EGU General Assembly 2025

GERICS Climate Service Center Germany
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Supplementary Information

High-resolution fully distributed hydrological modelling of flash floods based on convection-permitting regional climate model data

An integrated modelling framework

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S1 – CPRCM Data Suitability
Methodology

Comparison of historical hourly temperature, precipitation, wind speed, relative humidity and global radiation estimates from the non-hydrostatic ICON-CLM 2.6.4 at 3 km resolution (ICON3km) and its driving model ICON-CLM 2.6.4 with parametrised convection at 11 km (ICON11km), as well as the corresponding results from the hydrological simulations using the fully distributed physically based model WaSiM over the upper and central part of the Weiße Elster river basin in East Germany. The performances are further evaluated against point-based observations and adjusted radar data (RADOLAN) upscaled to respective resolution (RADOLAN3km and RADOLAN11km). On the following slides only the precipitation and discharge results are presented.

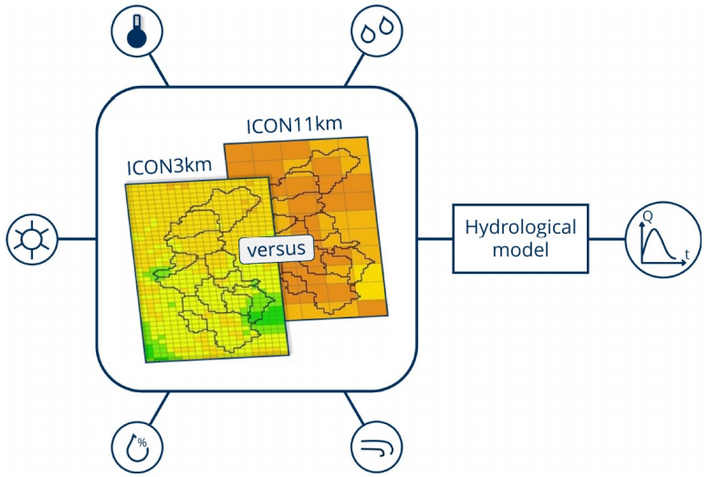

Fig. 1: Overview of the meteorological and hydrological analyses

S1 – CPRCM Data Suitability
Study Area

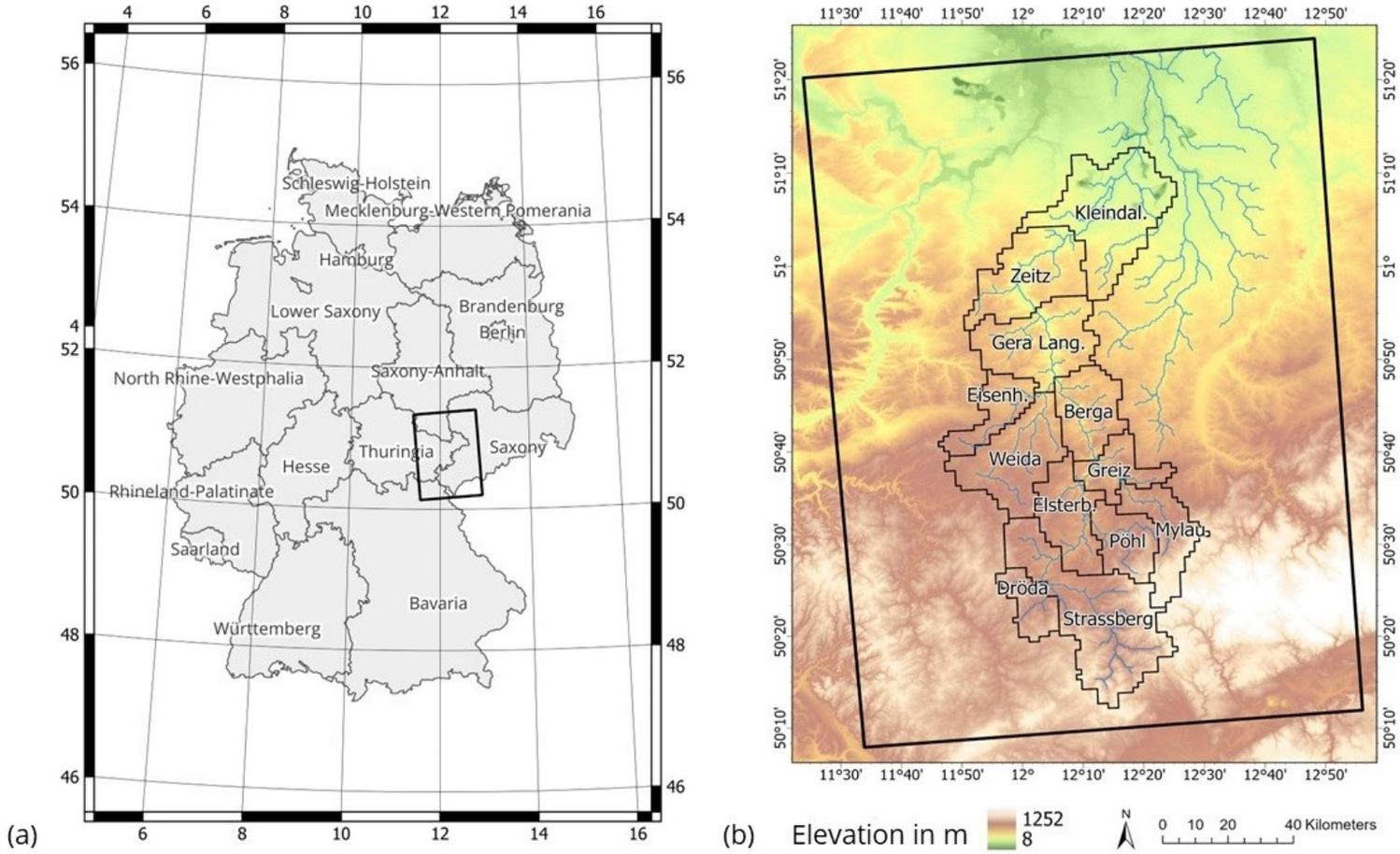

Fig. 2: (a) Location of the study area in Germany and (b) the studied subcatchments of the Weiße Elster river within the area over a digital elevation model of 30 m resolution (SRTM 1 Arc-Second Global by USGS)

S1 – CPRCM Data Suitability
Results – Precipitation

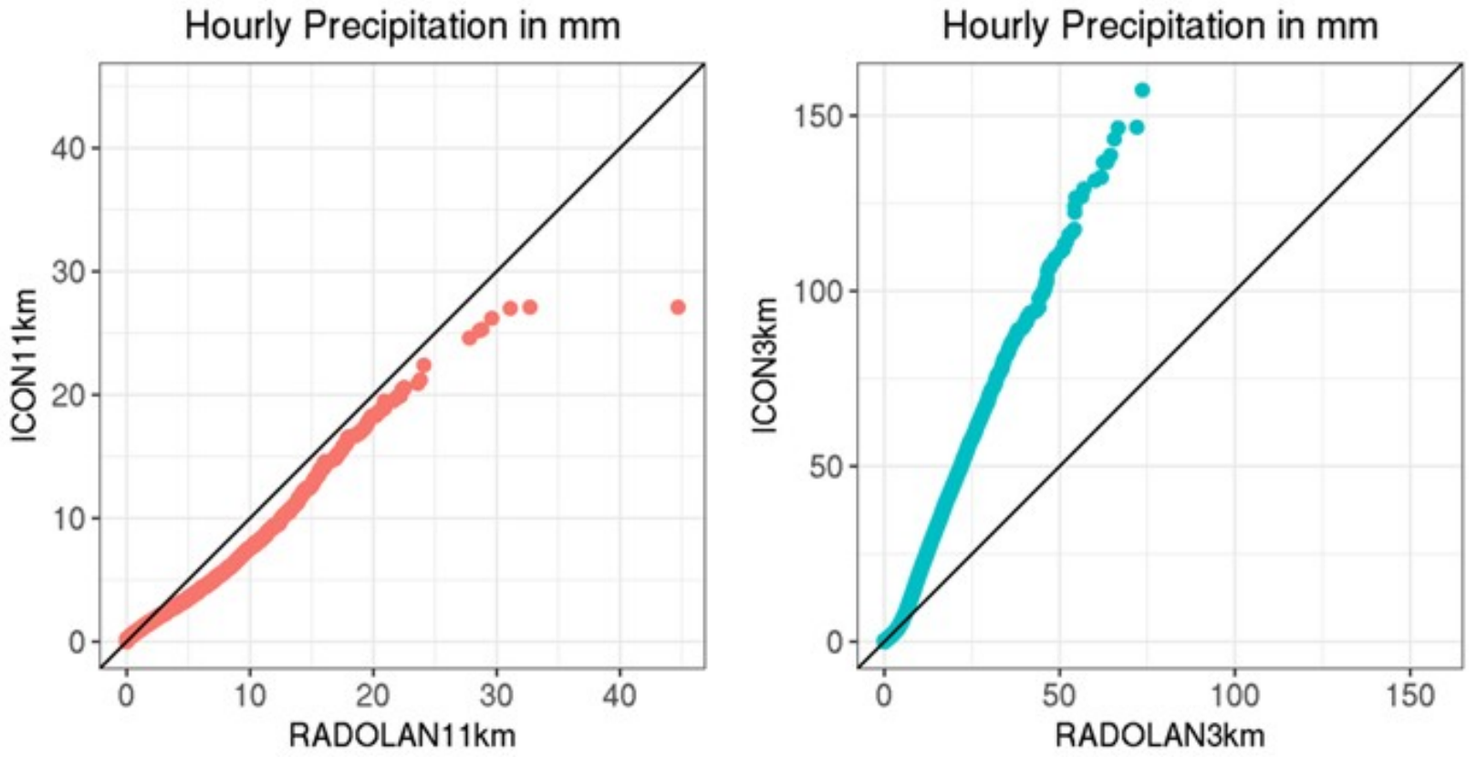

Fig. 3: QQ-plots for hourly precipitation over the period of 2005 to 2014 for ICON11km to RADOLAN11km (left) and ICON3km to RADOLAN3km (right)

S1 – CPRCM Data Suitability
Results – Precipitation

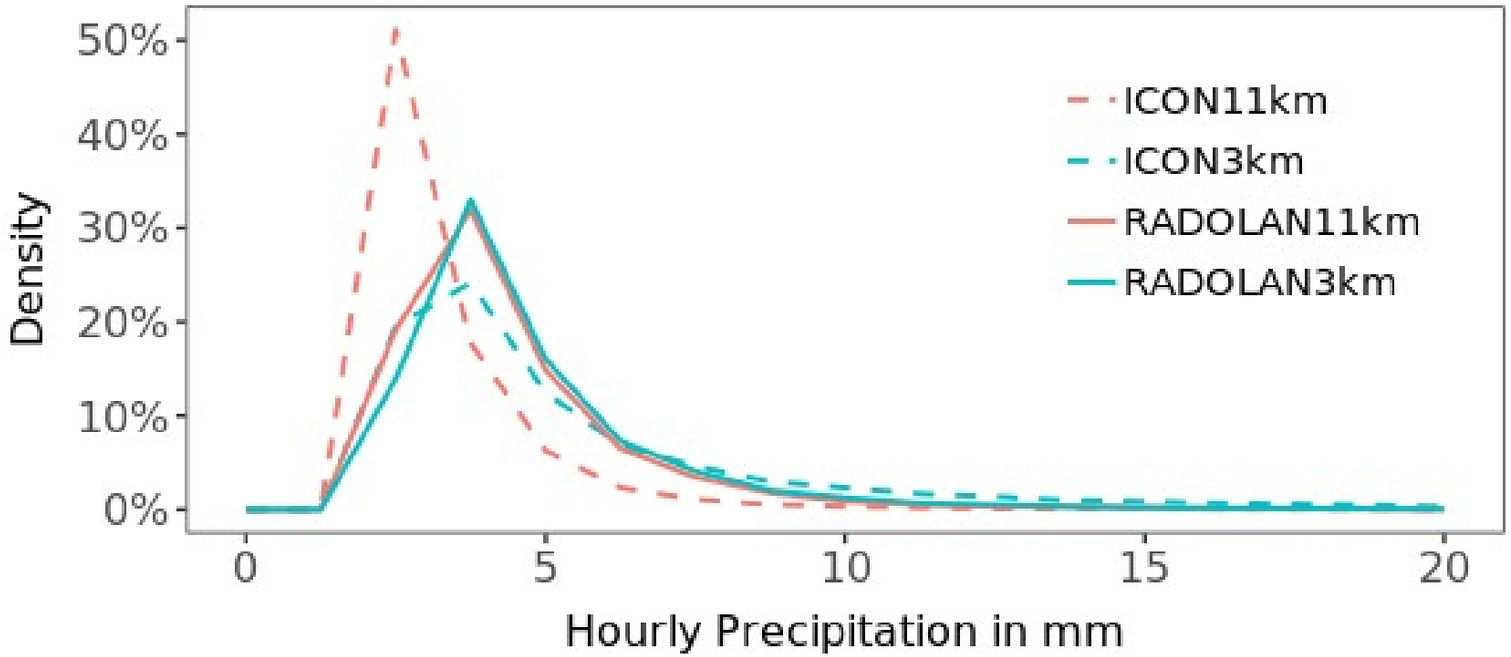

Fig. 4: Frequency polygons for ICON11km, ICON3km, RADOLAN11km and RADOLAN3km for the 99.5th-percentile of hourly precipitation

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Results – Precipitation

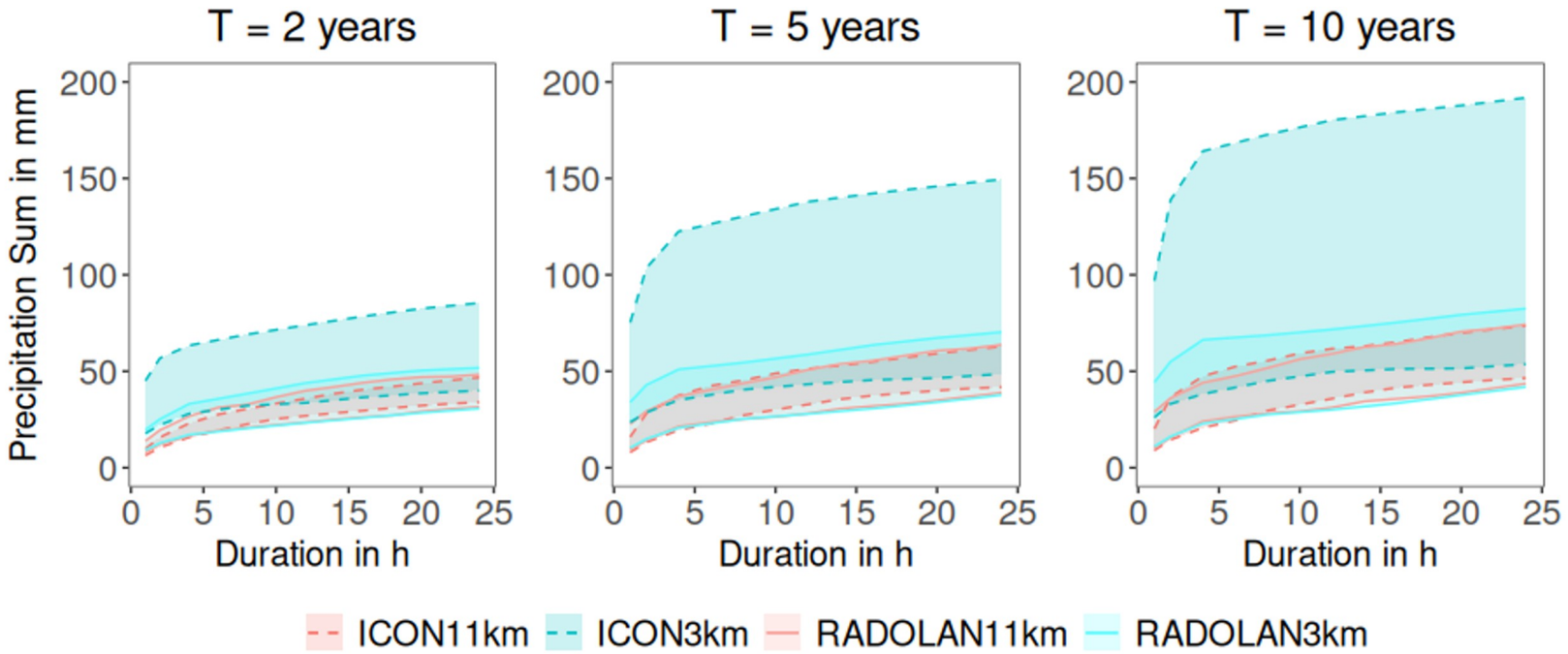

Fig. 5: Minimum-maximum bandwidth of the depth-duration-frequency curves from all cells within the study area by ICON11km and ICON3km, together with the corresponding RADOLAN11km and RADOLAN3km estimates for return periods T of 2, 5 and 10 years

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Results – Discharge

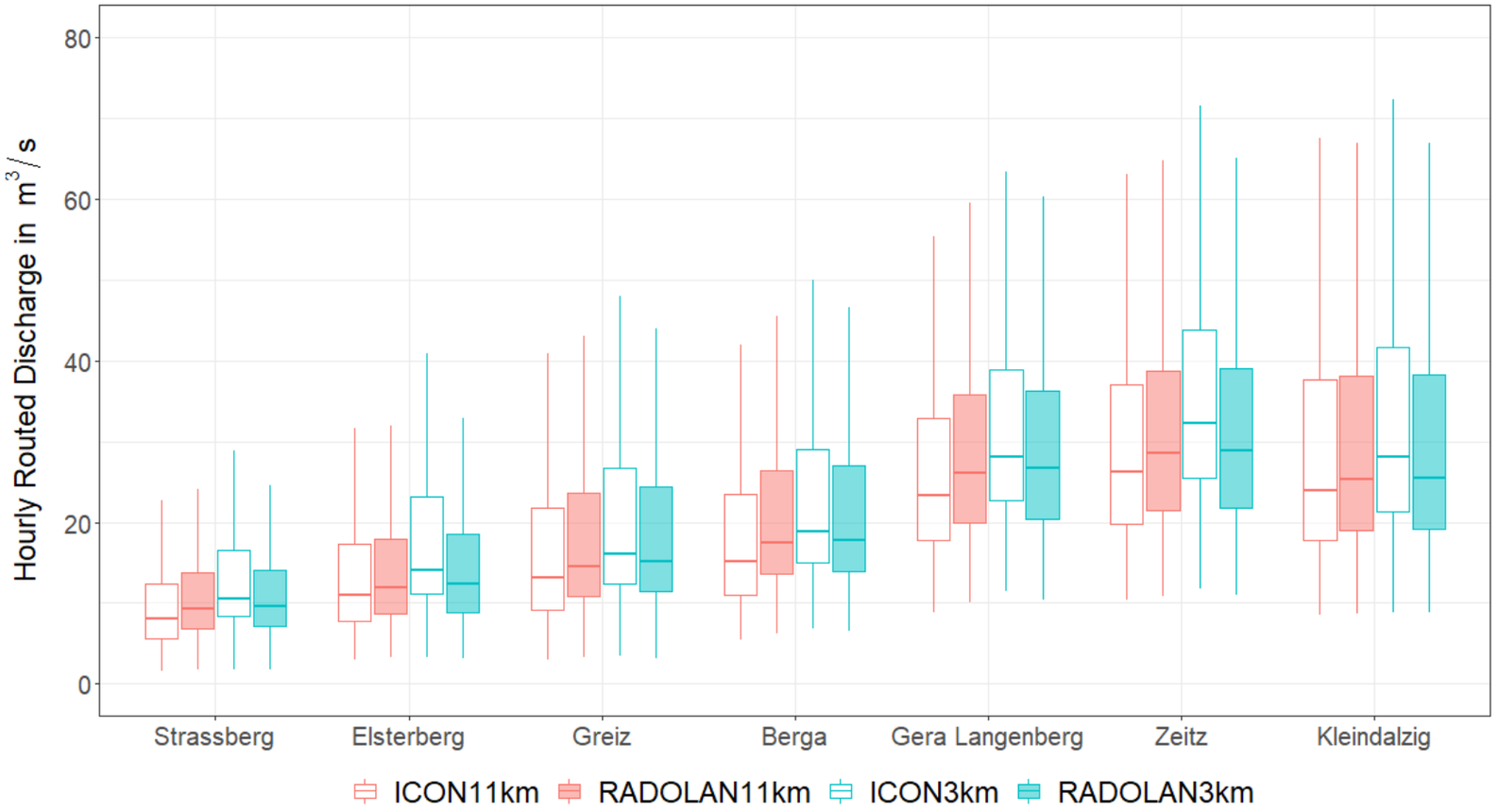

Fig. 6: Boxplots of hourly routed discharge (period of 2006 to 2014) computed by the WaSiM hydrological model driven with meteorological data from ICON11km and ICON3km, as well as with RADOLAN11km and RADOLAN3km

S1 – CPRCM Data Suitability

Results – Case Study (simulated hydrograph of the 2013 flood for the Zeitz catchment)

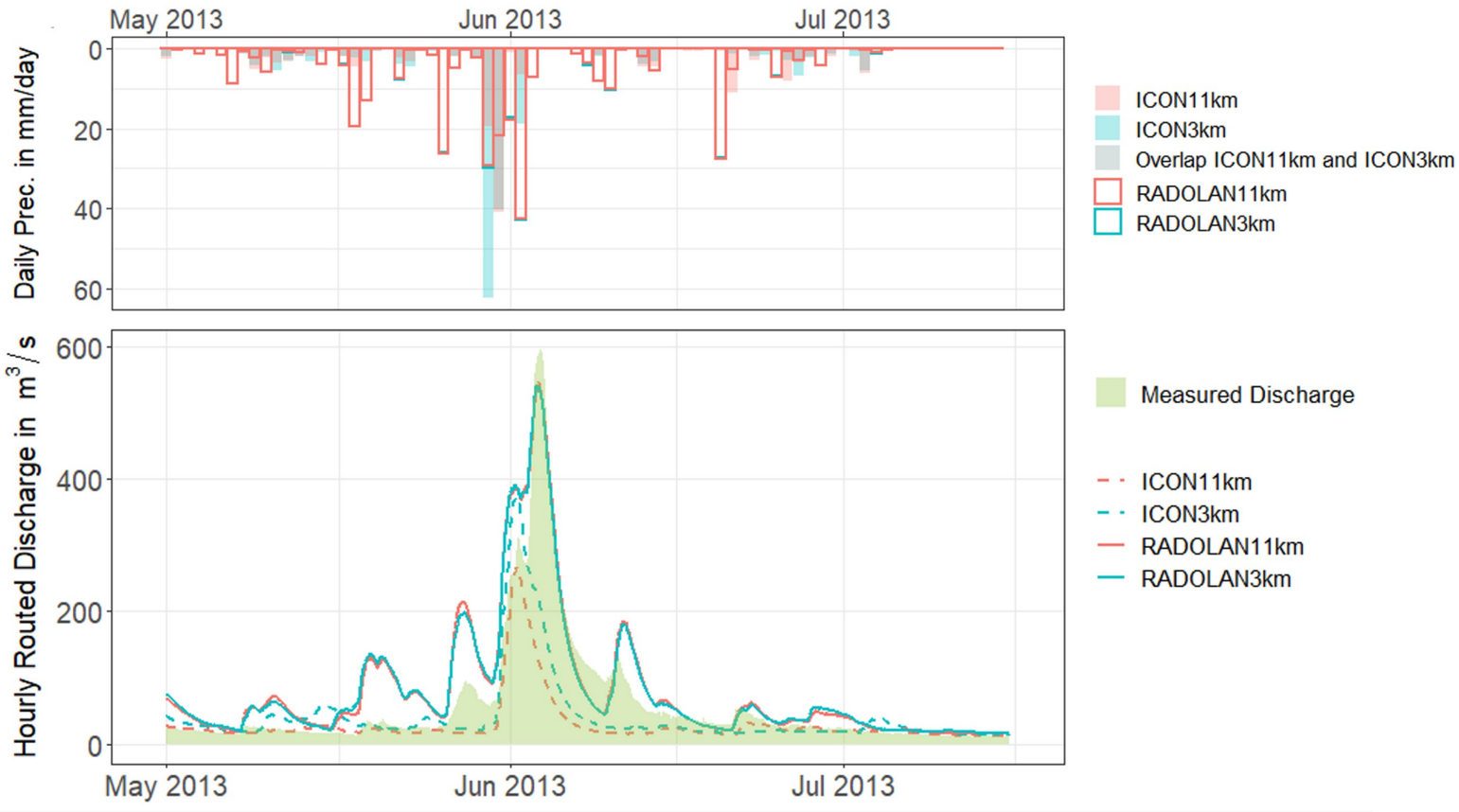

Fig. 7: Top: Daily precipitation estimates over the catchment of Zeitz and those upstream for the period of the 2013 flood for ICON11km, ICON3km, RADOLAN11km and RADOLAN3km; Bottom: the resulting hydrographs (using hourly data) for the catchment of Zeitz together with the discharge measurements