

## **Hydrological validation of H SAF Precipitation Products -Case study Mai/June flood 2013 in Central Europe**

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ECMWF/ H-SAF and HEPEX Workshops on coupled hydrology, Reading 3-7 November 2014

# The Washington Post

June 4, 2013 at 11:31 am

## Severe flooding inundates parts of Central Europe (PHOTOS)

By Justin Grieser

....

The city declared a state of emergency after swollen rivers cut off outside road access. Soldiers from the German army are being sent to flooded areas in southeastern Germany to provide disaster relief.

In the Czech Republic, the country is on high alert for its most severe flooding since at least 2002. Authorities closed the iconic Charles Bridge in Prague, where the Vltava River is flowing at 10 times its normal volume through the Czech capital, ...

<://www.washingtonpost.com/blogs/capital-weather-gang/wp/2013/06/04/severe-flooding-inundates-parts-of-central-europe-photos/>

# River basin Danube



An aerial view of the flooding in Passau, Germany, 03 June 2013.  
The floodings in Bavaria continue to worsen. (Peter Kneffel – AP)

# River basin Labe (CZ)/Elbe (DE)

The statue of spiritual leader Sri Chinmoy was partially submerged in water from the rising Vltava River in Prague Sunday. (David W. Cerny – Reuters)



An aerial view of the flooding in Passau, Germany, 03 June 2013.  
The floodings in Bavaria continue to worsen. (Peter Kneffel – AP)



# River basin Labe (CZ)/Elbe (DE)

flooded city centre of Grimma/Mulde, on June 3, 2013\_



An aerial view of the flooded town in Bavaria. The floodings in Bavaria c



# Flood Warning and Forecasting









Eine gemeinsame Initiative der deutschen Bundesländer




## Aktuelle Hochwasserlage Montag, 03.06.13, 19:44 Uhr

-  Warnlage
-  Lageberichte
-  Flussgebiete

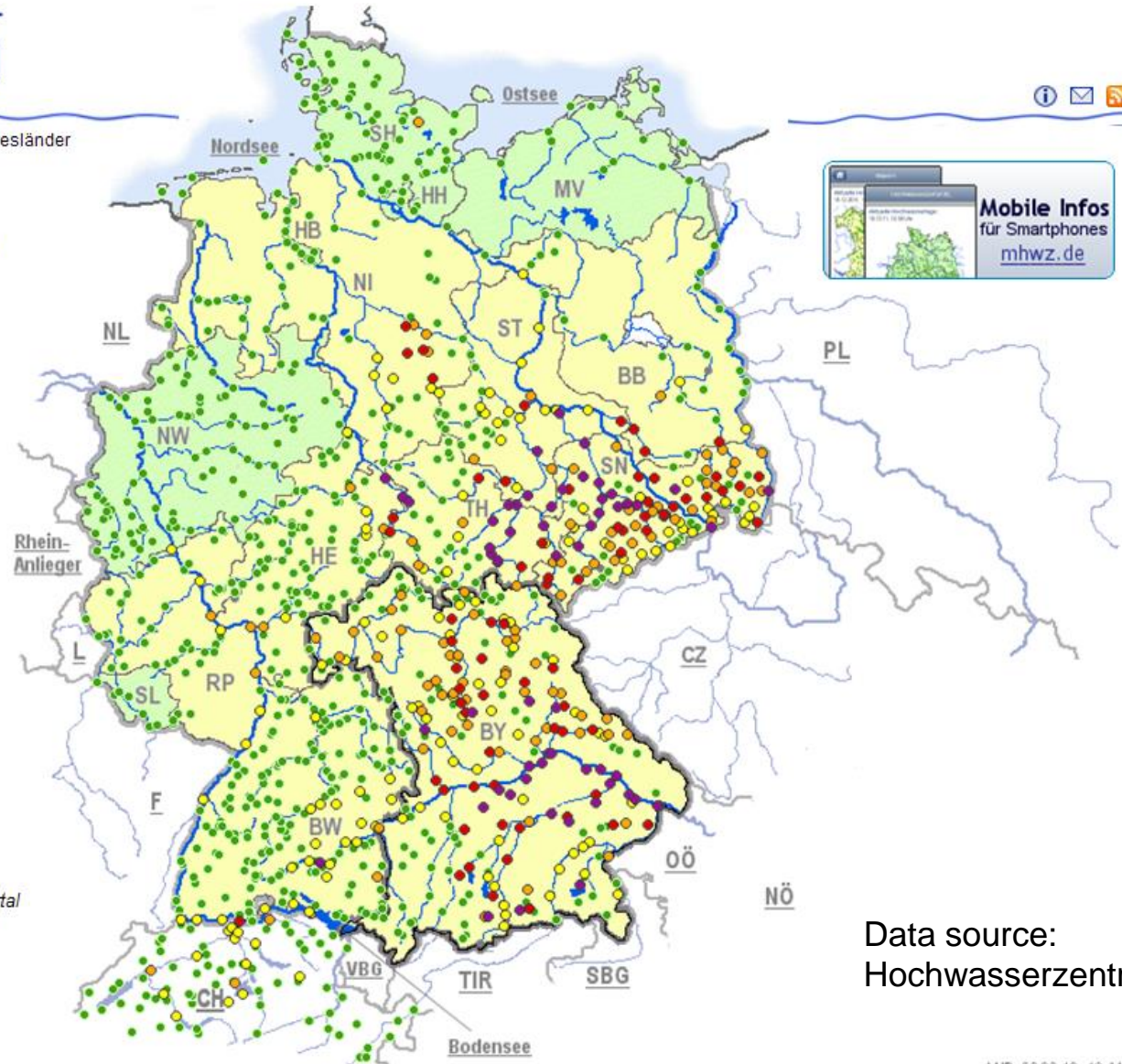
### Situation am Pegel: \*

-  Kleines Hochwasser
-  Mittleres Hochwasser
-  Großes Hochwasser
-  Sehr großes Hochwasser
-  Kein Hochwasser
-  Derzeit keine Daten

### Kurzinformation der Länder: \*

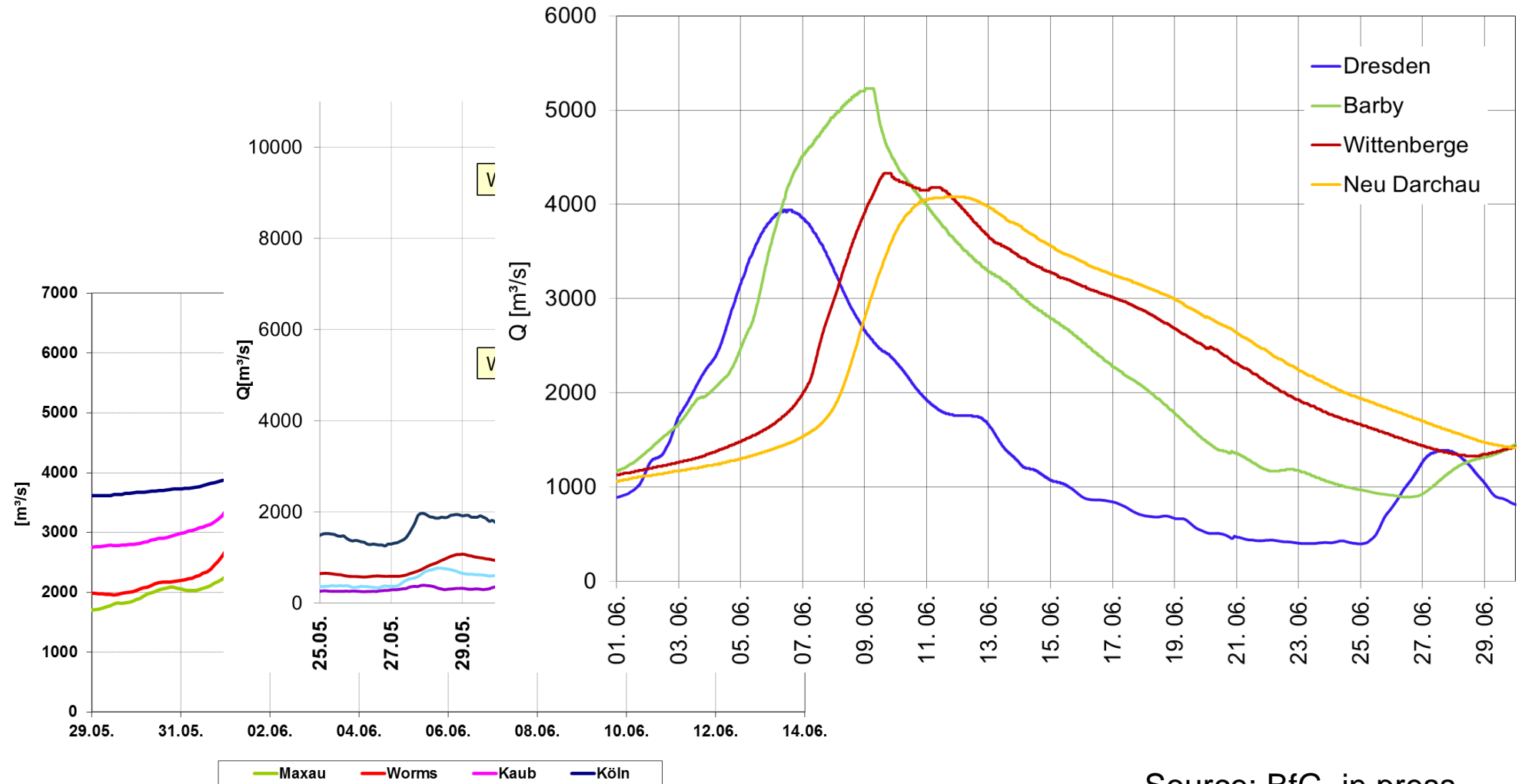
-  Hochwasser-Bericht oder -warnung
-  Kein Hochwasser-Bericht
-  Derzeit keine Informationen

\* Weitere Infos im jeweiligen Hochwasserportal  
des Landes durch Mausklick auf das Land.  
Alle Angaben ohne Gewähr.

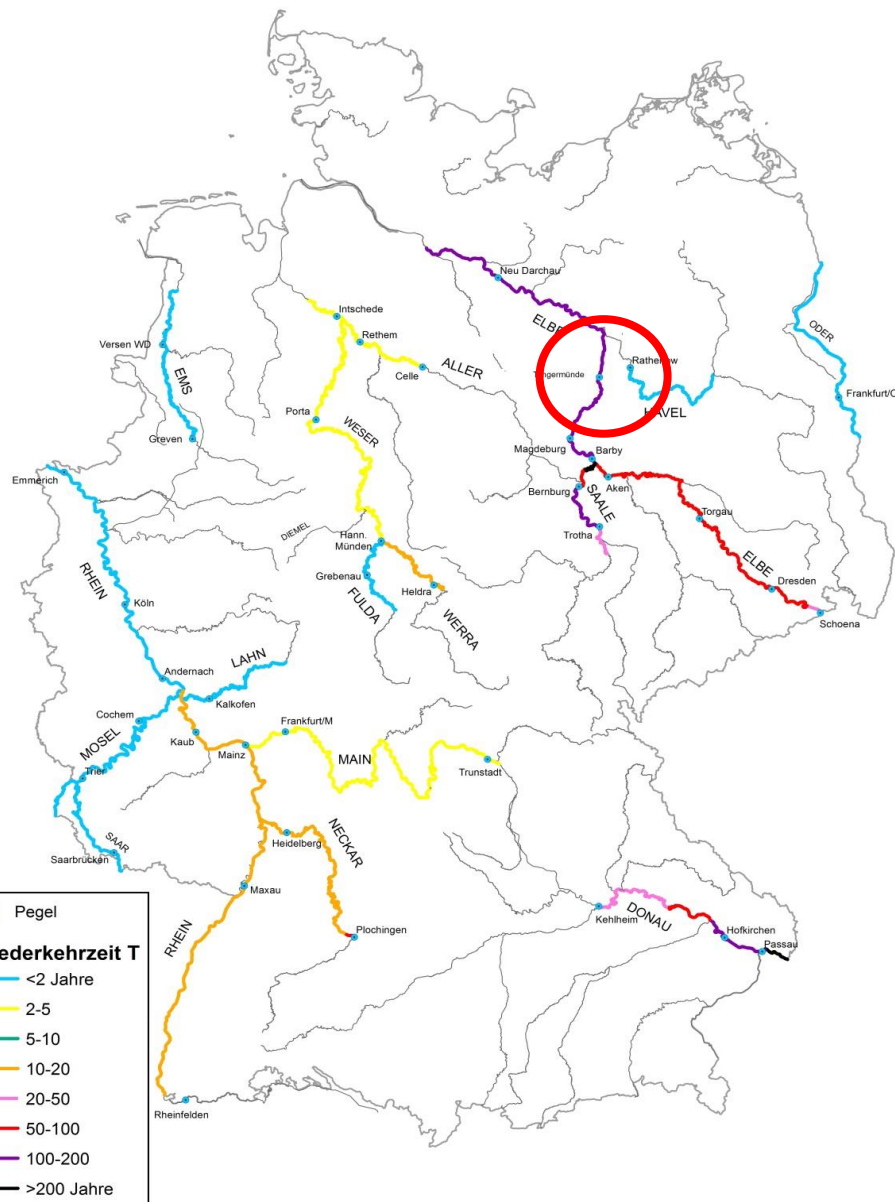


Data source:  
Hochwasserzentralen 2013

# Flood Wave propagation



Source: BfG, in press



# Overview

Flood situation in Germany for  
main river courses

Mai/June 2013

Return period of  $T_{\text{Year}}$  flood

Source: BfG, in press



# Example River Elbe: Dike break

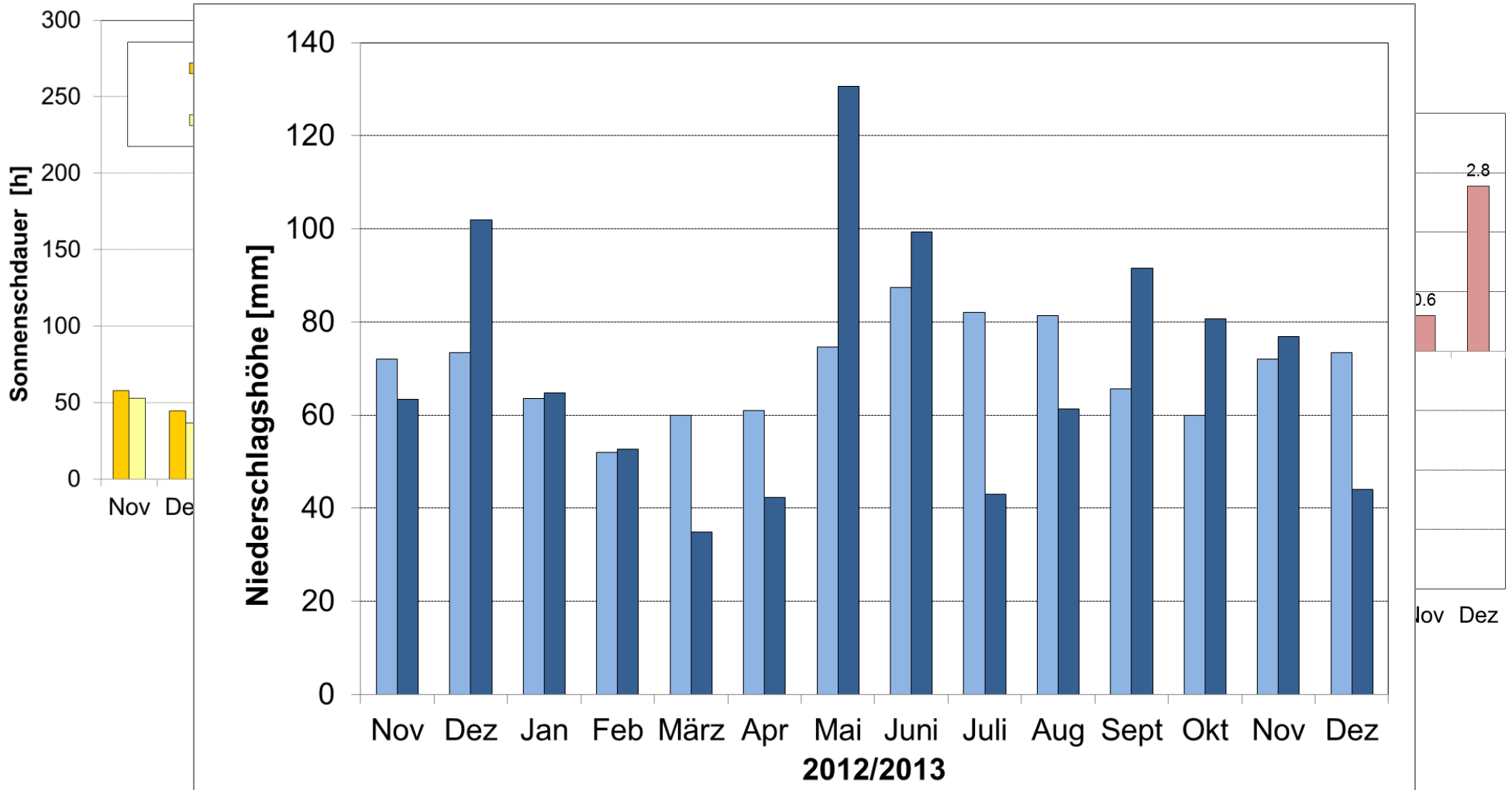
Dyke breakdown at  
Fischbeck 10.6.



(Source left: Vermessungsverwaltungen der Bundesländer und BKG )

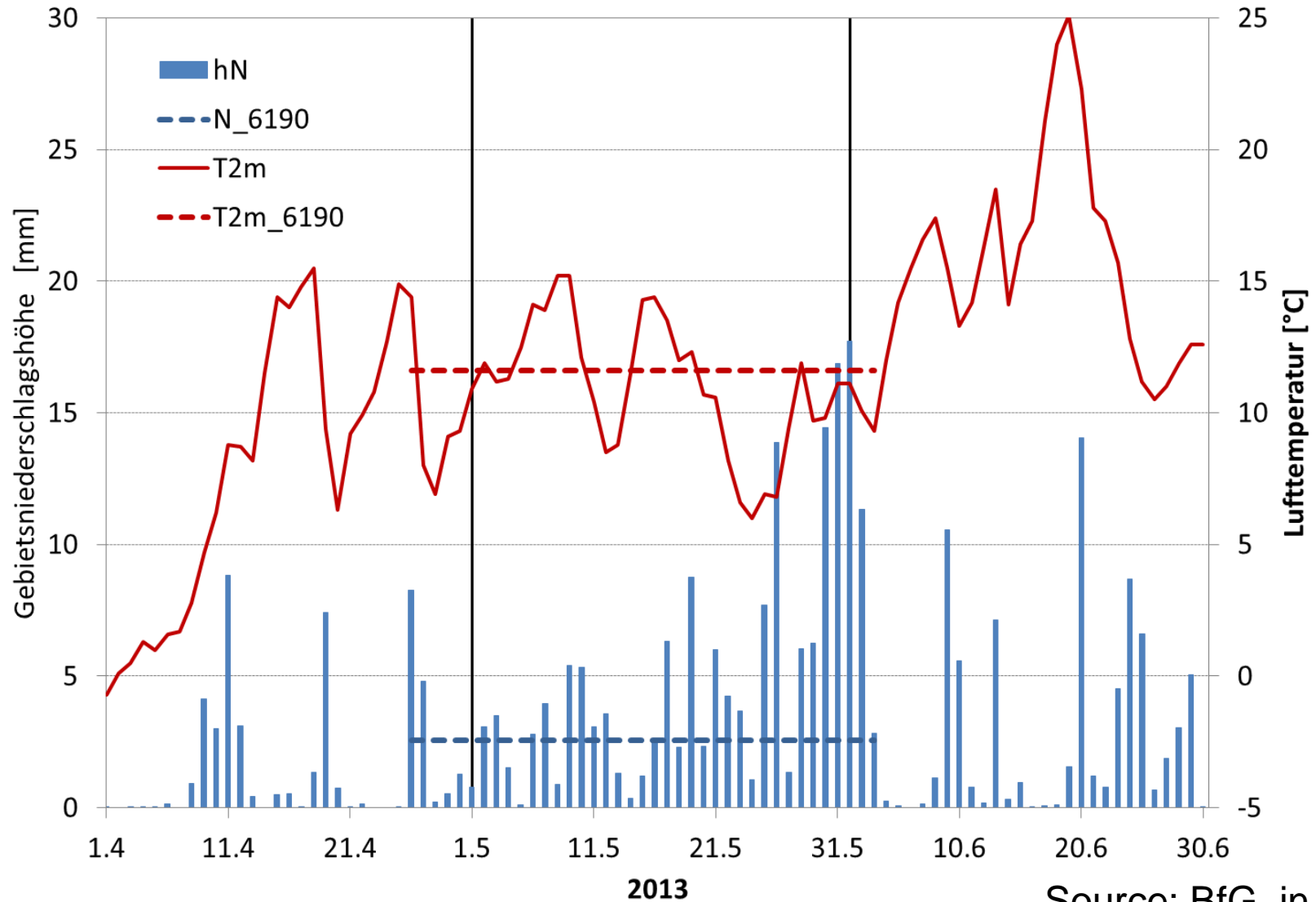
(Source right : BfG )

# Hydrometeorological causes



Source: BfG, in press

# Hydrometeorological causes



Source: BfG, in press



# Hydrometeorological causes

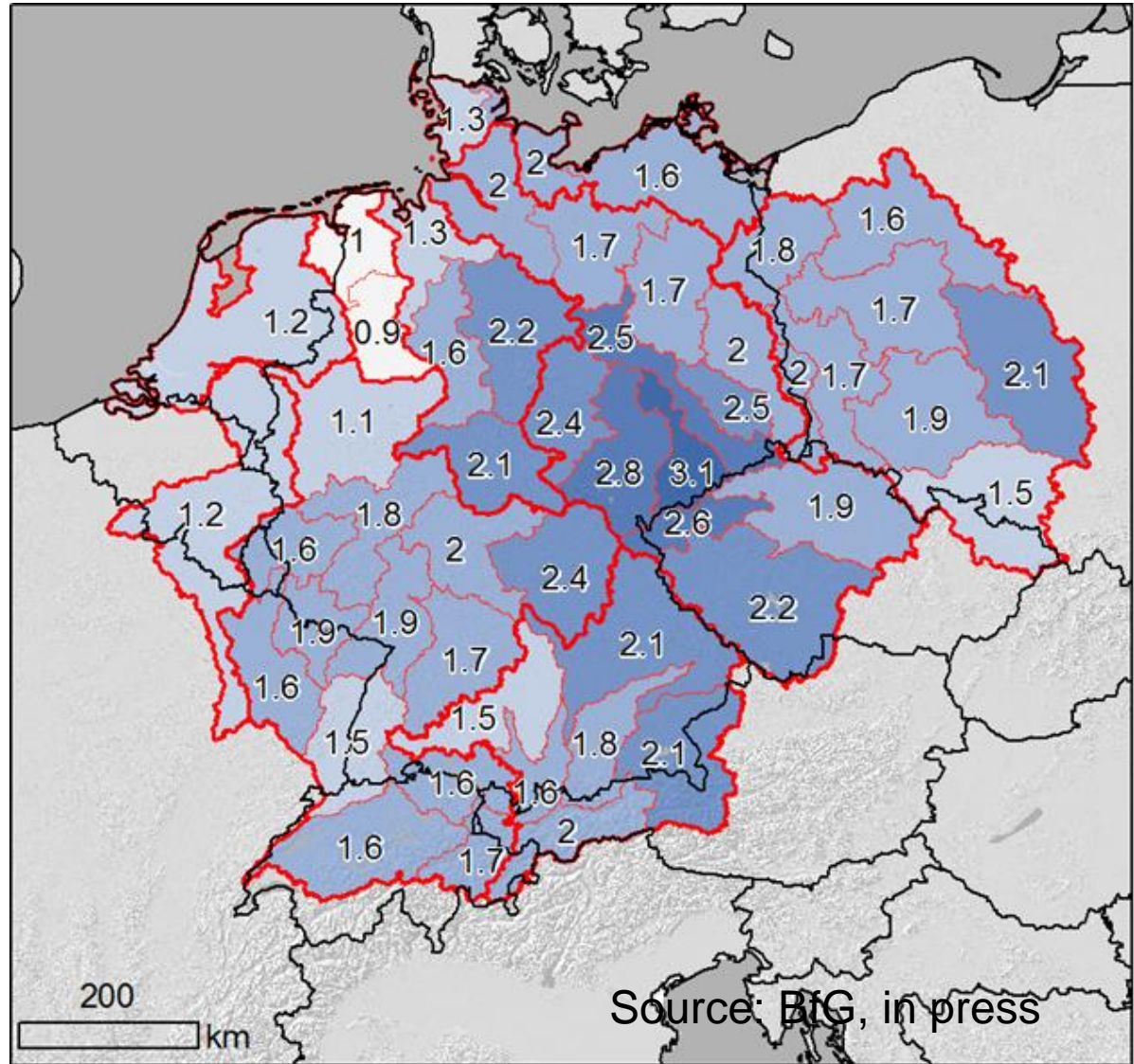
Anomaly of precipitation sums

Mai\*2013 (21.04. - 3.06.2013)  
to  
LTA Mai\* 1961 - 1990

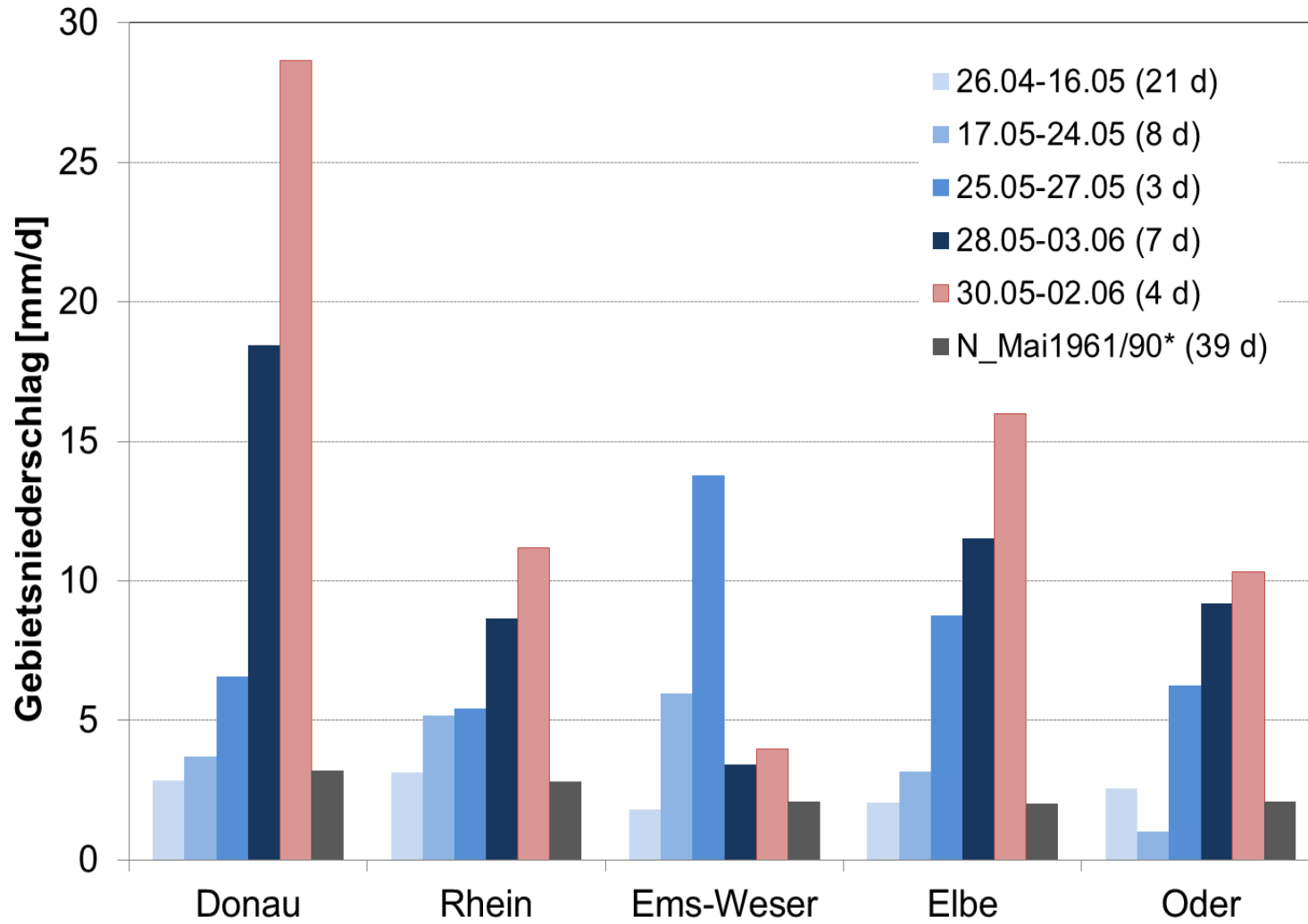
-compiled  
precipitation data  
sets 1951-2013  
(**Eobs & HYRAS**)

- defined 50 river  
basins

- calculated areal  
means

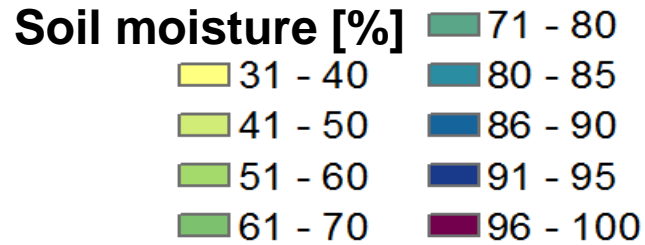


# Hydrometeorological causes



Source: BfG, in press

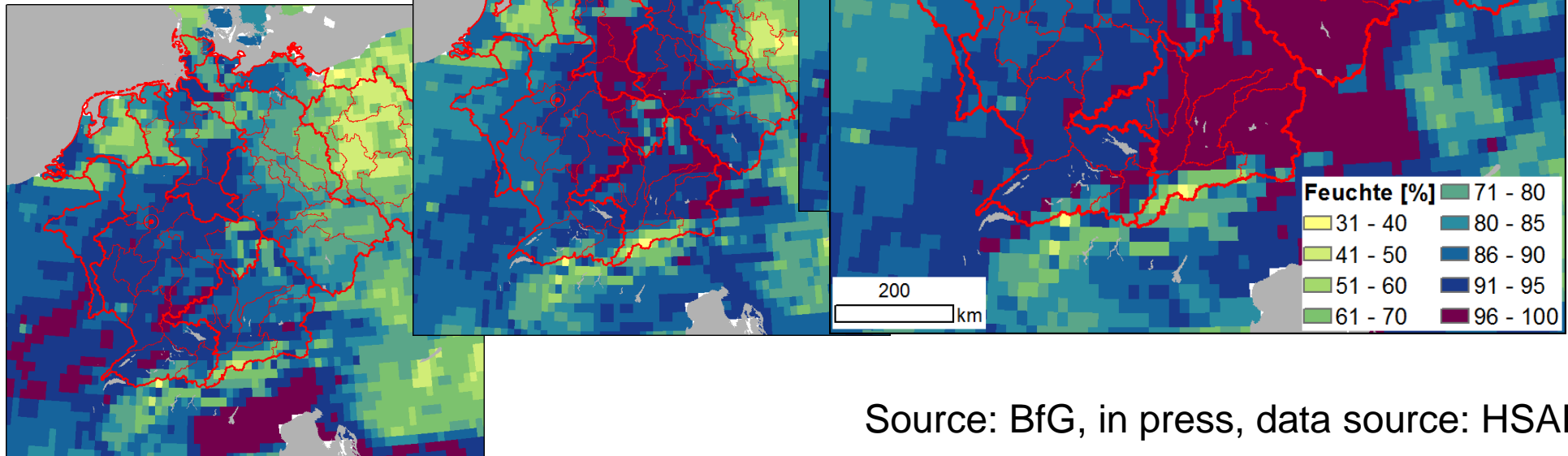
# Areal soil moisture (HSAF H14, 7-28cm)



**03.06.2013**

**28.05.2013**

**25.05.2013**



Source: BfG, in press, data source: HSAF

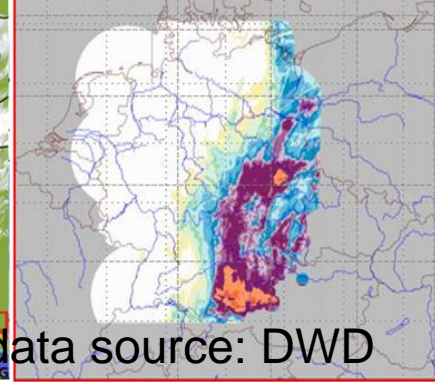
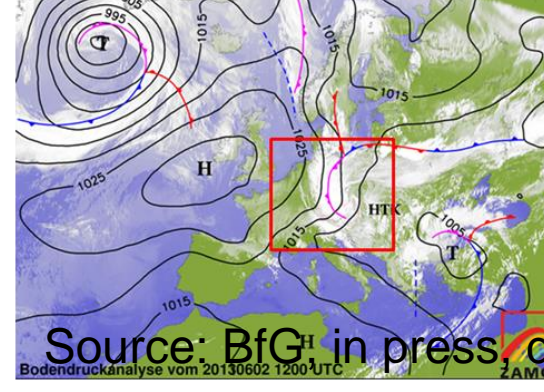
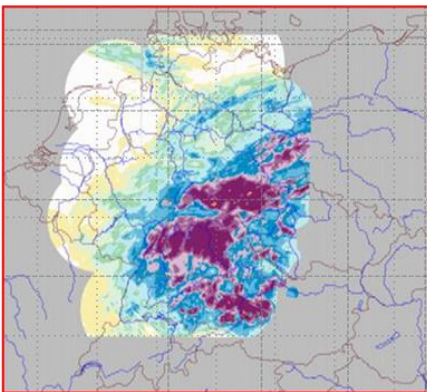
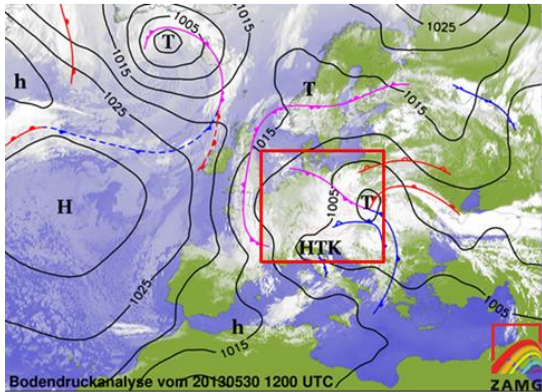
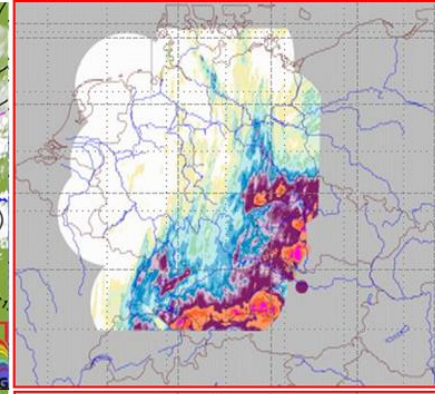
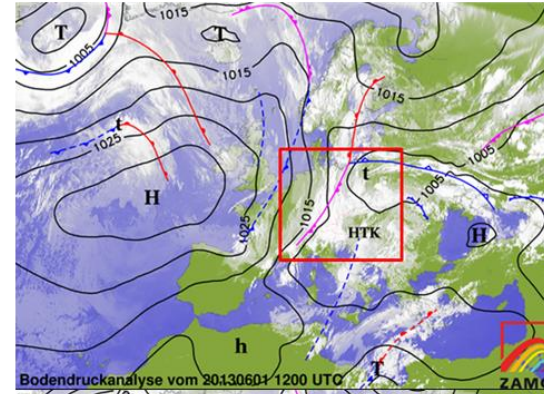
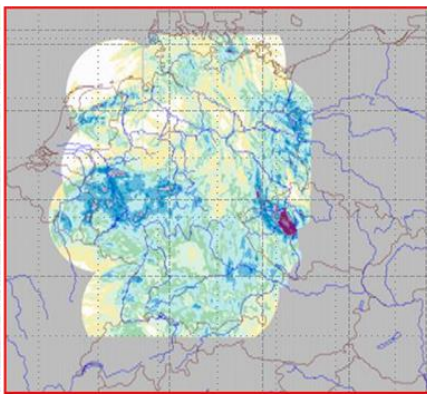
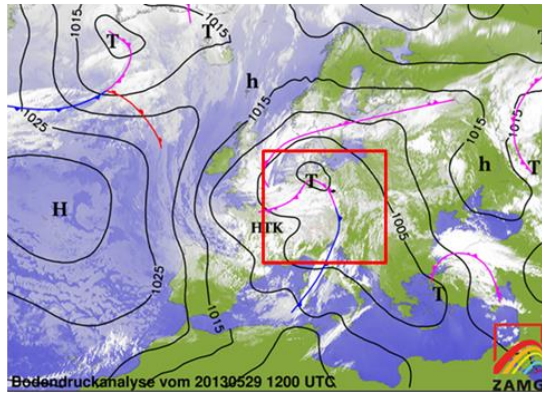
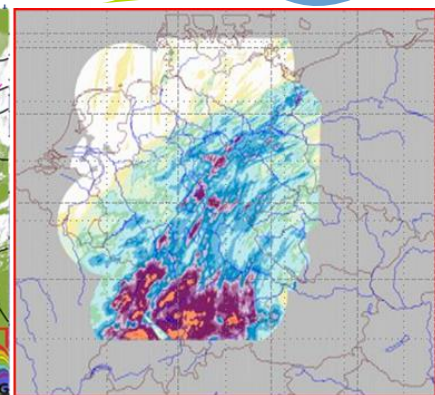
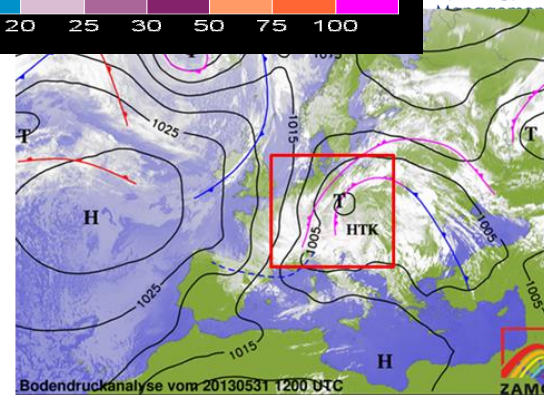
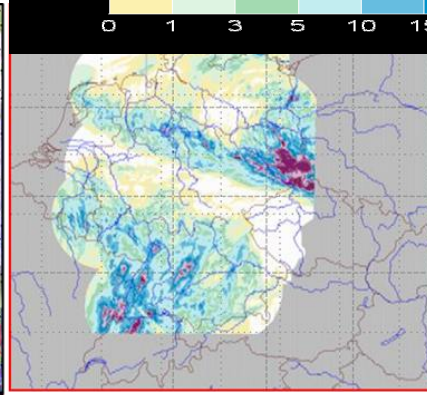
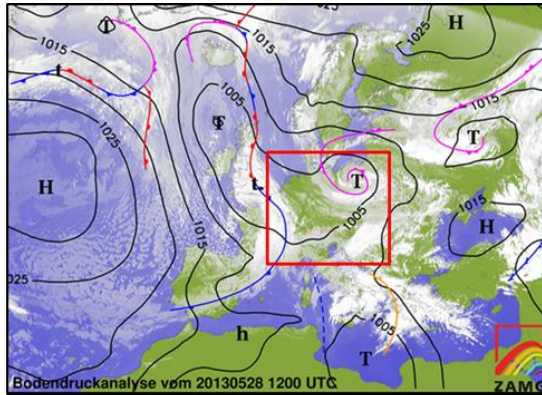
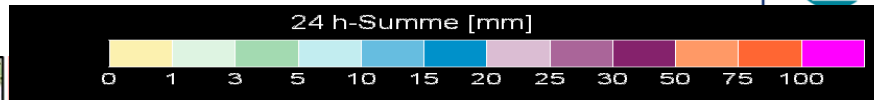


# Synoptic situation & RADOLAN

The EUMETSAT  
Network of  
Satellite Application  
Facilities

**HSAF**  
Support to Operational  
Hydrology and Water

**bfg** Bundesanstalt für  
Gewässerkunde



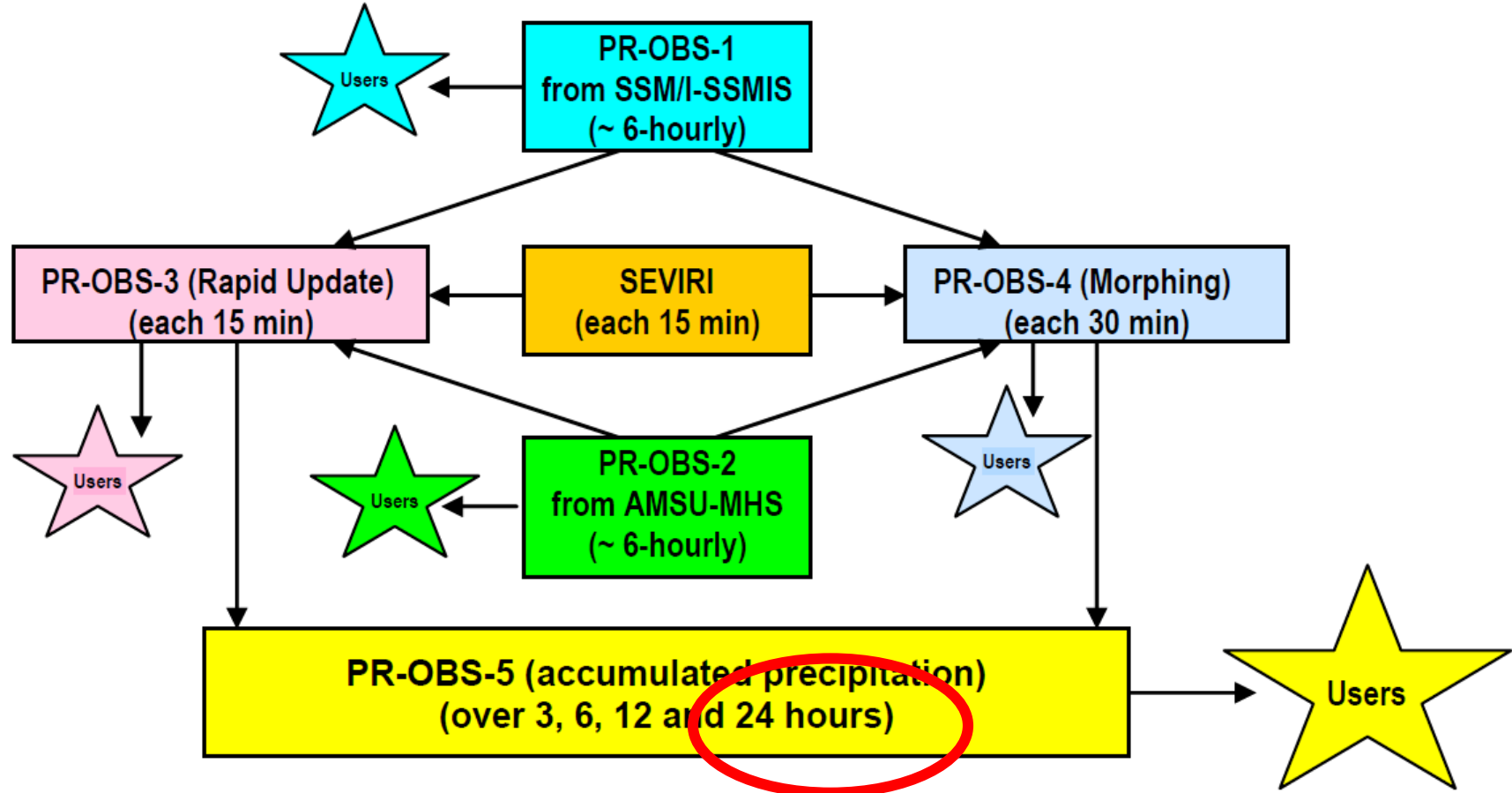
Source: BfG<sup>H</sup> in press, data source: DWD

28.05. bis 30.05.2013

31.05. bis 2.06.2013



# HSAF Precipitation



Architecture of the PR-OBS-5 product generation chain

Source: HSAF, Product User Manual - PUM-05, 2012

# HSAF Meteorological validation

Scores of dichotomou:

Performance  
diagram  
(Roebber, 2009)

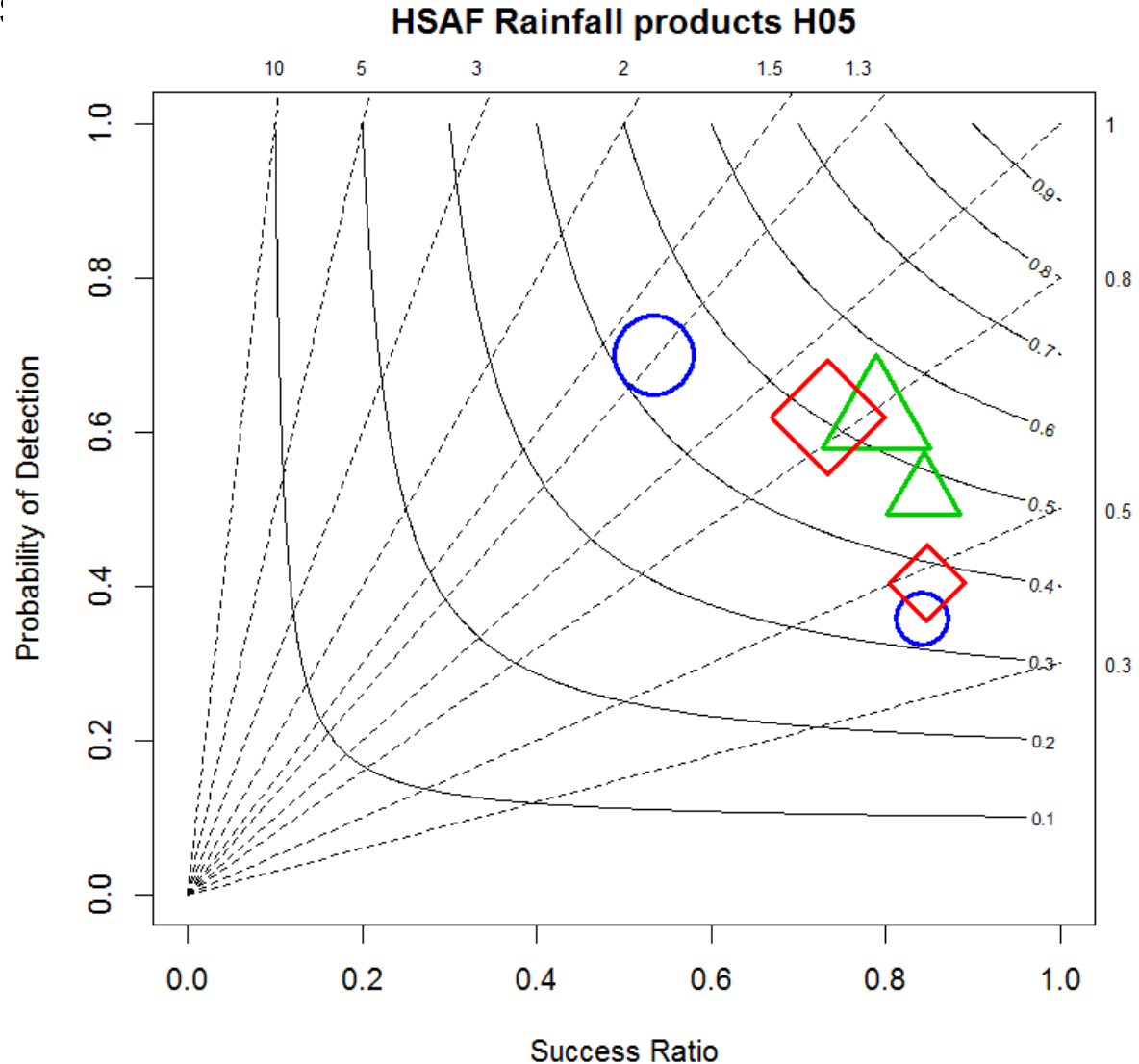
**April**

**Mai (triangle)**

**June**

Radolan – H05\_24h

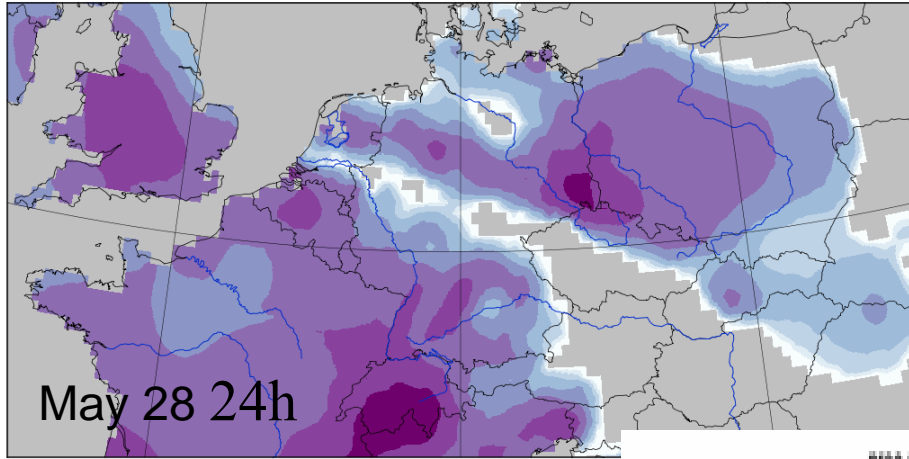
SYNOP – H05\_2h



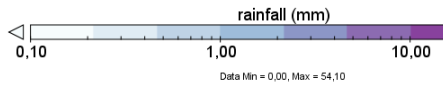


# HSAF Meteorological validation

## Eobs 0.25 °, 24h, 6:00 UTC



May 28 24h

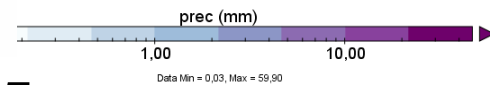
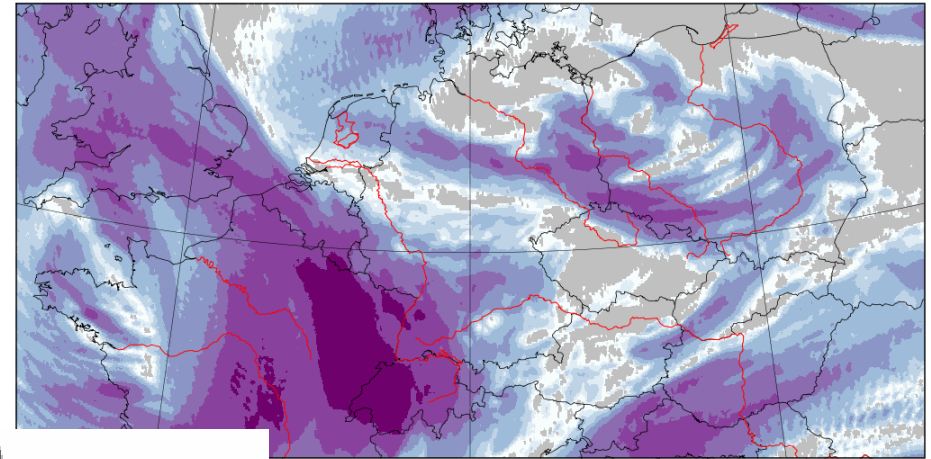


rainfall

0.1 1.0

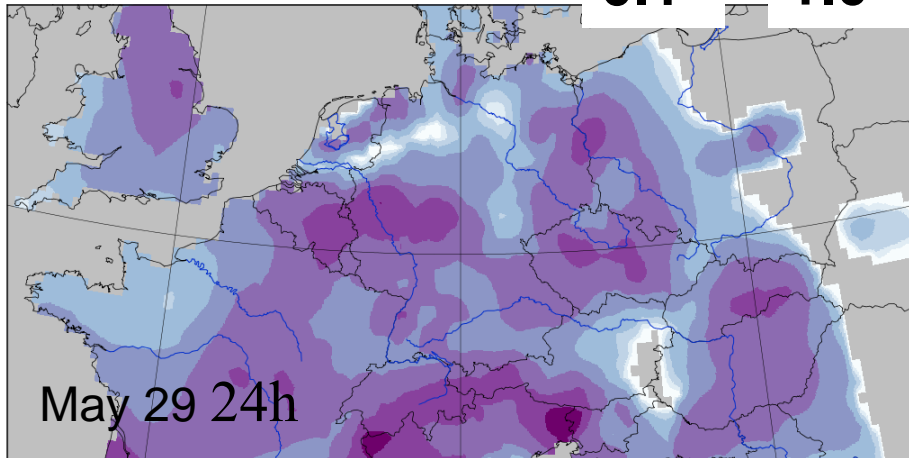
prec (mm)

## H05 24h, 6:00 UTC

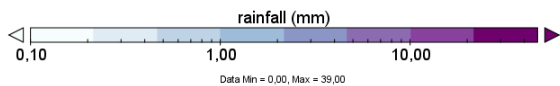


prec (mm)

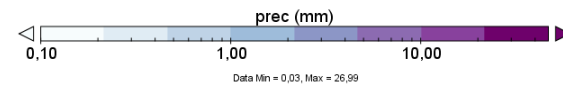
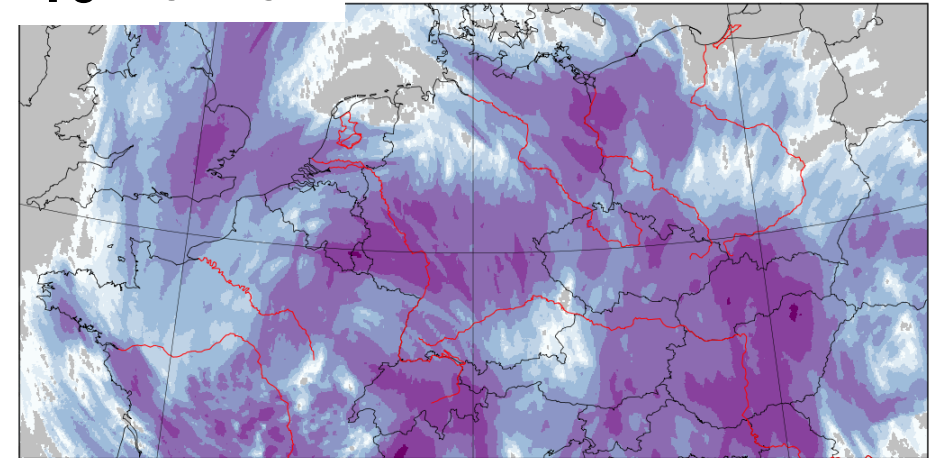
10 20 45



May 29 24h



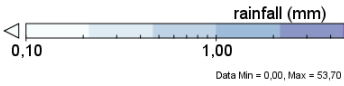
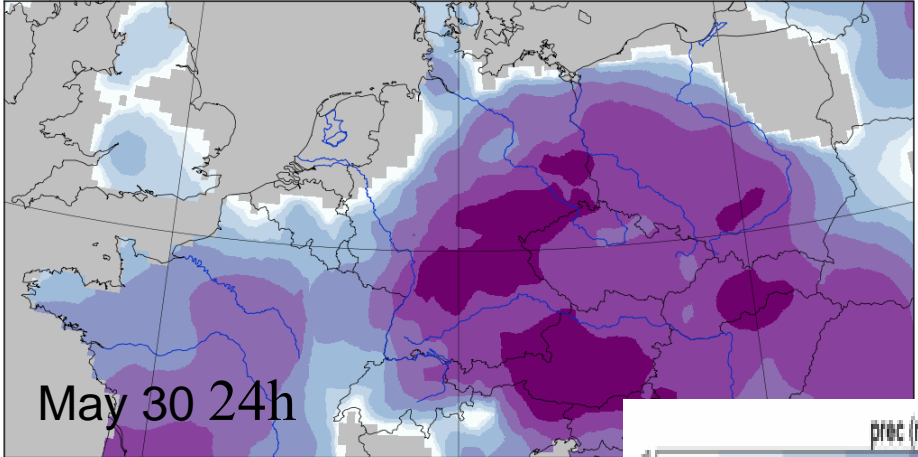
rainfall



prec (mm)

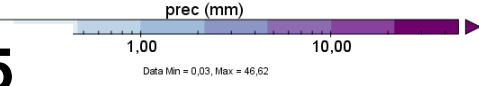
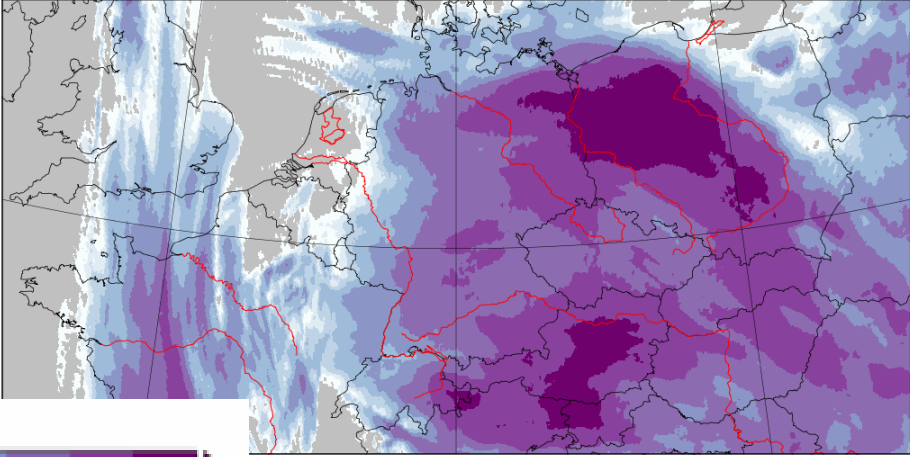
# HSAF Meteorological validation

rainfall

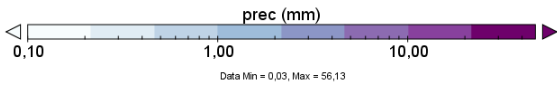
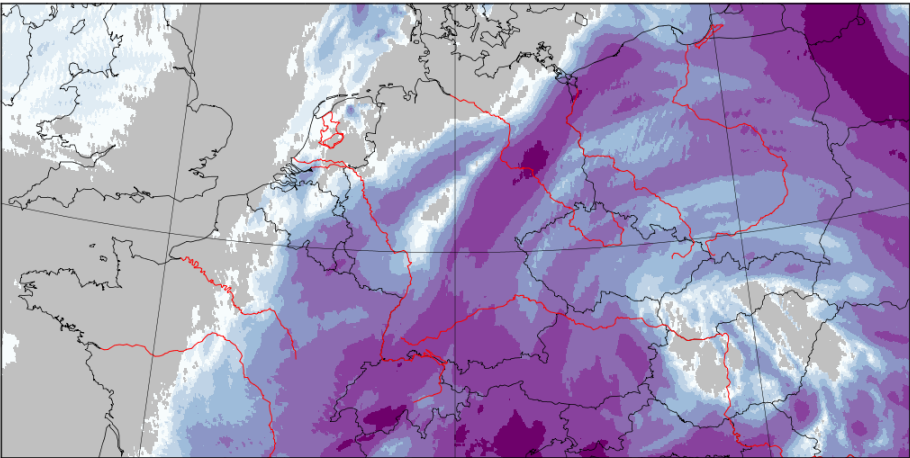
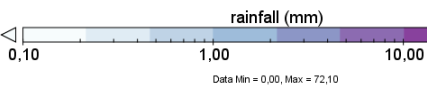
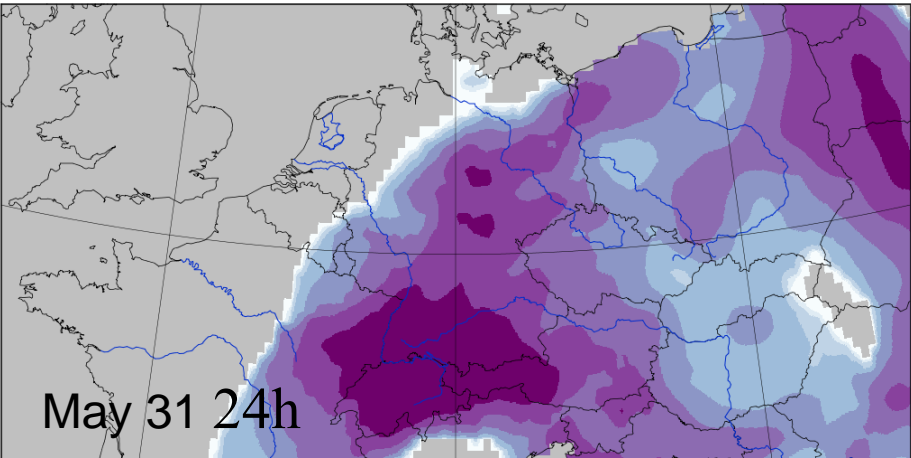


0.1 1.0

H05 24h-sum

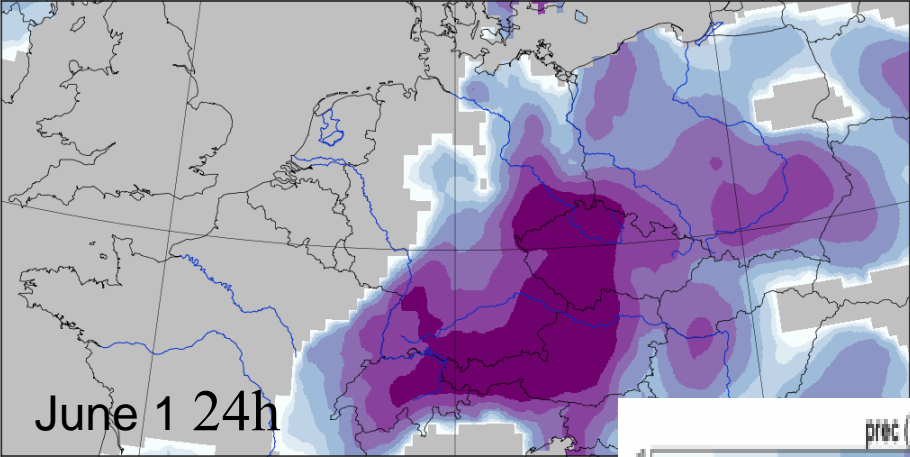


10 20 45

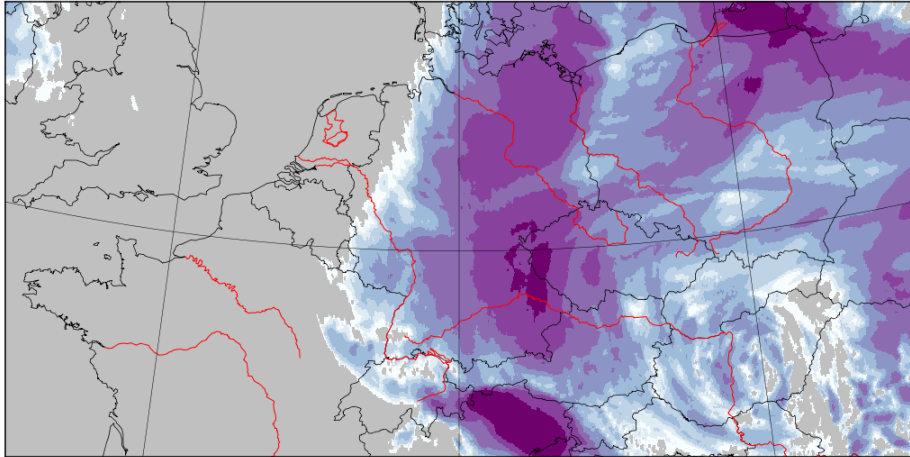
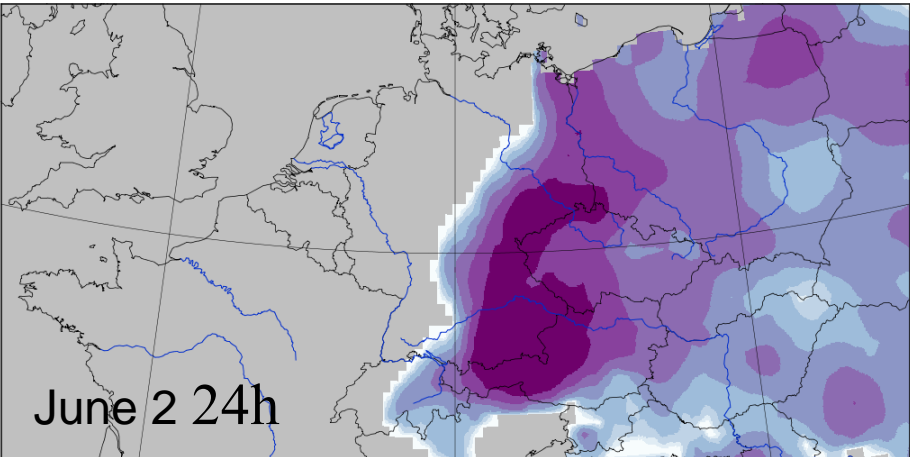
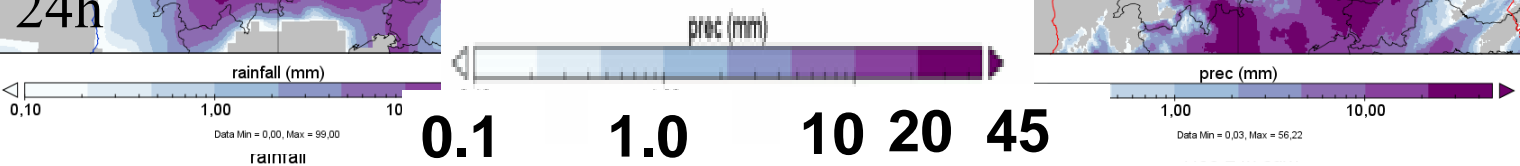
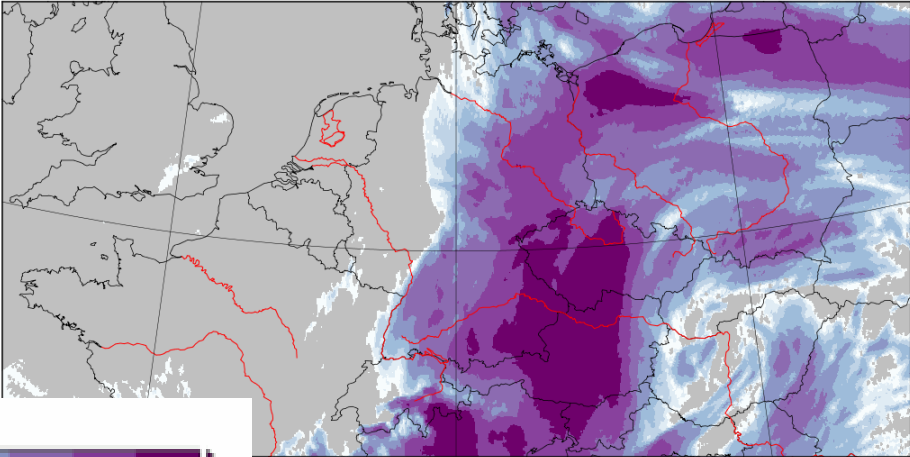


# HSAF Meteorological validation

rainfall



H05 24h-sum





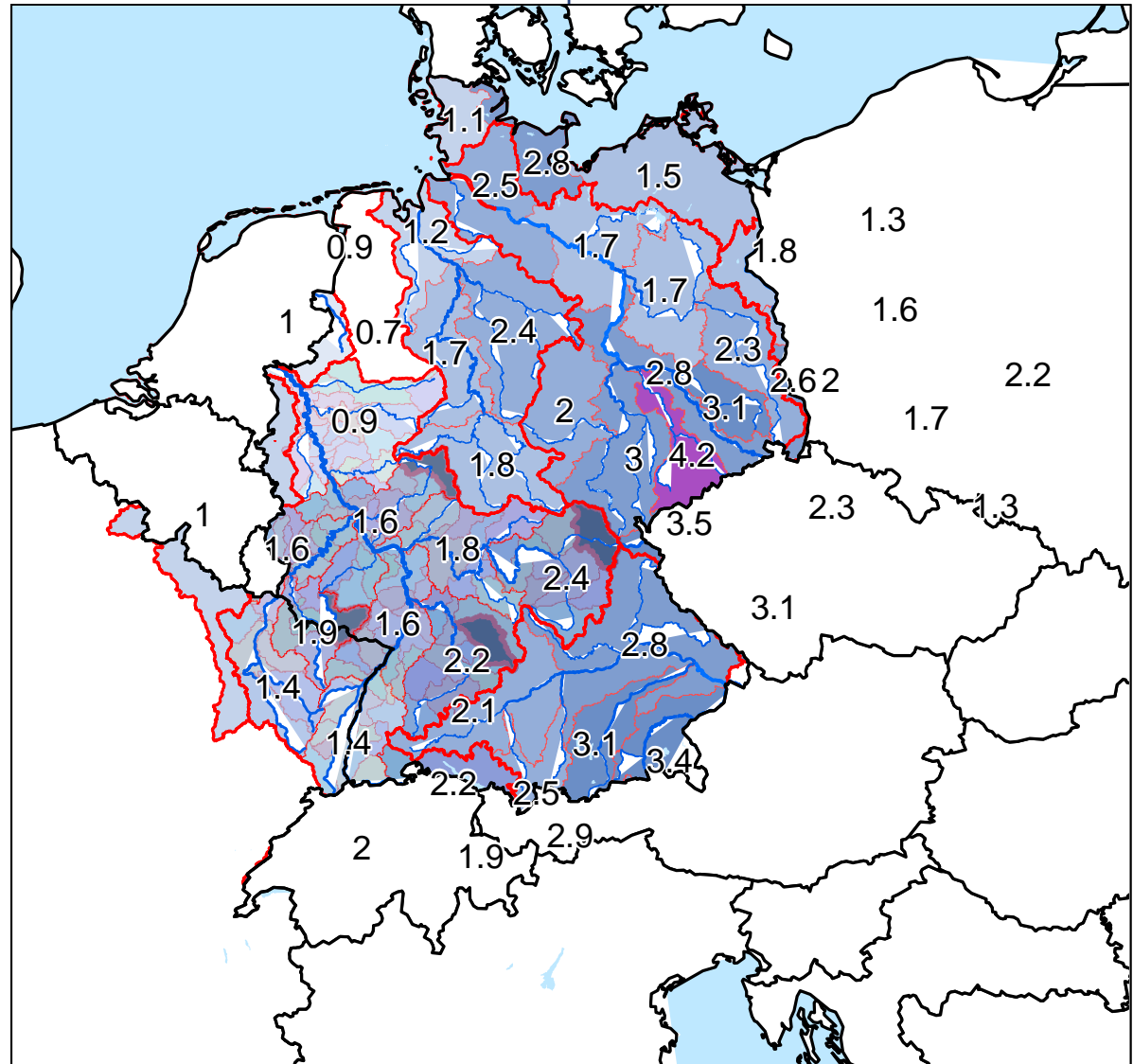
# HSAF Hydrovalidation

Anomaly of  
max 5d- precipitation  
sums

Mai\*2013  
(21.04. - 3.06.2013)  
to  
LTA Mai\* 1961 – 1990

&

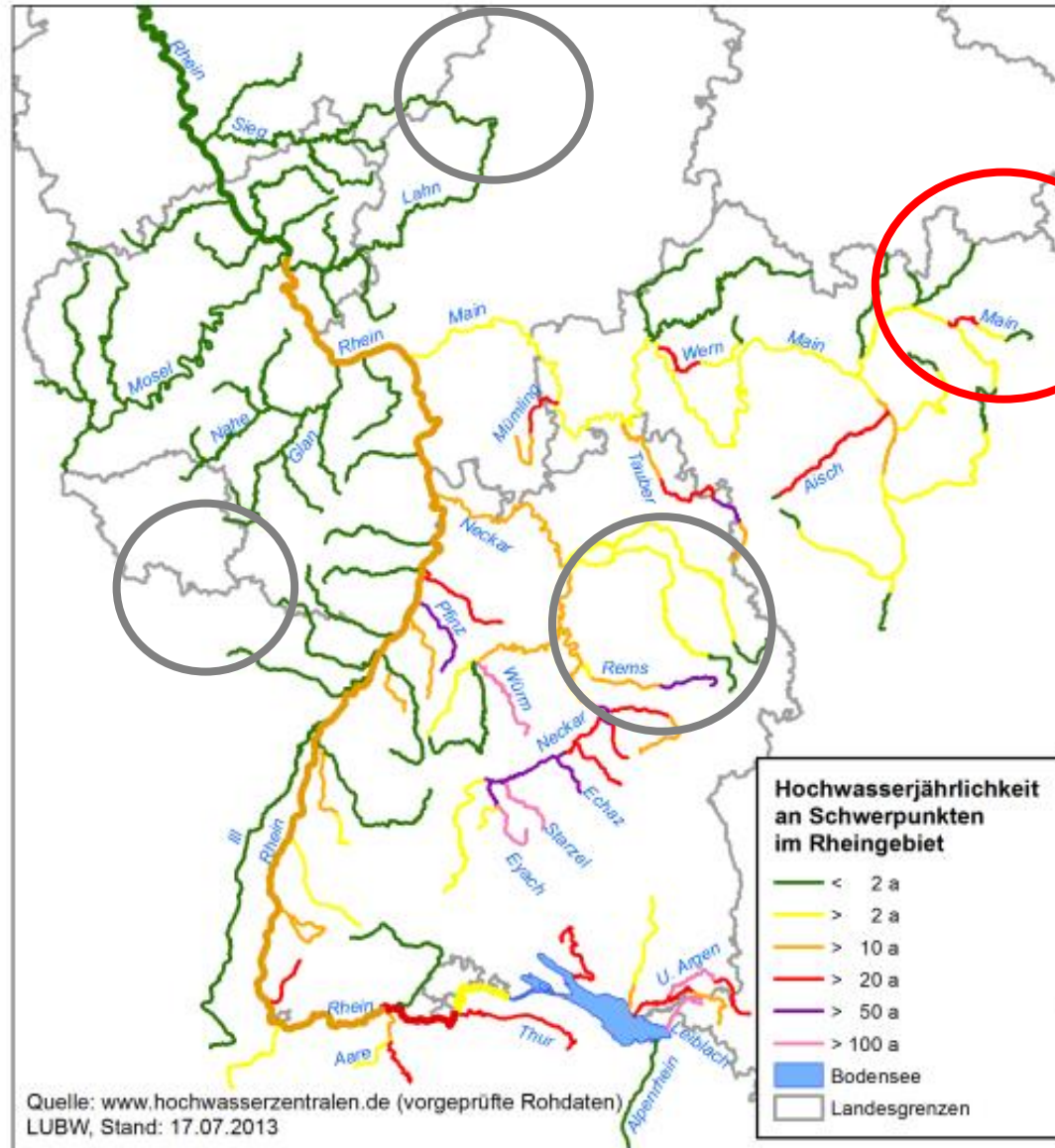
HSAF Hydrovalidation  
River basins



## Overview

Flood situation  
in HSAF  
river basins  
Mai/June 2013

Return period  
of  $T_{\text{Year}}$  flood

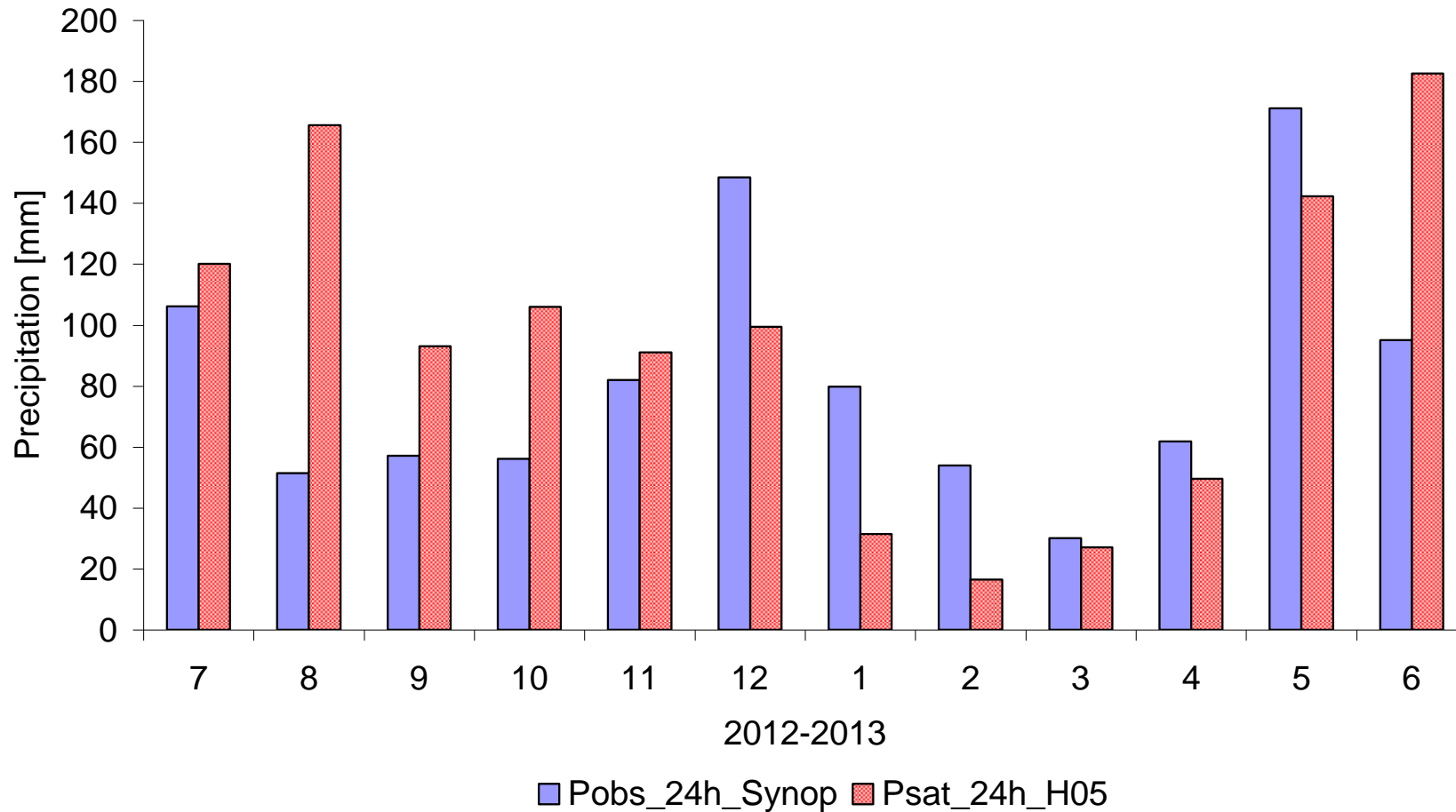


Gauge  
Schwuerbitz  
River Main

Data source:  
Hochwasserzentralen 2013

# HSAF H05\_24h Hydrovalidation

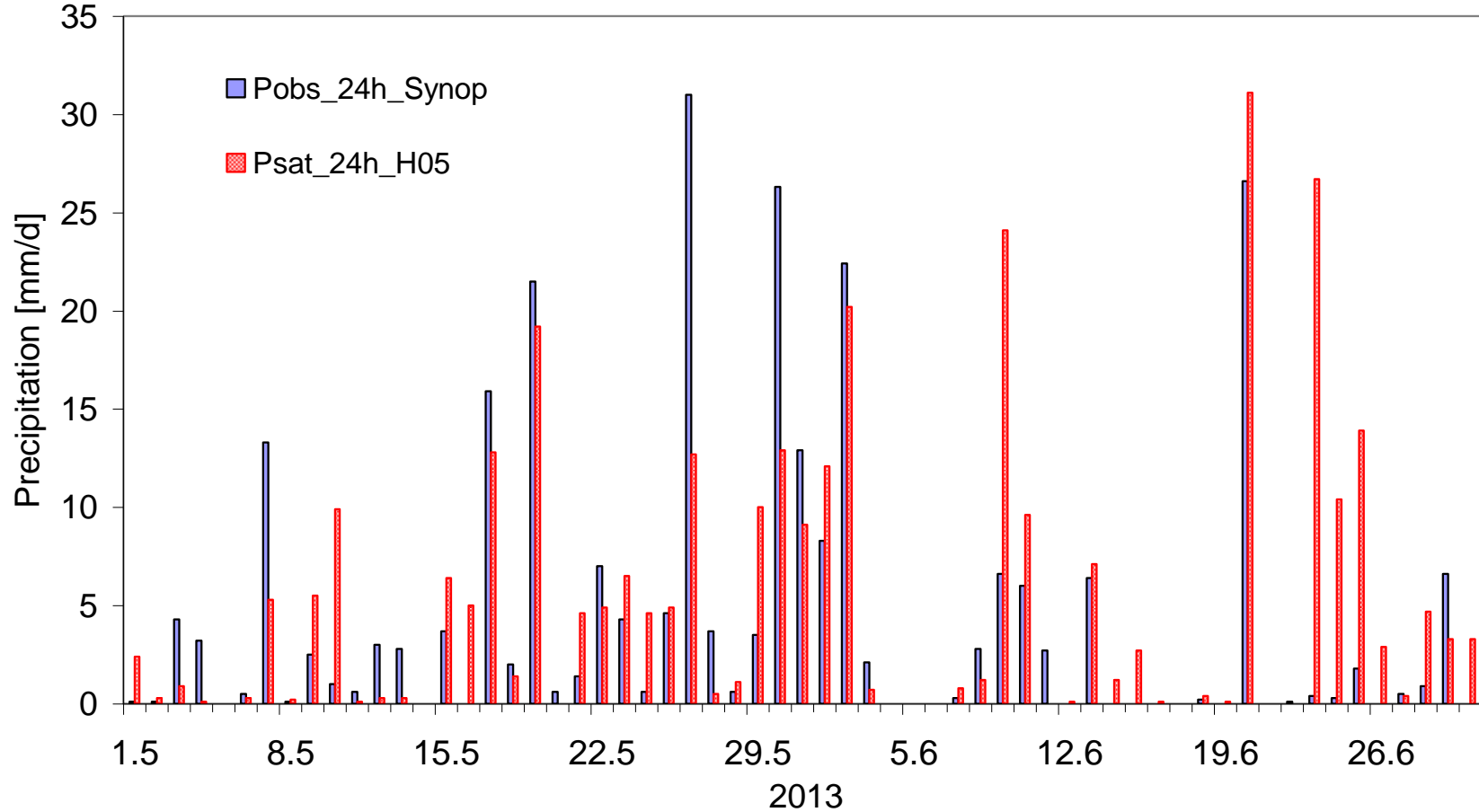
## River basin at gauge Schwuerbitz/Main





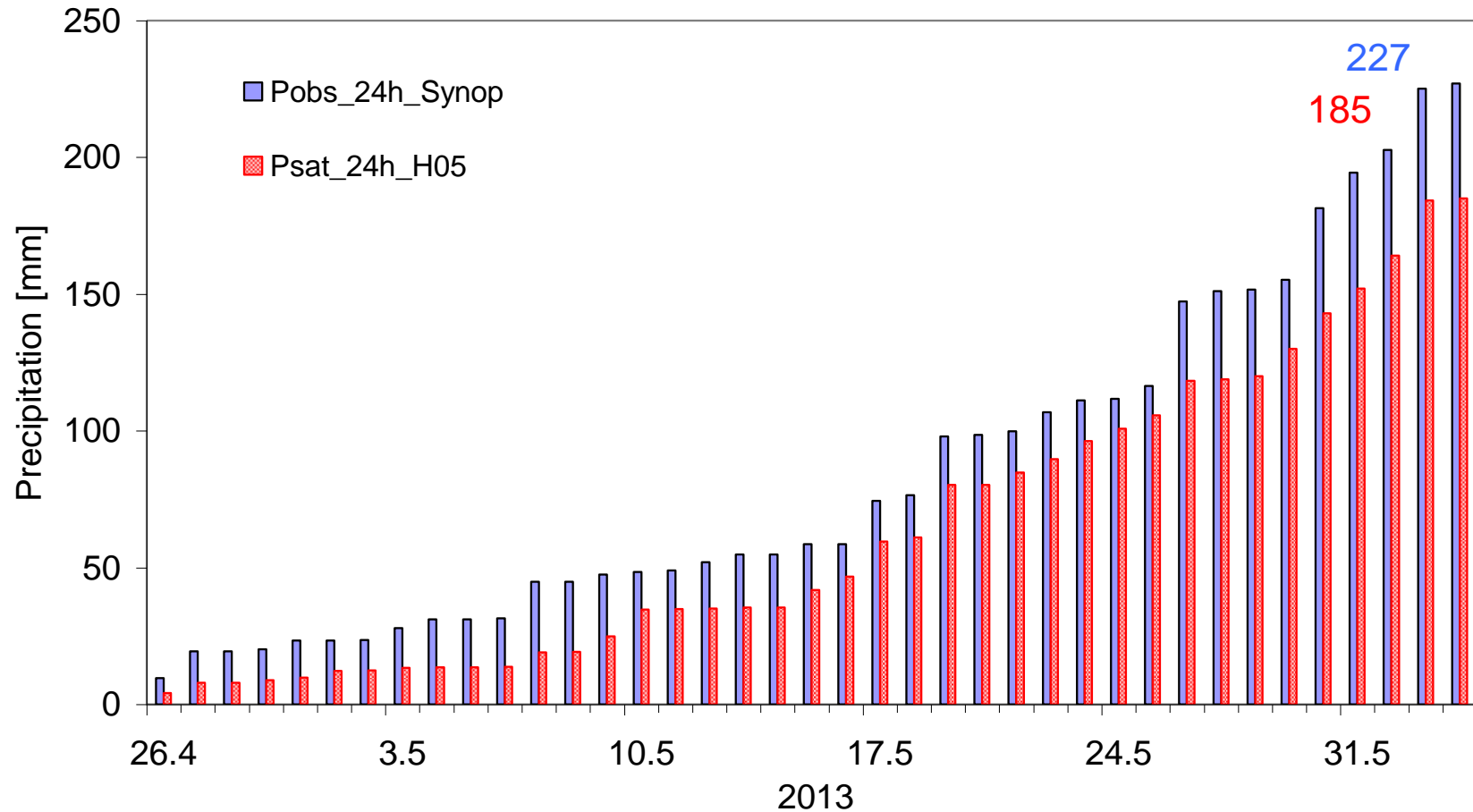
# HSAF H05\_24h Hydrovalidation

## River basin Main at Gauge Schwerbitz



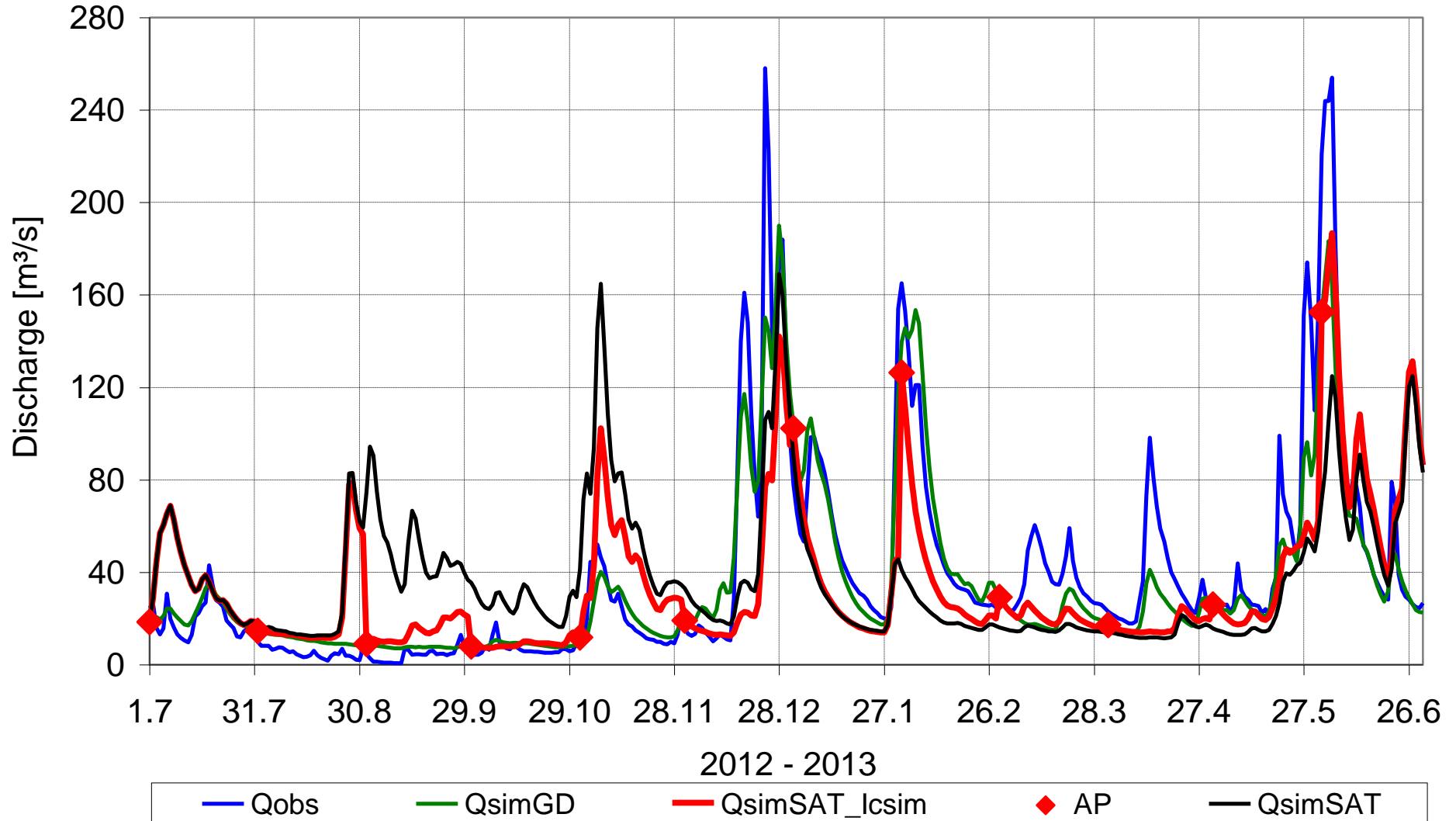
# HSAF H05\_24h Hydrovalidation

## River basin Main at Gauge Schwuerbitz



# HSAF H05\_24h Hydrovalidation

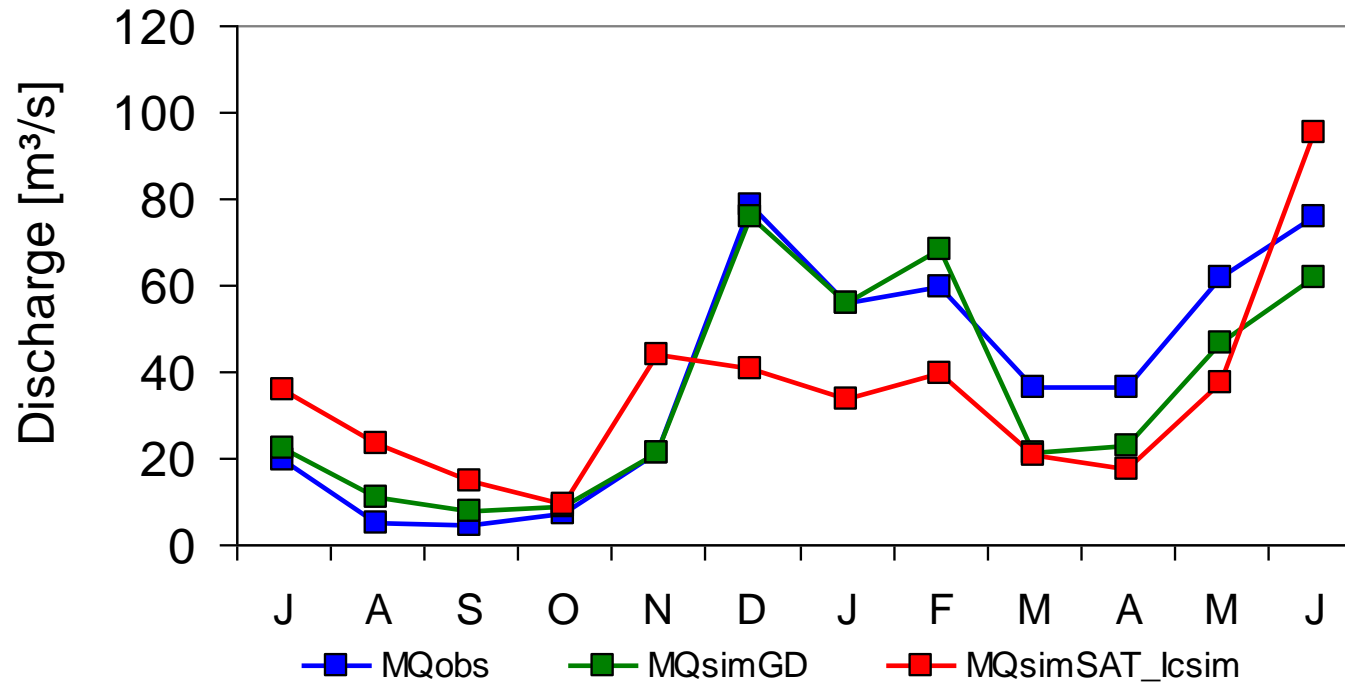
## Gauge Schwuerbitz/Main





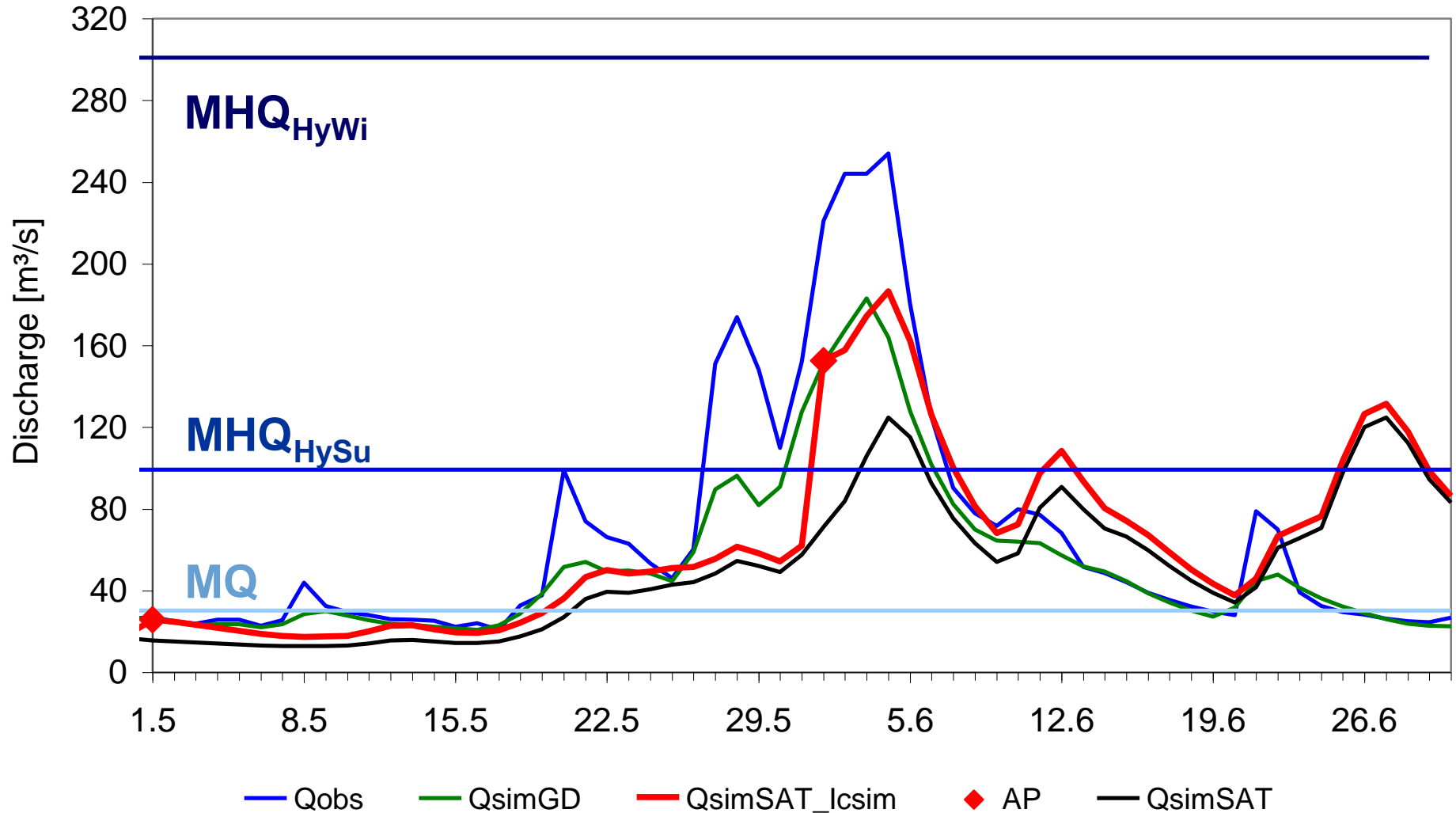
# HSAF H05\_24h Hydrovalidation

## Gauge Schwuerbitz/Main



# HSAF H05\_24h Hydrovalidation

Gauge Schwerbitz/Main



# Conclusions

Large areas of central Europe are experiencing their worst flooding in decades after long lasting stratiform (?) heavy rainfall

Extreme events requires for detailed analysis (monitoring) for understanding the governing processes and to improve short term forecasting and climate (impact prediction)

HSAF Products **shows potential** to support this work by leading to better temporal and spatial data coverage in large river basins

Nevertheless a lot of **pitfalls** (data format, geo-referencing, physical meaning...) are still available and have to be solved

Validation work has to move towards **uncertainty analysis** including estimating **predictive uncertainty**

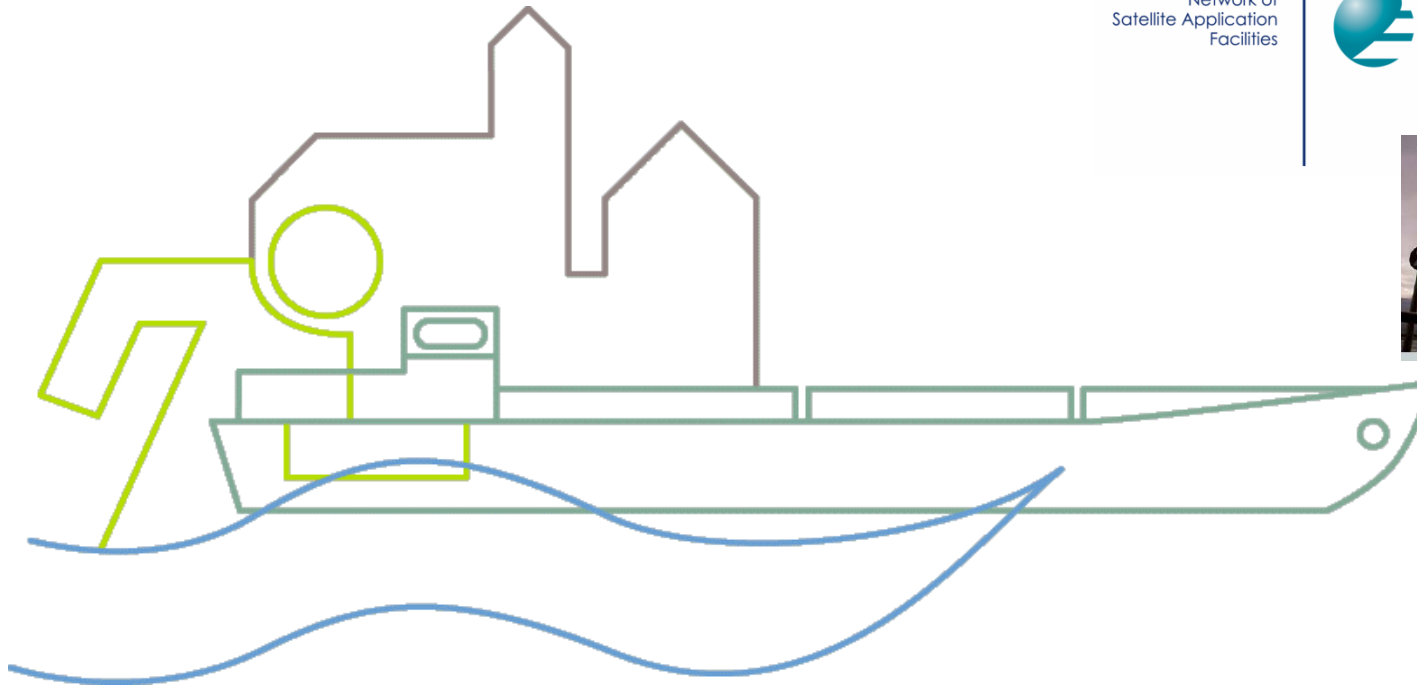
For operative applications a bias correction or calibration of the products seems necessary

Work on data assimilation technique in **operative hydrological models** to demonstrate the added value of HSAF data is ongoing

(see presentations of Dmytro Lisniak and Dirk Schwanenberg)

More detailed case studies of hydrometeorological and hydrological events are necessary and the **reliability** of the products has to be tested and improved





# Thank you for your attention !

Peter Krahe

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E-Mail: [krahe@bafg.de](mailto:krahe@bafg.de)  
Web: <http://www.bafg.de/M2>



# Date and amount of highest daily areal depth in the period (04.05. bis 04.06.2013)

