HELMHOLTZ
Centre for Environmental Research

New insights for real-time flood forecasting in Germany

Lessons learned from 2021 summer flood in Ahr river

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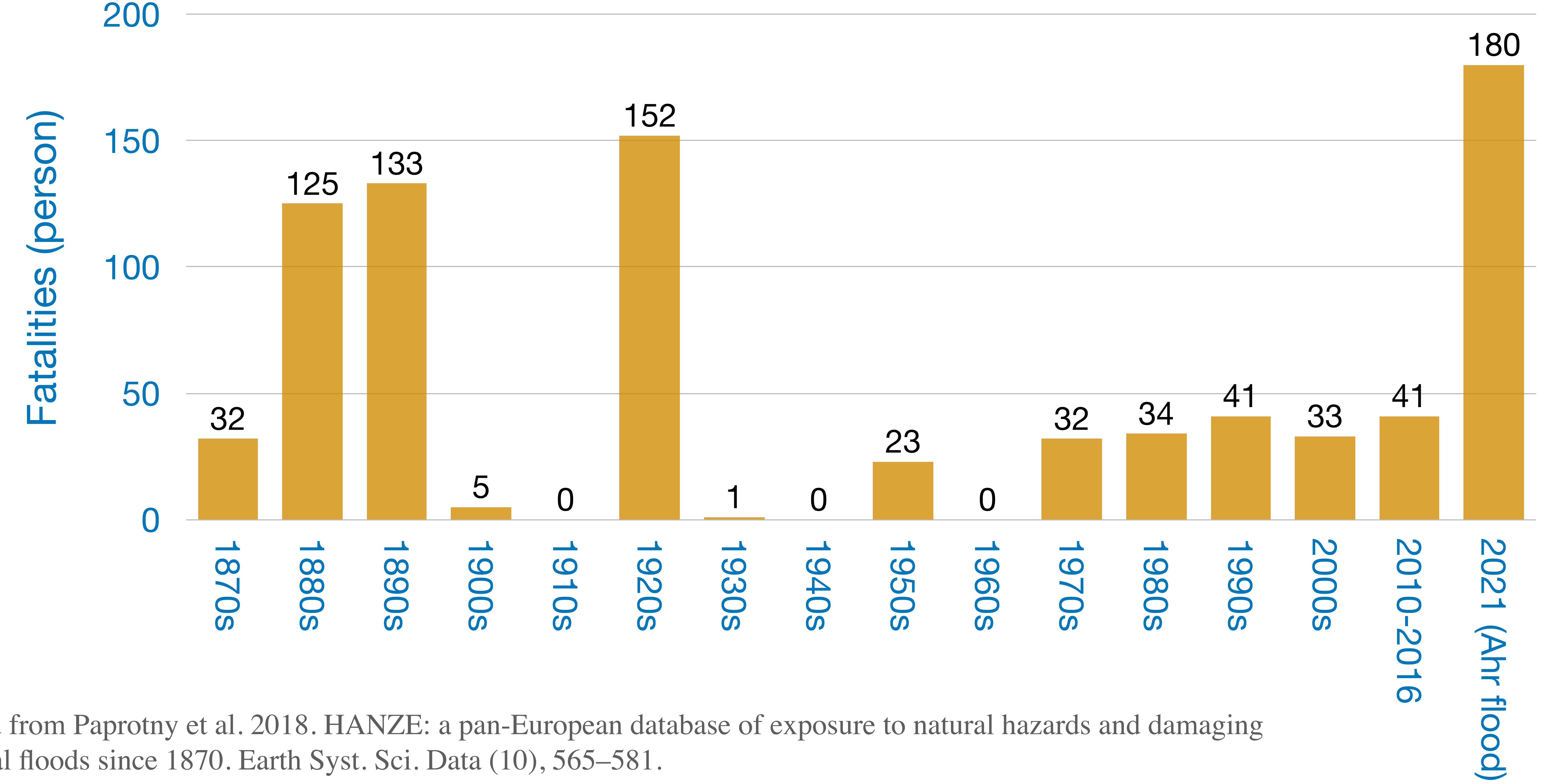
www.ufz.de

Death toll in Germany caused by river and flash floods



Adapted from Paprotny et al. 2018. HANZE: a pan-European database of exposure to natural hazards and damaging historical floods since 1870. Earth Syst. Sci. Data (10), 565–581.

2021 summer flood in west Germany - An exceptional event

Information on Ahr flood (2021) discharge and flood frequency analysis in Altenahr gauge for hazard mapping

Reconstructed 2021 flood peak	975 to1100 m³/sec
Largest historical flood (before July 2021)	236 m³/sec

HQexterem (without historical events)	286 m³/sec
HQexterem (including historical events of 1804, 1888, 1910, 1918, 1920)	339 - 460 m³/sec

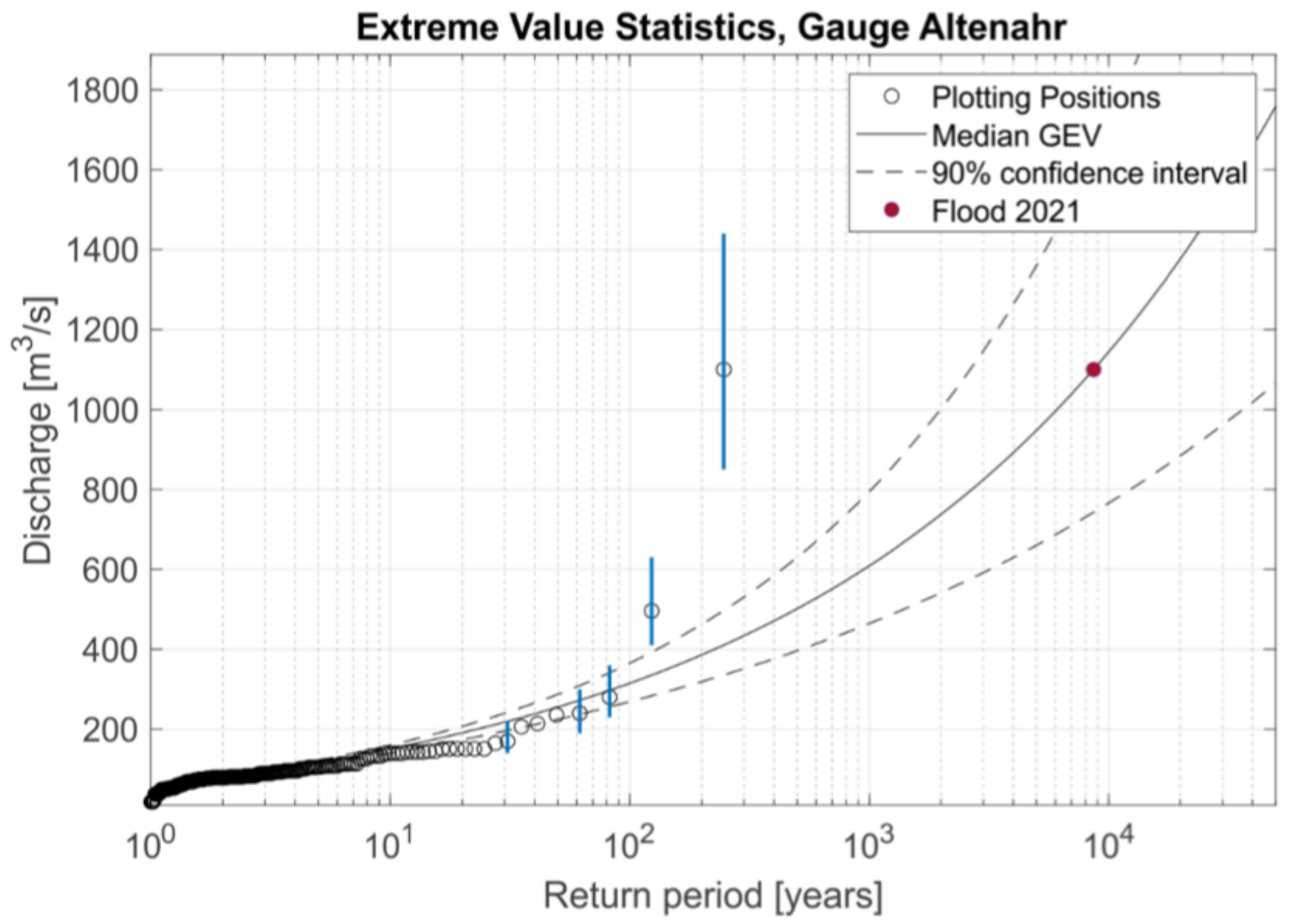


Table and Figure Courtesy of Sergiy Vorogushyn (Lessons from the July 2021 flood: Analysis of flood hazard and its impacts)

Operational flood and impact forecasting systems

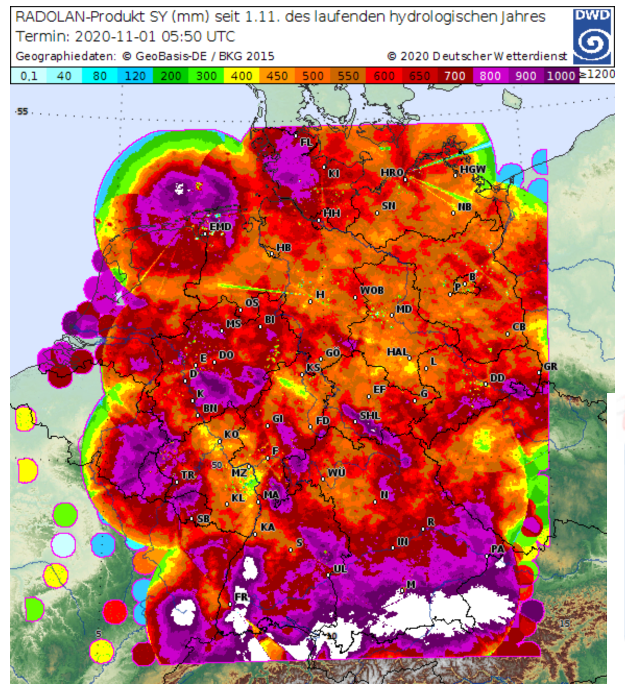
Components

Meteorological Inputs

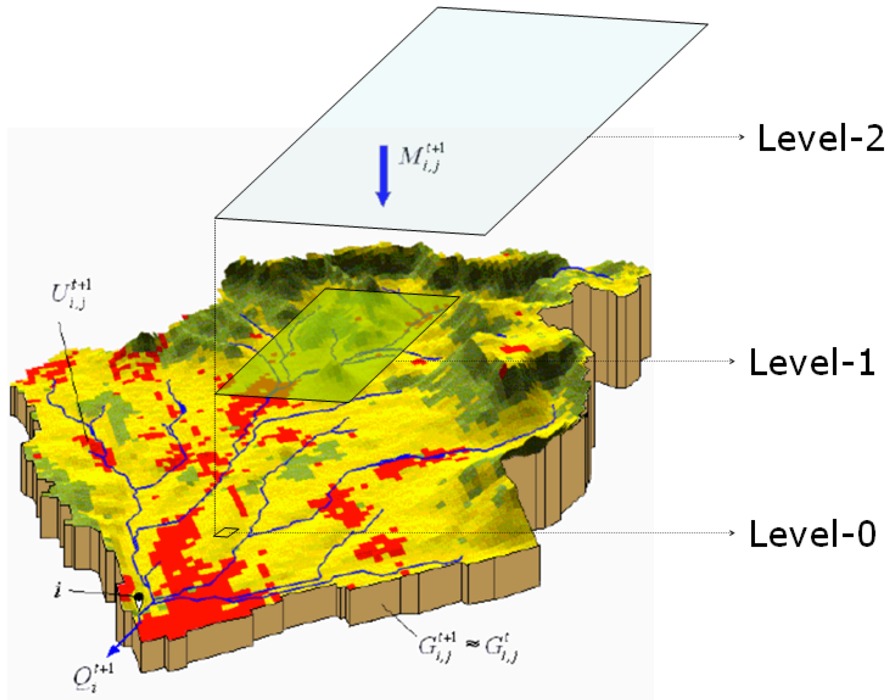
Observations

Quantitative precipitation estimation

hourly
24-hourly



Generate hydrologic initial conditions



Weather Forecasts

Time steps

1-h
3-h
6-h

Lead-time

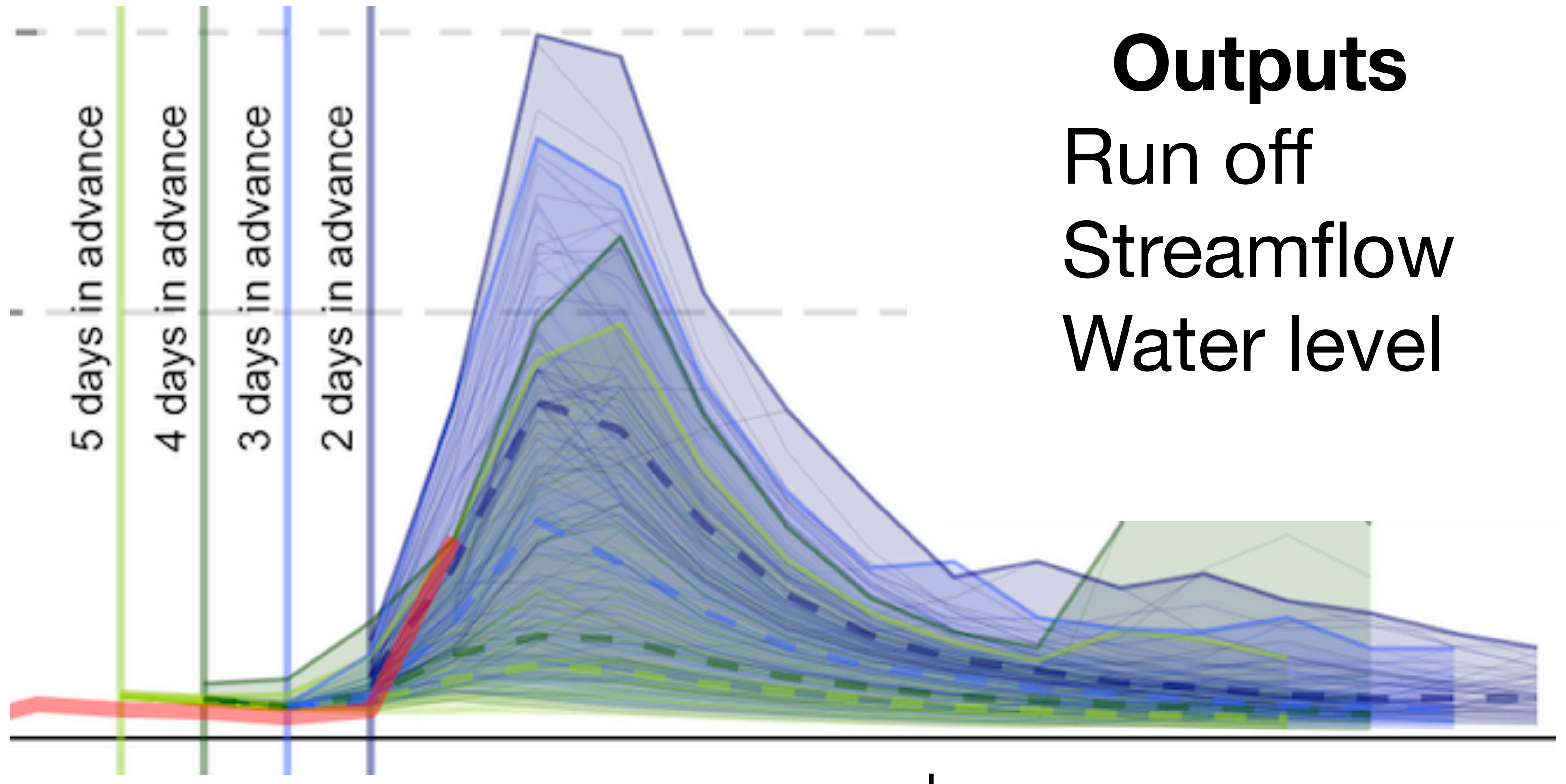
Nowcasting
Short-range
Medium-range
Long-range

Frequency

4x day
2x day
1x day

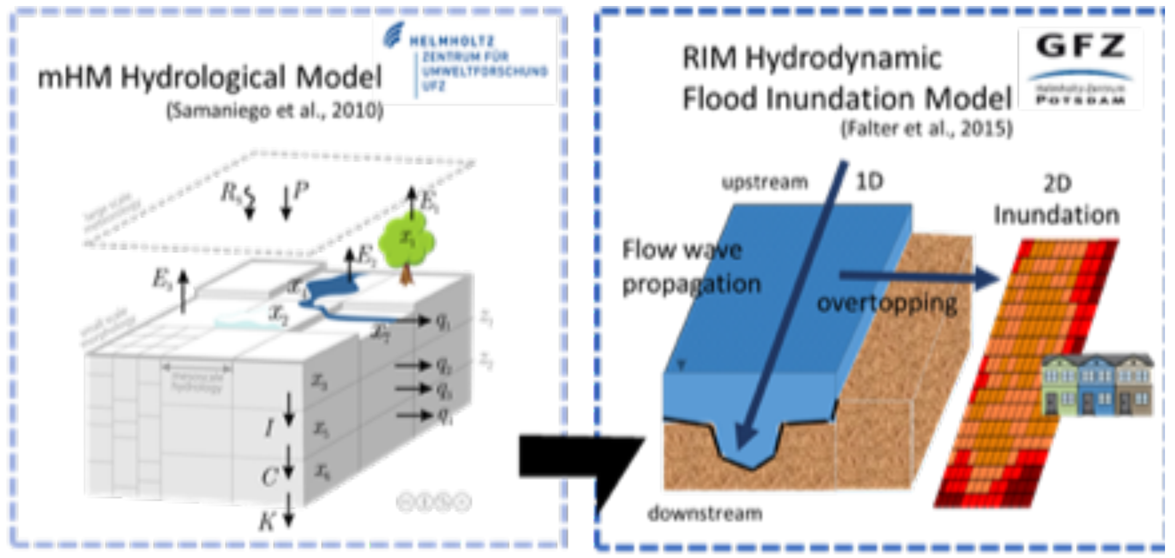
Hydrological Forecasting

Ensemble Forecasting



Outputs
Run off
Streamflow
Water level

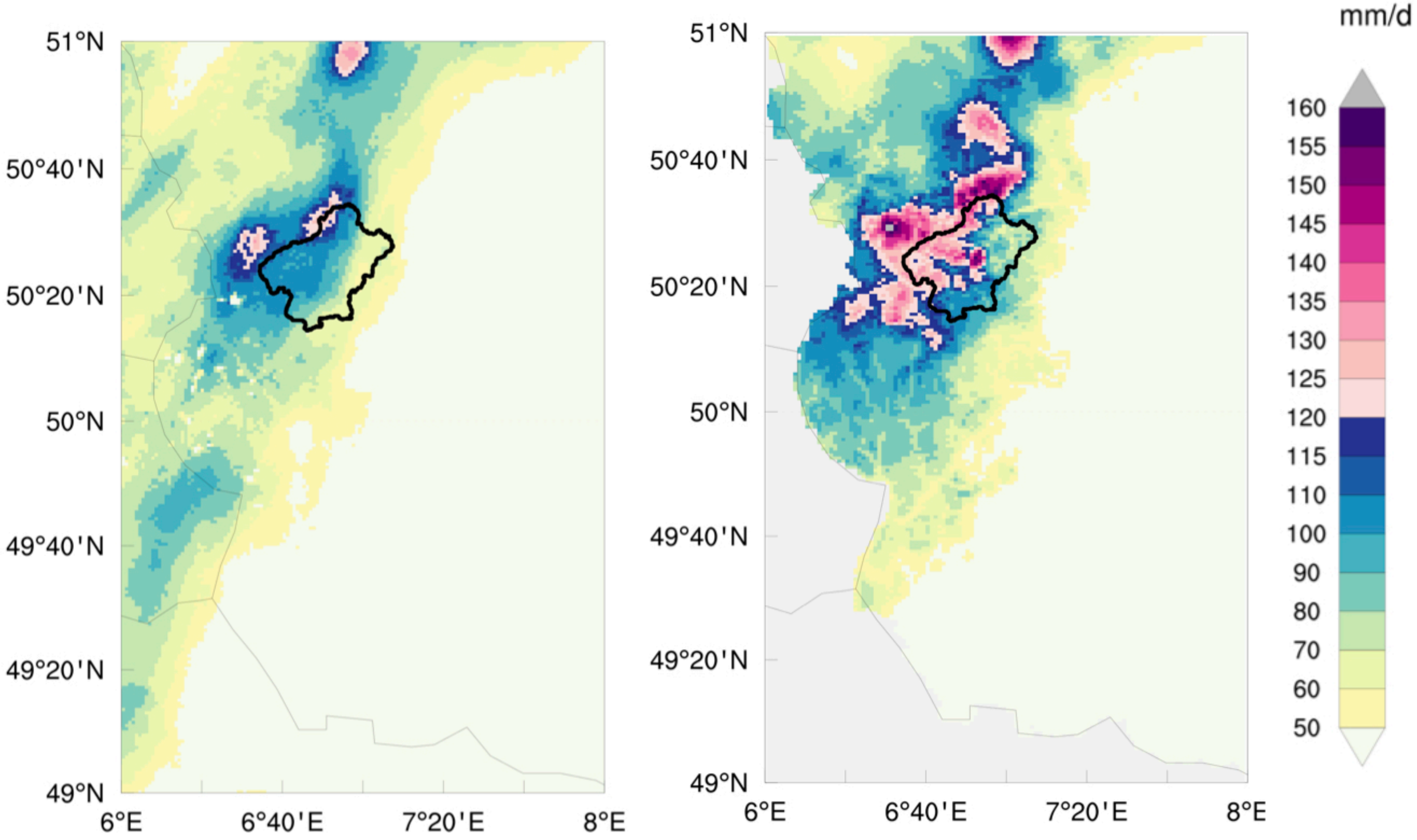
Regional inundation modeling



Near-real time precipitation product uncertainty

RADOLAN
Radar-Online-Adjustment

REGNIE
(regionalised)



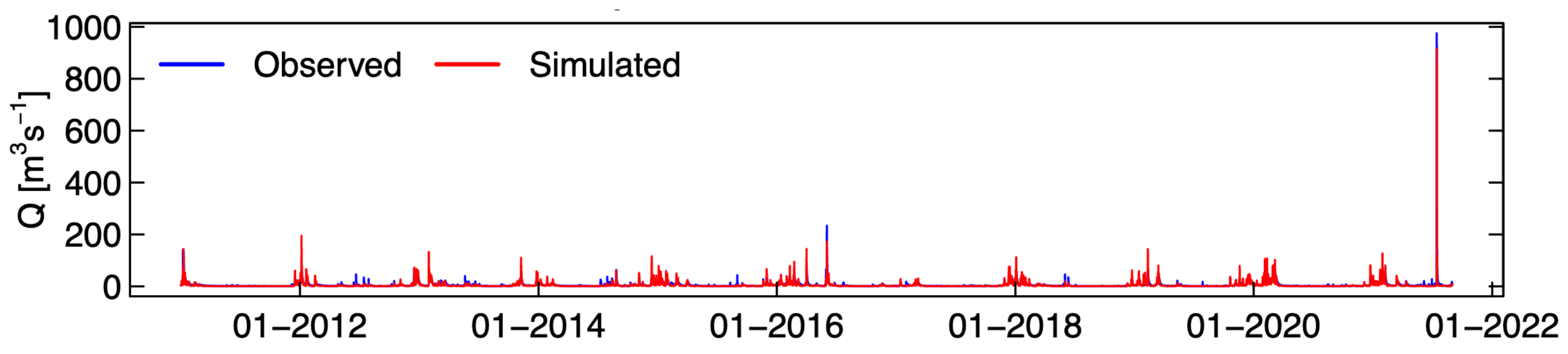
Characteristics of Grided precipitation products used for flood simulation

product/ describtion	Radolan	REGNIE
Temporal resolution	Hourly	24-hour
Time period	2006 - now	1934 -now
July 14 Area-average domain 6.5 7.25 E 50 50.75 N	73 mm	93 mm

Hydrologic Modeling

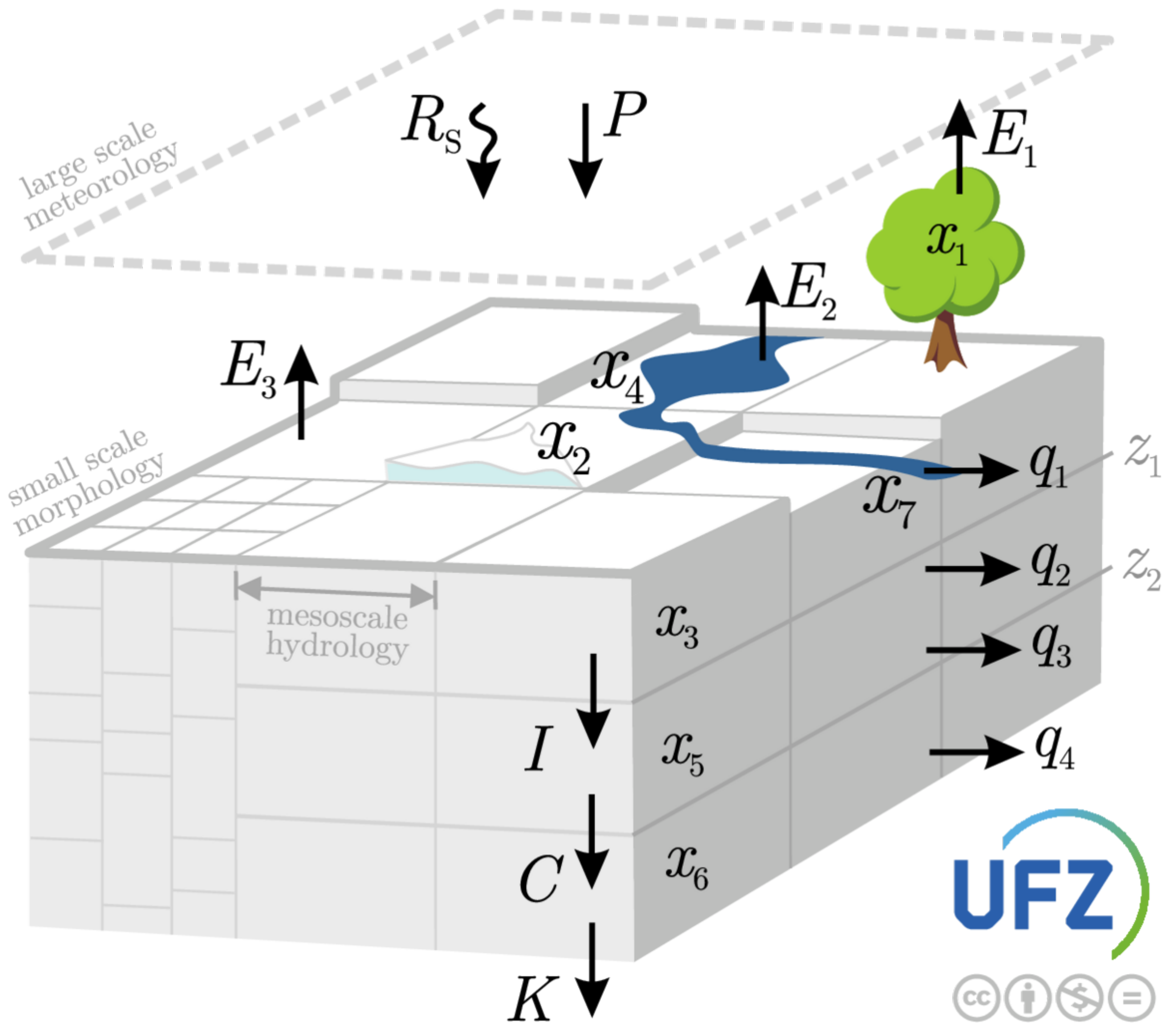
Enhancement

Enable reading hourly meteorological forcing and calibrating hourly simulations



The mesoscale Hydrologic Model

mHM



open-source

grid-based

Parameter Regionalisation

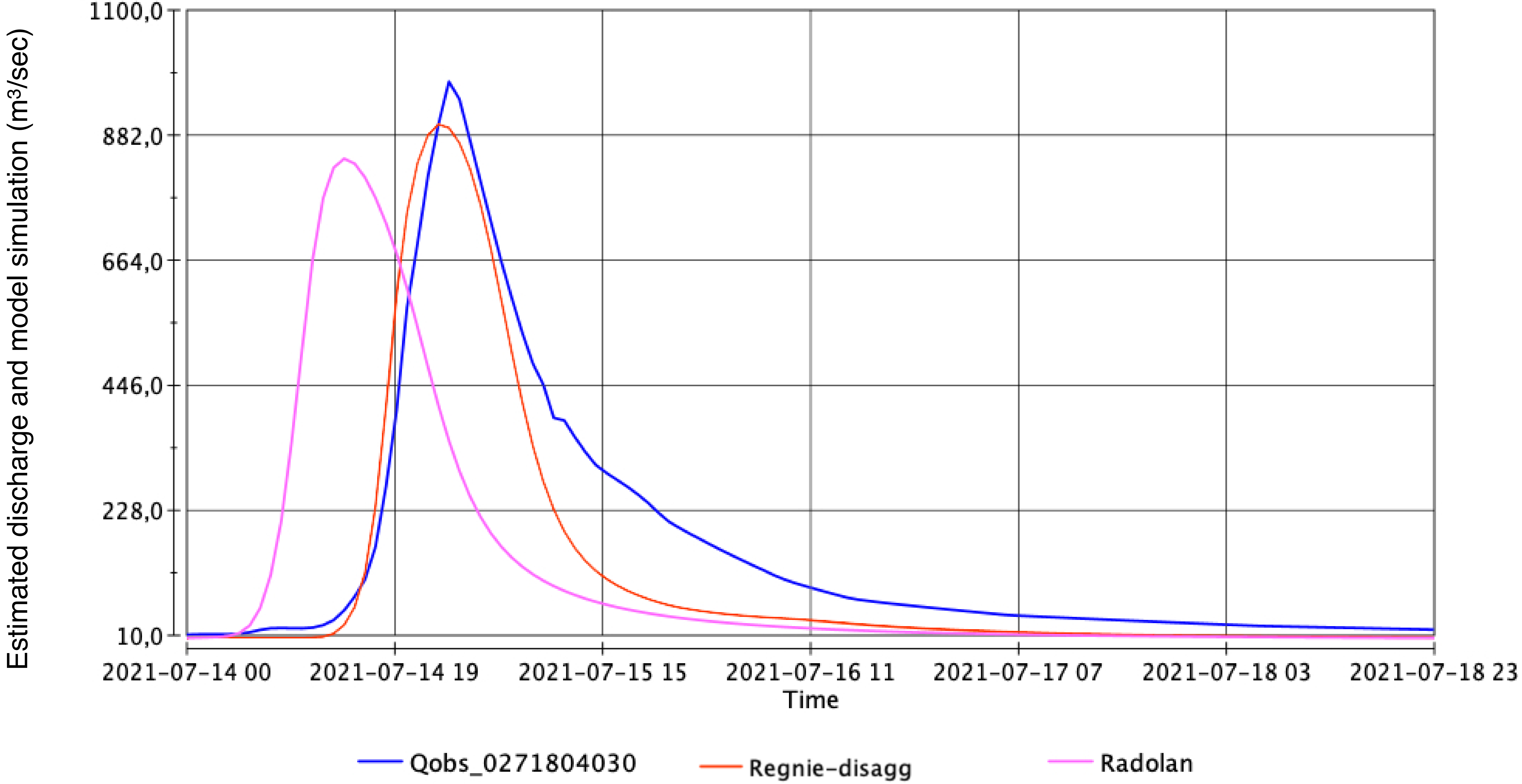
German drought monitoring

multi-scale

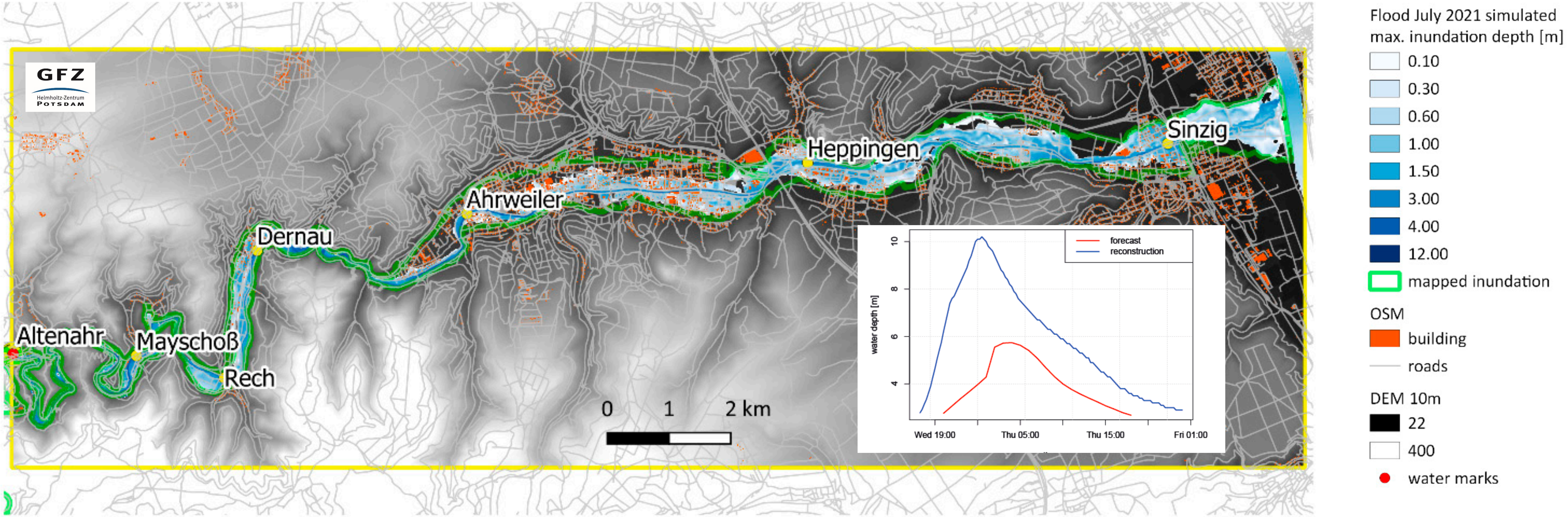
https://git.ufz.de/mhm/mhm

Comparison of flood peak generated by two high resolution grided precipitation product

mHM flood simulations and reconstructed flood peak



Flood impact forecasting



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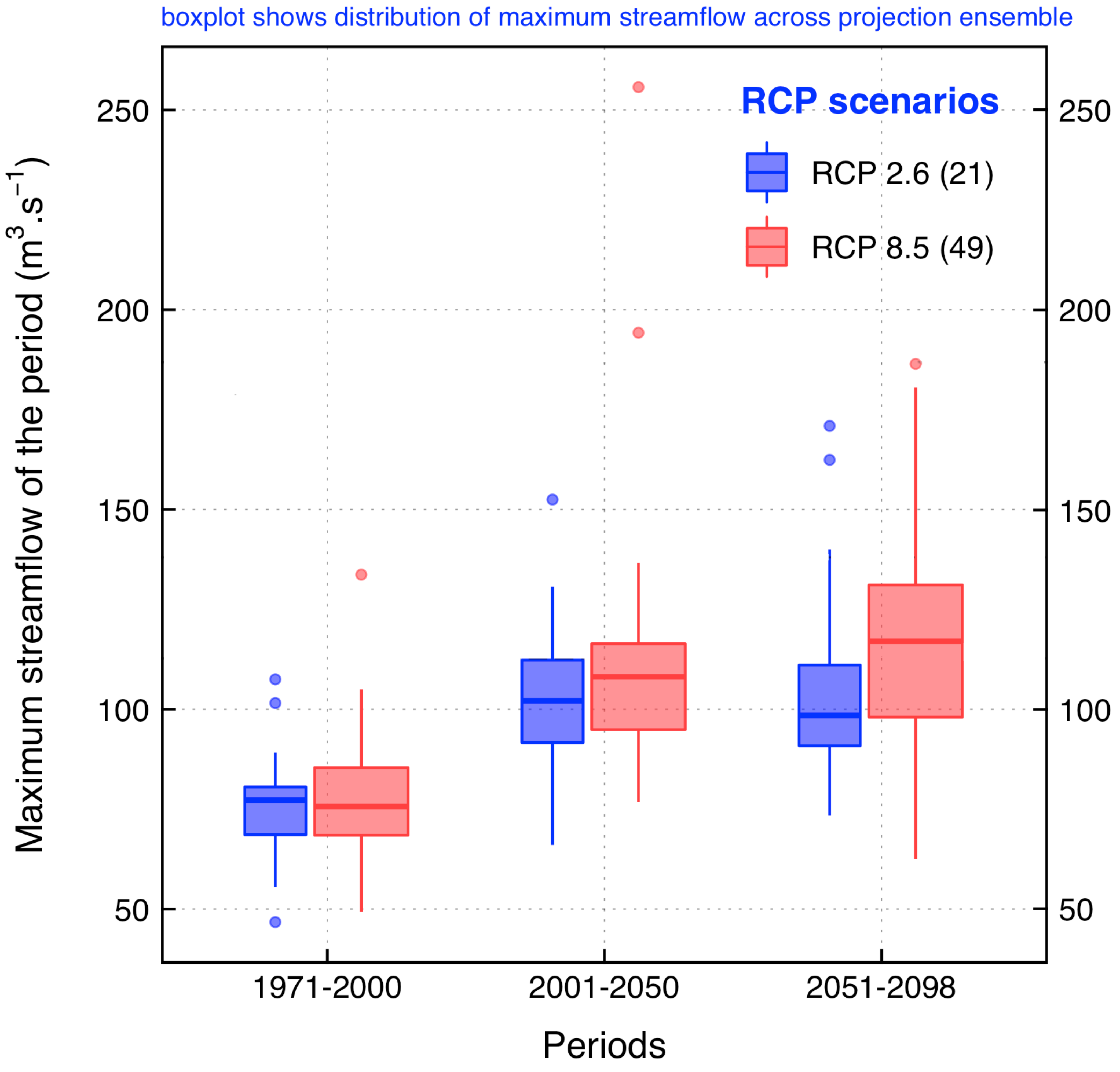
Streamflow projections based on CORDEX-mHM ensembles

- 88 ensembles from
- EURO-CORDEX
- Spatially disaggregated
- Bias adjusted



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References

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