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Do convection-permitting regional climate models have added value for hydroclimatic simulations? A test case over small and medium-sized catchments in Germany

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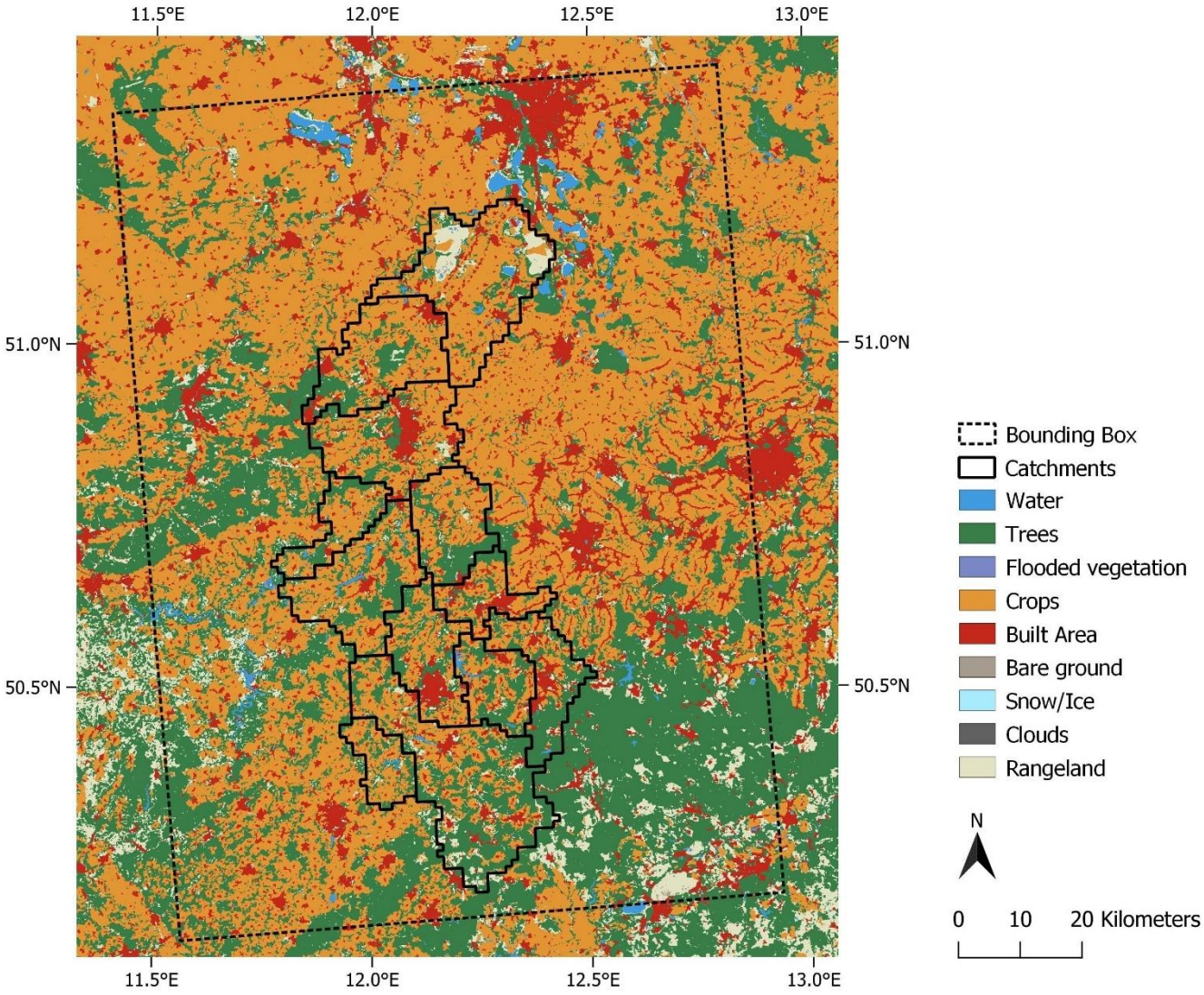

Fig. S1: Land cover in the study area (data base: Karra et al., 2021)

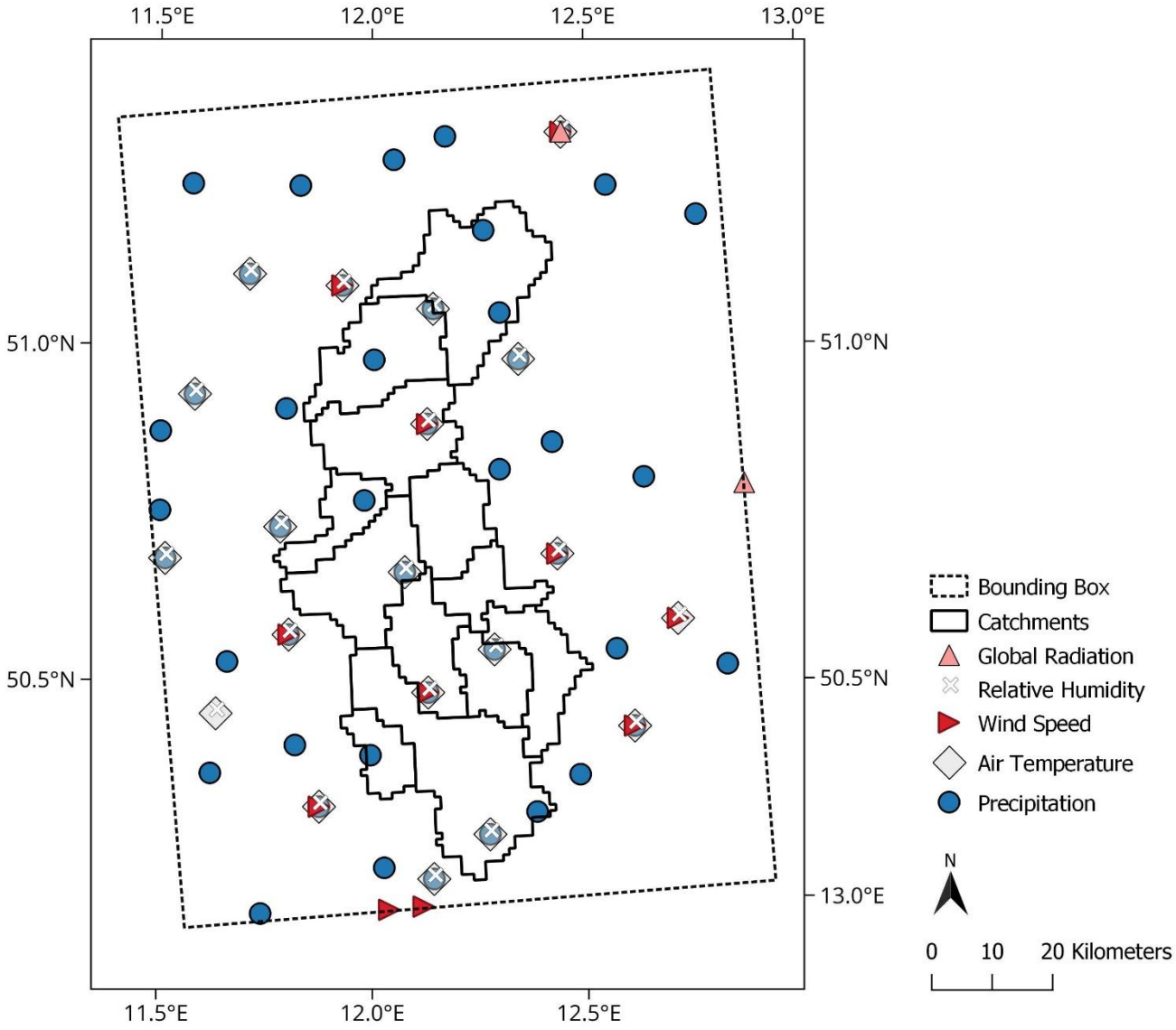

Fig. S2: Point-based observational network within the bounding box

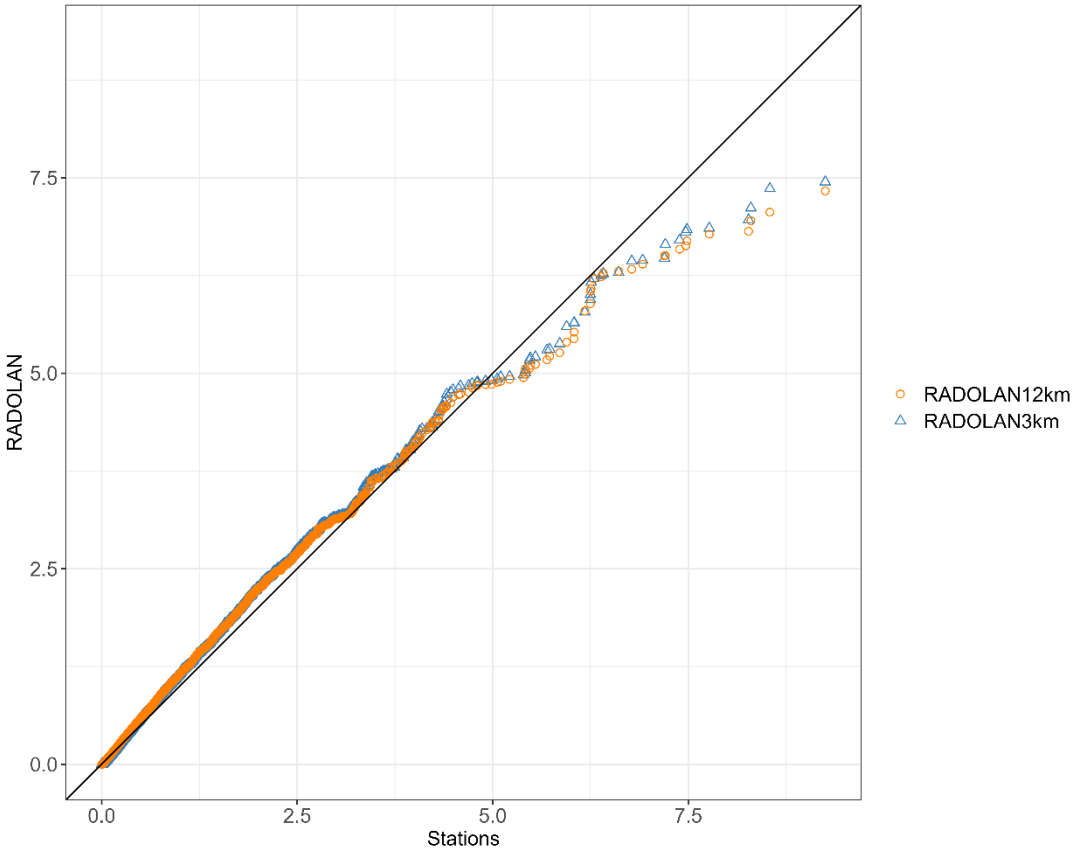

Fig. S3: QQ-plots for catchment spatial averages of the Thiessen-interpolated hourly rainfall estimates from RADOLAN3km, resp. RADOLAN12km to the catchment spatial averages of the Thiessen-interpolated hourly rain gauge measurements, as computed in a preprocessing step by the hydrological model WaSiM, for the period from 2005 to 2014

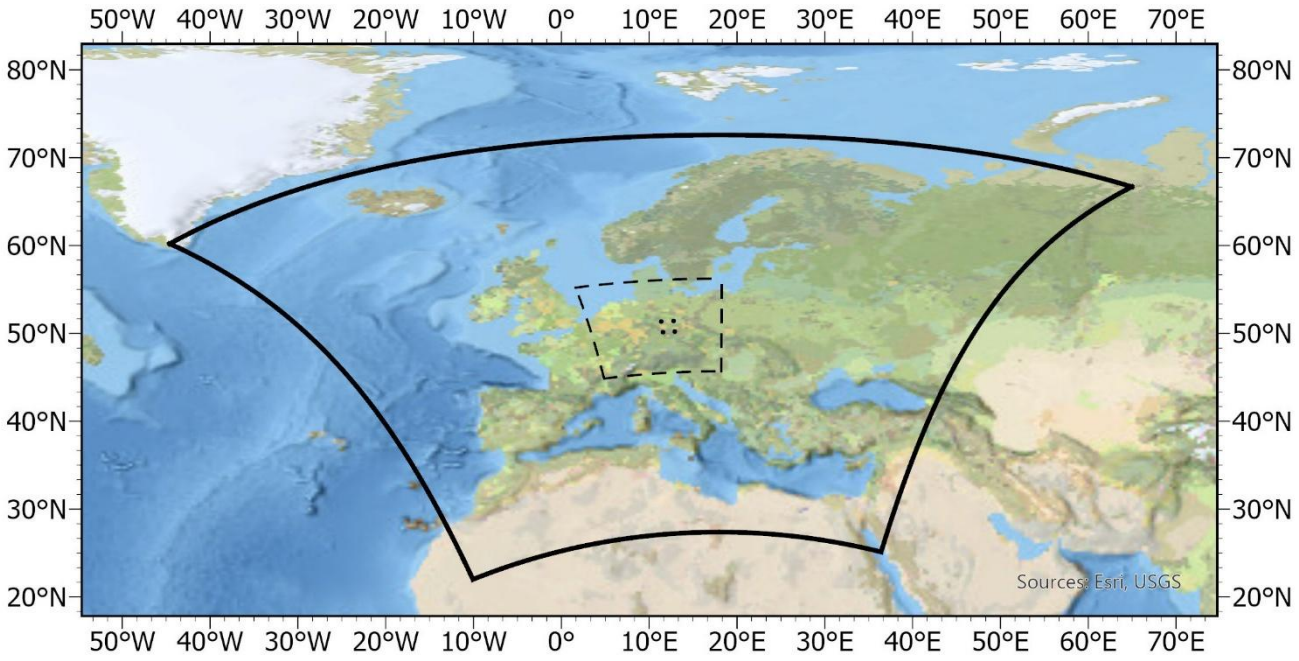

Fig. S4: RCM EURO-domain (solid) and CPRCM CEU-domain (dashed), together with the edges of the study area (points) (sources: ESRI, USGS)

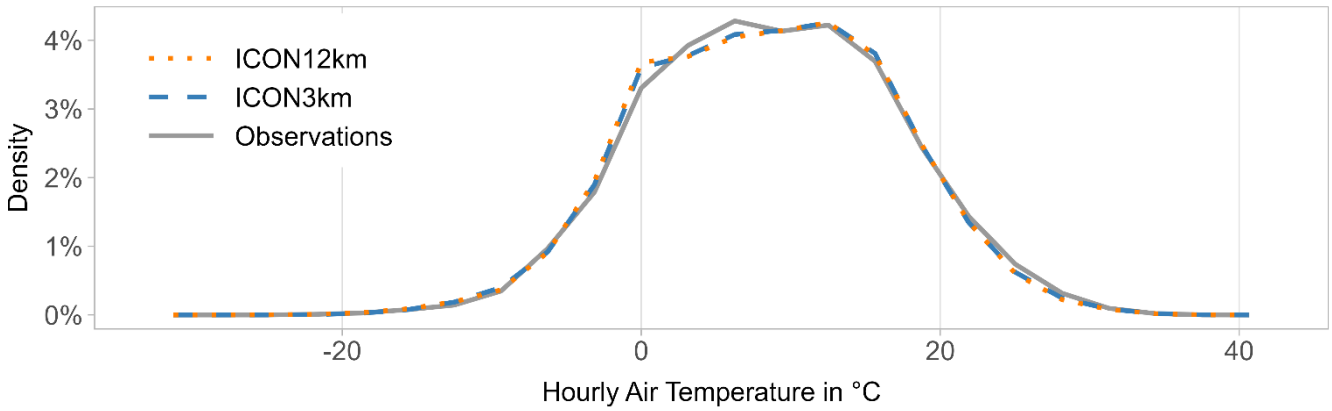

Fig. S5: Frequency polygons for hourly air temperature as observed, and calculated by ICON3km and ICON12km for the period from 2005 to 2014

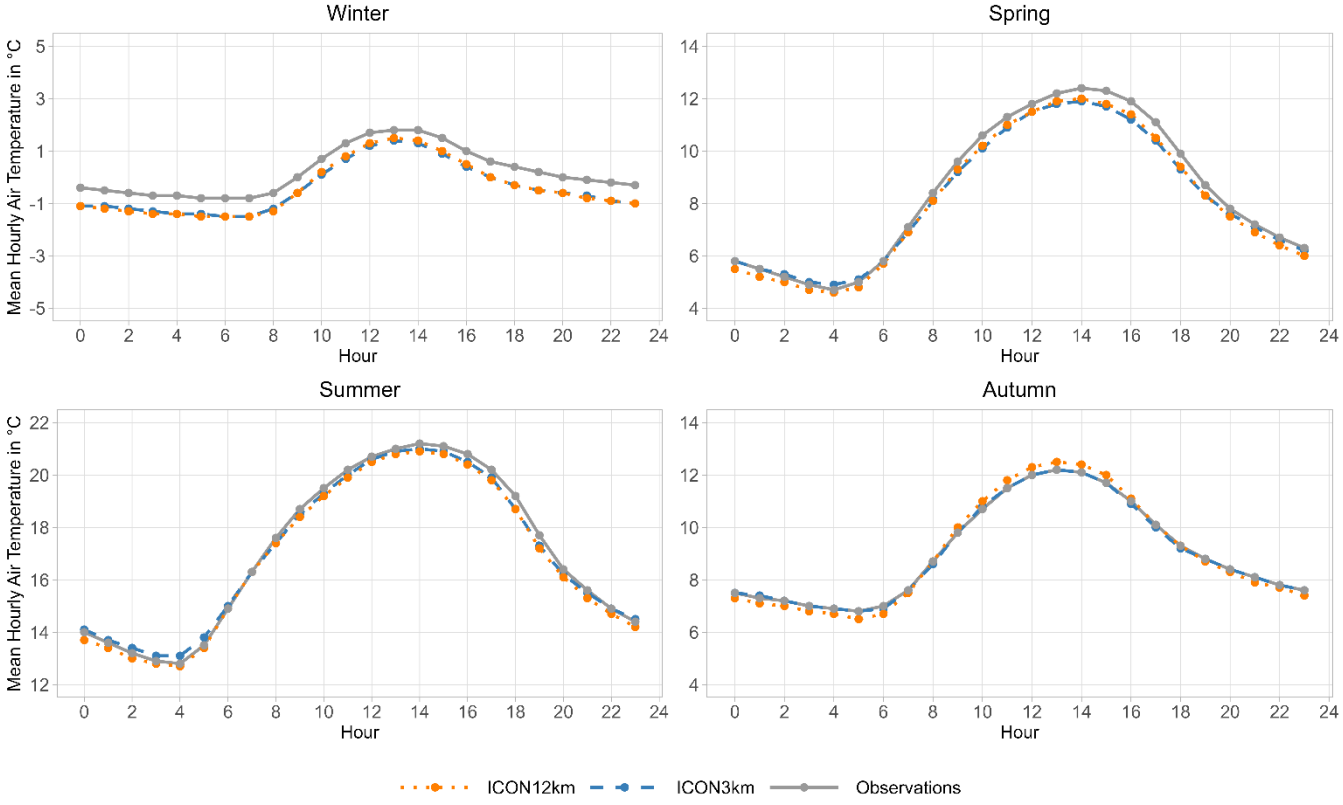

Fig. S6: Seasonal diurnal cycles of mean hourly air temperature computed by ICON12km and ICON3km, as well as the observations for the period from 2005 to 2014. Note different axis ranges.

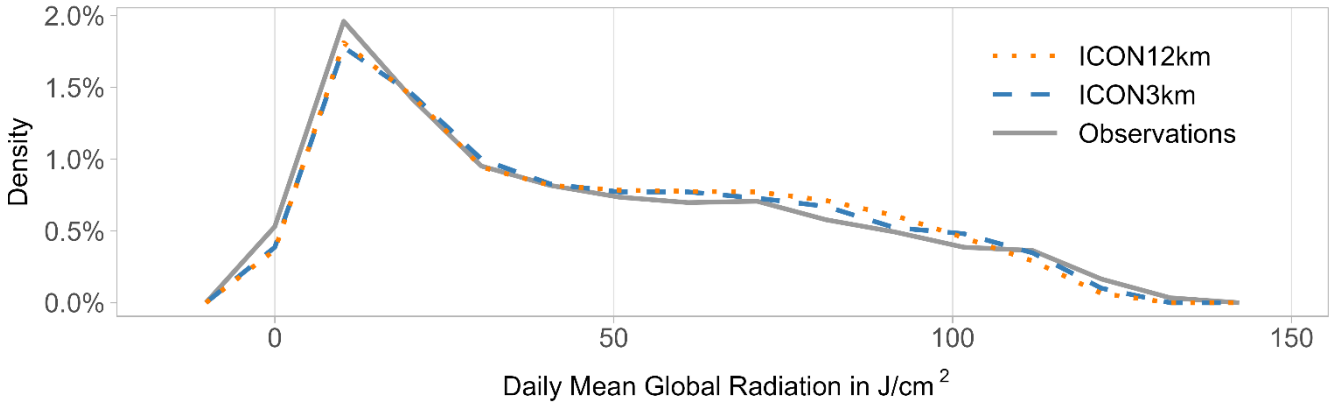

Fig. S7: Frequency polygons for daily mean global radiation as calculated by ICON12km and ICON3km and as observed for the period from 2005 to 2014

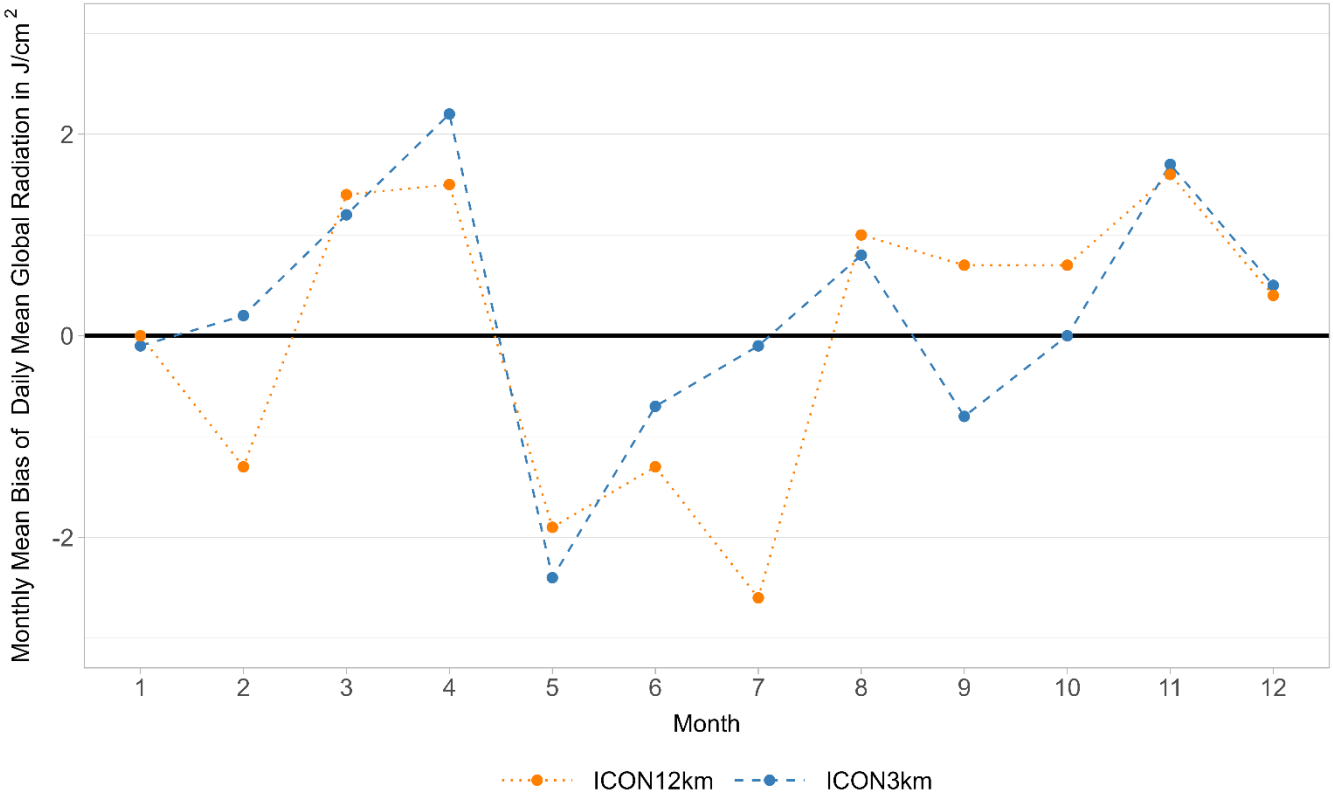

Fig. S8: Monthly mean bias of daily mean global radiation of ICON12km and ICON3km for the period from 2005 to 2014

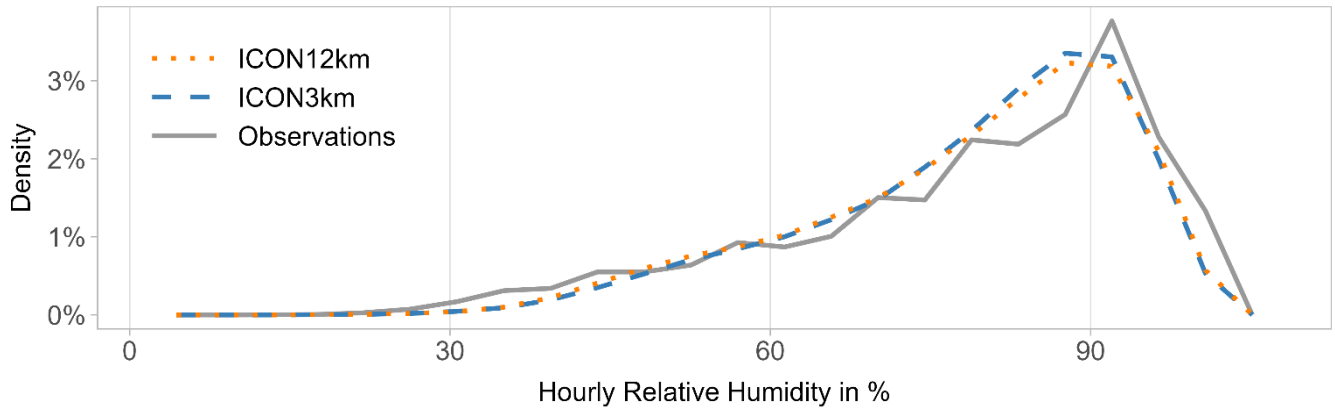

Fig. S9: Frequency polygons for hourly relative humidity as calculated by ICON12km and ICON3km and as observed for the period from 2005 to 2014

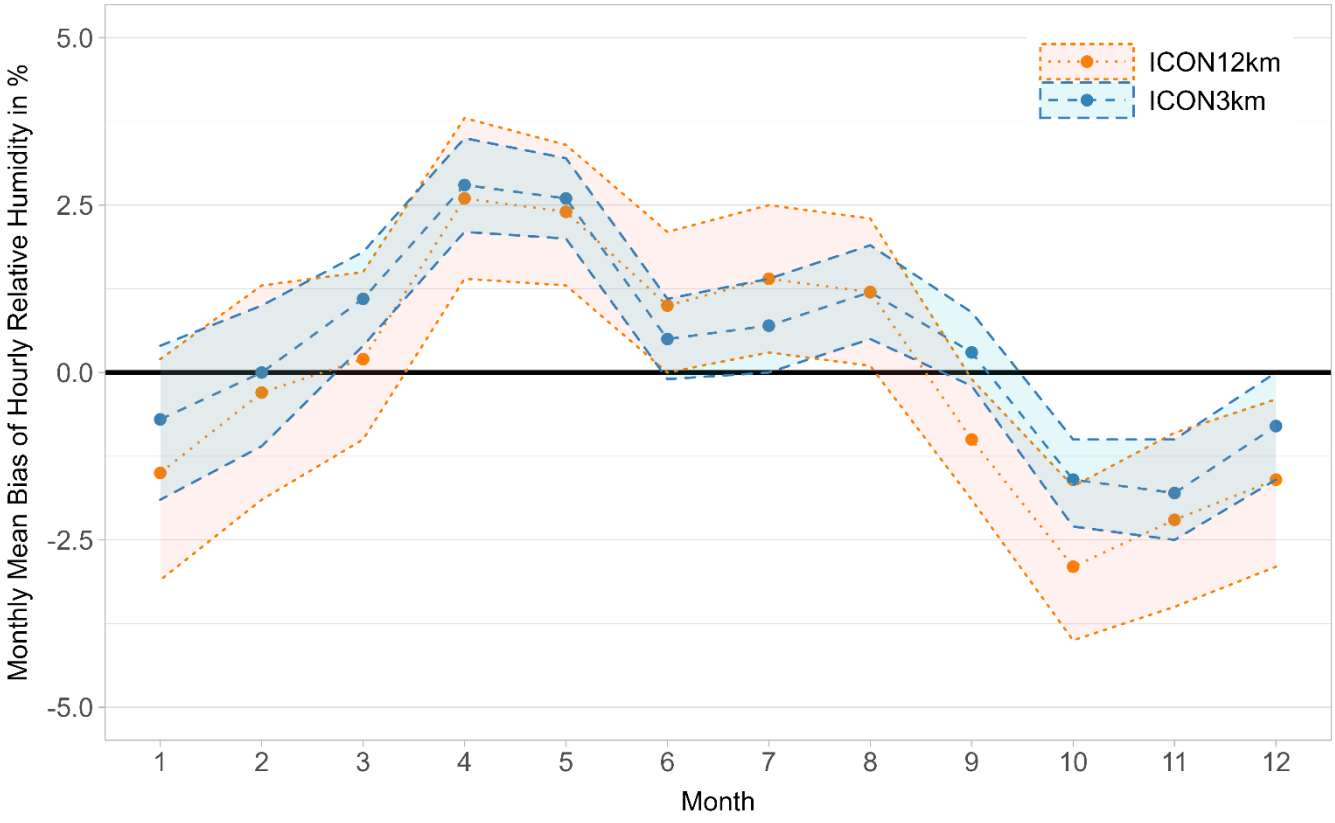

Fig. S10: Monthly mean bias of hourly relative humidity of ICON3km and ICON12km for the period from 2005 to 2014, as well as the 95%-confidence intervals from the station means

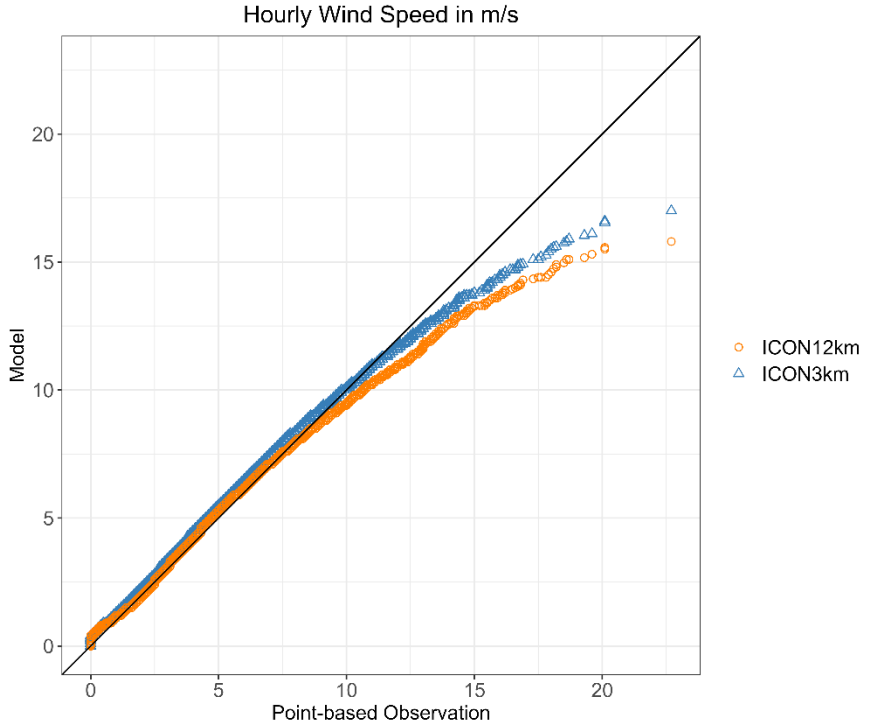

Fig. S11: QQ-plots for hourly wind speed for ICON12km to RADOLAN12km and ICON3km to RADOLAN3km for the period from 2005 to 2014

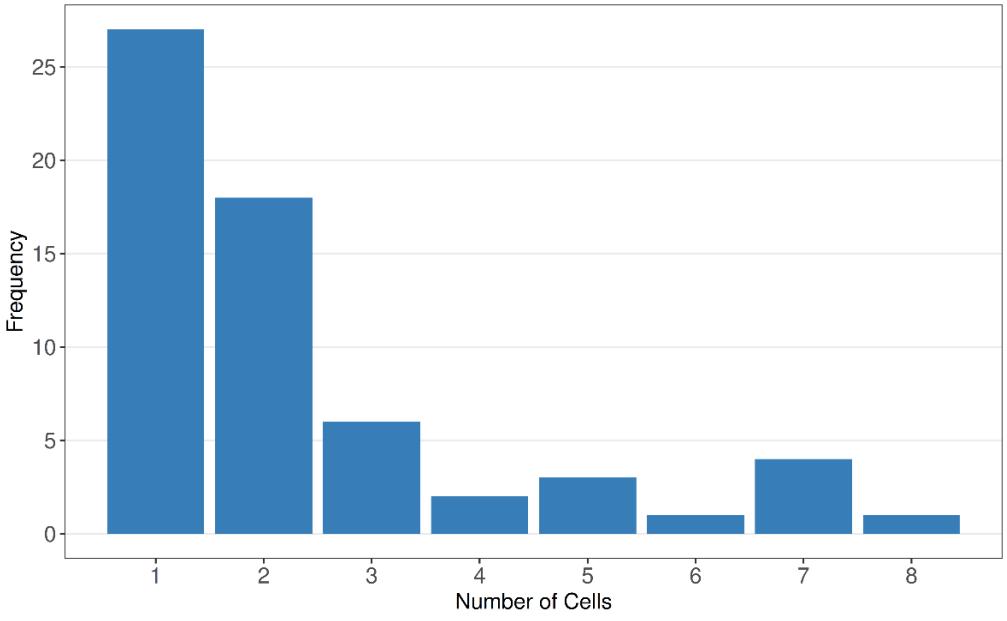

Fig. S12: Frequencies of the number of cells per time step in ICON3km showing precipitation intensities higher than 110% of the maximal intensity recorded in RADOLAN3km. The sum of all frequencies is 146.

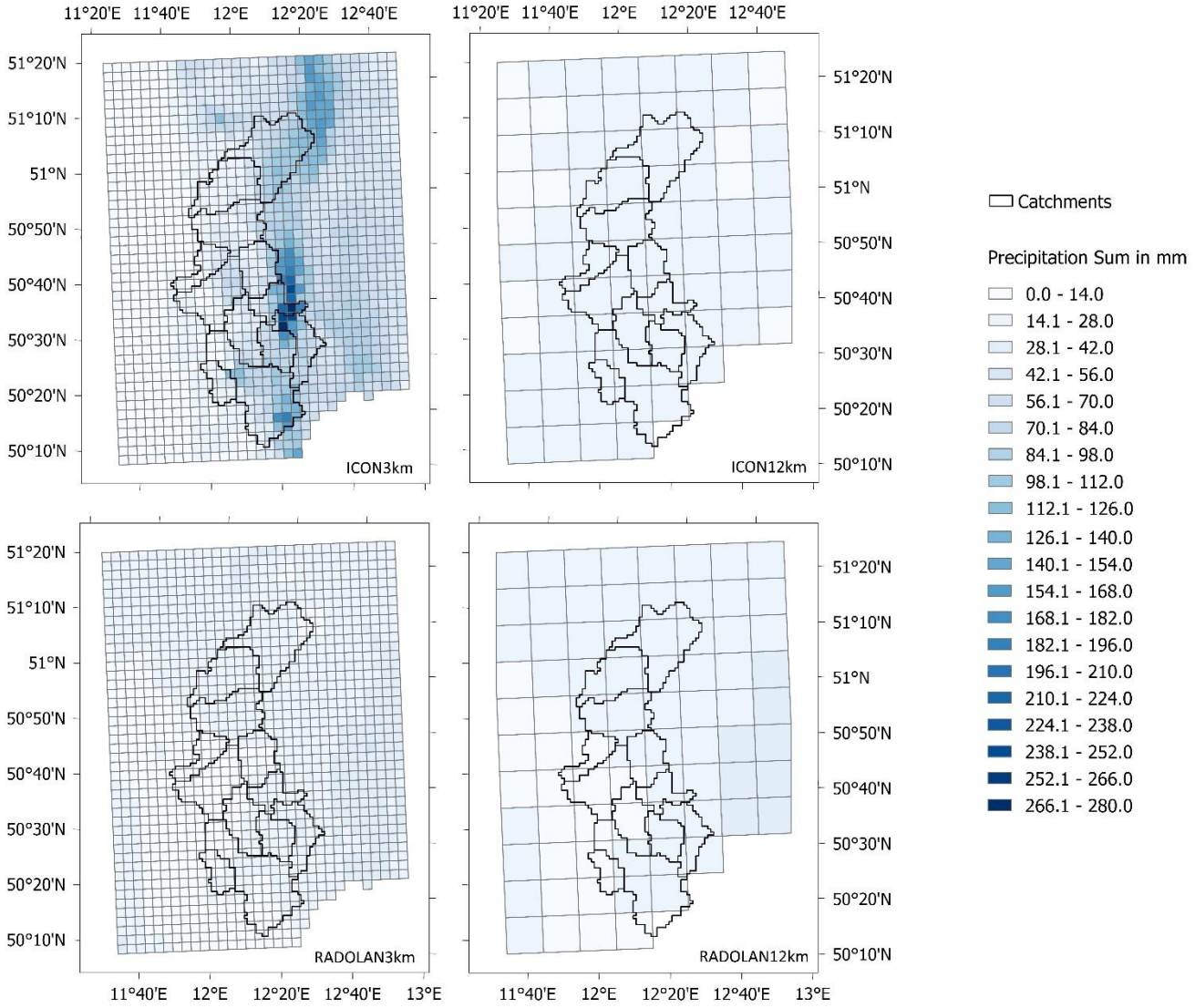

Fig. S13: Maps of the precipitation sums for the time window ± 12 h around the peak time (2009-07-17 17:00) of a selected ICON3km-simulated heavy precipitation event for ICON3km (top left), ICON12km (top right), RADOLAN3km (bottom left) and RADOLAN12km (bottom right)

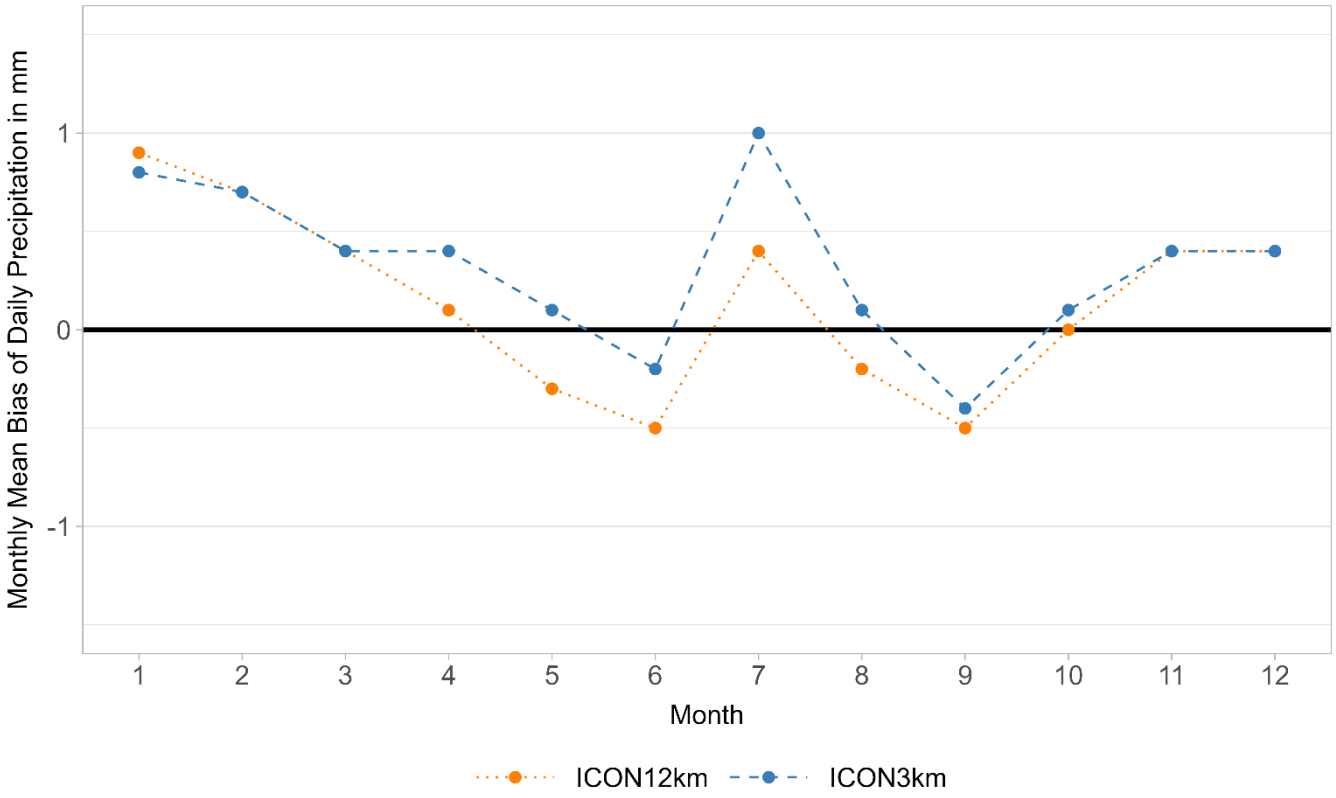

Fig. S14: Monthly mean bias of daily catchment-average precipitation of ICON3km and ICON12km for the period from 2005 to 2014

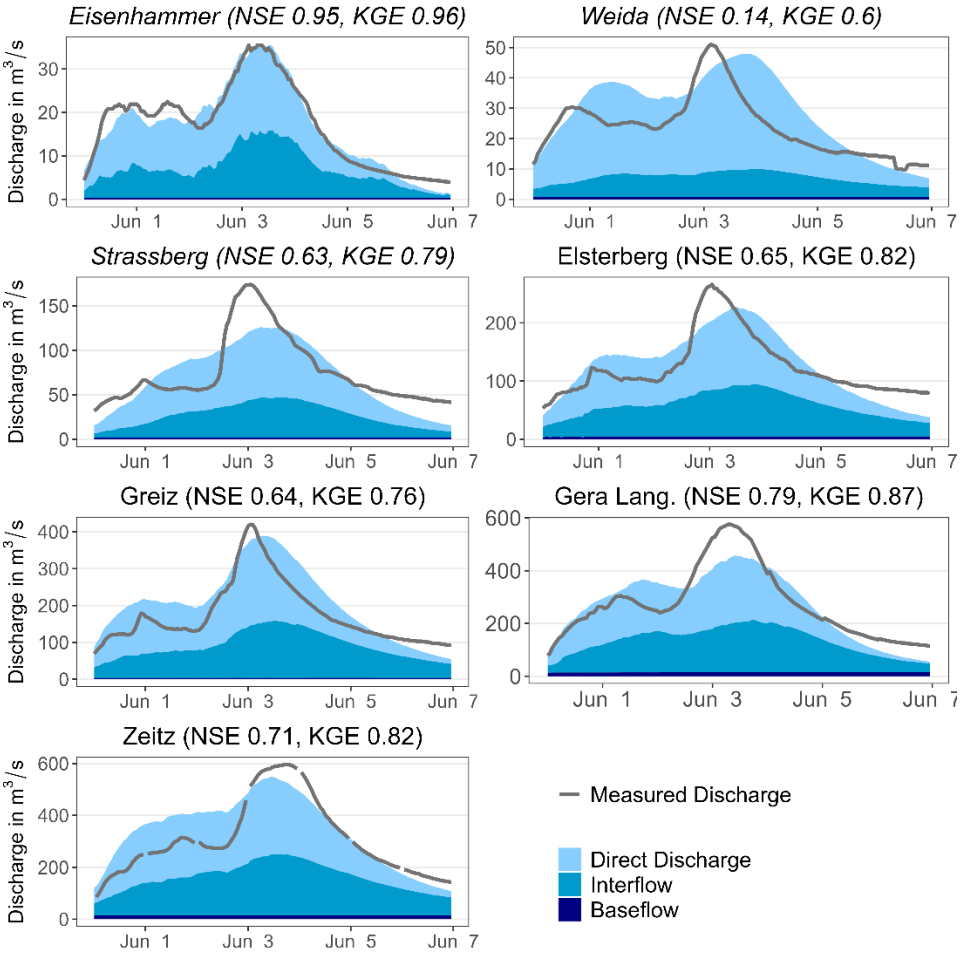

Fig. S15: Calibration results for the flood of 2013

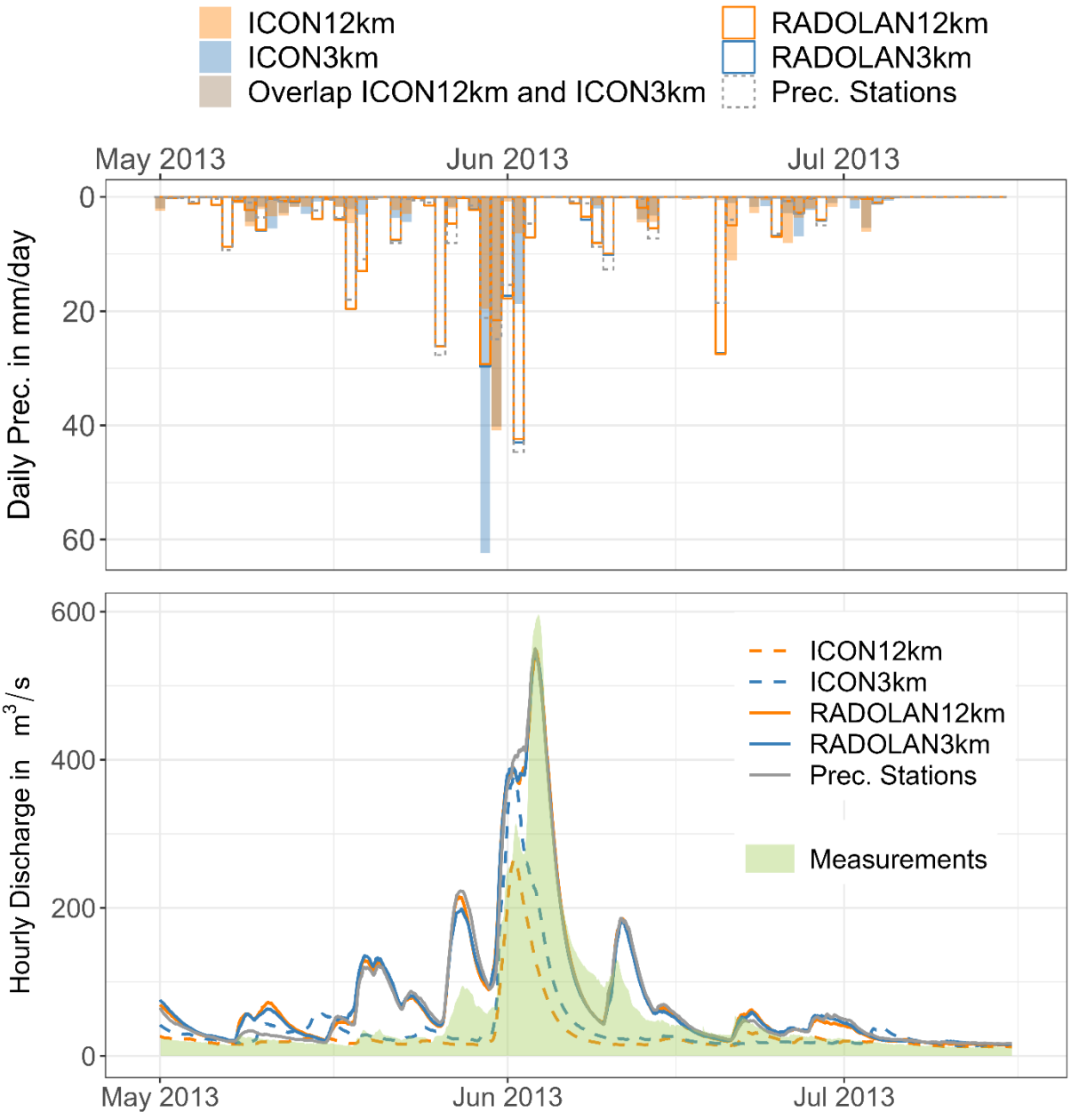

Fig. S16: Daily spatial average precipitation estimates over the catchment of Zeitz and those upstream for the period of the 2013 flood for ICON12km, ICON3km, RADOLAN12km, RADOLAN3km and the interpolated precipitation station measurements, Bottom: the resulting hydrographs (using hourly data) for the catchment of Zeitz together with the discharge measurements

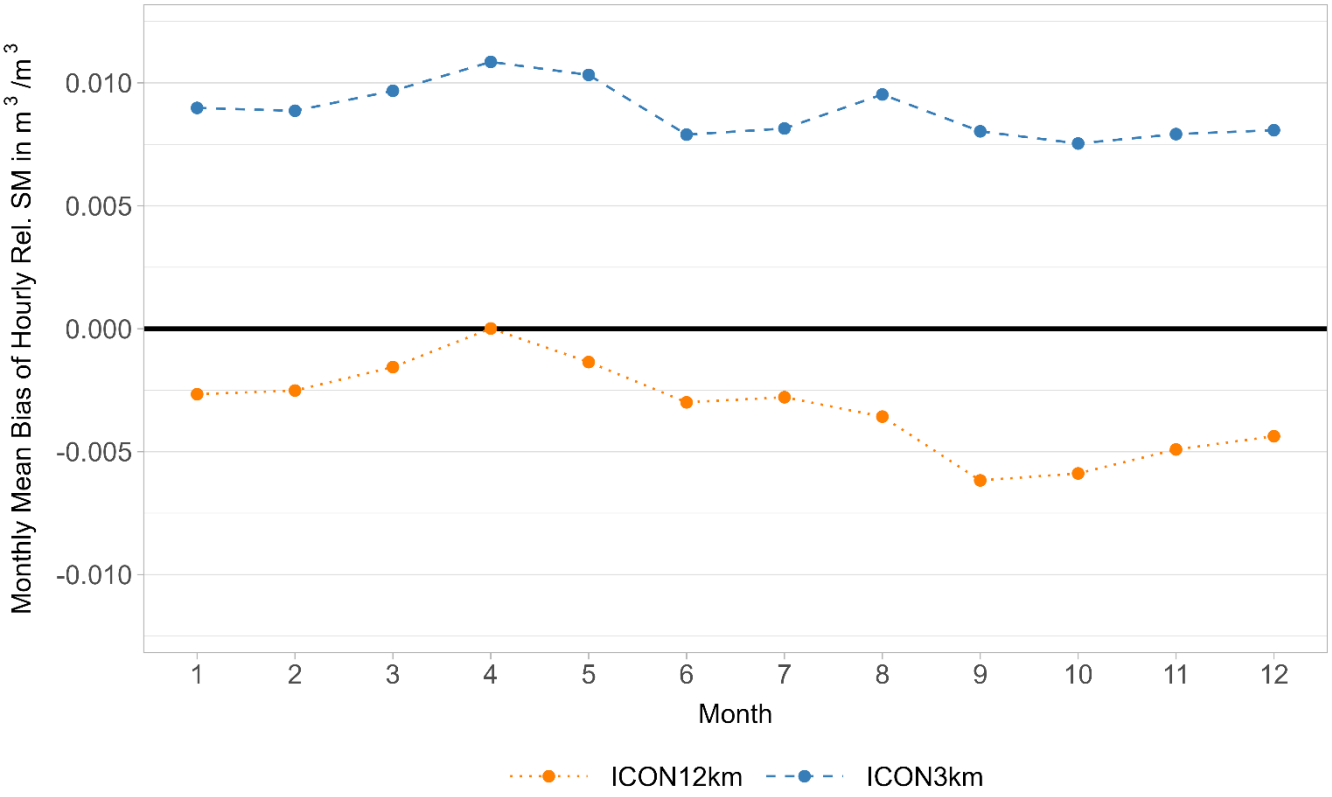

Fig. S17: Monthly mean bias of hourly relative soil moisture (SM), as calculated by the hydrological model driven with ICON3km and ICON12km for the period from 2006 to 2014

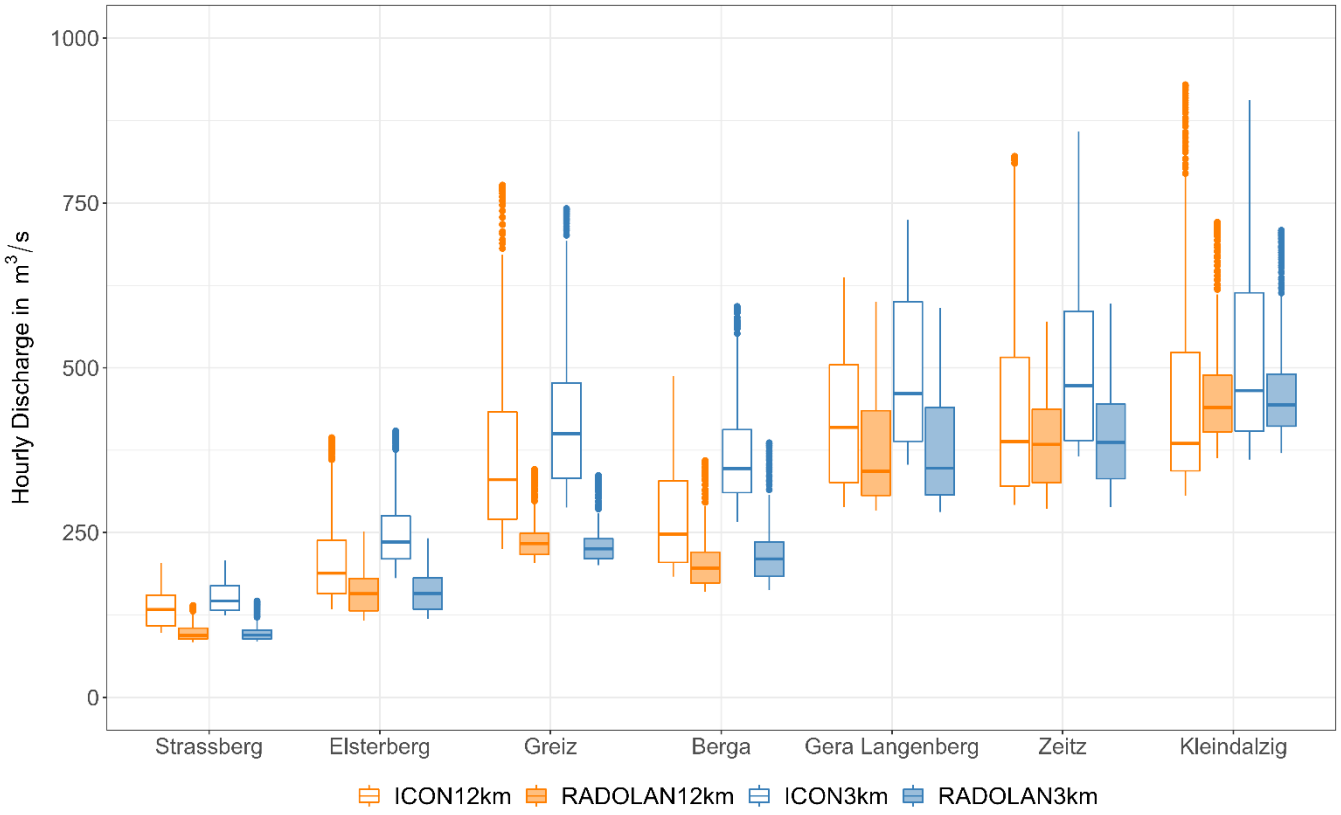

Fig. S18: Boxplots of the 99.5th percentiles of hourly discharge (period from 2006 to 2014) computed by the WaSiM hydrological model driven with meteorological data from ICON12km and ICON3km, as well as with adjusted radar data of respective equal resolution (RADOLAN12km and RADOLAN3km) for catchments of the main stem of the Weiße Elster river within the study area

References

Karra, K., Kontgis, C., Statman-Weil, Z., Mazzariello, J. C., Mathis, M., and Brumby, S. P.: Global land use/land cover with Sentinel 2 and deep learning, in: 2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS, 11–16 July 2021, Brussels, Belgium, ISBN 978-1-6654-0369-6, 2021.