EGSIEM

European Gravity Service for Improved Emergency Management

Title: WP6 (Hydrological Service)

Ben Gouweleeuw, Andreas Güntner (GFZ)

EGSIEM Progress Meeting

University of Bern

June 11-12.2015

HORIZON 2020

WP6: Hydrological Service

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Preparation of a flood data catalogue

- based on Dartmouth Flood Observatory (University of Colorado)
- more than 2100 flood events worldwide since 2003
- for 300 events the affected areas is > 200 000 km²
- qualitative flood information

	Register #	Country	Detailed Locations	Began	Ended	Duration (days)	Dead	Displaced	Main cause	Severity	Affected area (km²)	Magnitude	Centroid X (degree)	Centroid Y (degree)
2	4248	Kenya	Narok, SW Kenya	27.04.2015	02.05.2015	6	13	3000	Heavy Rain	1.5	20433	5.26	36.25	-0.80
3	4247	Australia	SE Queensland	01.05.2015	02.05.2015	2	5	0	Torrential Rain	2	192631	5.89	150.51	-25.94
4	4246	Brazil	st severely affected	01.04.2015	02.05.2015	32	0	1000	Heavy Rain	1.5	450354	7.33	-67.80	-6.98
5	4245	Pakistan	Peshawar	26.04.2015	28.04.2015	3	44	4800	Torrential Rain	1.5	21148	4.98	71.89	33.51
6	4244	Australia	nd near-coast areas	20.04.2015	28.04.2015	9	4	1000	Heavy Rain	2	175487	6.50	150.61	-33.38
7	4243	Haiti	nent, Port-au-Prince	04.04.2015	06.04.2015	3	6	1000	Heavy Rain	1	3672	4.04	-72.19	18.69
8	4242	Kazahkstan	Karaganda Oblas	23.03.2015	15.04.2015	24	0	5600	Snowmelt	1	213897	6.71	65.59	48.40
9	4241	Madagascar	apital, Antananarivo	05.03.2015	15.04.2015	42	0	25000	Heavy Rain	1.5	68755	6.64	47.01	-18.16
10	4240	China	f Hunan and Jiangxi	04.04.2015	15.04.2015	12	0	12000	Tropical Storm Maysak	1.5	145835	6.42	110.68	27.93
11	4239	India	Jammu and Kashmi	20.03.2015	31.03.2015	12	44	2907	Heavy Rain	1.5	70288	6.10	76.41	33.18
12	4238	Chile	bo in northern Chile	25.03.2015	08.04.2015	15	27	2514	Heavy Rain	2	154773	6.67	-68.89	-22.36
13	4237	Brazil	n Brazil, Rio Branco	23.02.2015	15.04.2015	52	0	10000	Heavy Rain	1	173697	6.96	-68.91	-9.12
14	4236	Kenya	r Gongo and Kotien	05.04.2015	15.04.2015	11	13	6500	Heavy Rain	1.5	32935	5.74	35.11	0.05
15	4235	Brazil	r, Amazonas State	15.03.2015	23.03.2015	9	0	280	Heavy Rain	1.5	168905	6.36	-67.73	-7.69

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- expand by data on event rainfall, runoff volumes, GRACE-based storage anomalies

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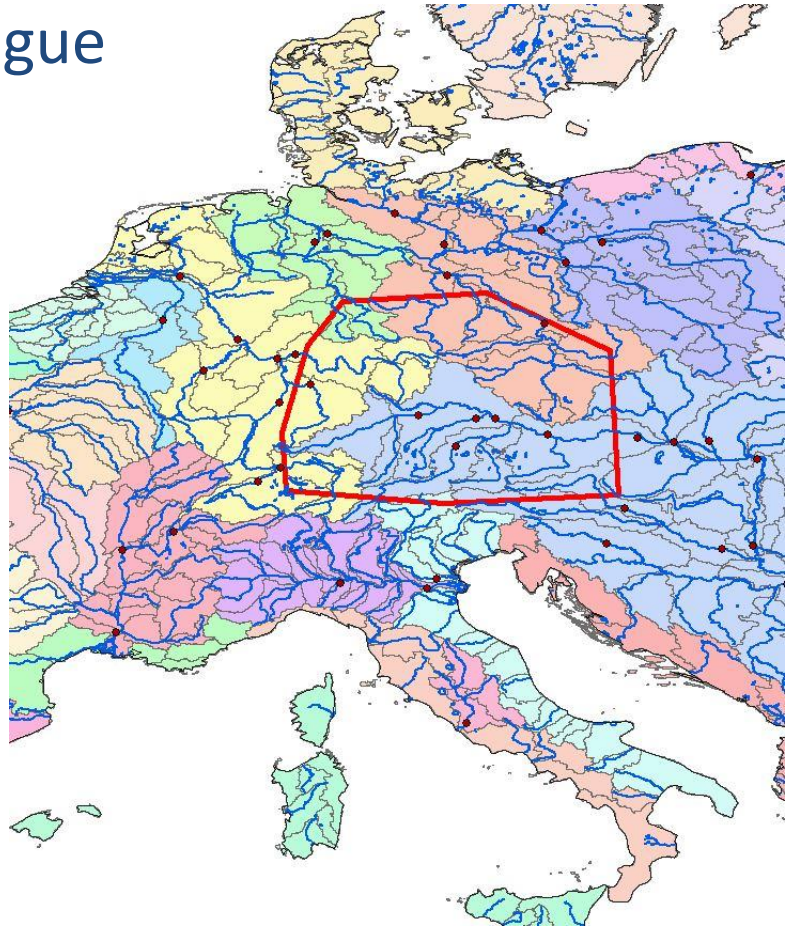
Preparation of a flood data catalogue

- based on Dartmouth Flood Observatory
- expand by data on event rainfall, runoff volumes, GRACE-based storage anomalies
- PostGIS spatial database (extended PostgreSQL)



Example:
Dartmouth extent of flood event June 2013
GRDC river discharge gauging station

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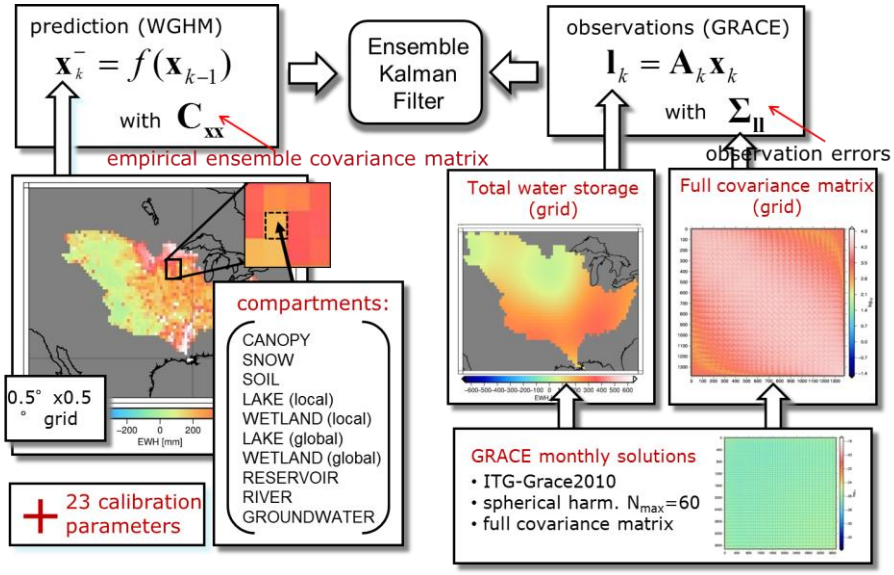
New GRACE water storage products: Evaluation in calibration and data assimilation schemes of hydrological models

- Action Item 004 realized: Definition of co-operation with U Bonn (J. Kusche) for data assimilation of daily GRACE data into WGHM
- Extension of existent monthly assimilation scheme
- realization: first months of 2016



Eicker et al. (2014), Surv. Geophys.

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- Action Item 004 realized: Definition of co-operation with U Bonn (J. Kusche) for data assimilation of daily GRACE data into WGHM
- Extension of existent monthly assimilation scheme
- realization: first months of 2016
- selected test area: Ganges/Brahmaputra basin

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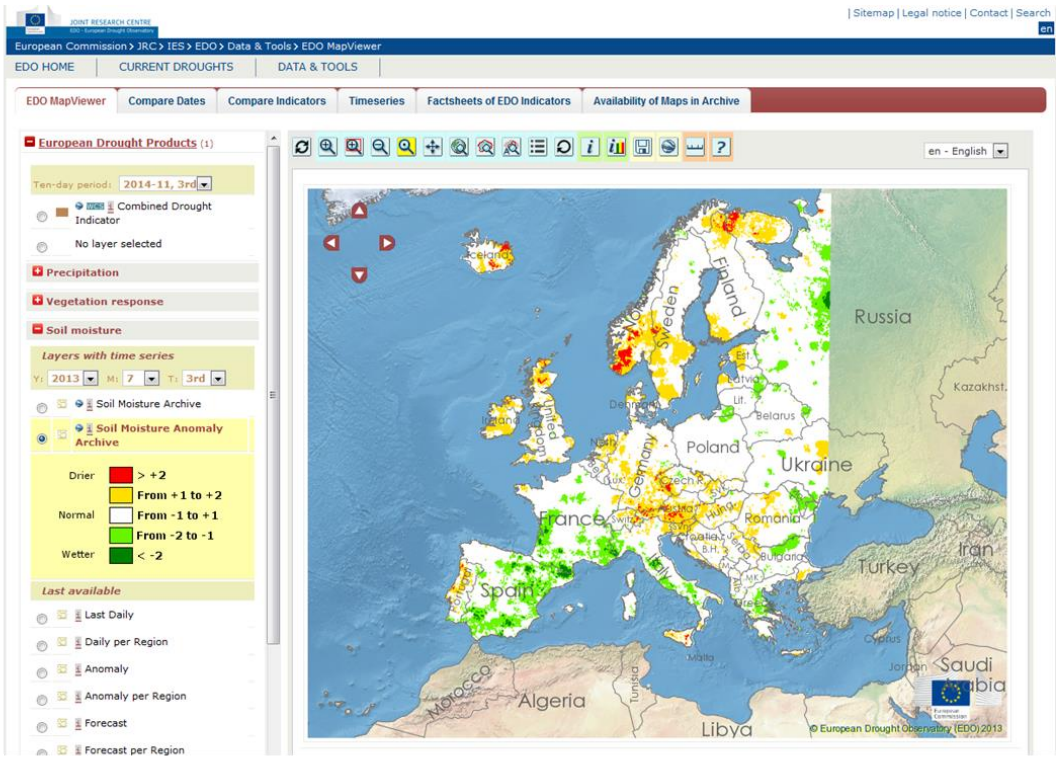
Flood and drought indicators - Cooperation JRC (Joint Research Centre)

Evaluation of GRACE-based products in
- EDO (European Drought Observatory)

GRACE-based total water storage anomalies as part of drought indicators / mapping



http://edo.jrc.ec.europa.eu/

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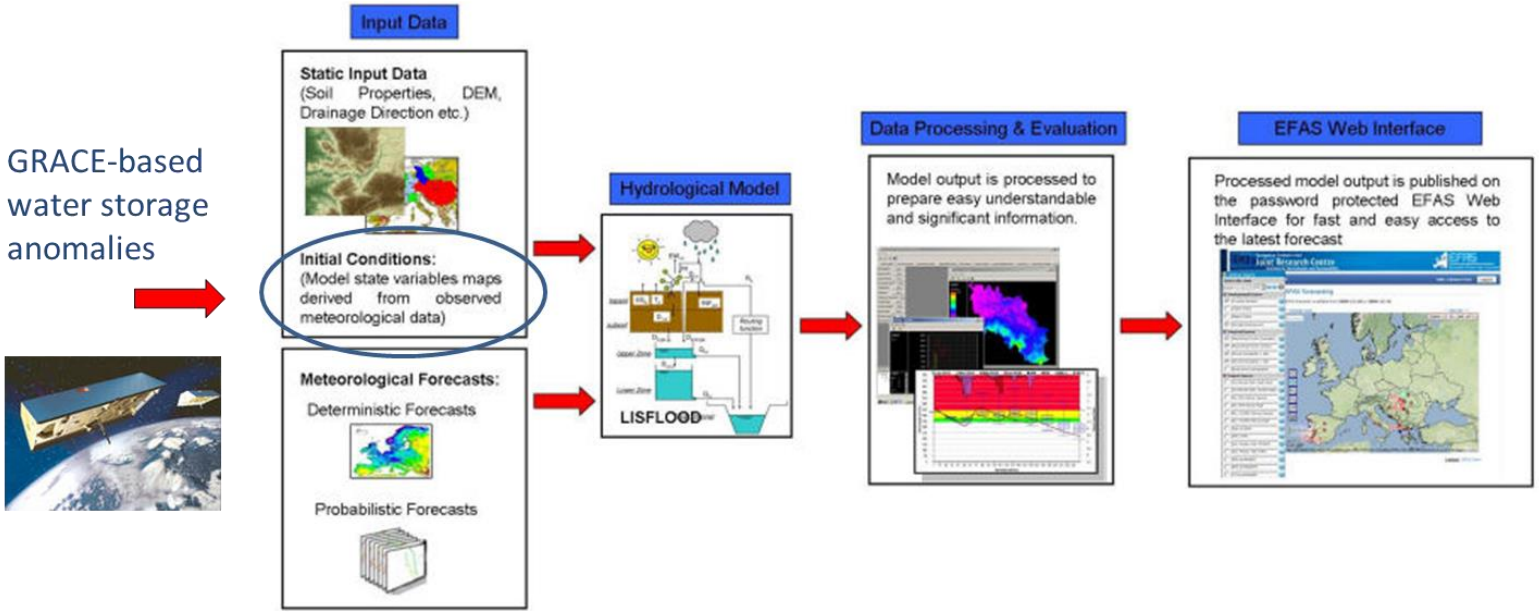
Evaluation of GRACE-based products in
- EFAS (European Flood Alert System)
- GloFAS (Global Flood Alert System)



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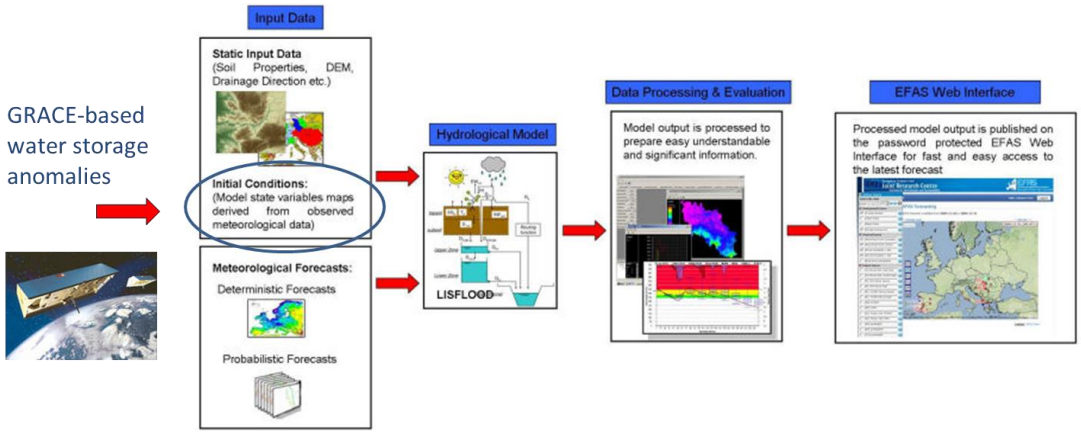

- first step: JRC provides water storage data simulated with the hydrological models used in the alert systems (LISFLOOD, HTESSEL)

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Publications:

Remote Sens. **2015**, *7*, 7324-7349; doi:10.3390/rs70607324

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Article

Droughts and Floods in the La Plata Basin in Soil Moisture Data and GRACE

Sarah Abelen [1,*], Florian Seitz [1], Rodrigo Abarca-del-Rio [2] and Andreas Güntner [3]

Co-operation with TU München / DGFI and Universidad de Concepción

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Droughts and Floods in the La Plata Basin in Soil Moisture Data and GRACE

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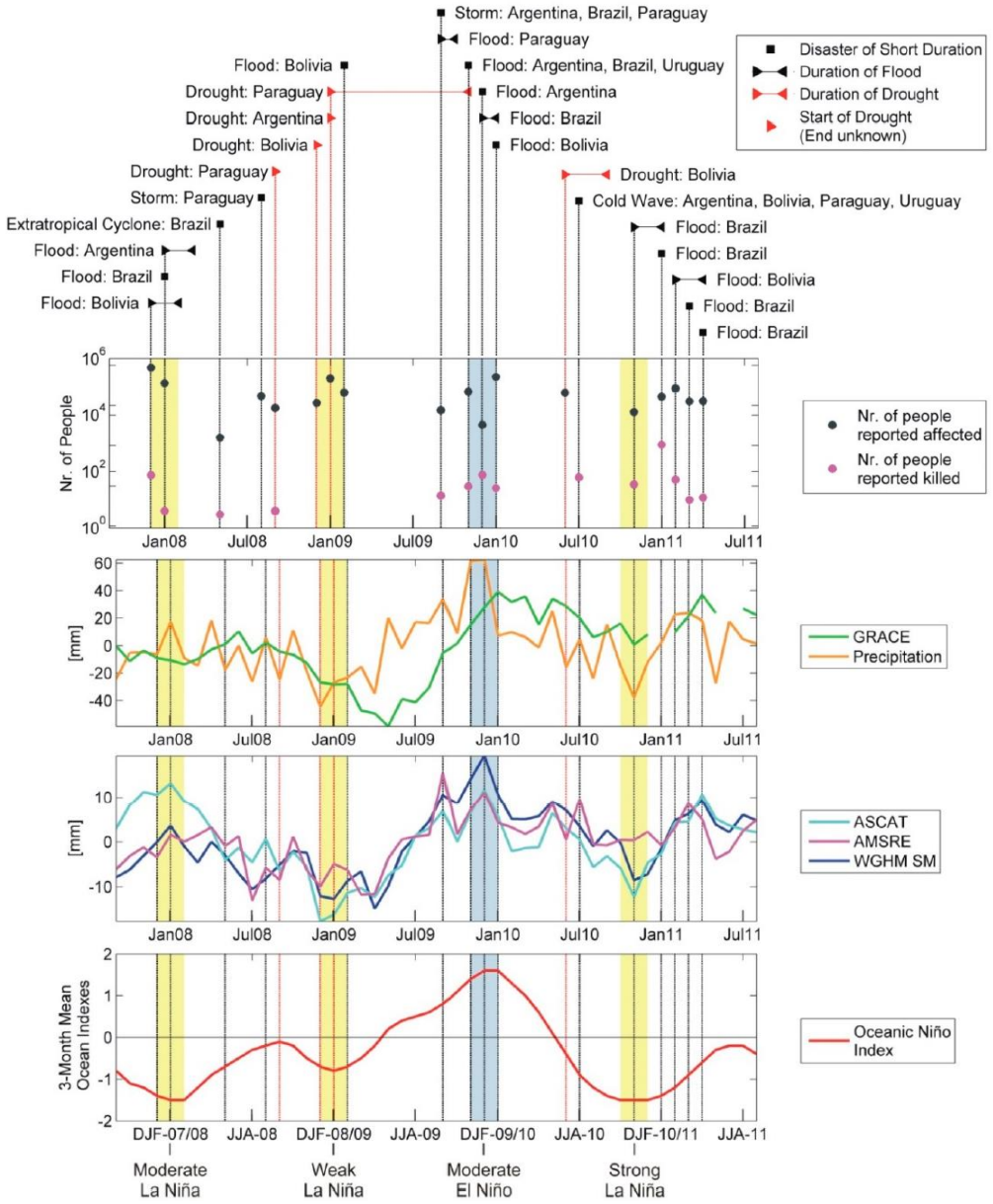

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Flood and drought indicators - Cooperation JRC (Joint Research Centre)

Evaluation of GRACE-based products in
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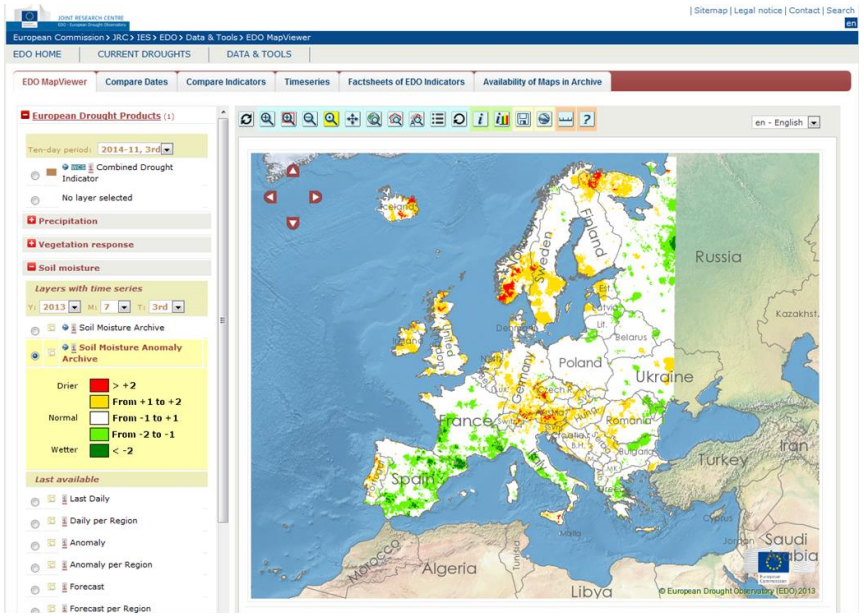
GRACE-based total water storage anomalies as part of drought indicators / mapping



http://edo.jrc.ec.europa.eu/

- first step: JRC provides water storage data simulated with the hydrological models used in the alert systems (LISFLOOD, HTESSEL)

Indicators of hydrological extremes

- Drought: complex phenomenon affecting all components of the hydrological cycle
  > many different indices

- Flood: readily identifiable & relatively short-lived event
  > flood severity versus flood potential

Drought

- Many indices based on different variables (e.g., precipitation, soil moisture, vegetation health, river runoff) for different types of drought
- Single variable may not suffice
- Multivariate indices to describe drought more comprehensively (severity, frequency, duration)

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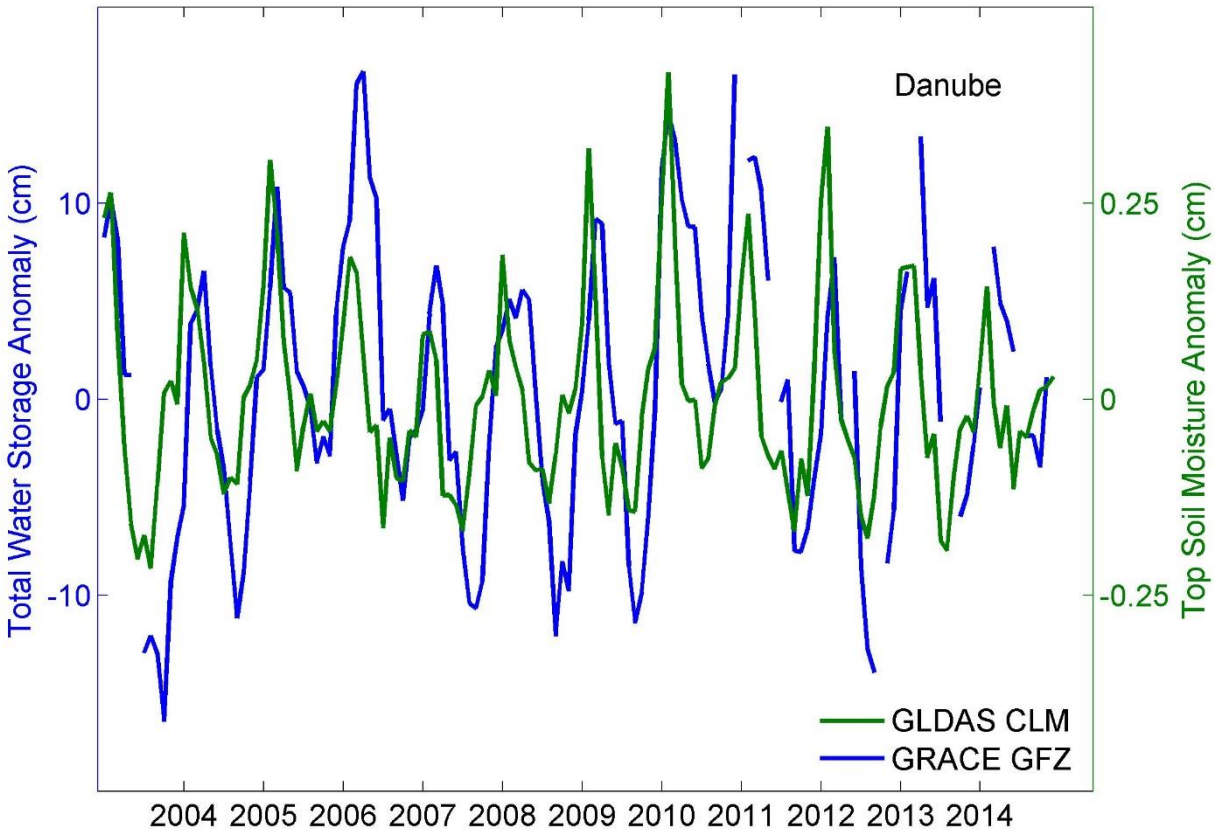

Multivariate Standardized Drought Index (MSDI)[1]

- Extension of the Standard Precipitation Index (SPI)
- Joint probability of precipitation and soil moisture
- Non-parametric joint distribution concept
- $P(x_k,y_k)=(m_k-0.44)/(n+0.12)$ (Gringorten, 1963)
- Applied to monthly anomalies of modelled top soil moisture (GLDAS CLM) and GRACE TWS (GFZ)

[1]Hao and AghaKouchak, 2014: A Nonparametric Multivariate Multi-Index Drought Monitoring Framework, Journal of Hydrometeorology, 15, 89-101.

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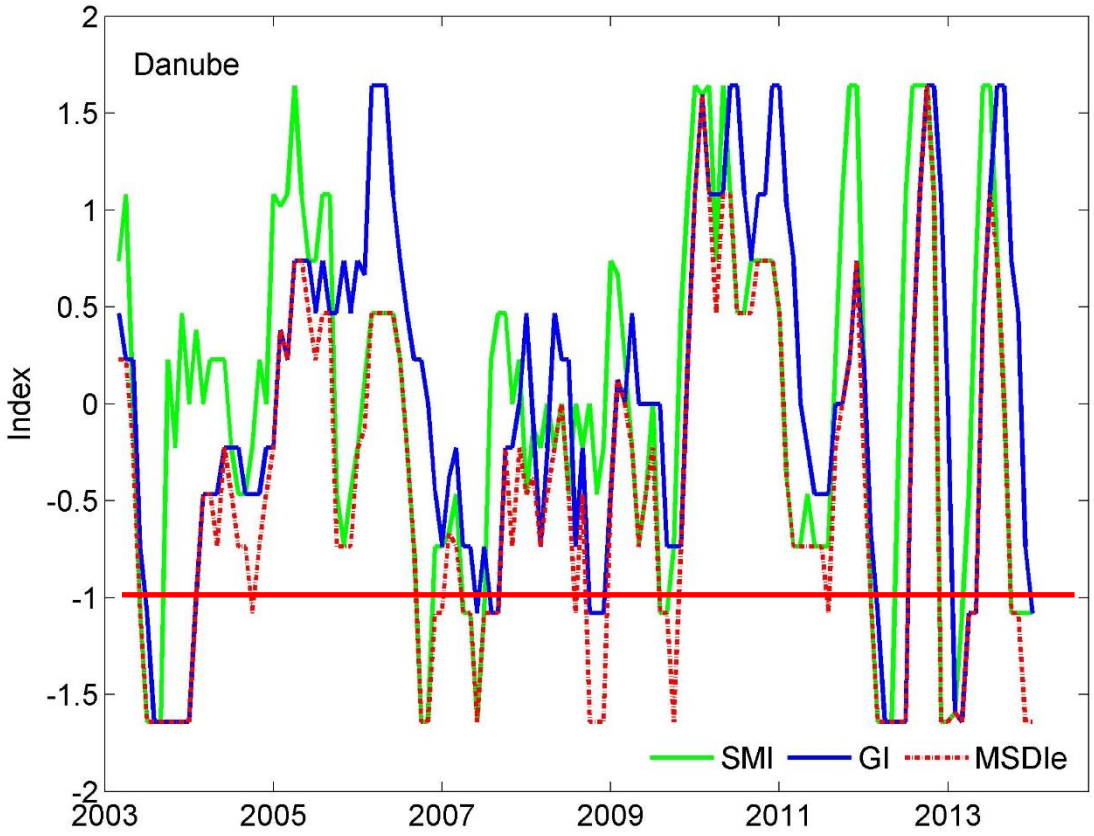

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Flood

- Flood **severity** indices based on peak river discharge (threshold exceedence, annual maximum)
- Flood **potential** indices based on catchment wetness (antecedent precipitation, soil moisture, river discharge)
- Basin-scale estimates of **daily** water storage from GRACE as flood potential index

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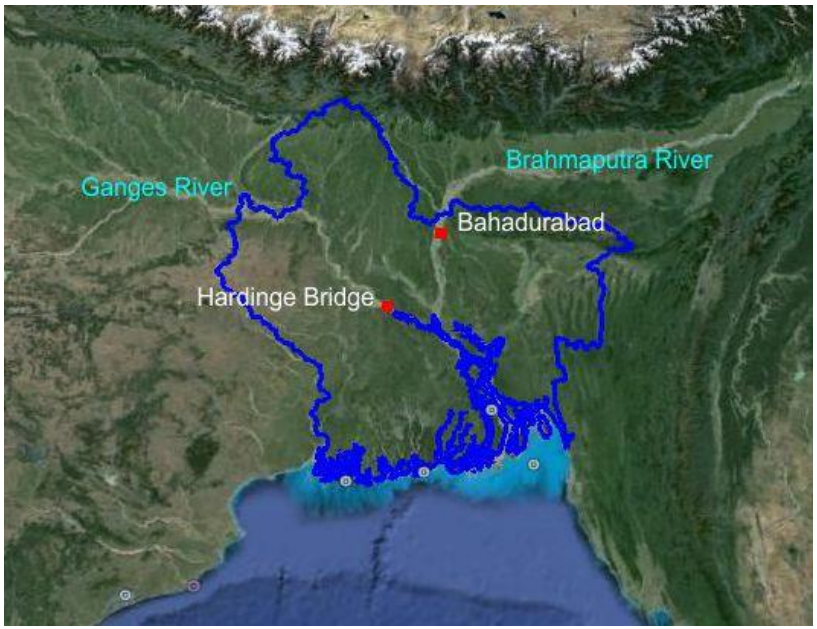
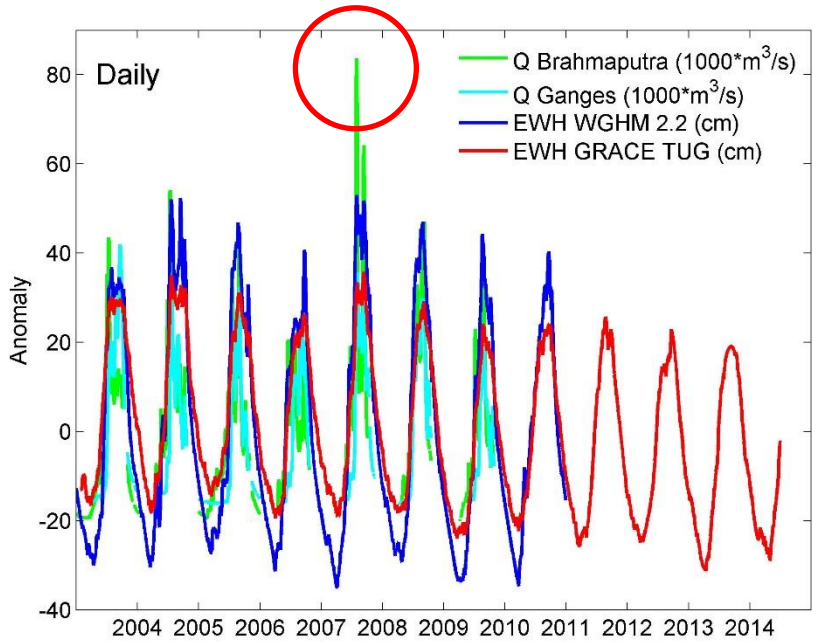
Evaluation of daily GRACE products: first results for selected areas/flood events





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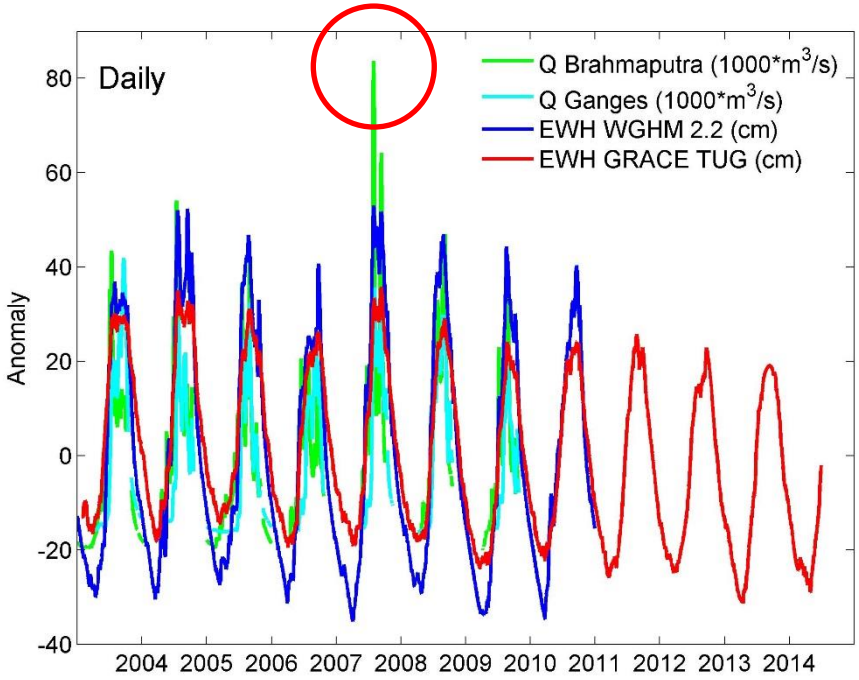
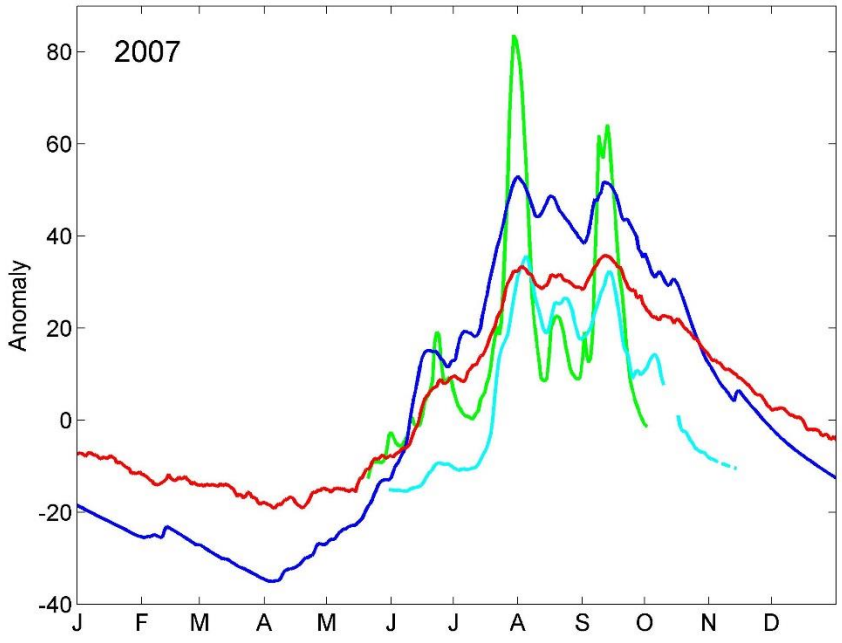
Ganges/Brahmaputra Delta (size ~ 220.000 km^2)





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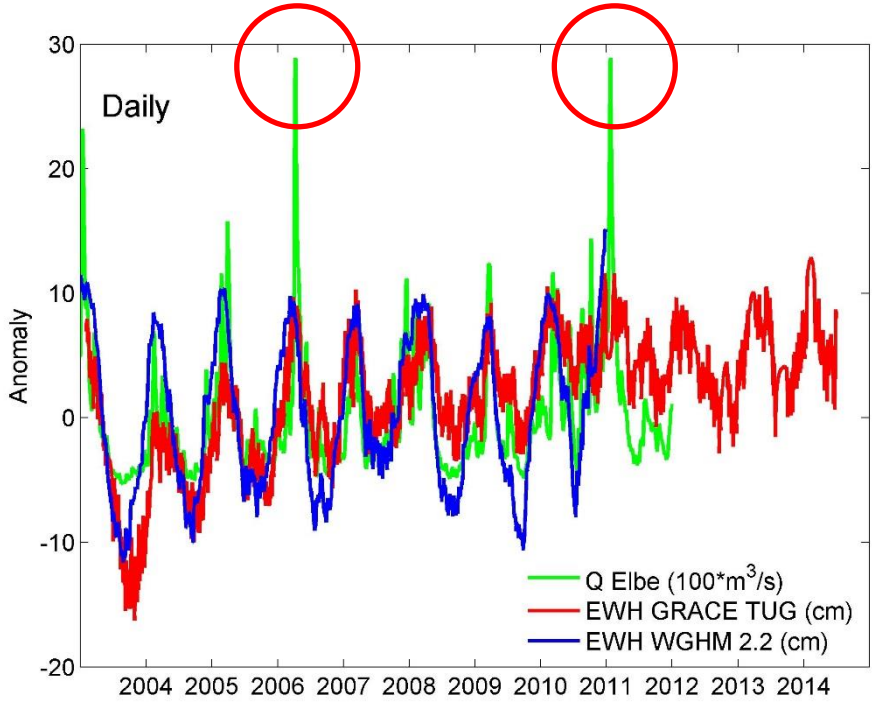
Elbe (size ~ 140.000 km^2)



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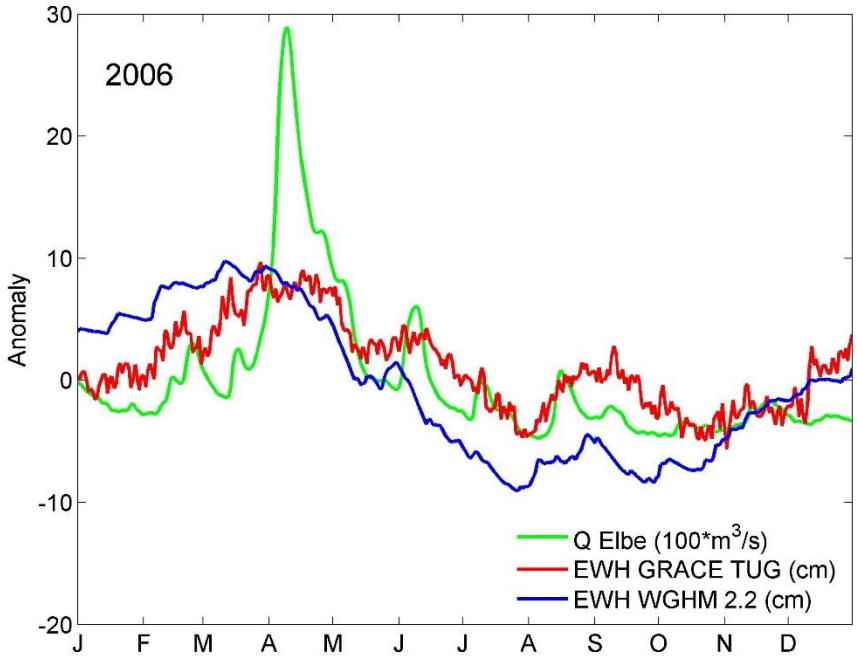
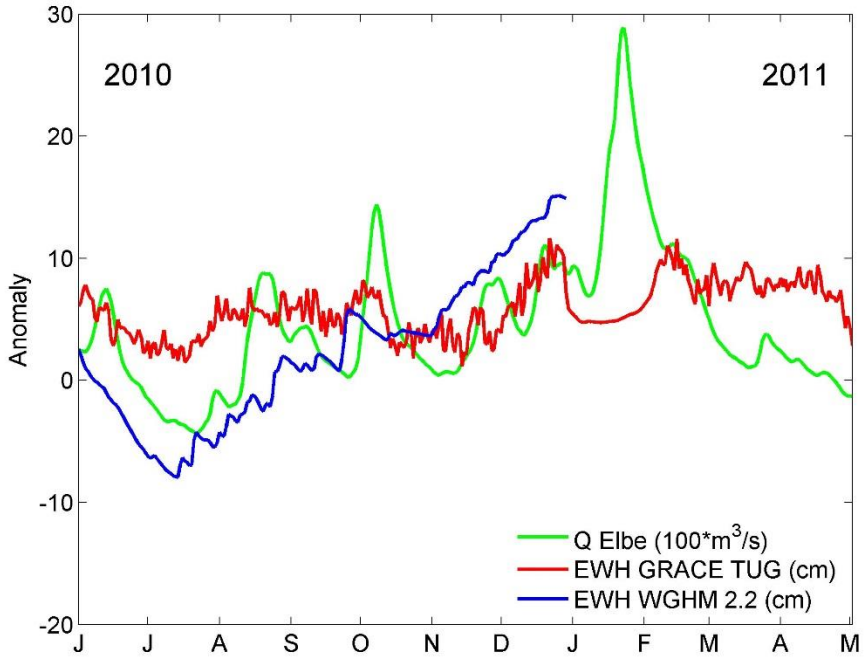
Elbe





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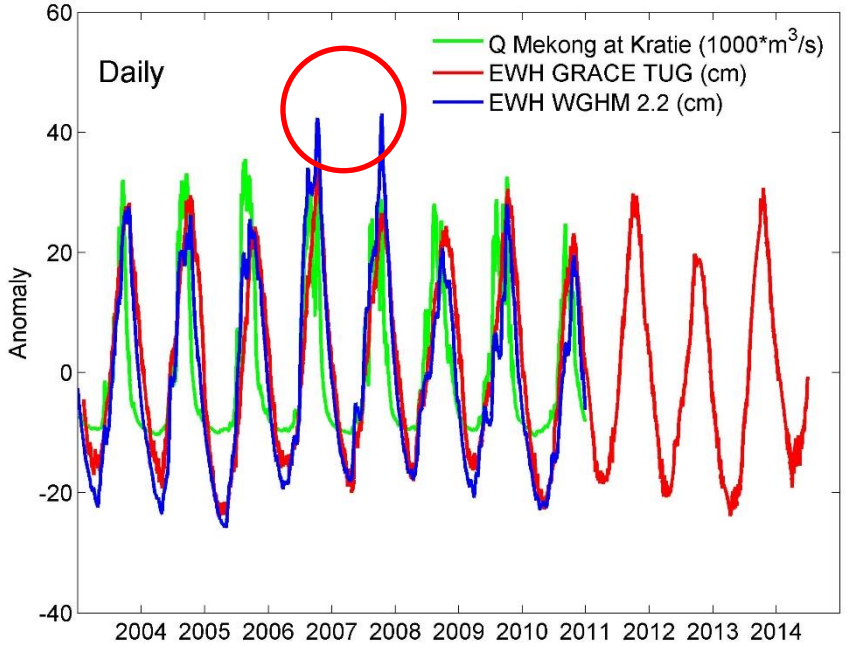
Lower Mekong



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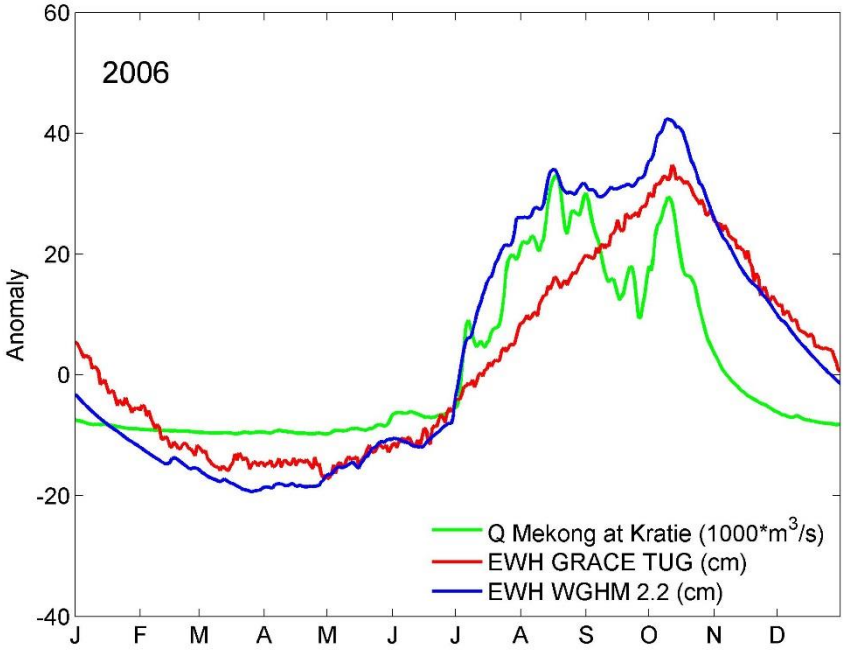
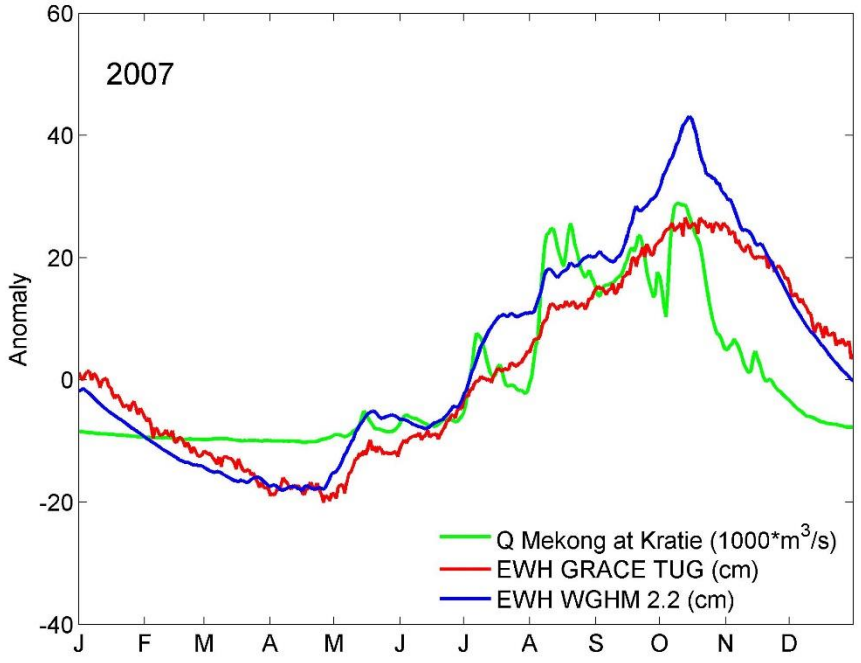
Lower Mekong





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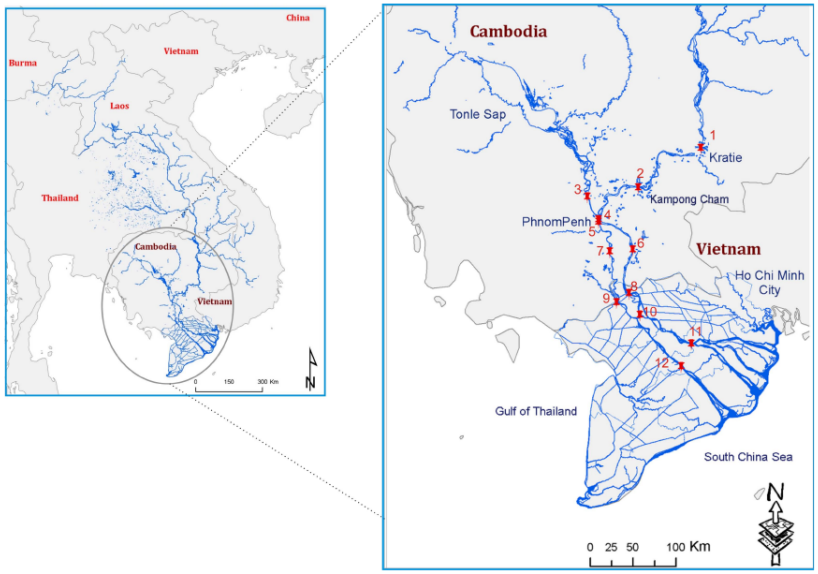

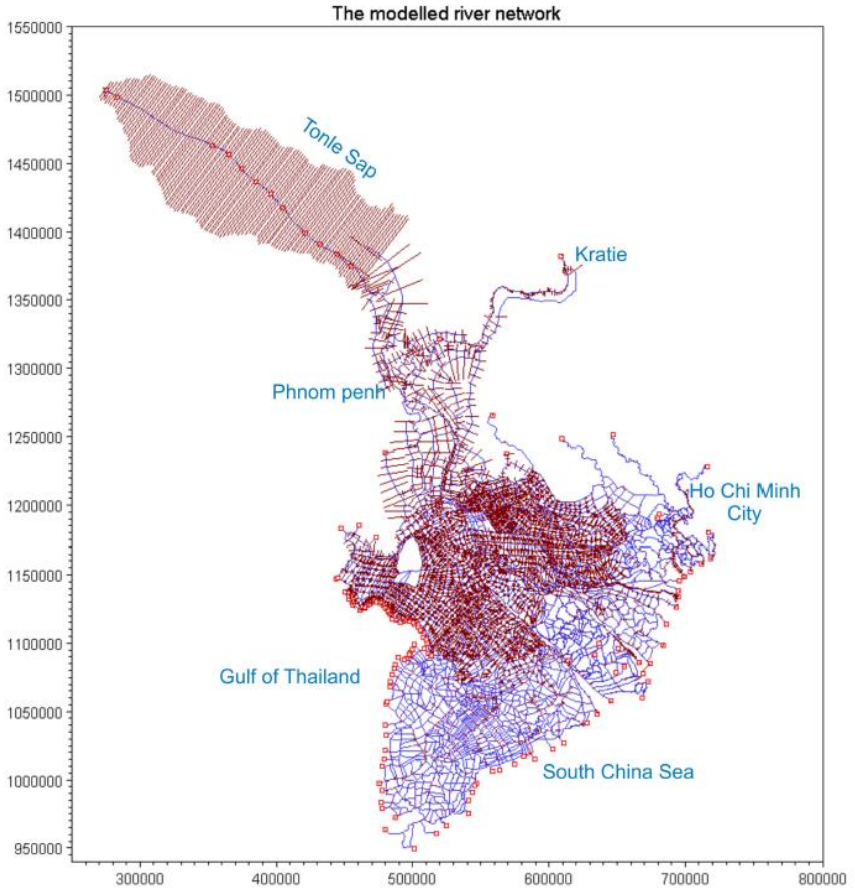

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Multi-objective automatic calibration of hydrodynamic models utilizing inundation maps and gauge data

N. V. Dung[1,3], B. Merz[1], A. Bárdossy[2], T. D. Thang[3], and H. Apel[1]

Hydrol. Earth Syst. Sci., 15, 1339–1354, 2011

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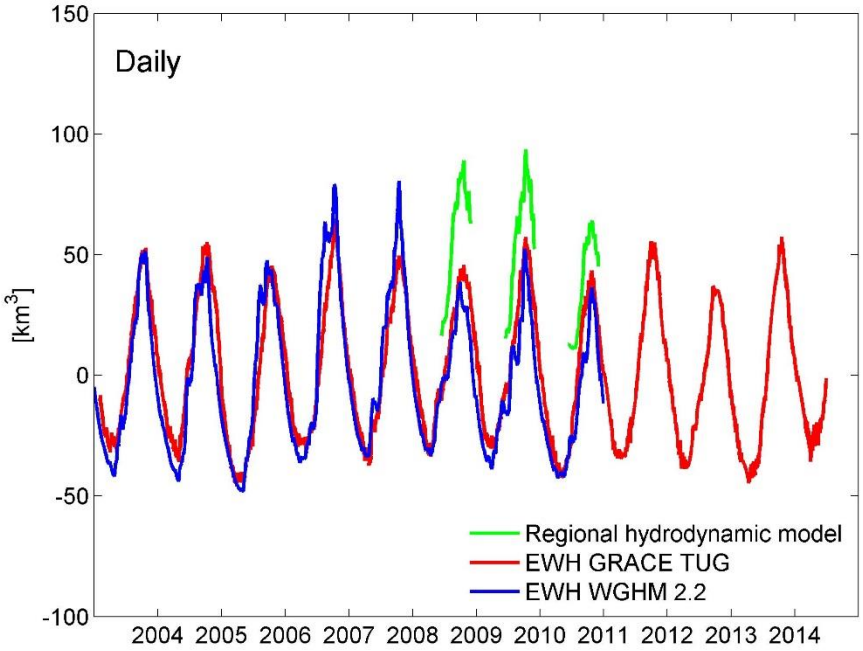
Lower Mekong



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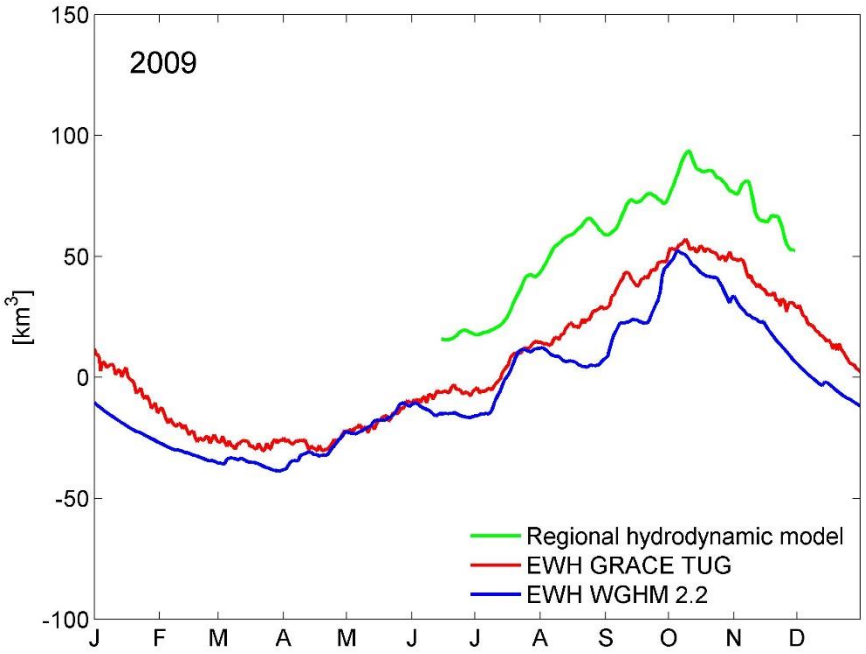

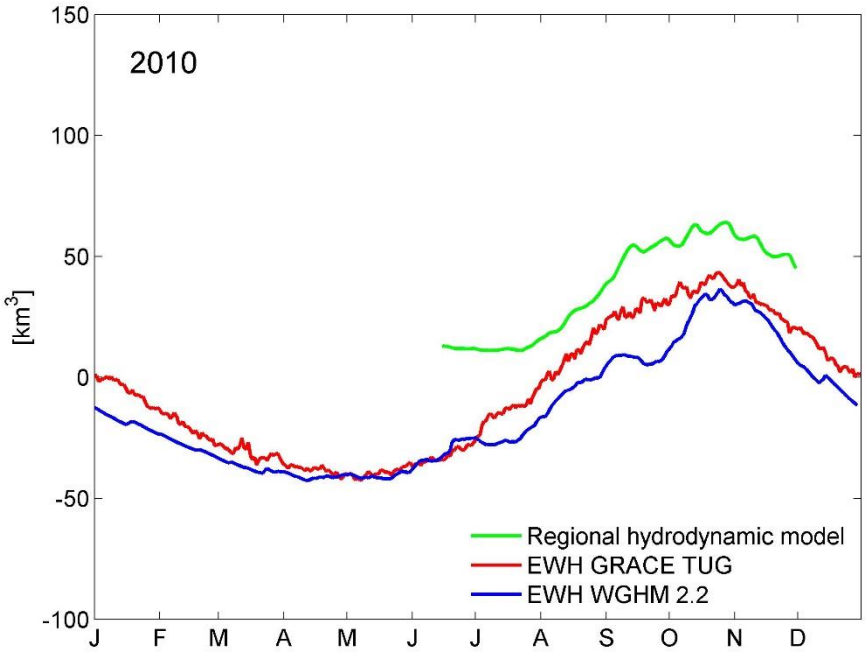

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Conclusions

- Longer term memory of GRACE TWS gives scope for added value to multivariate indices
- Encouraging preliminary result for daily GRACE product in terms of sensitivity to individual flood peaks