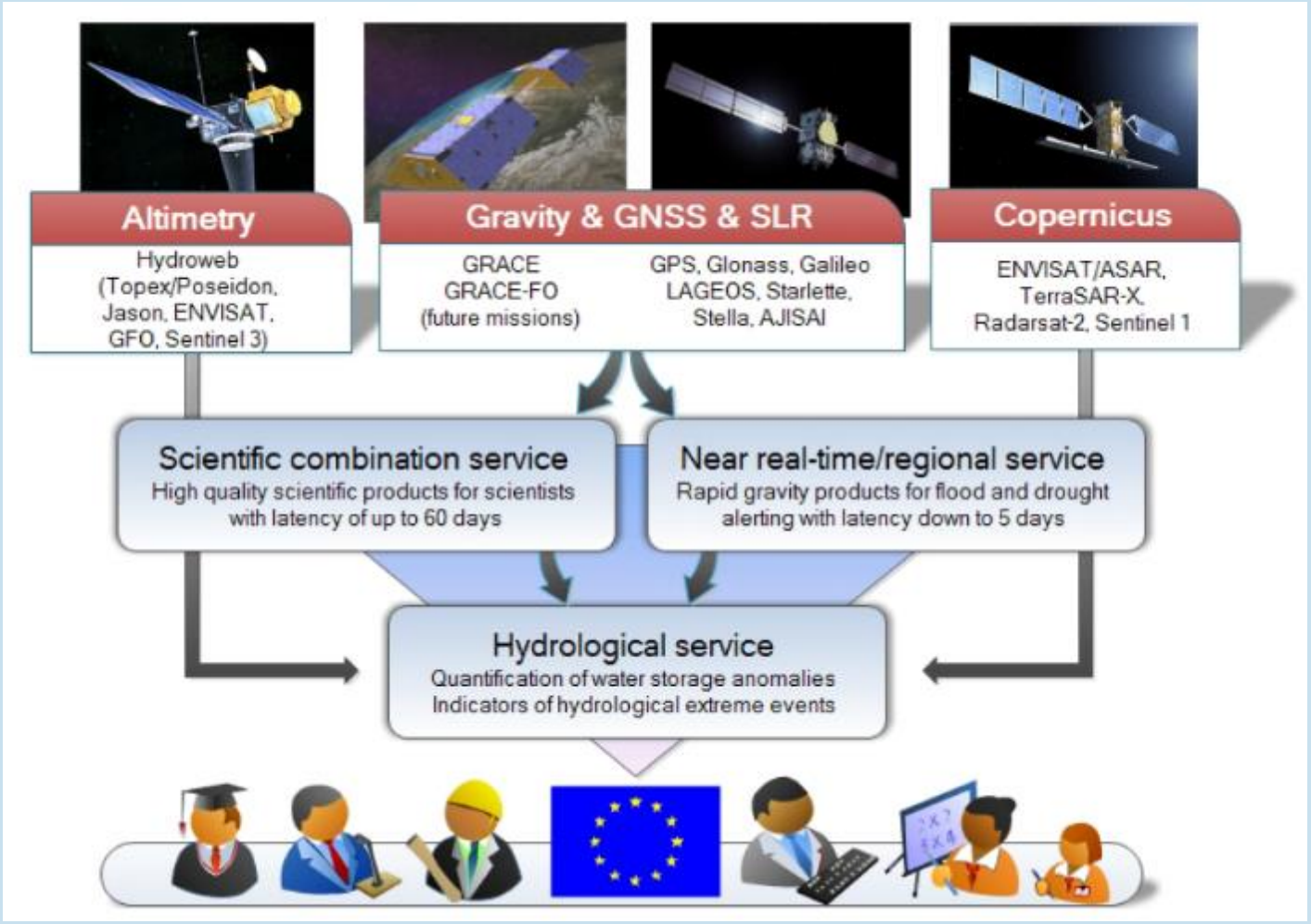
# Practical: EGSIEM plotter

## … with some short details on the state-of-the-art of the project

# 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.**

# Water is a natural force …



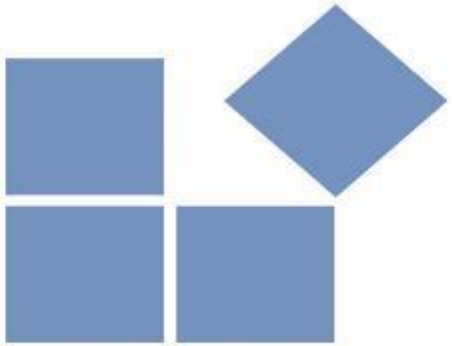

# Water is a natural force …



-… and has a small head


**4.4 BILLION AFFECTED**

Equal to 64% of the world's population[1].



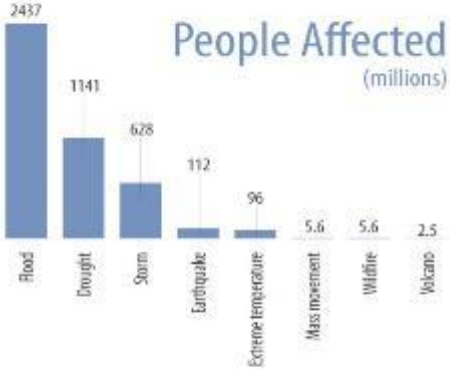
**$2.0 TRILLION DAMAGE (USD)**

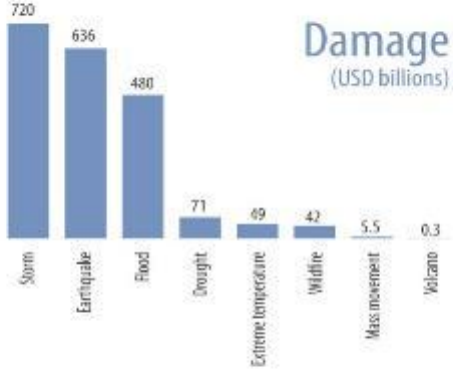
Similar to 25 years of total Overseas Development Aid[2].

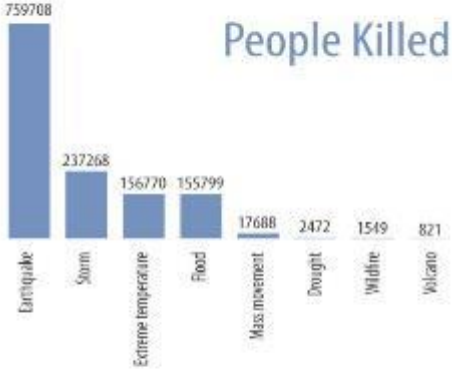
**1.3 MILLION KILLED**

Comparable to 3125 jumbo jets[3].

## Impact by disasters




## Impact by top 10 countries

**China**
**2.5 BILLION**
people affected

| | |
|---|---|
| India | 928 million |
| Bangladesh | 136 million |
| Philippines | 92 million |
| Thailand | 72 million |
| Pakistan | 64 million |
| Ethiopia | 46 million |
| Kenya | 44 million |
| Iran Islam Rep | 40 million |
| Viet Nam | 39 million |

**USA**
**560 BILLION**
in damage (USD)

| | |
|---|---|
| Japan | 402 billion |
| China P Rep | 331 billion |
| Thailand | 45 billion |
| India | 43 billion |
| Italy | 36 billion |
| Germany | 31 billion |
| France | 31 billion |
| Chile | 31 billion |
| Australia | 28 billion |

UNISDR
The United Nations Office for Disaster Risk Reduction
http://www.unisdr.org

Version: 13 June 2012

DATA SOURCES

EM-DAT - http://www.emdat.be/ - The OFDA/CRED International Disaster Database; Data version: 13 June 2012 - v12.07

Humanitarian Symbol Set (2008):
http://www.unglwg.org/map/guideline.php

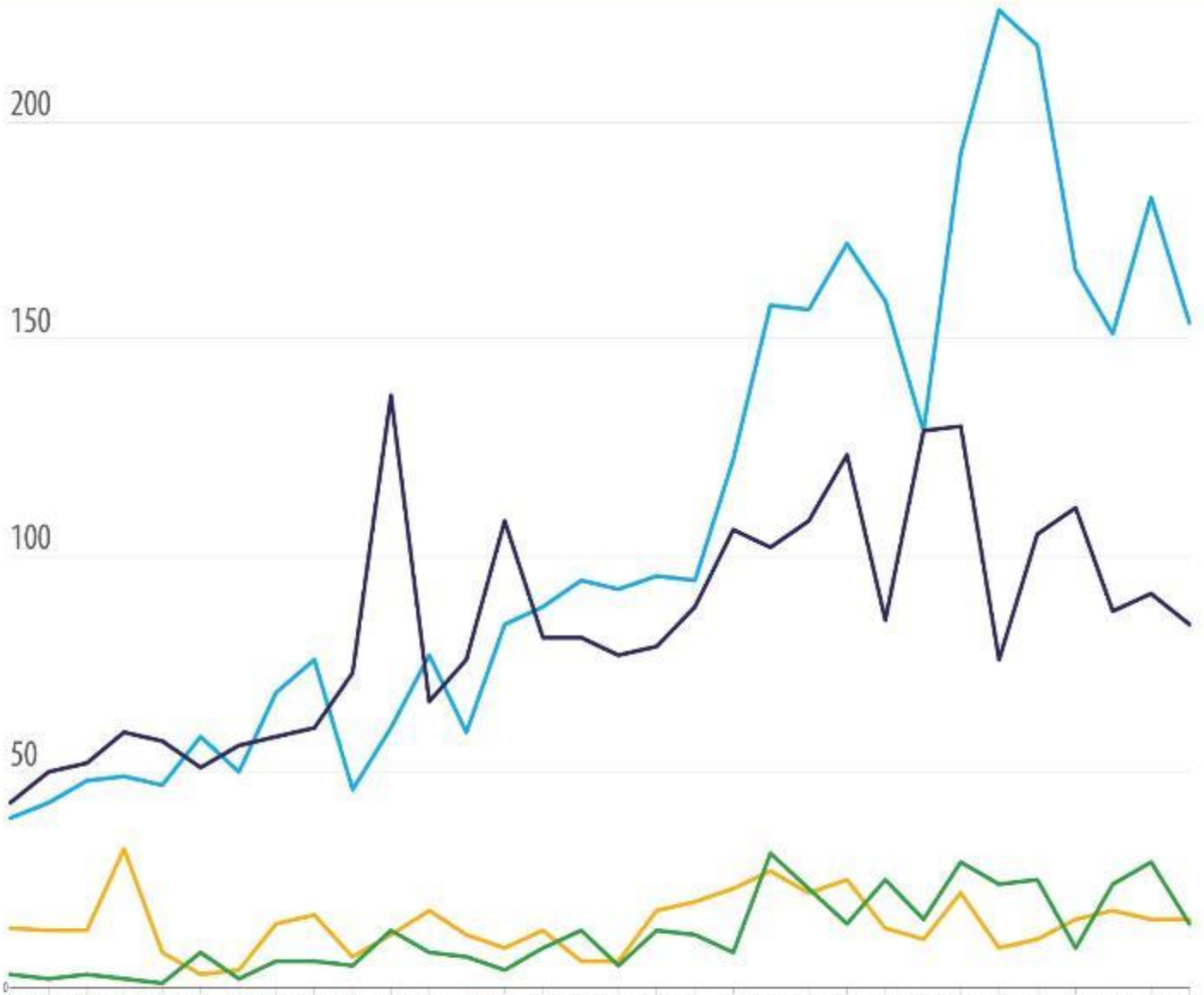
# Number of Climate-related Disasters Around the World (1980-2011)

**3455 FLOODS**

**2689 STORMS**

**470 DROUGHTS**

**395 EXTREME TEMPS**

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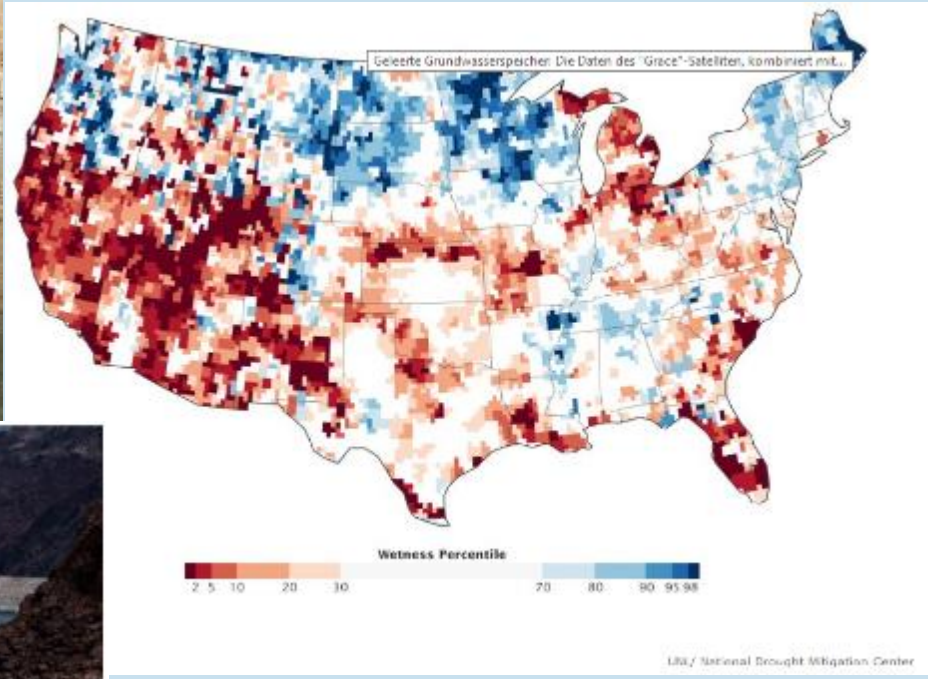
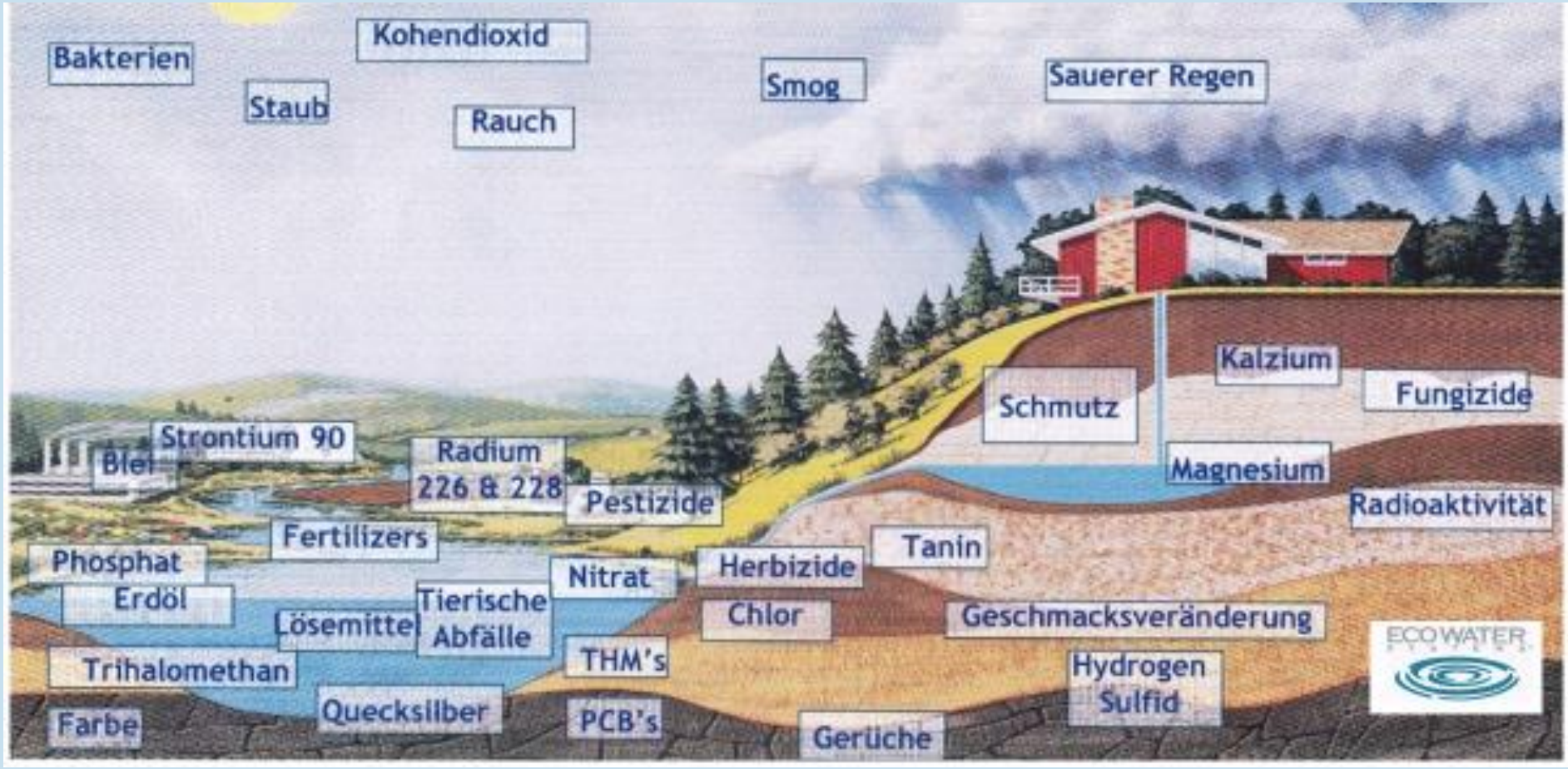
| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLOOD | 39 | 43 | 48 | 49 | 47 | 58 | 50 | 68 | 76 | 46 | 60 | 77 | 59 | 84 | 88 | 94 | 92 | 95 | 91 | 122 | 158 | 157 | 172 | 159 | 129 | 193 | 226 | 218 | 166 | 151 | 183 | 154 |
| STORM | 43 | 50 | 52 | 59 | 57 | 51 | 56 | 58 | 60 | 73 | 137 | 66 | 76 | 108 | 81 | 81 | 77 | 79 | 88 | 106 | 102 | 108 | 123 | 85 | 129 | 130 | 76 | 105 | 111 | 87 | 91 | 84 |
| DROUGHT | 14 | 13 | 13 | 12 | 8 | 3 | 4 | 13 | 17 | 7 | 12 | 18 | 12 | 9 | 13 | 6 | 6 | 18 | 20 | 23 | 27 | 22 | 25 | 14 | 11 | 22 | 9 | 11 | 16 | 18 | 16 | 16 |
| EXTREME TEMPERATURE | 3 | 2 | 3 | 2 | 1 | 8 | 2 | 6 | 6 | 5 | 13 | 8 | 7 | 4 | 9 | 13 | 5 | 13 | 12 | 8 | 31 | 23 | 15 | 25 | 16 | 29 | 24 | 25 | 9 | 24 | 29 | 15 |

# Missing water is a natural force …




# Missing water is a natural force …

# Wasser ist belastet …



Can we see floods?

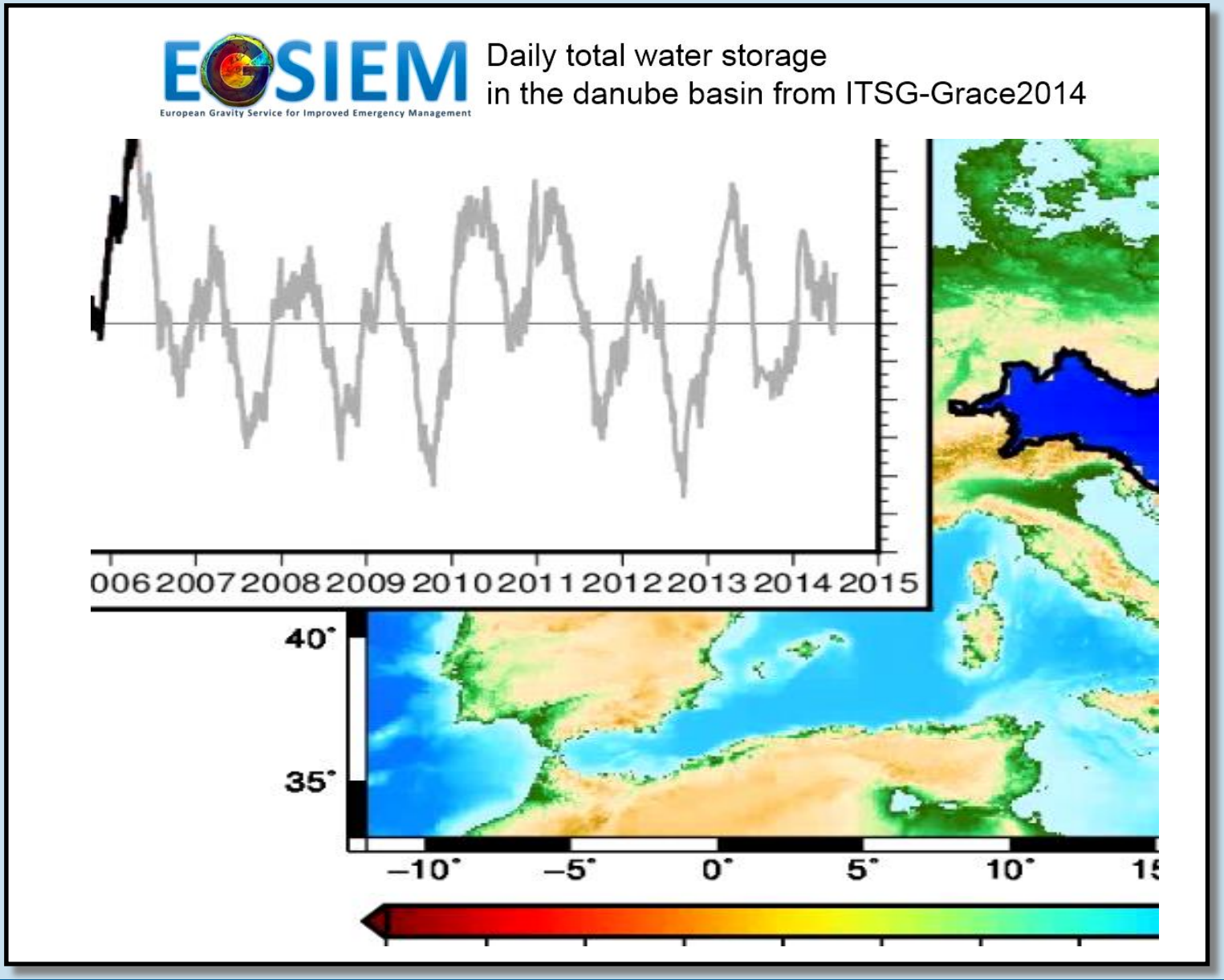
# Gravity for early warning?

Saturated soils

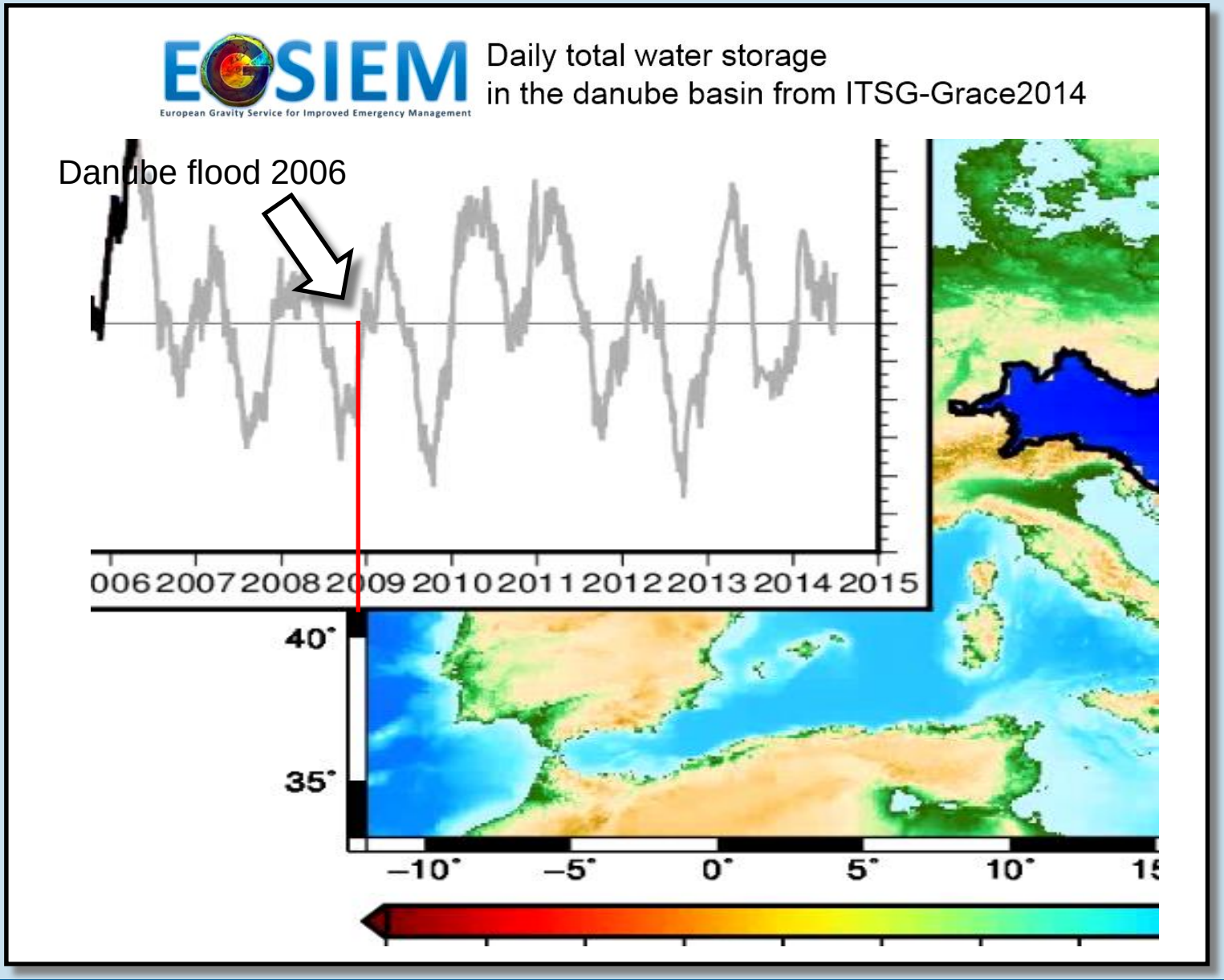
wetness index

Danger of flooding

# Floods


EGSIEM
European Gravity Service for Improved Emergency Management
Daily total water storage
in the danube basin from ITSG-Grace2014
006 2007 2008 2009 2010 2011 2012 2013 2014 2015
40°
35°
–10°
–5°
0°
5°
10°

# Floods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40°
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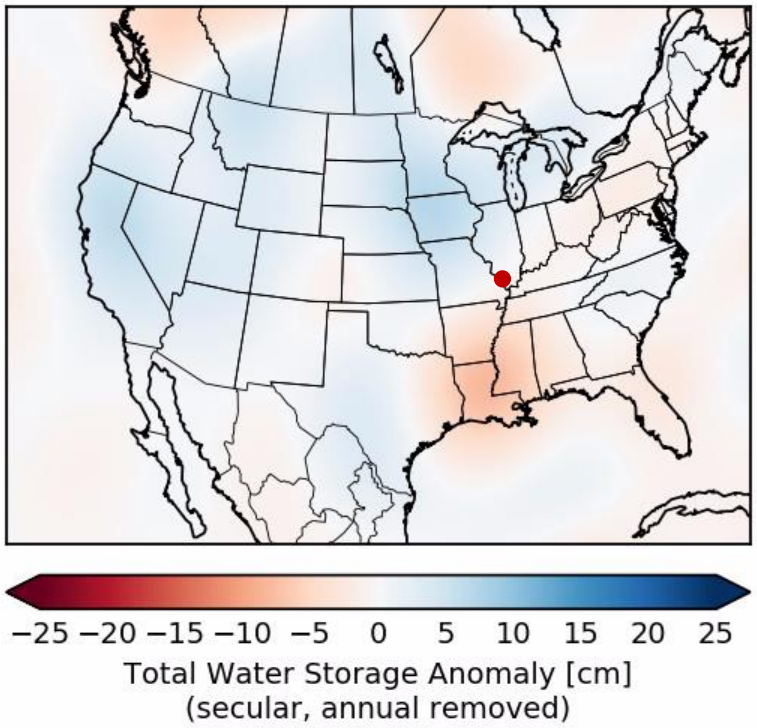
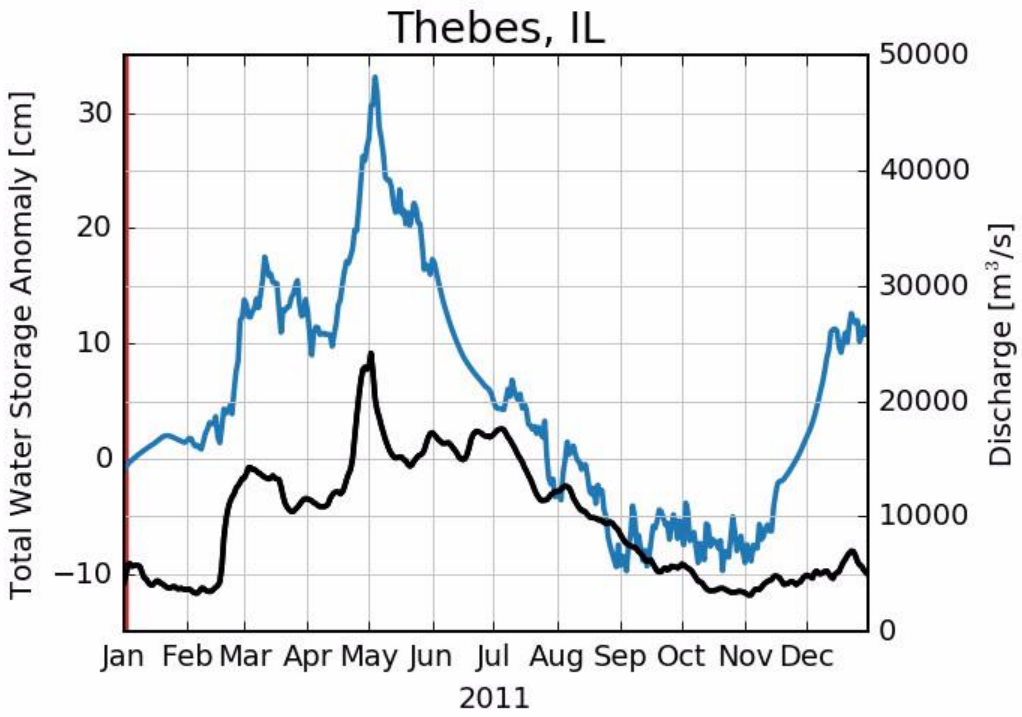
10°

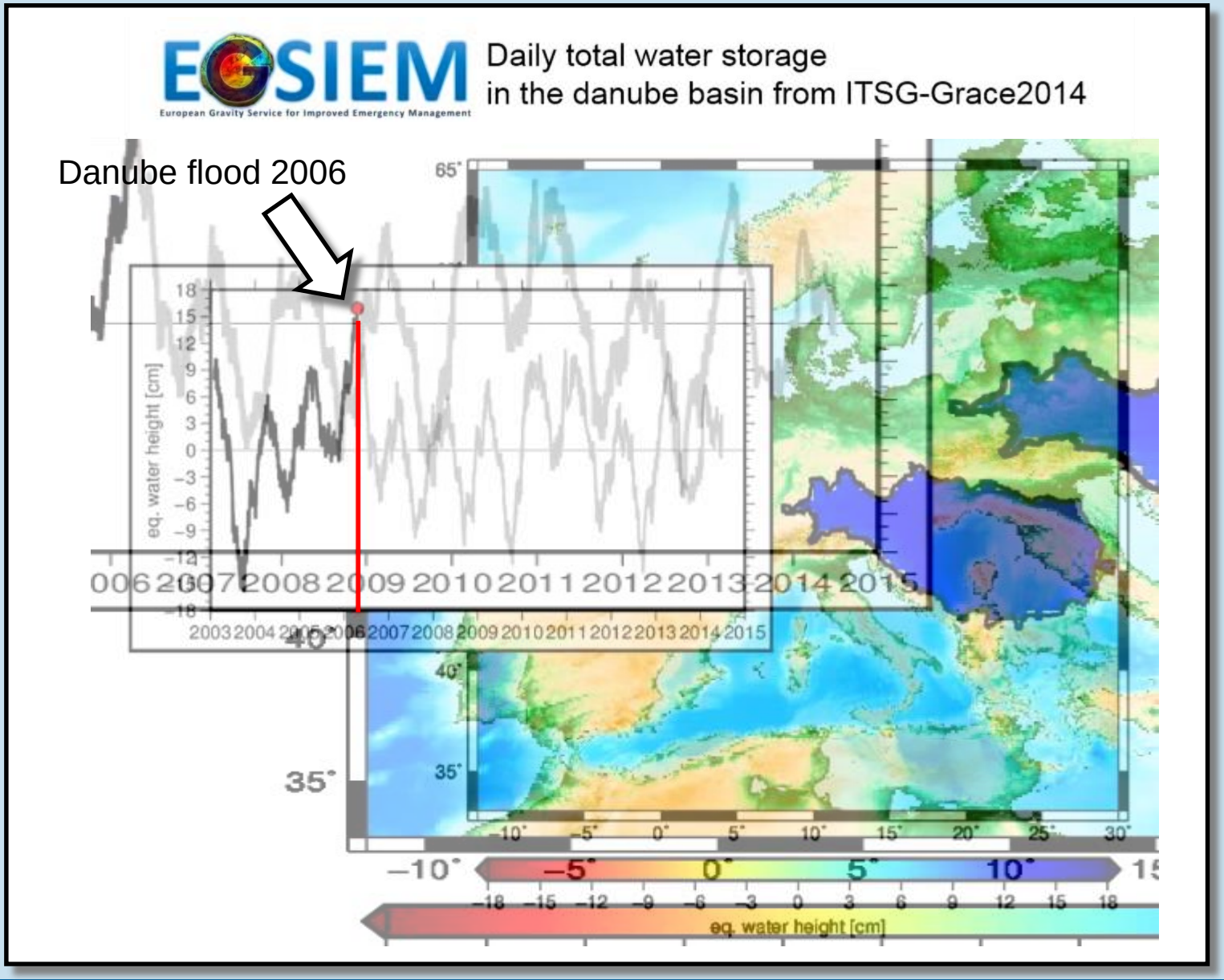
# Improved Daily Gravity Field Solutions – ITSG-Grace2016




-Great Mississippi Flood of 2011



# Floods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eq. water height [cm]
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
65°
40°
35°
−10° −5° 0° 5° 10°
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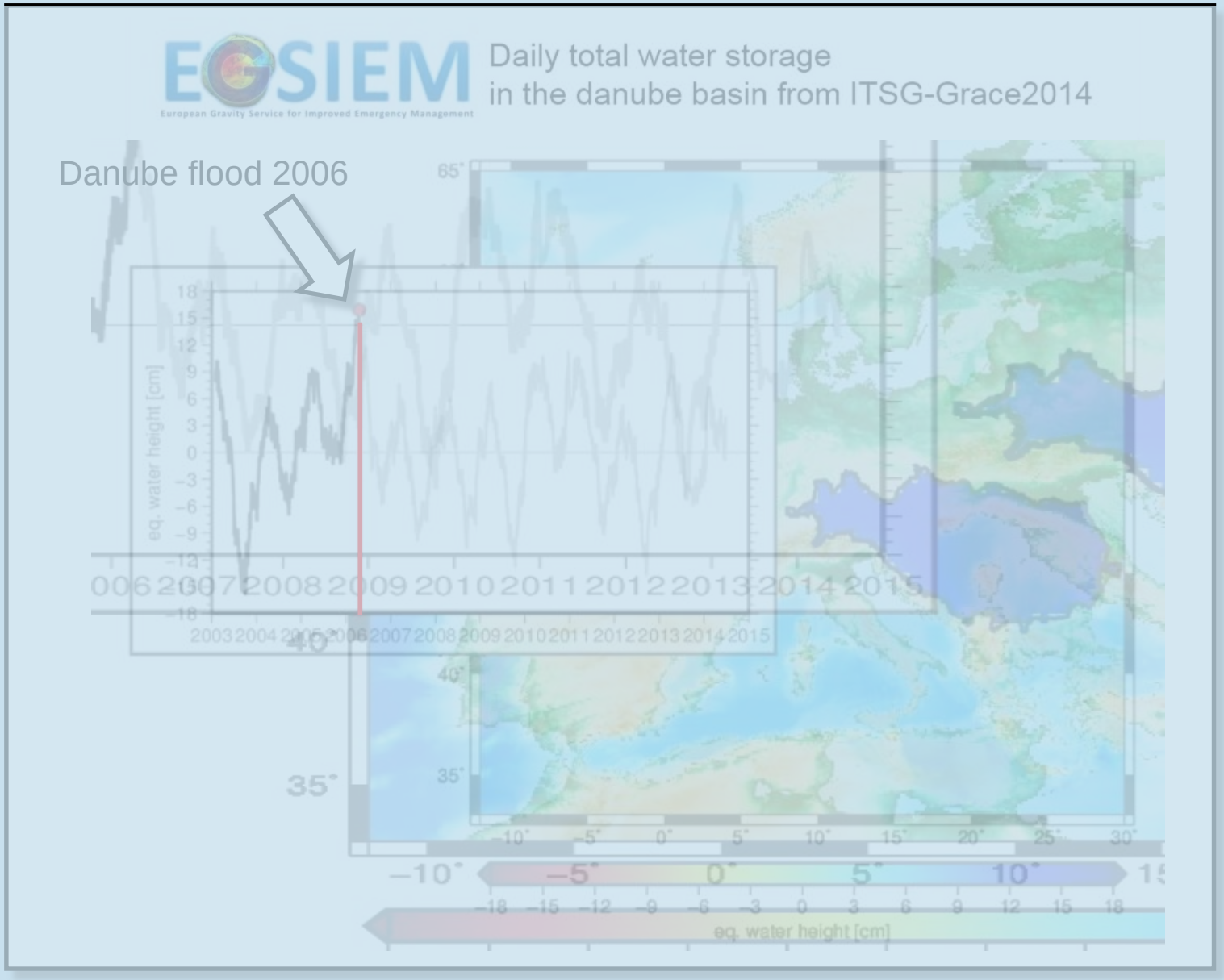
# Floods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65°
40°
35°
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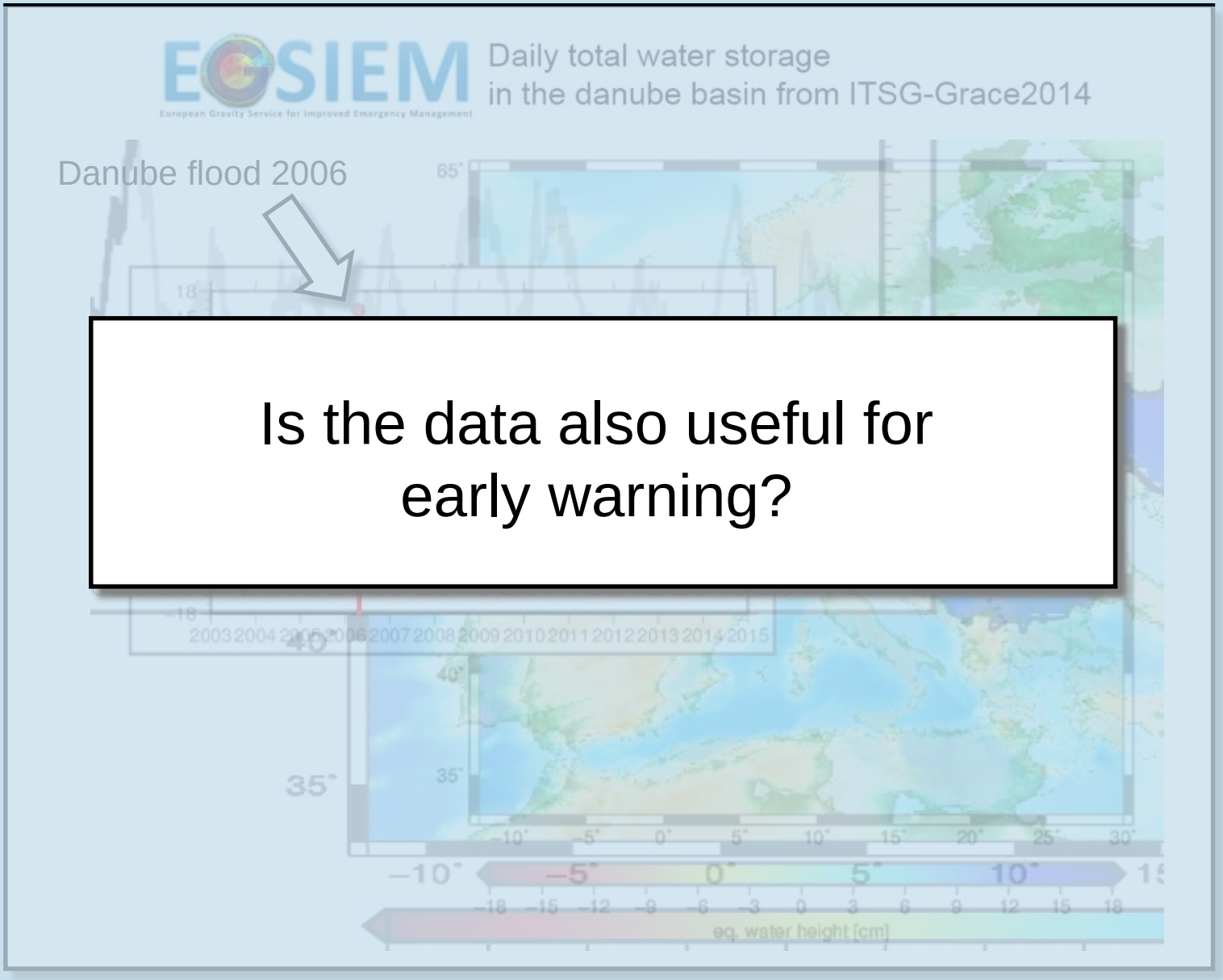
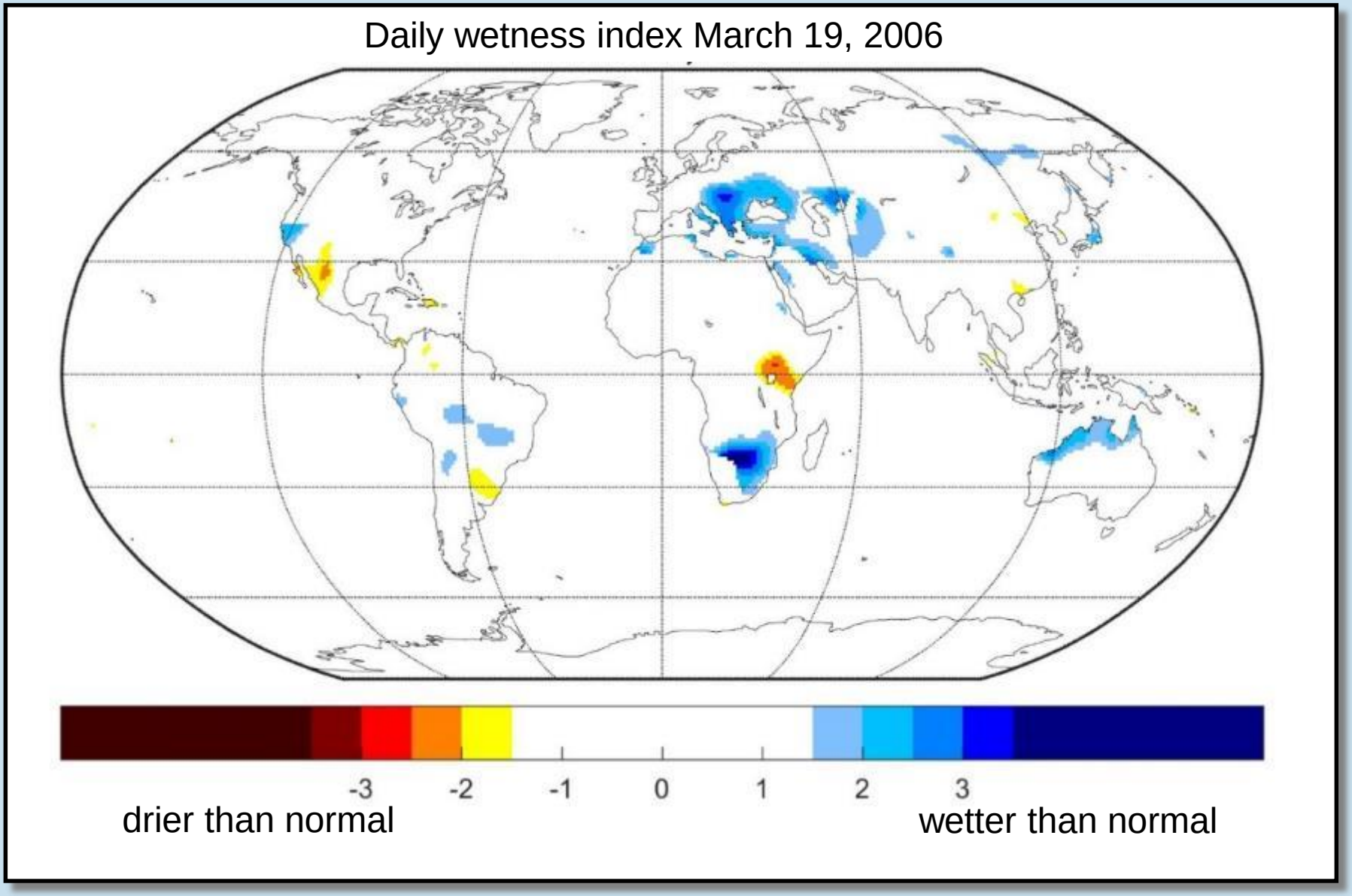
−18 −15 −12 −9 −6 −3 0 3 6 9 12 15 18
eq. water height [cm]

# Floods




Is the data also useful for early warning?

# Gravity for early warning?



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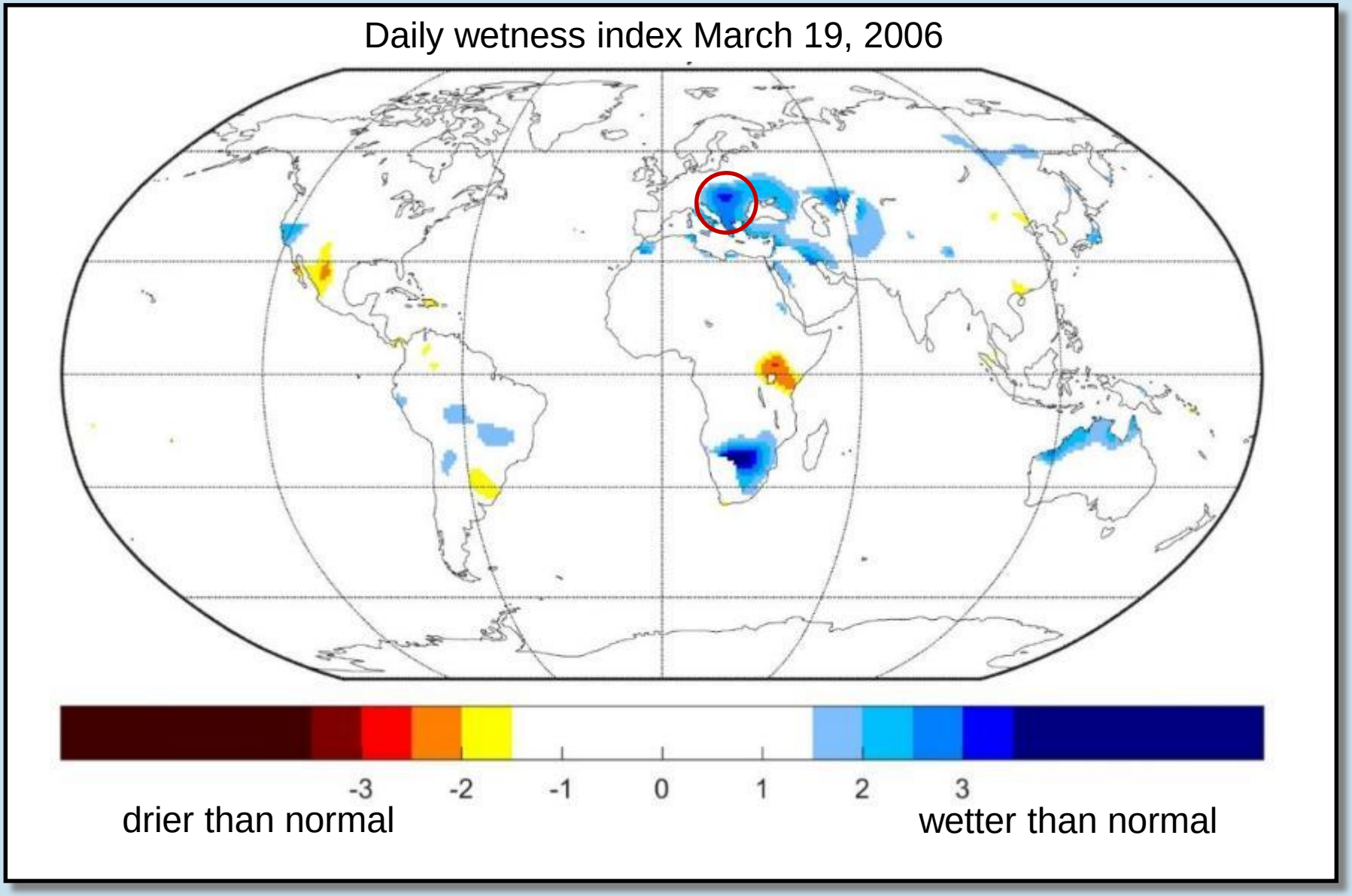

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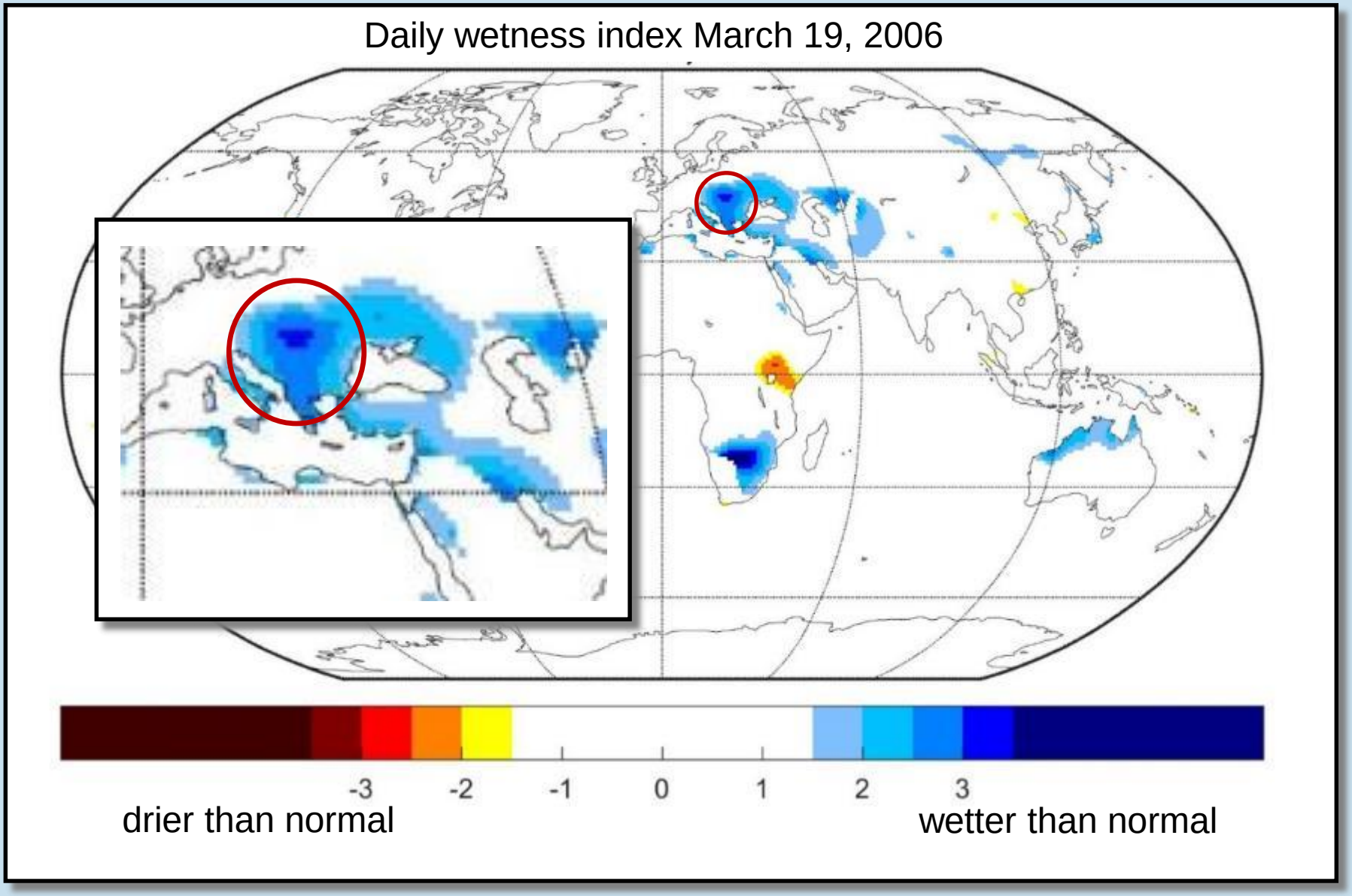

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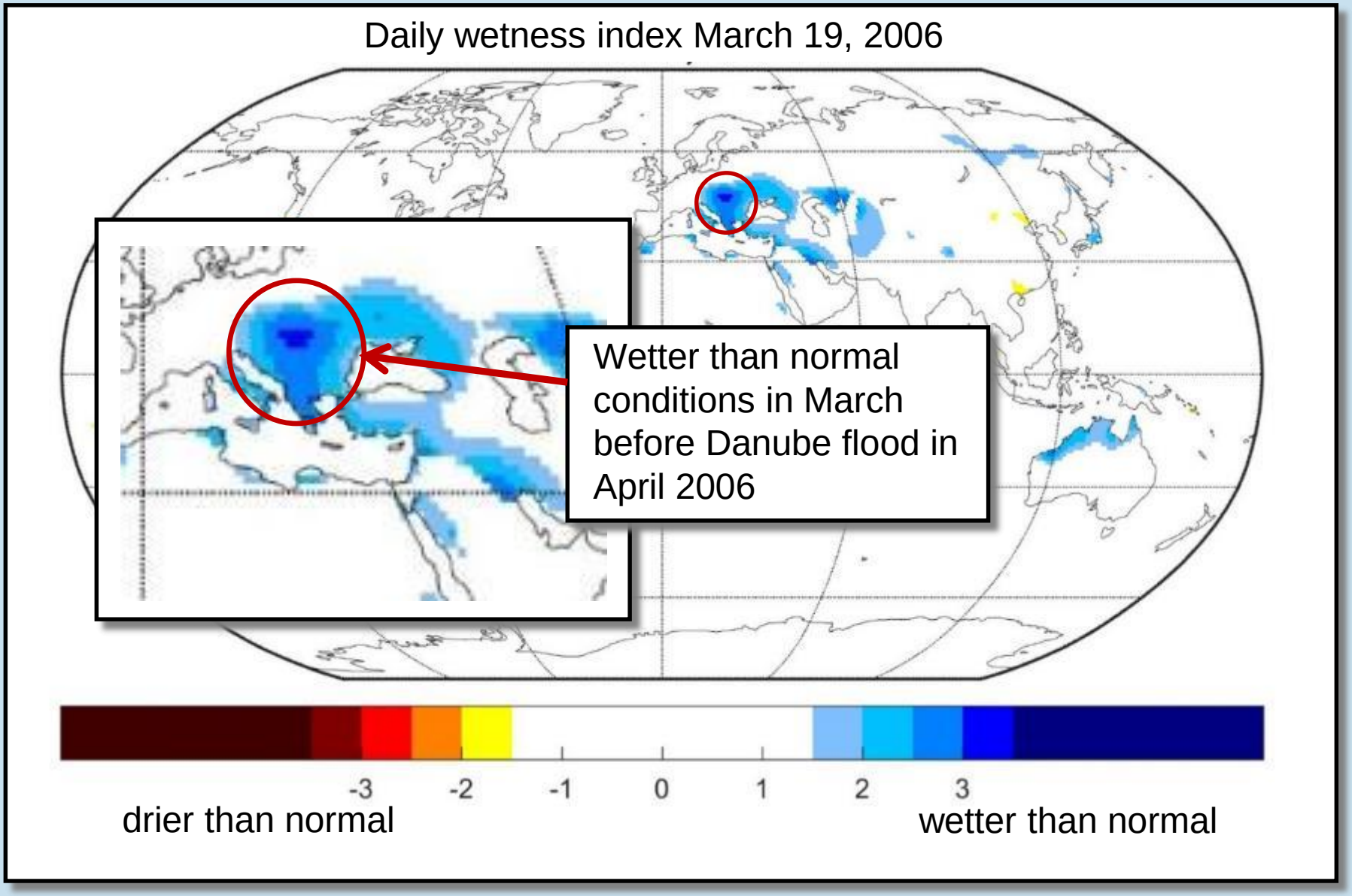
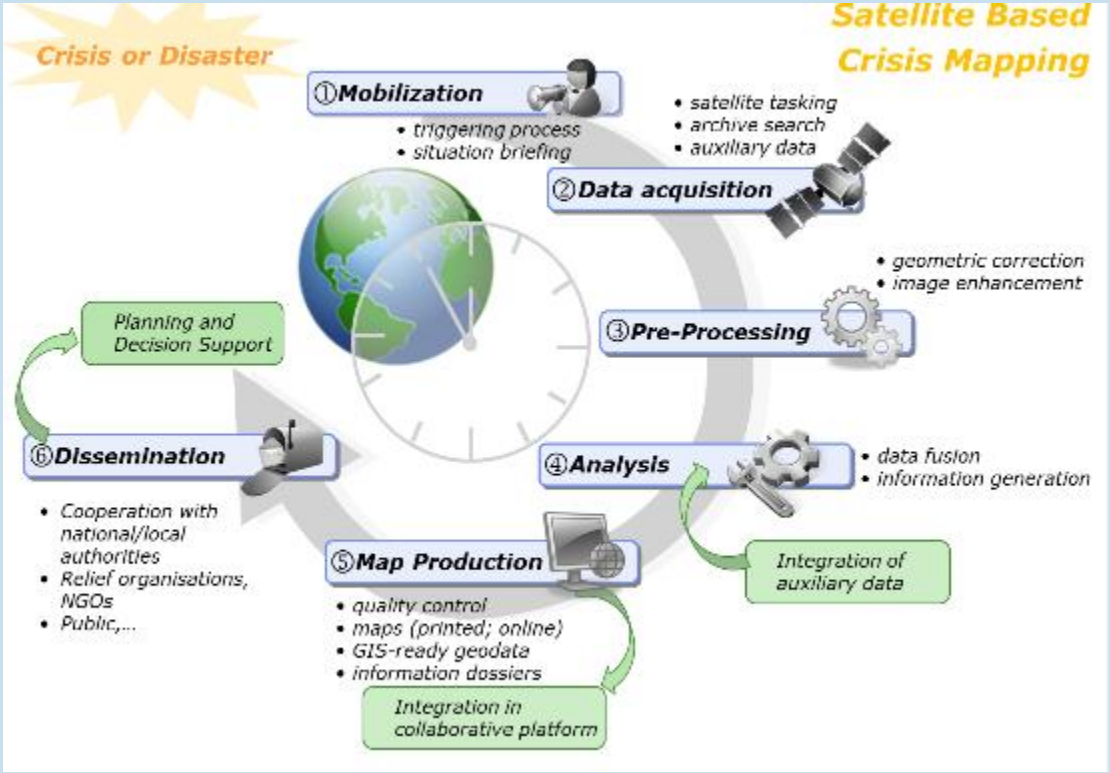


# How to use it?

- **Improved rapid mapping by on-demand programming of satellite acquisitions**



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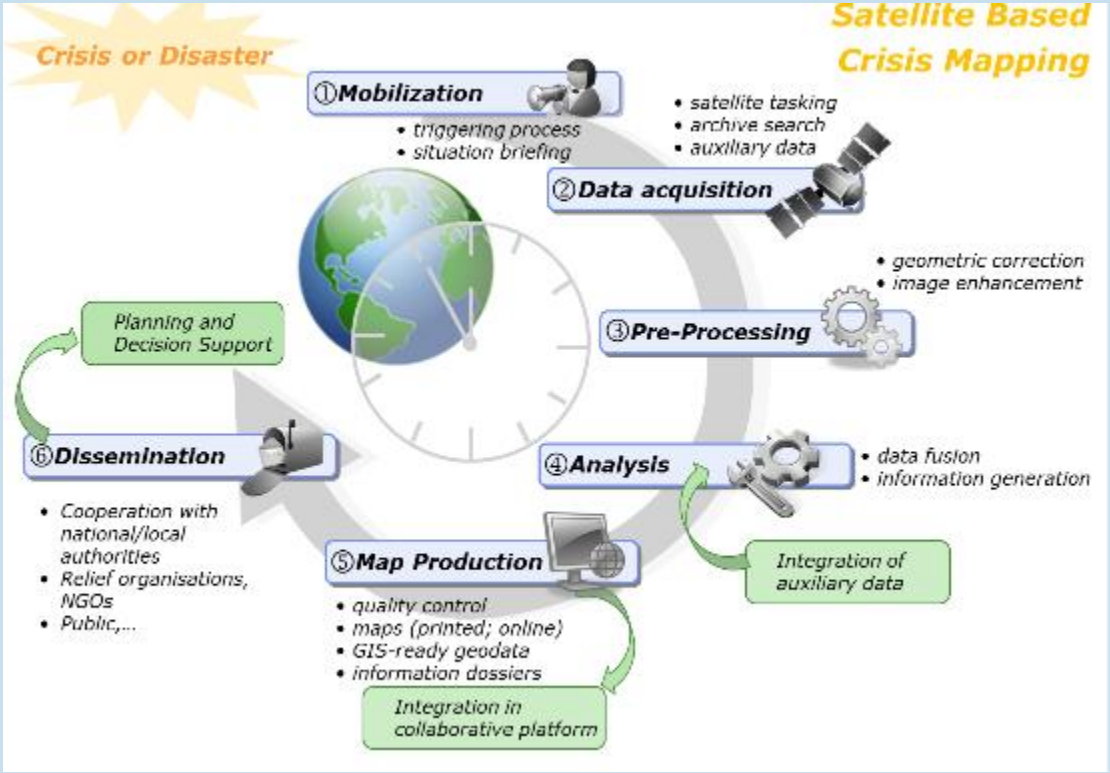
- **Improved rapid mapping by on-demand programming of satellite acquisitions**
- **Integration into automatic flood emergency management services**



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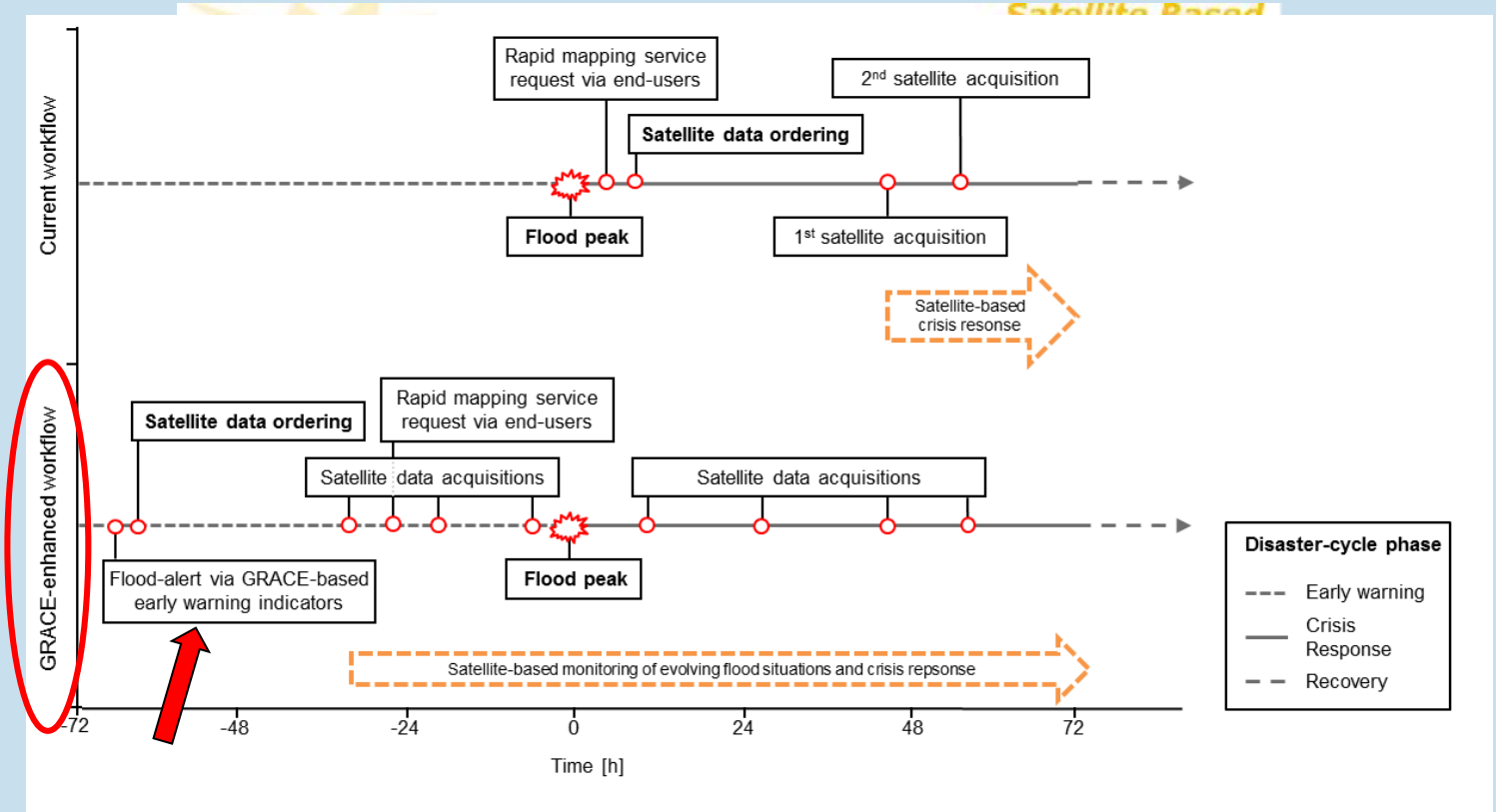
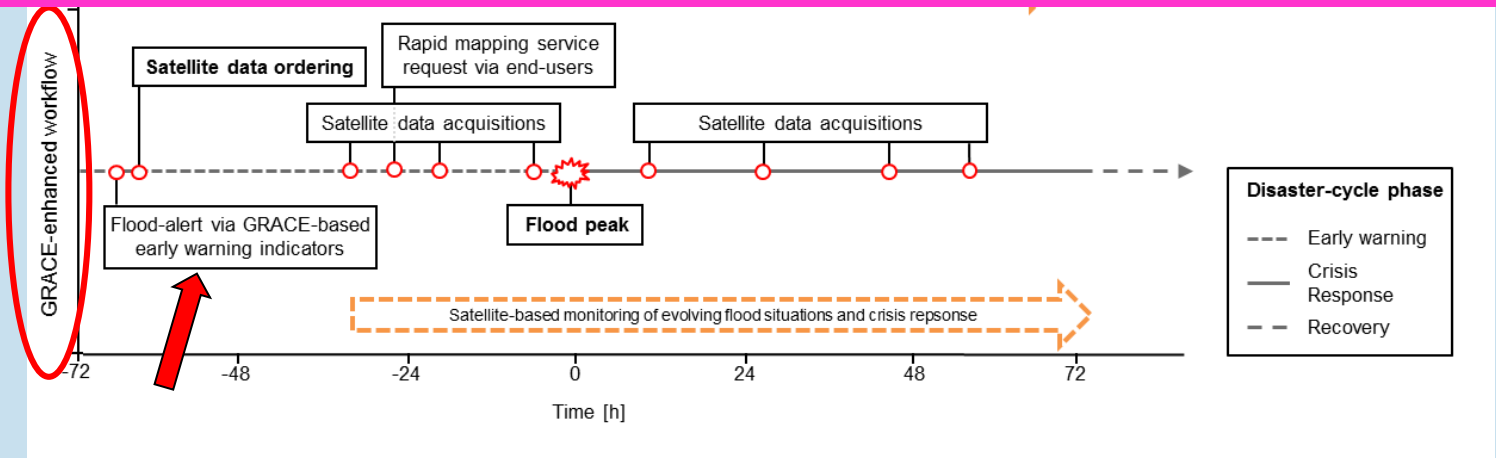
- **Integration into automatic flood emergency management services**



# How to use it?

- Improved rapid mapping by on-demand programming of satellite acquisitions
- 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.



# Gravity for early warning?

Gravity information needed in near-real time with high (daily) temporal resolution

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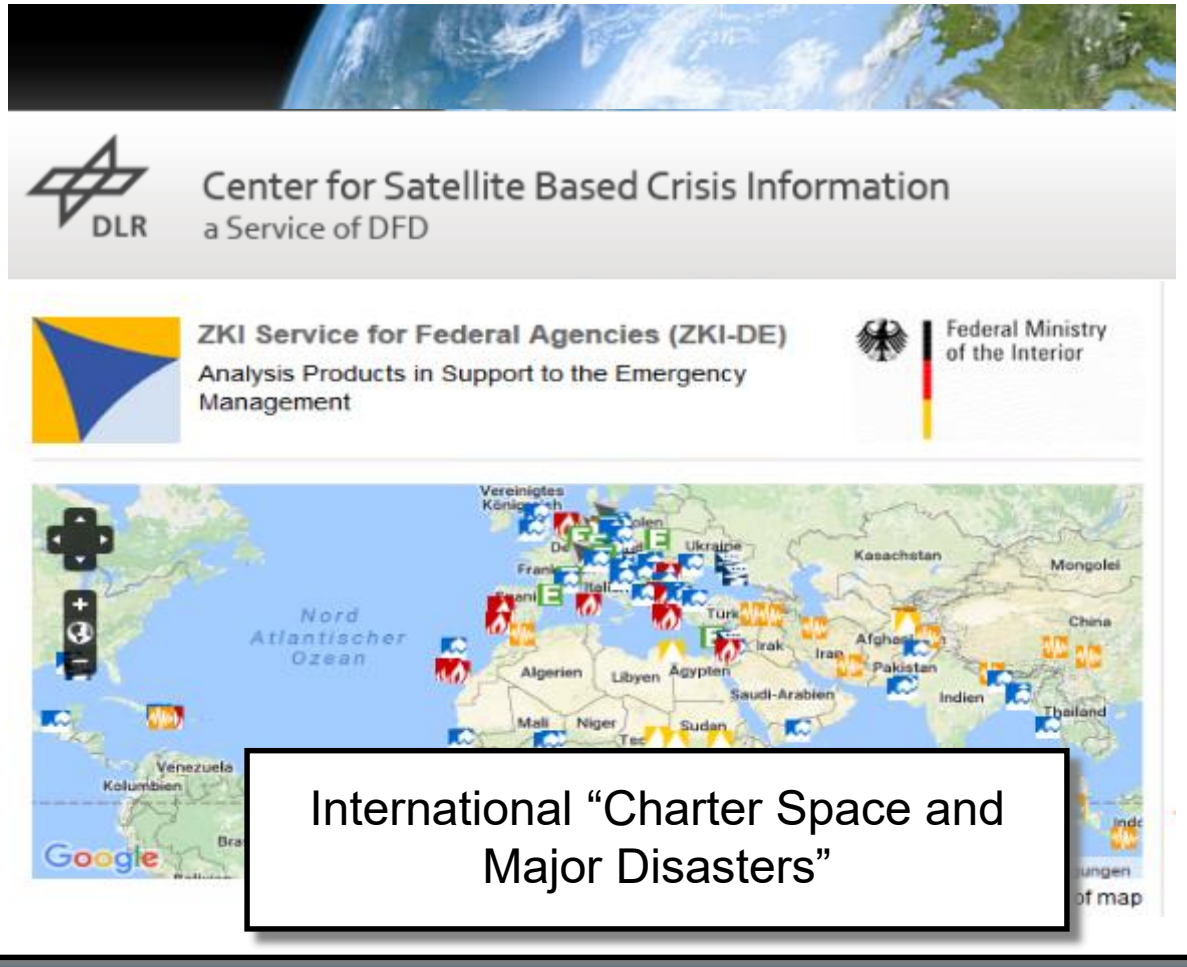



International “Charter Space and Major Disasters”

# Gravity for early warning?

Gravity information needed in near-real time with high (daily) temporal resolution


European Commission

European Commission
Joint Research Centre
Institute for Environment and Sustainability

EFAS
European Flood Awareness System

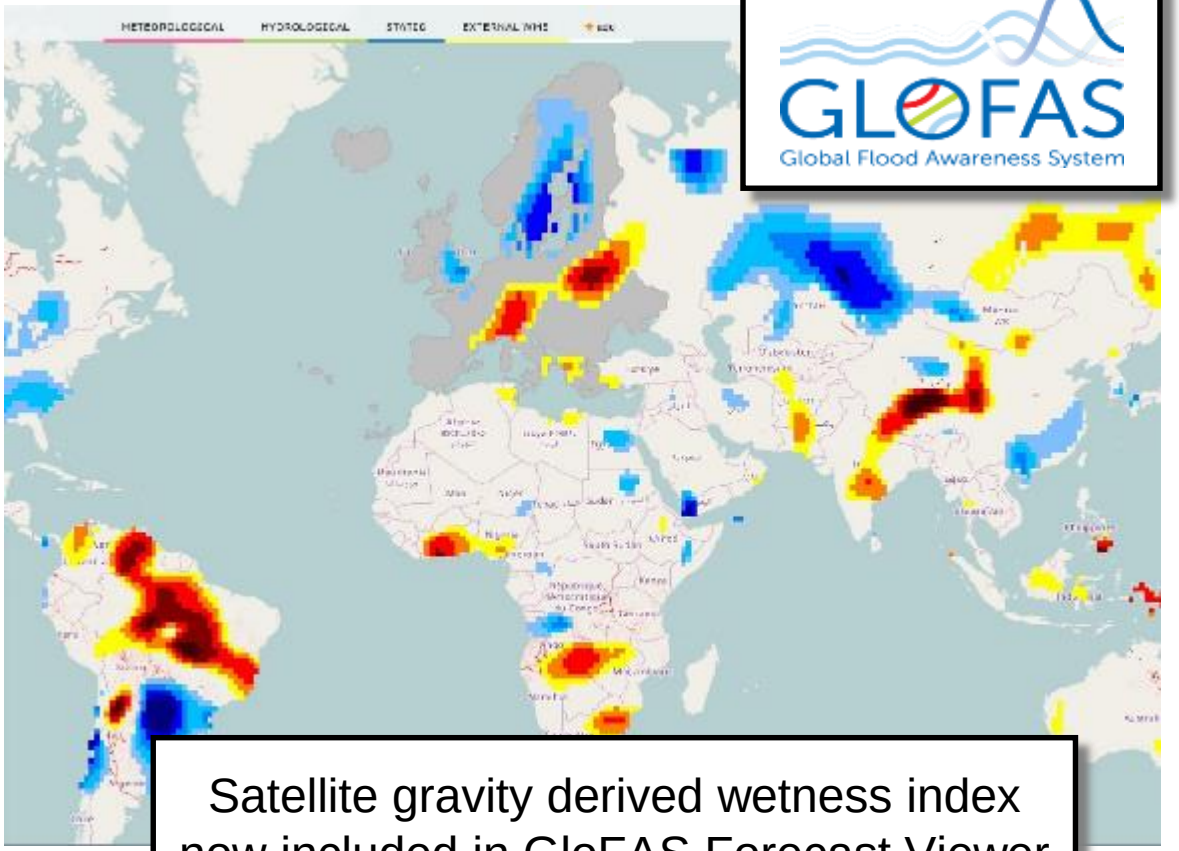
GLOFAS
Global Flood Awareness System

Include gravity in flood early warning systems!

# Gravity for early warning?

Gravity information needed in near-real time with high (daily) temporal resolution

EGSIEM
European Gravity Service for Improved Emergency Management




Satellite gravity derived wetness index now included in GloFAS Forecast Viewer

EGSIEM Autumn School for
Satellite Gravimetry Applications
11.-15. September 2017, Potsdam


# Practical: EGSIEM Plotter

Matthias Weigelt, Mail: weigelt@ife.uni-hannover.de

Purpose: The EGSIEM plotter is a powerful and convenient tool to allow for an easier access to GRACE products. It lifts the burden of handling spherical harmonic coefficients from users. The objective of this practical is to get familiar with the EGSIEM Plotter, use the different products, compare and download time-series data for further processing.

**Exercise 1** – **set up different time series**: use for all time-series *water heights* as gravity functional and the *EGSIEM L3 hydrology* data set

a) First choose a point in the upper Danube river basin, e.g. near Munich or Ulm and plot the time series by pushing the *Plot* or *Replot* button.
b) Add a second time-series for a point in the middle of the river basin, i.e. near Vienna, and a third time-series at the mouth of the river near the black sea. What differences do you observe? Where do the differences come from?
c) Add an additional series and try to approximate the size of the Danube river basin by a quadrilateral. Finally, add a time-series for the basin and compare all the time-series. Especially compare that the amplitude of quadrilateral or the basin is normally slightly smaller than for single points. What may be the explanation?

**Exercise 2** – **daily vs. monthly solutions**

a) Compare the TUGRAZ ITSG2016 daily Kalman solution vs. the TU GRAZ ITSG16 DDK5 or GFZ Rel05a DDK time-series for the Amazon basin in terms of geoid heights. What do you observe?
b) Plot the same two time-series for the Danube basin in terms of water heights. Try to identify the flood period in the 2006. Compare the daily solution to the monthly solution and quantify the peak for both solutions? What difference do you observe?
c) Wikipedia states an extended flood period between February and April 2006 for Europe. Estimate the length of the flooding period in the Danube basin. Test all other European basins and check if you can identify a flood peak. Which areas have been affected most?

**Exercise 3** – **regression**

a) Prepare again a daily time series in terms of water height for a point in the middle of Greenland and one at the south-western edge of Greenland. Use the trend-map to choose the two points such that one is in the minimum ice melt and one in the maximum ice-melt. What do you observe?
b) Add a linear regression model for both points. Compare the trend estimate by opening the data panel (push the show data button).

c) Add a third time-series at the location of your maximum ice-melt but set the regression to periodic. Compare the trend of the linear model and of the periodic model. Why is there a difference? Which of the two models is more reliable in your opinion?

**Exercise 4 - Advanced topics**

a) For an arbitrary point on land set the gravity functional to water heights and set the data set to EGSIEM grace HYD. Show the data and download it.
b) Repeat a) for EGSIEM L3 hydrology, EGSIEM atmosphere HYD, EGSIEM ocean HYD and EGSIEM gia HYD
c) Read the data into Matlab – you may write your own reading routine or you simply import the data.
d) Hydrology is calculated according to GRACE – Atmosphere – Ocean – GIA. Calculate the result and compare it to the EGSIEM L3 hydrology time series. What do you observe.
e) Repeat a) to d) but include a regression model to remove trend, bias, the annual and semi-annual signal. Your reading routine needs to be adapted as the parameters are given as a comment to the data.

Have fun!