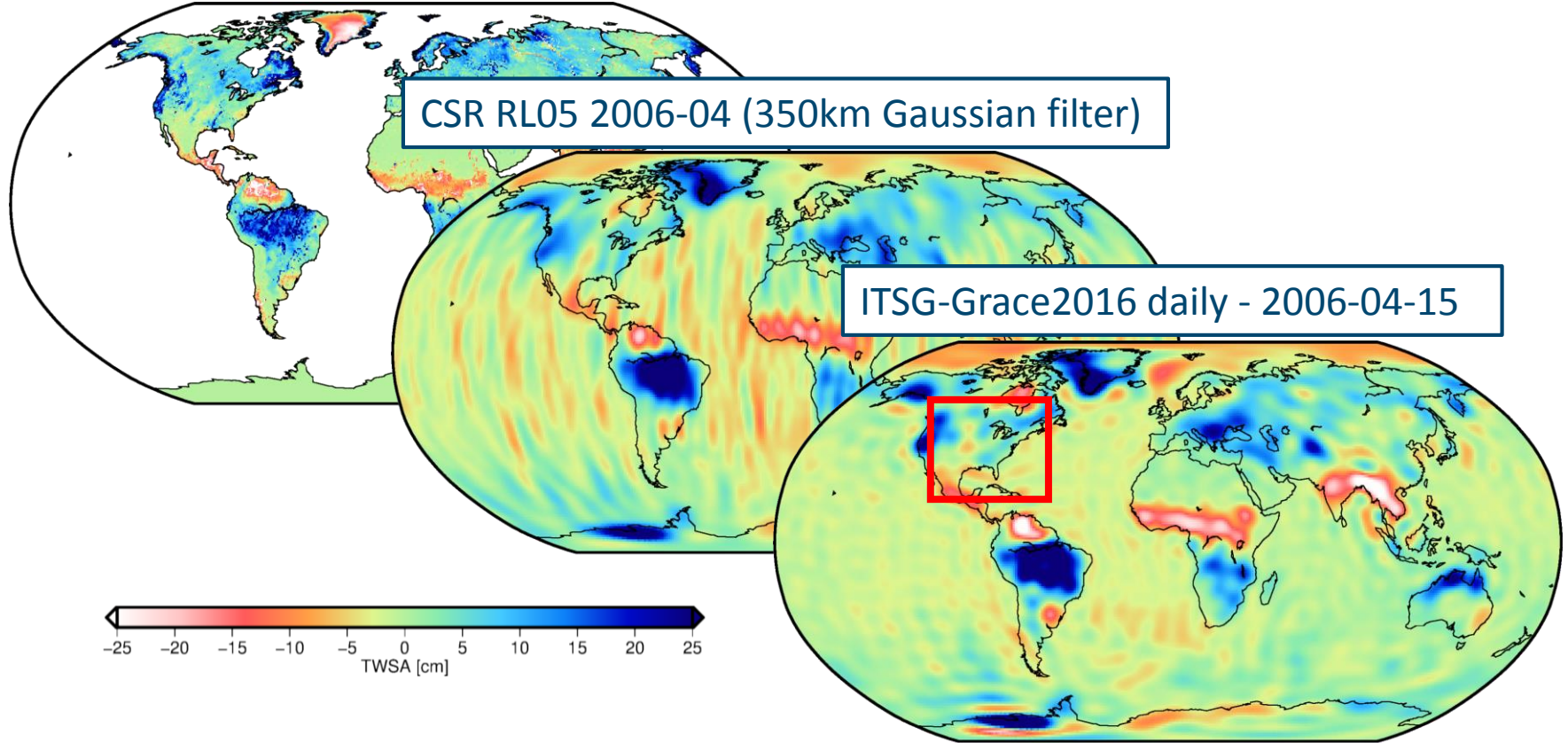
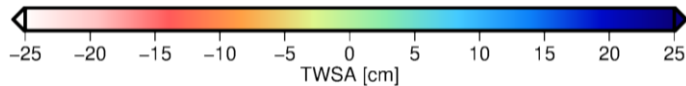


Post processing results – ITSG-Grace2016

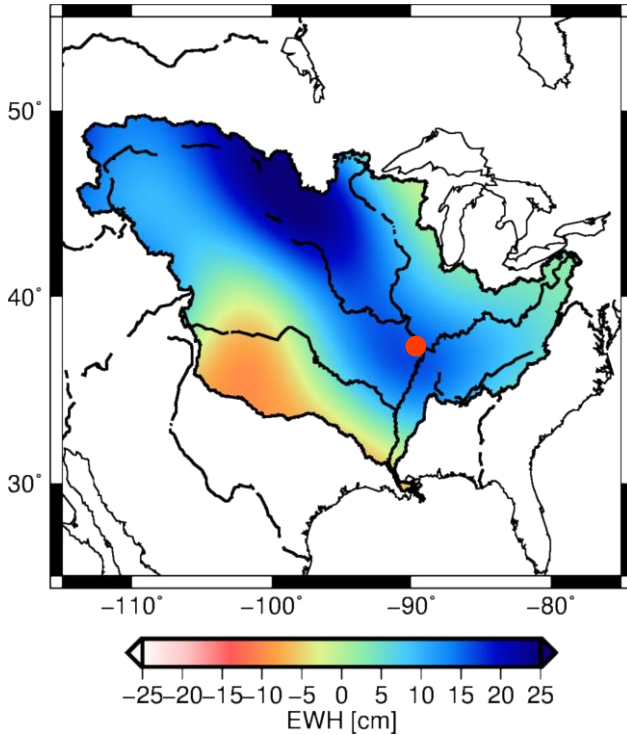
WGHM - 2006-04-15

CSR RL05 2006-04 (350km Gaussian filter)

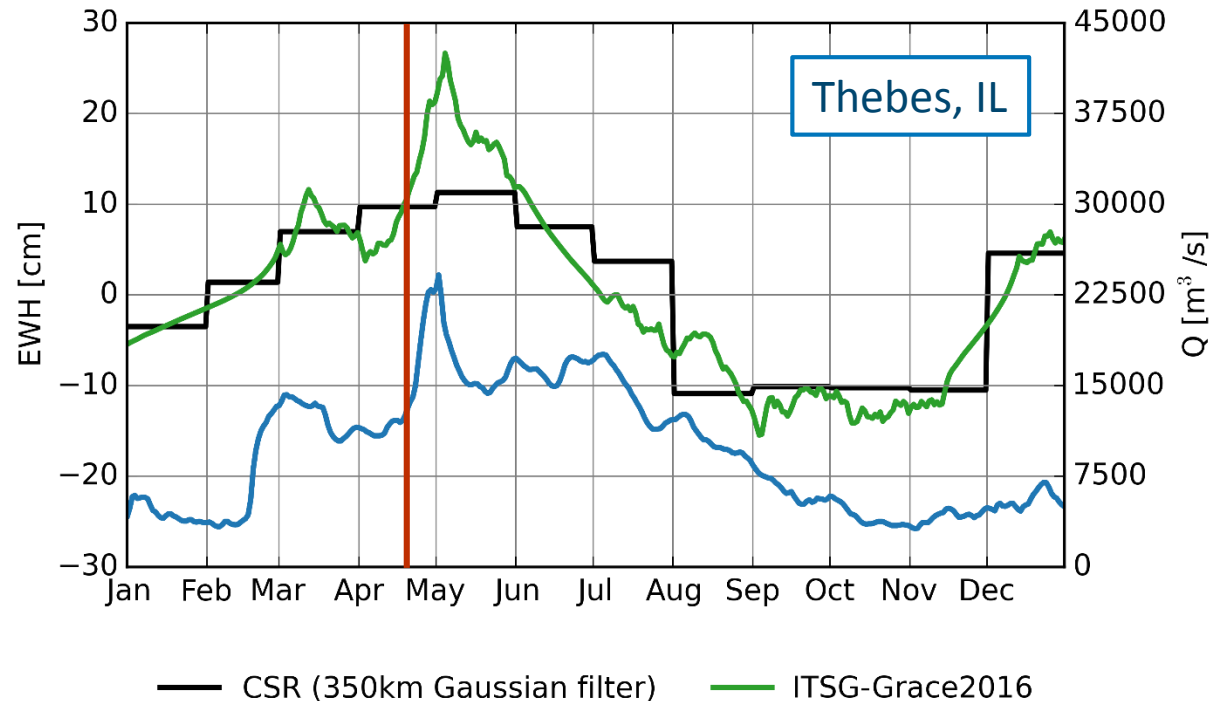
ITSG-Grace2016 daily - 2006-04-15



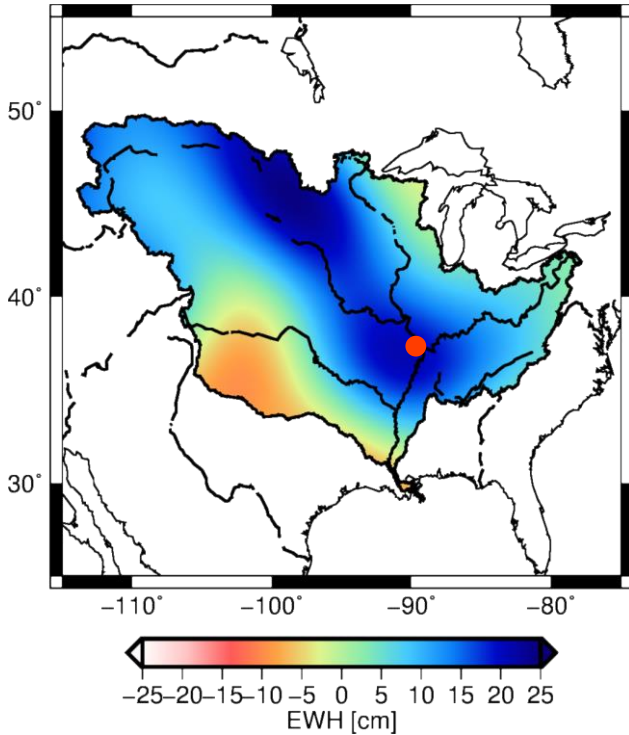
Post processing results – ITSG-Grace2016



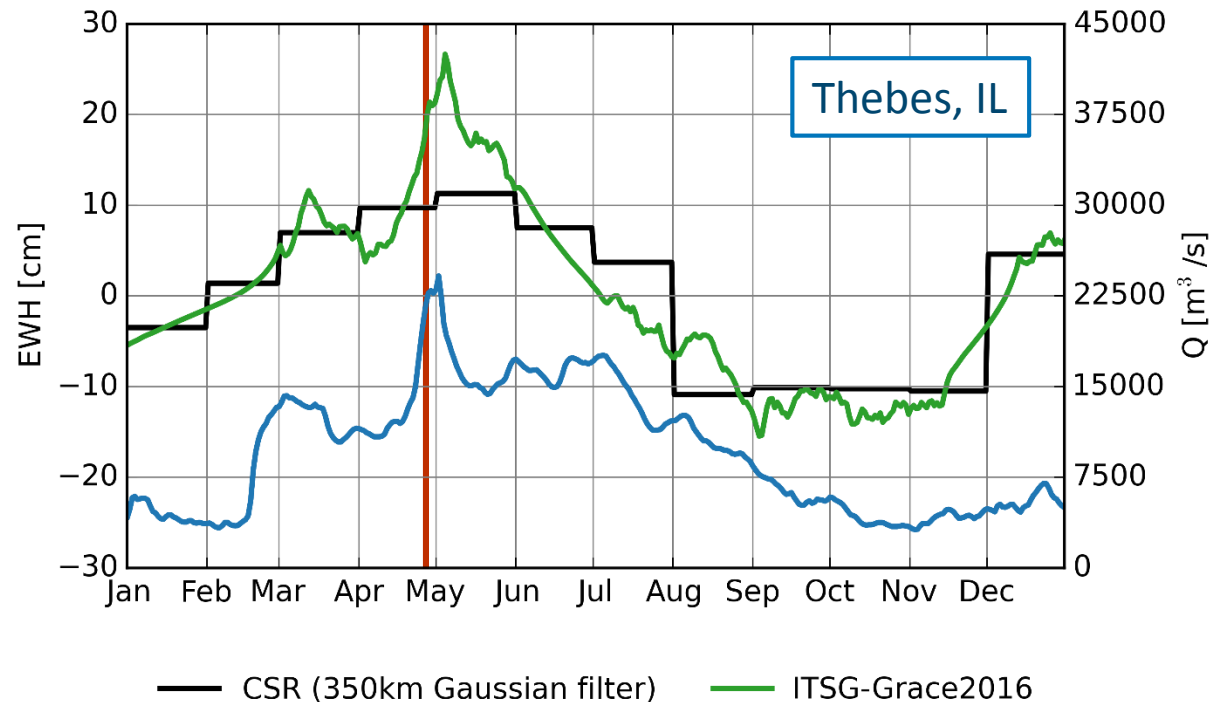
Great Mississippi Flood of 2011



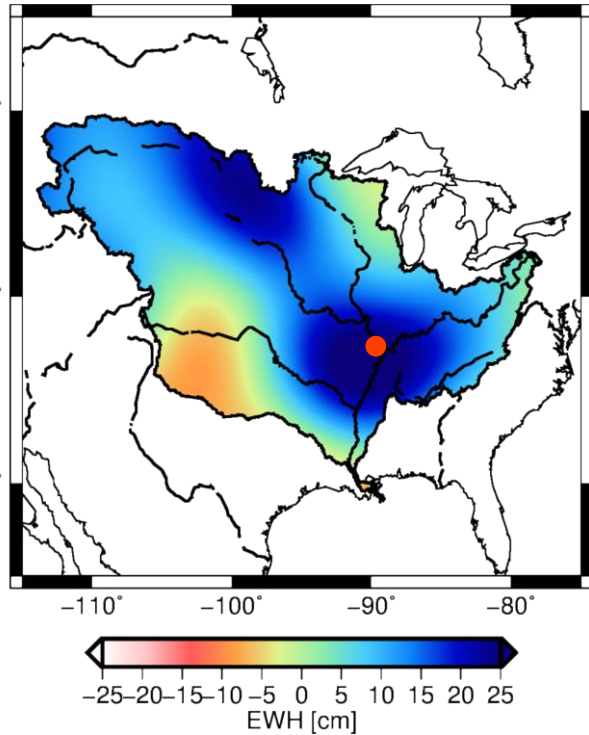
Post processing results – ITSG-Grace2016



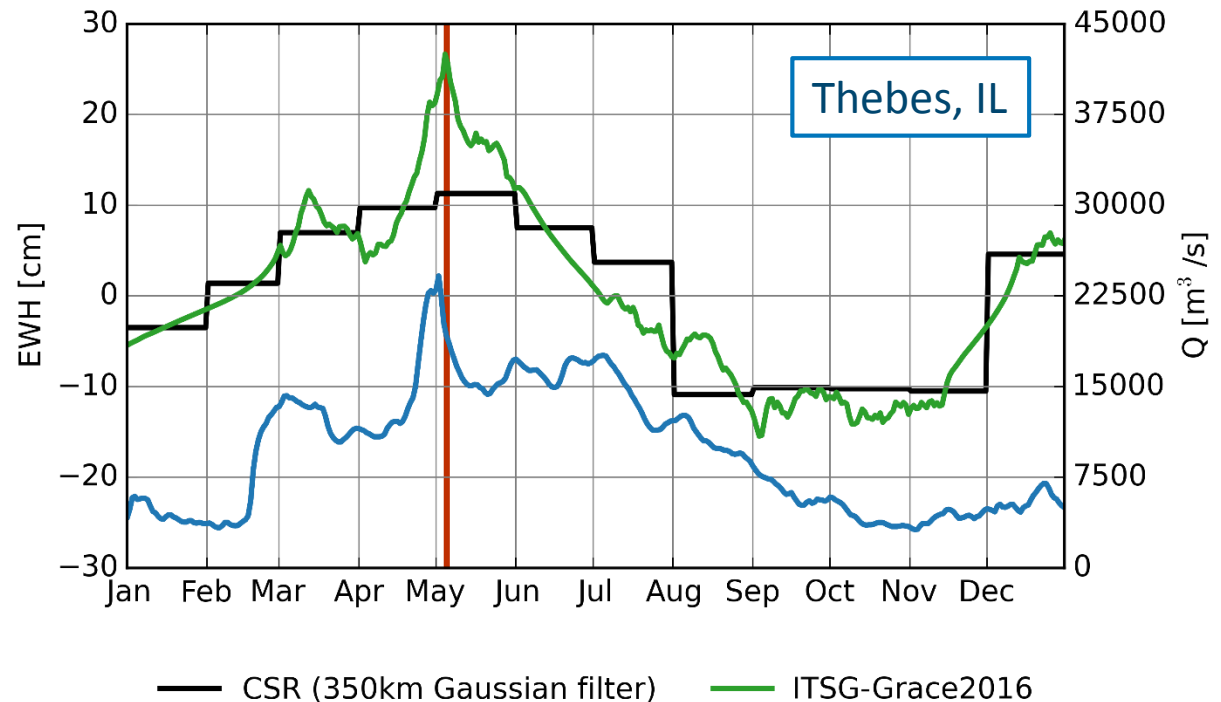
Great Mississippi Flood of 2011



Post processing results – ITSG-Grace2016



Great Mississippi Flood of 2011

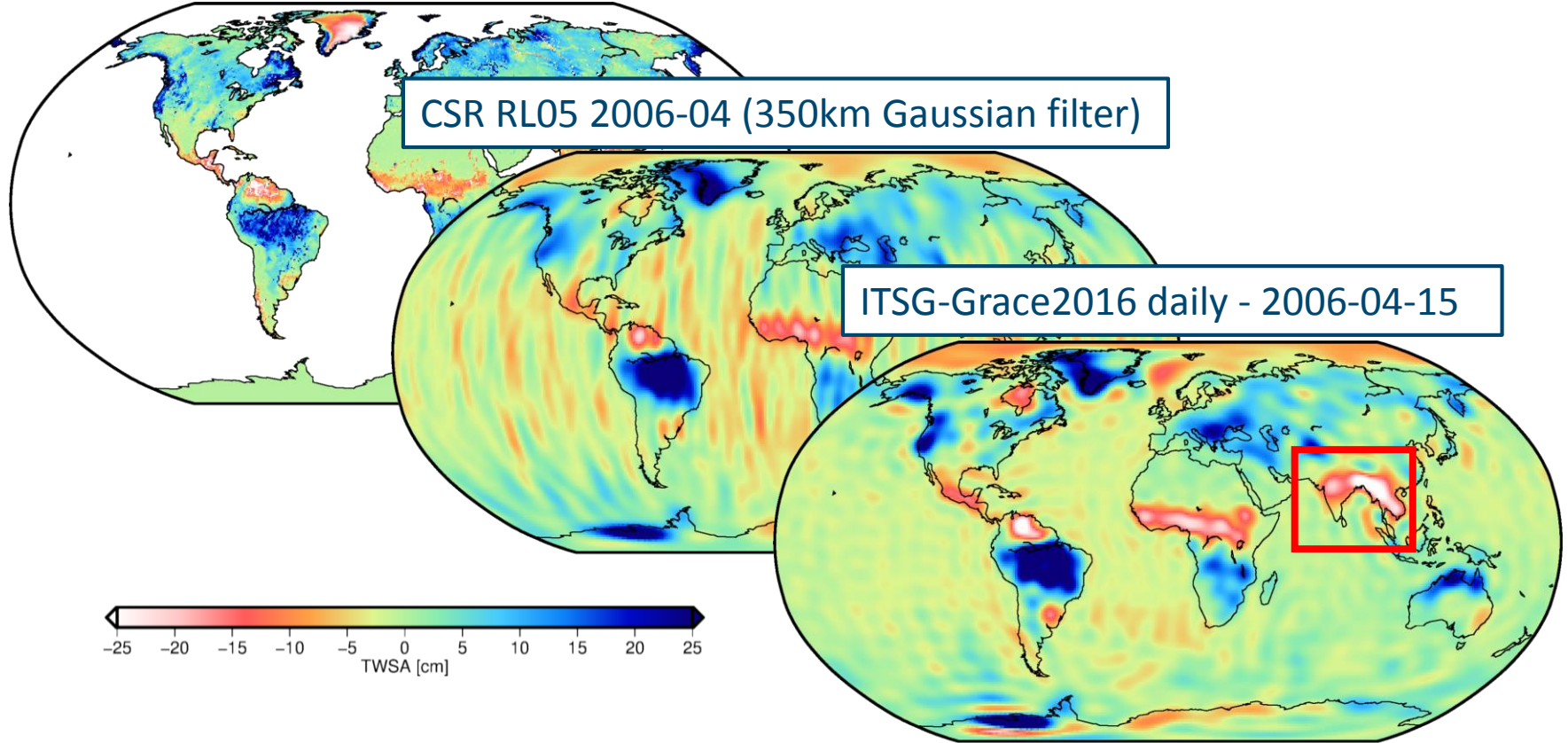
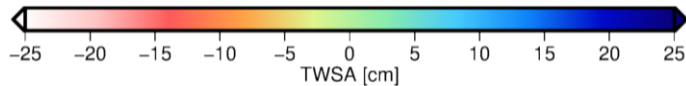


Post processing results – ITSG-Grace2016

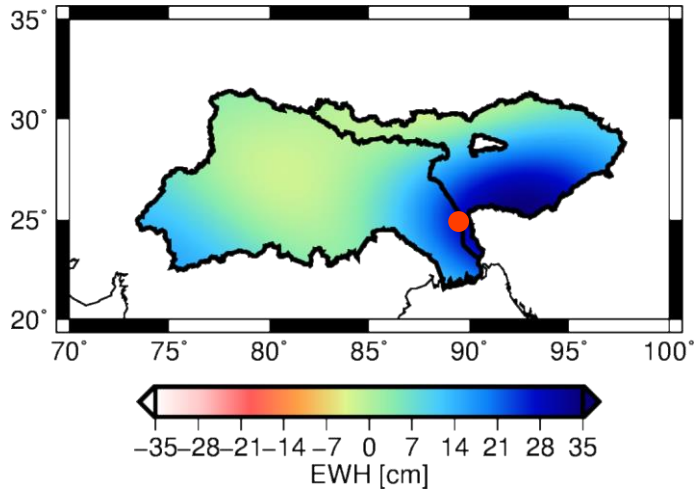
WGHM - 2006-04-15

CSR RL05 2006-04 (350km Gaussian filter)

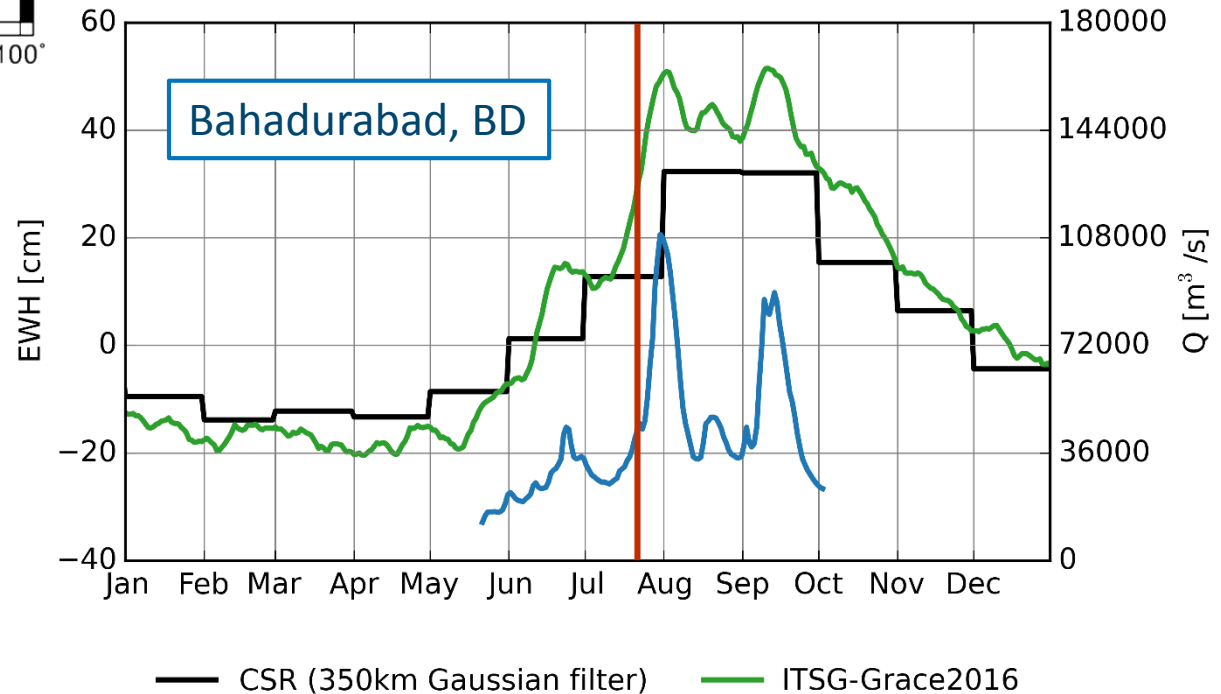
ITSG-Grace2016 daily - 2006-04-15



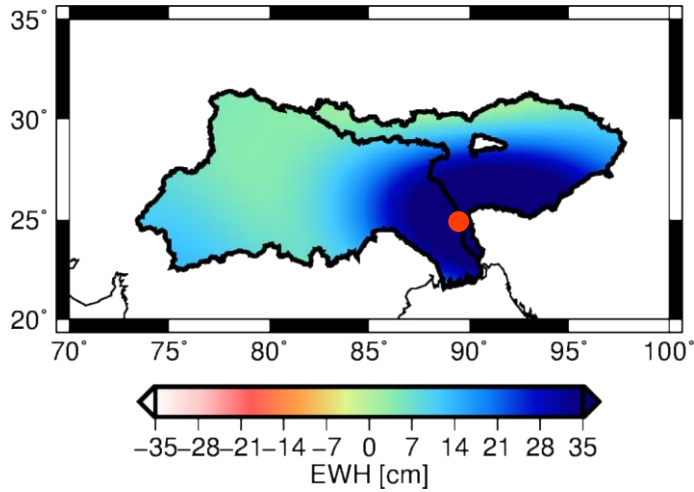
Post processing results – ITSG-Grace2016



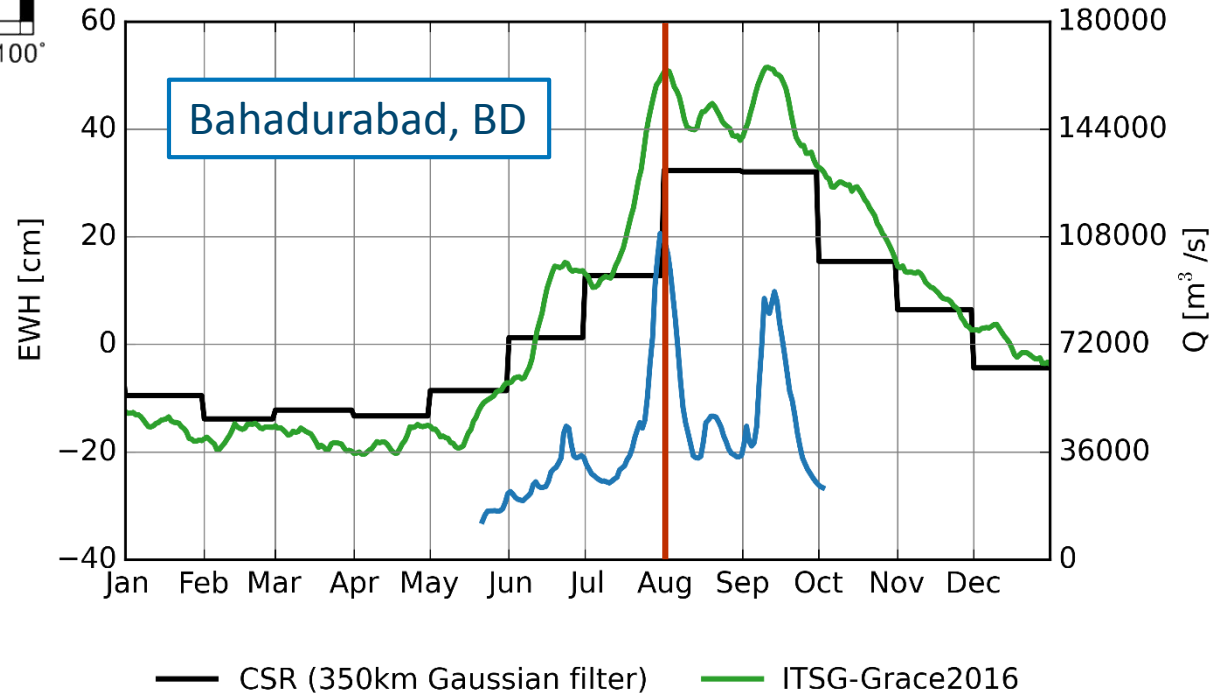
Ganges/Brahmaputra floods 2007



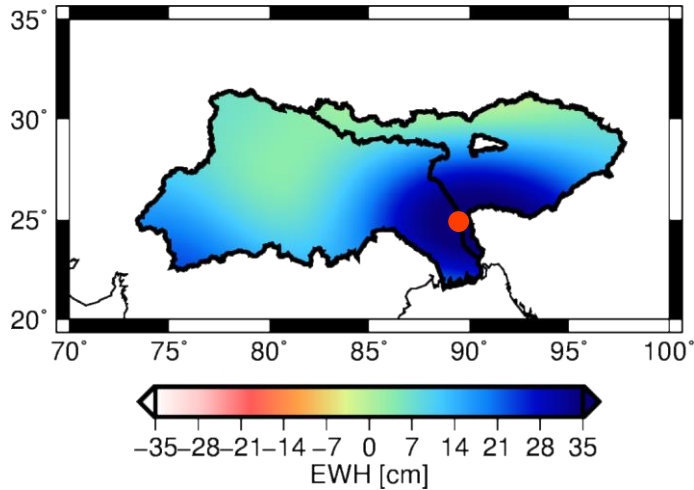
Post processing results – ITSG-Grace2016



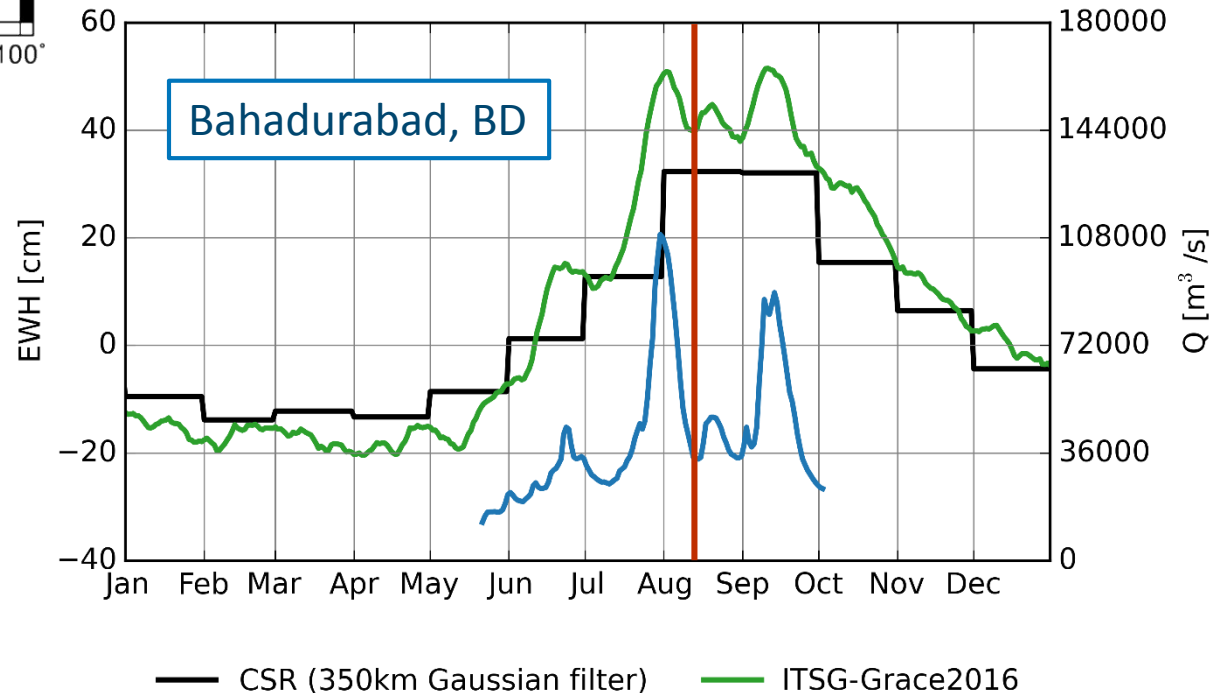
Ganges/Brahmaputra floods 2007



Post processing results – ITSG-Grace2016



Ganges/Brahmaputra floods 2007



Conclusion and outlook

- GRACE can provide information for much shorter time spans than the standard monthly solutions
- Reduced latency will enable monitoring of floods and droughts as they occur
- EGSiem near real-time operational test run starts in 2017
 - Global and regional daily GRACE gravity fields with 5 days latency
 - Check out www.egsiem.eu for updates
- ITSG-Grace2016 solutions are available under ifg.tugraz.at/ITSG-Grace2016

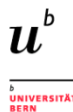
EGSIEM

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.

Discharge data provided by the Global Runoff Data Centre, 56068 Koblenz, Germany



Leibniz
Universität
Hannover



Horizon2020