

# Supplementary Material: NUKLEUS - A First Kilometre Scale Multi-model Climate Ensemble for Germany: Evaluation

Kevin Sieck<sup>1</sup>, Joaquim G. Pinto<sup>2</sup>, Beate Geyer<sup>3</sup>, Klaus Keuler<sup>4</sup>, Christian Beier<sup>4</sup>, Chistoph Braun<sup>2</sup>, Florian Ehmele<sup>2</sup>, Hendrik Feldmann<sup>2</sup>, Thomas Frisius<sup>1</sup>, Philipp Heinrich<sup>3</sup>, Marie Hundhausen<sup>2</sup>, Ronny Petrik<sup>3,5</sup>, and Katja Trachte<sup>4</sup>

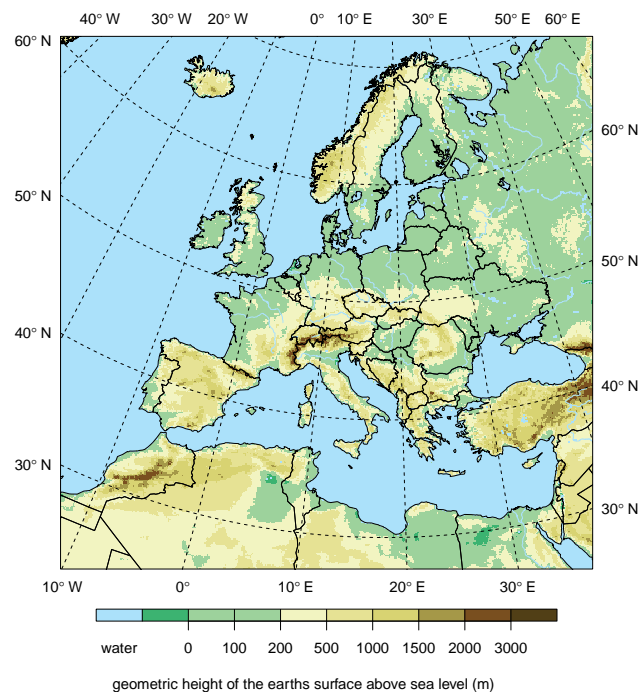
<sup>1</sup>Climate Service Center Germany (GERICS), Helmholtz-Zentrum Hereon, Hamburg, Germany

<sup>2</sup>Institute of Meteorology and Climate Research – Troposphere Research (IMKTRO), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

<sup>3</sup>Chair of Atmospheric Processes, Brandenburg University of Technology (BTU) Cottbus-Senftenberg, Cottbus, Germany

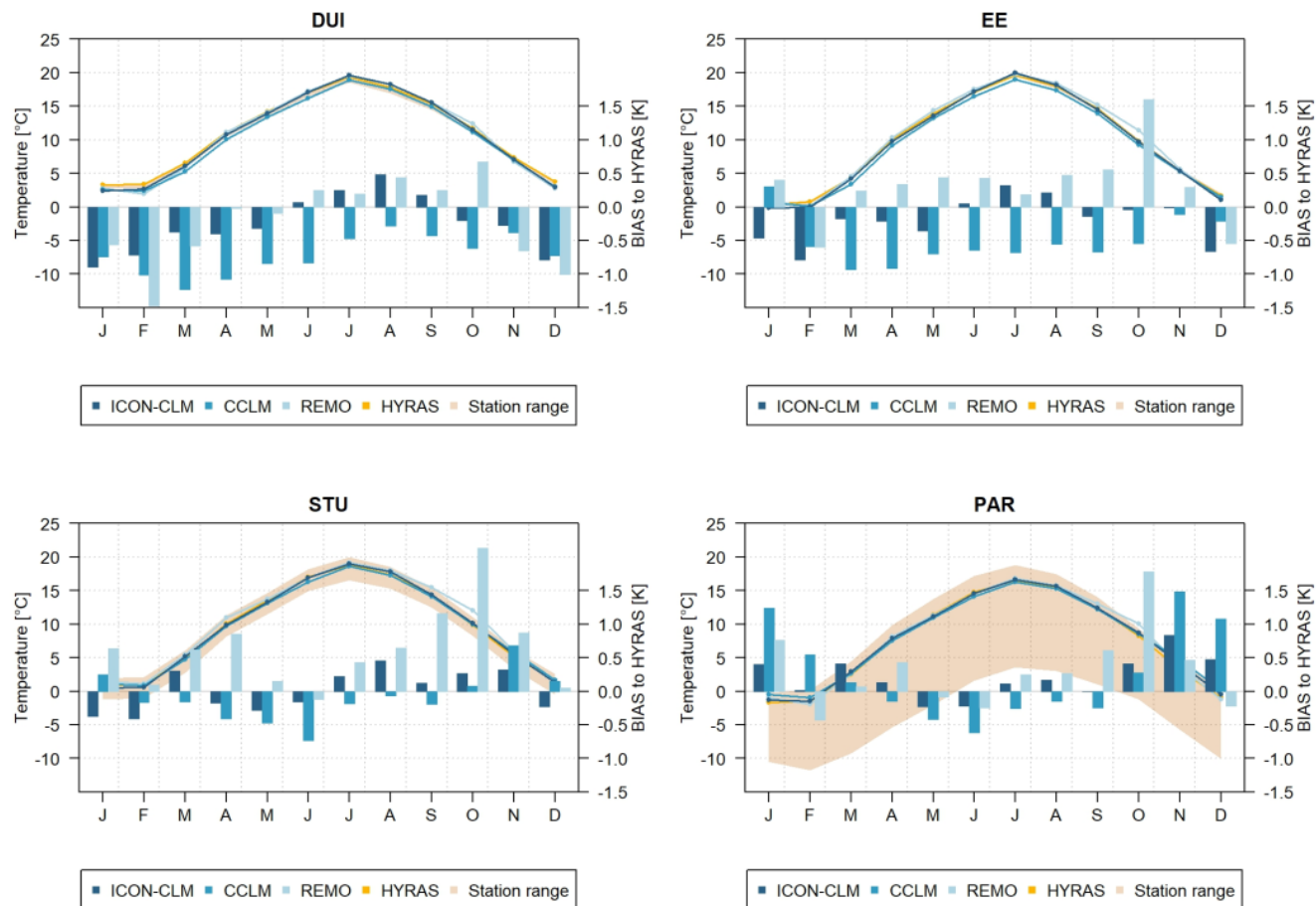
<sup>4</sup>Institute of Coastal Systems - Analysis and Modeling, Helmholtz-Zentrum Hereon, Geesthacht, Germany

<sup>5</sup>German Navy Headquarters, Rostock, Germany

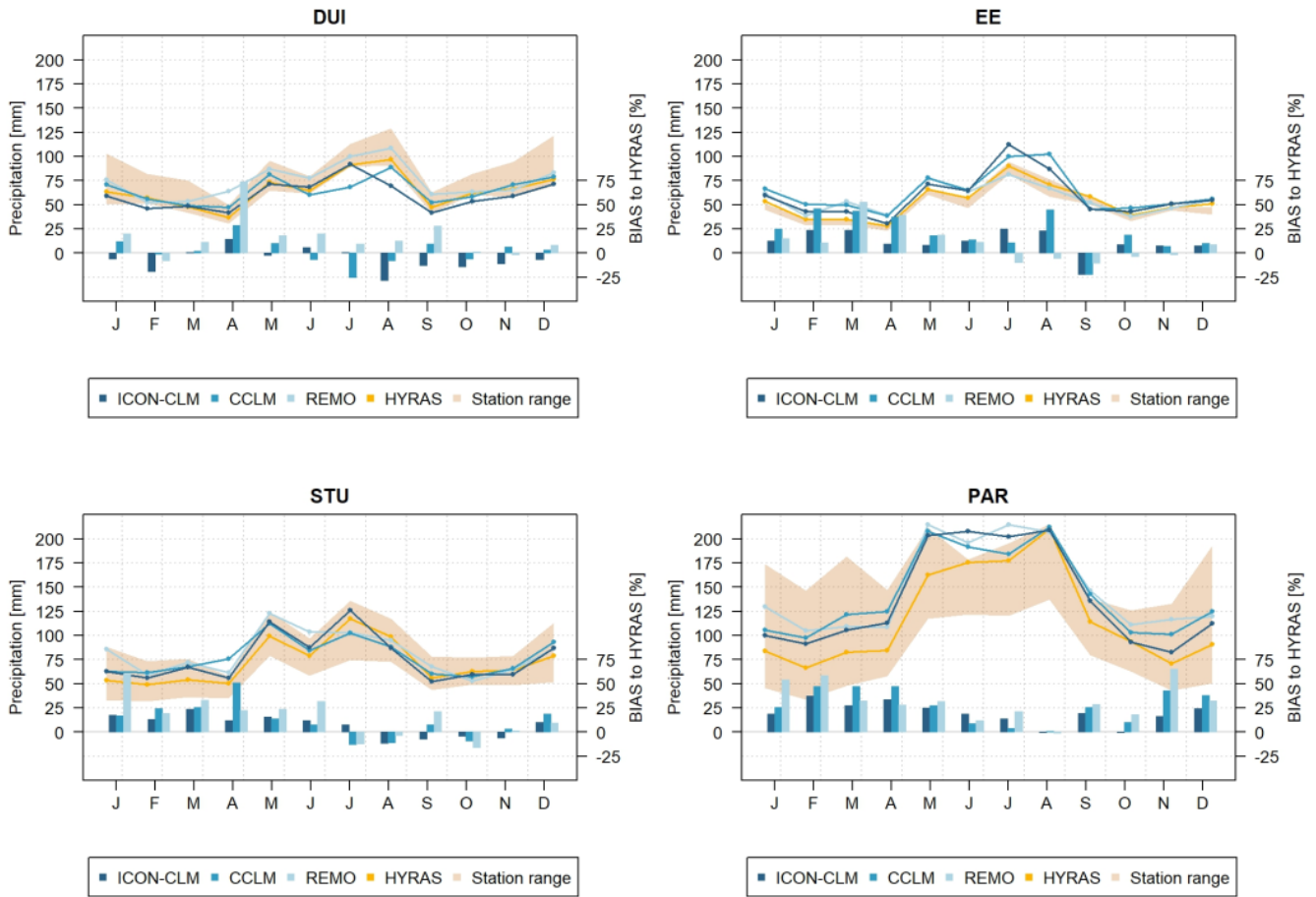


**Figure S1.** Simulation domain for the first nesting step GCM-RCM (EURO-CORDEX domain EUR-12) with its orography.

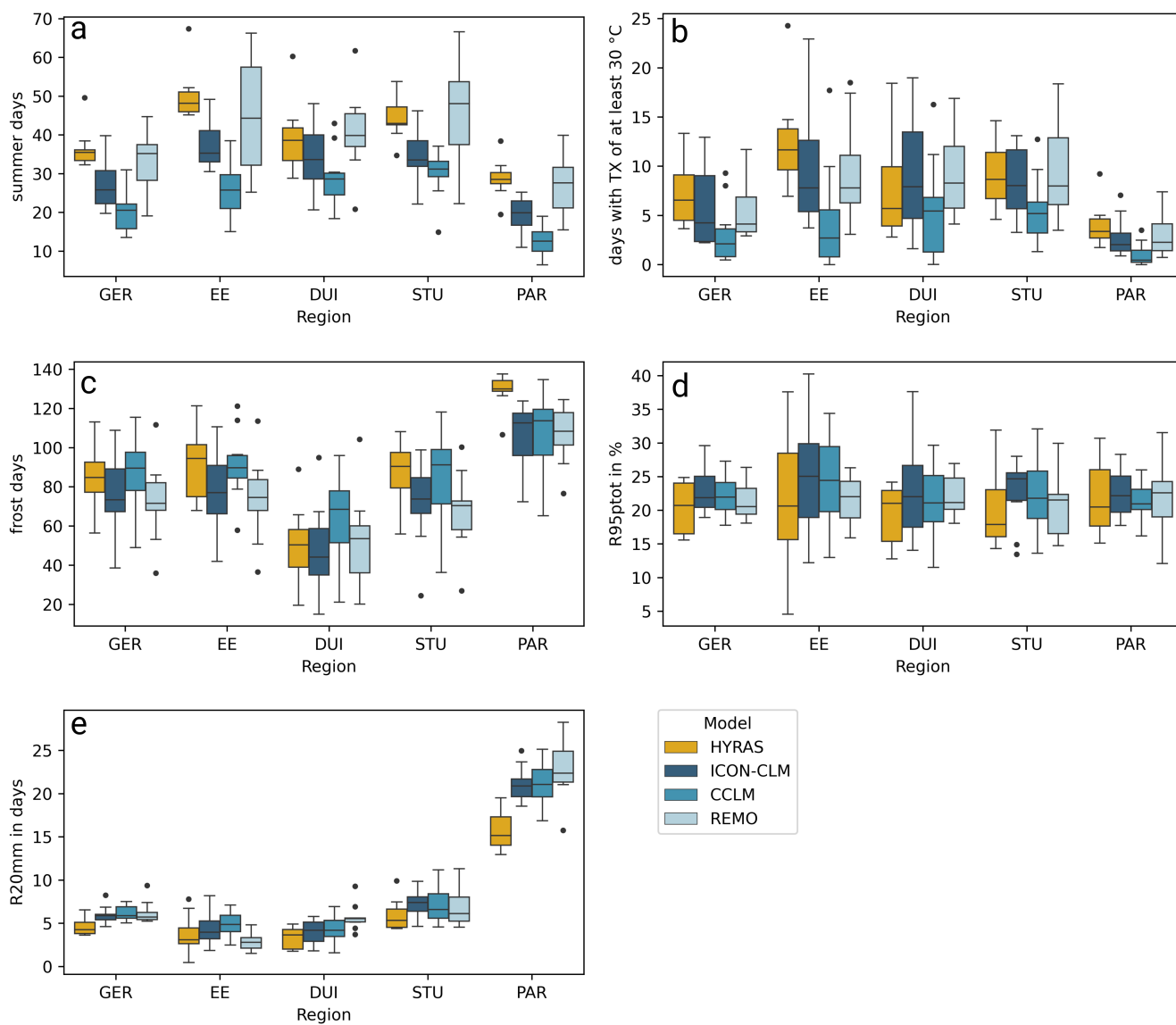
## 1 Annual cycle and climate indices



**Figure S2.** Annual cycle of monthly mean 2 m temperature (curves, left axis) and temperature bias (shaded bars, right axis) for the period 2005–2014 and the three CPM simulations on CEU-3 with ICON-CLM (dark blue), CCLM (blue) and REMO (light blue) against HYRAS reference data (dark yellow curve) averaged over the pilot regions DUI, EE, STU, and PAR.

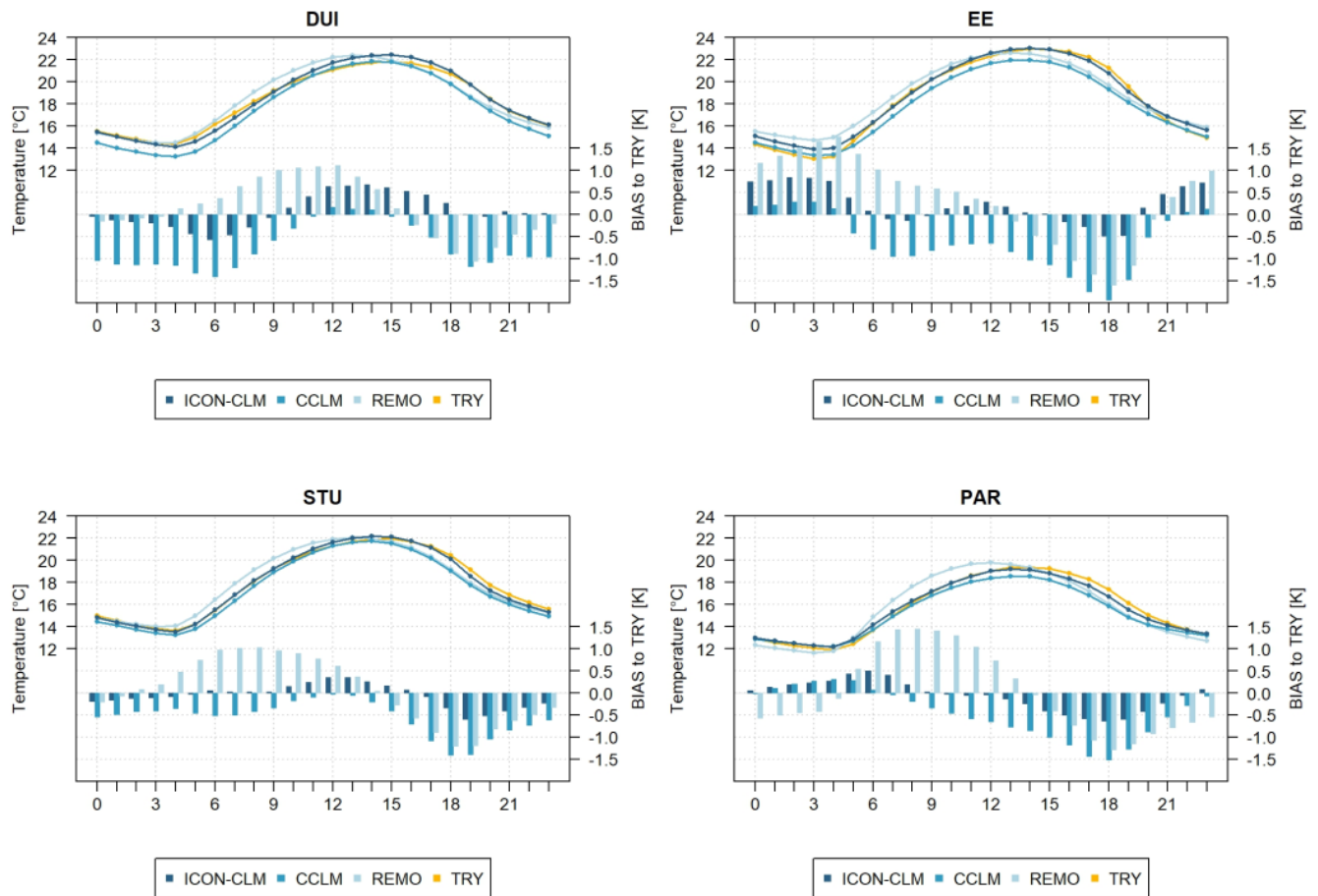


**Figure S3.** Annual cycle of monthly precipitation (curves, left axis) and precipitation bias (shaded bars, right axis) for the period 2005–2014 and the three CPM simulations on CEU-3 with ICON-CLM (dark blue), CCLM (blue) and REMO (light blue) against HYRAS reference data (dark yellow curve) averaged over the pilot regions DUI, EE, STU, and PAR.

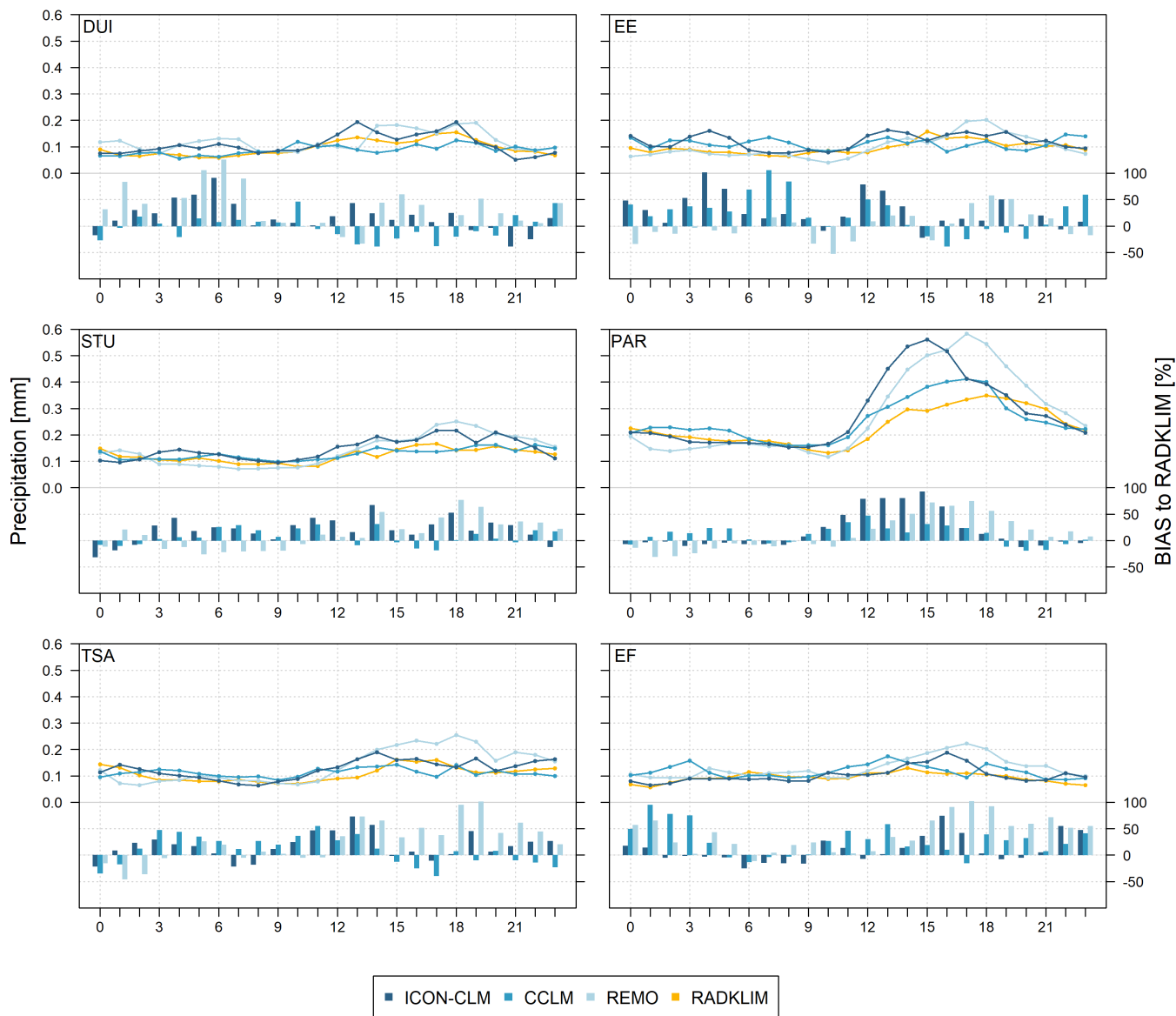


**Figure S4.** Distribution of the annual (a) Number of summer days (SU), (b) Number of days with  $T_{max}$  of greater than or equal to  $30^\circ\text{C}$  ( $T_{maxge30}$ ), (c) Number of frost days (FD), (d) Contribution from very wet days (R95ptot), (e) Number of very heavy rain days (R20mm). The indices are averaged over the grid points in the respective pilot region.

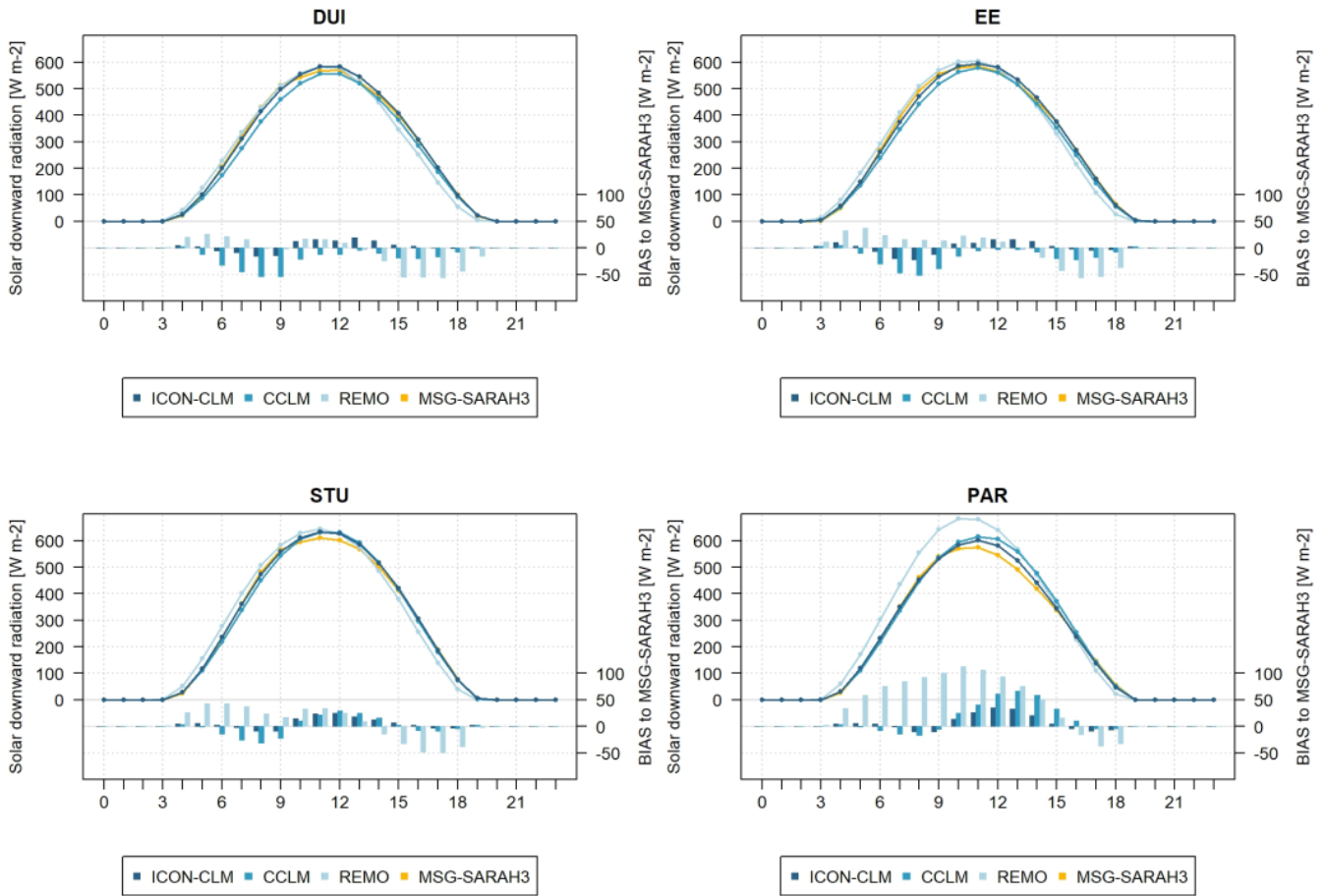
## 2 Diurnal cycle



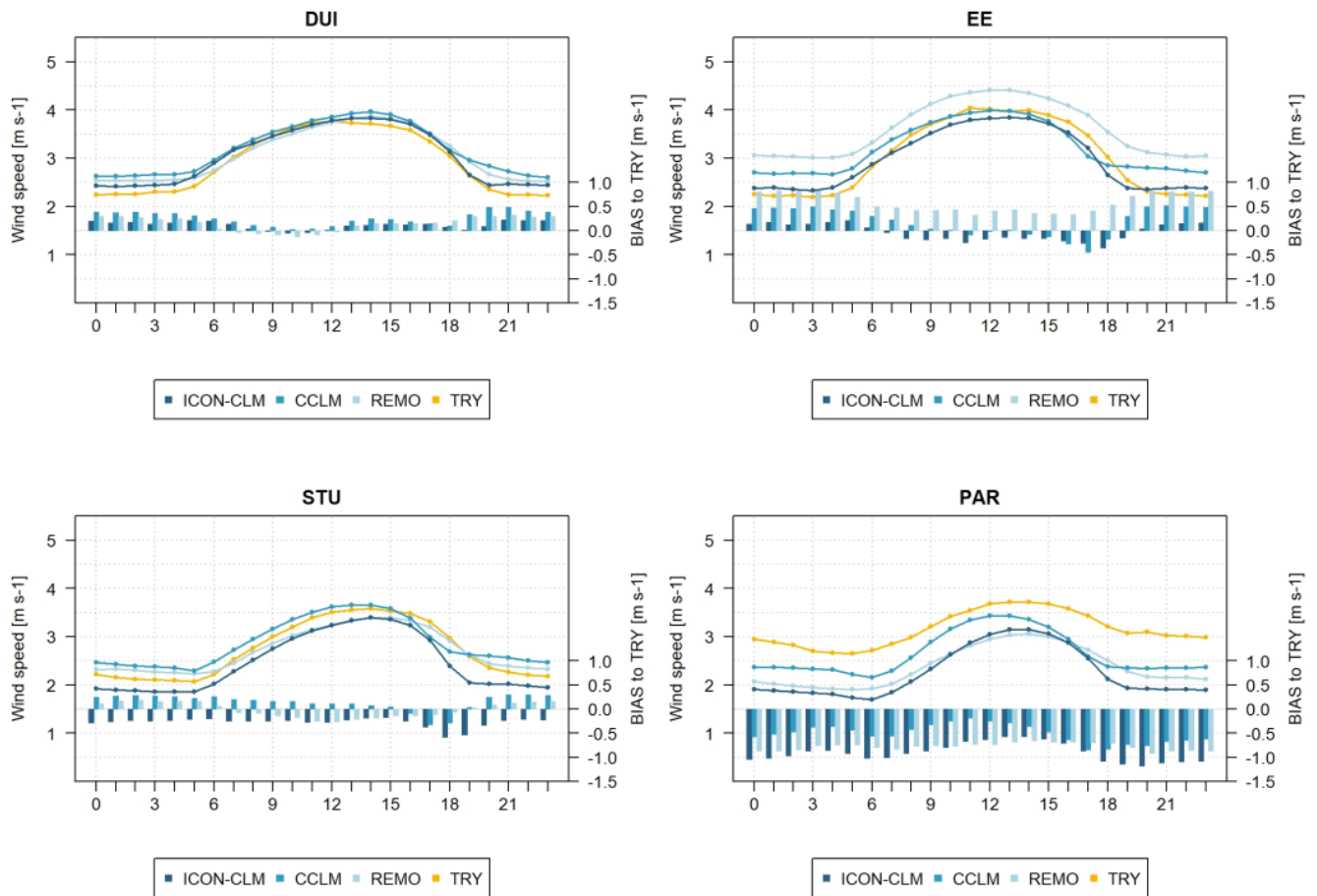
**Figure S5.** Diurnal cycle of 2 m temperature for the months June and July (curves, left axis) and temperature bias (shaded bars, right axis) for the period 2005–2014 and the three CPM simulations on CEU-3 with ICON-CLM (dark blue), CCLM (blue) and REMO (light blue) against TRY reference data (dark yellow curve) averaged over the pilot regions DUI, EE, STU, and PAR.



**Figure S6.** Diurnal cycle of precipitation for the months June and July (curves, left axis) and precipitation bias (shaded bars, right axis) for the period 2005–2014 and the three CPM simulations on CEU-3 with ICON-CLM (dark blue), CCLM (blue) and REMO (light blue) against RADKLIM v172 reference data (dark yellow curve) averaged over the pilot regions DUI, EE, STU, and PAR. TSA and EF from Fig. 16 are added with the new y-axis to enable easy comparison.

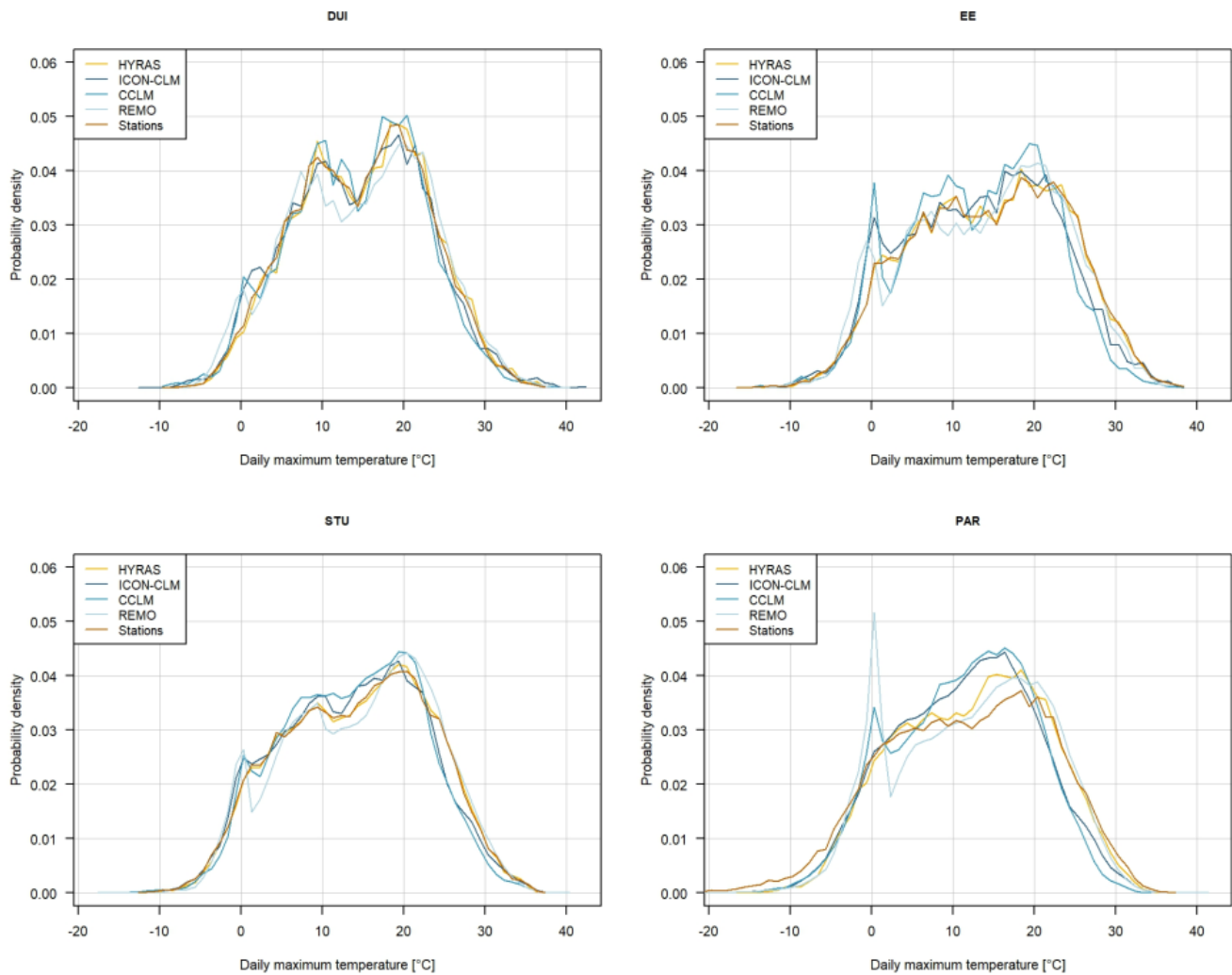


**Figure S7.** Diurnal cycle of solar downward radiation for the months June and July (curves, left axis) and radiation bias (shaded bars, right axis) for the period 2005–2014 and the three CPM simulations on CEU-3 with ICON-CLM (dark blue), CCLM (blue) and REMO (light blue) against MSG-SARAH3 reference data (dark yellow curve) averaged over the pilot regions DUI, EE, STU, and PAR.

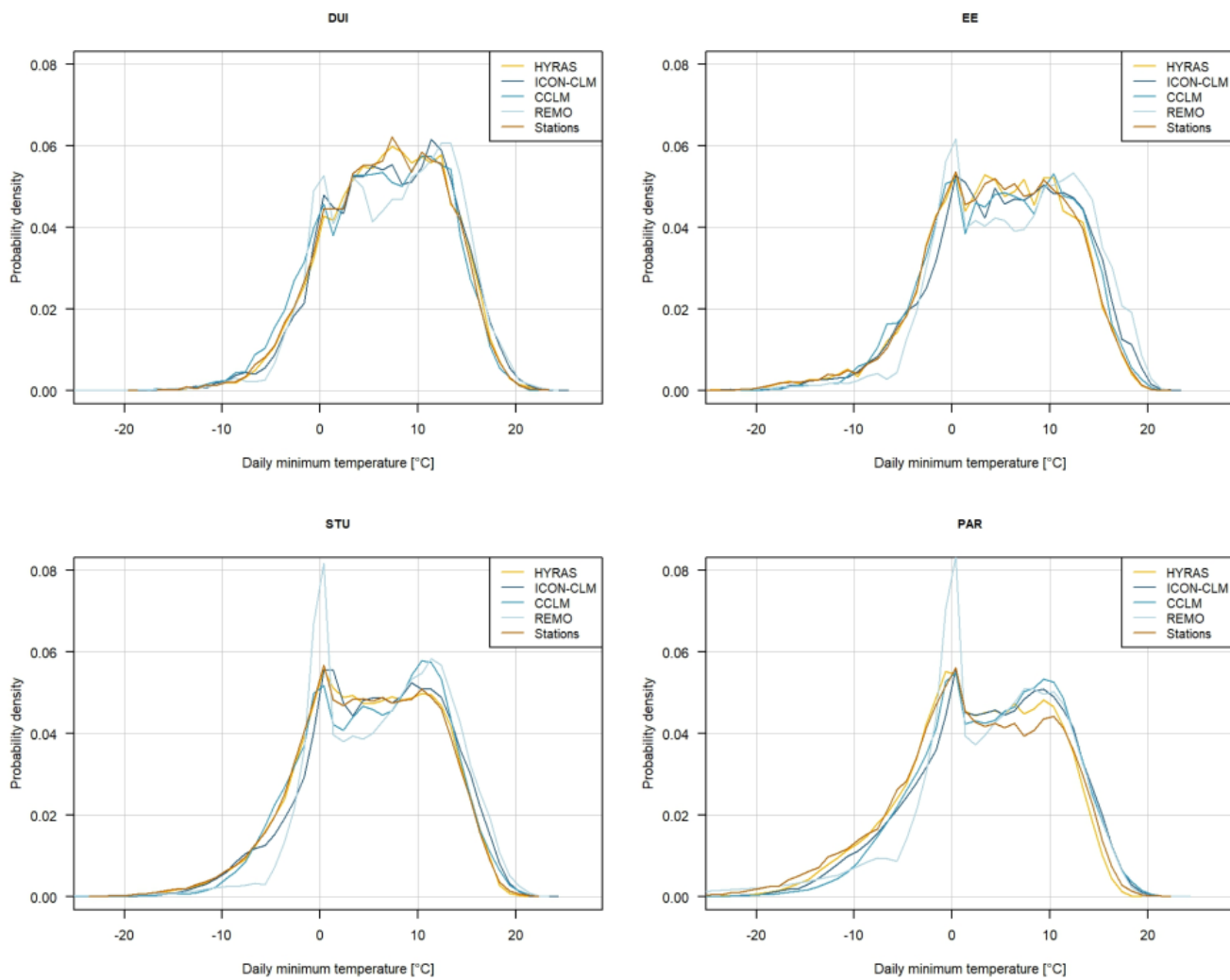


**Figure S8.** Diurnal cycle of wind speed in 10 m height for the months June and July (curves, left axis) and wind speed bias (shaded bars, right axis) for the period 2005–2014 and the three CPM simulations on CEU-3 with ICON-CLM (dark blue), CCLM (blue) and REMO (light blue) against TRY reference data (dark yellow curve) averaged over the pilot regions DUI, EE, STU, and PAR.

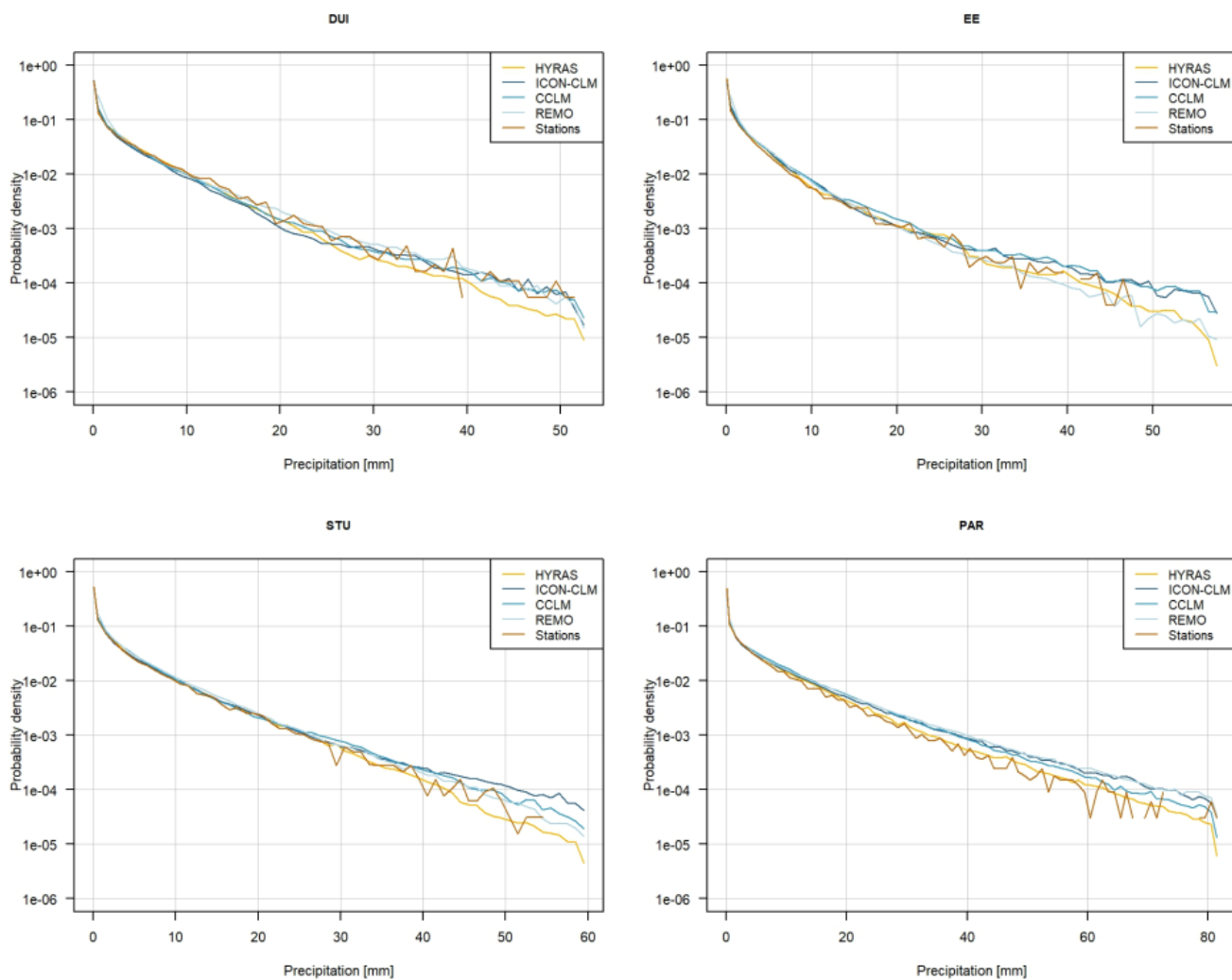
### 3 Frequency distributions



**Figure S9.** Frequency distribution of daily maximum temperature for the period 2005–2014 of the three CPM simulations on CEU-3 with ICON-CLM, CCLM, and REMO and the HYRAS reference data calculated over pilot regions DUI, EE, STU, and PAR.



**Figure S10.** Frequency distribution of daily minimum temperature for the period 2005–2014 of the three CPM simulations on CEU-3 with ICON-CLM, CCLM, and REMO and the HYRAS reference data calculated over pilot regions DUI, EE, STU, and PAR.



**Figure S11.** Frequency distribution of daily precipitation intensities for the period 2005–2014 of the three CPM simulations on CEU-3 with ICON-CLM, CCLM, and REMO and the HYRAS reference data calculated over pilot regions DUI, EE, STU, and PAR.