

# Evaluation of extreme precipitation indices using CMIP6 over Central Europe

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## Abstract

This study will use the daily data of the newest ensembles of climate models CMIP6, which are designed to construct projections of future climate. This data is available from the portal of World Climate Research Program (WCRP) Coordinated Regional Downscaling Experiment (CORDEX). In order to evaluate the extreme rainfall index of CMIP6 over Central Europe, we used EObs datasets with a spatial resolution of 0.25°. These indices are (1) the number of extreme days exceeding a threshold of 20 mm/day (R20mm) and (2) 10 mm/day (R10mm), (3) Consecutive dry days (CDD) for a threshold of 1 mm/day and 2 mm/day, and (4) Consecutive wet days (CWD) for a threshold of 1 mm/day and 2 mm/day. The evaluation was conducted over two periods: 1981 to 2010 with 13 models, and 2015 to 2021 based on Shared Socioeconomic Pathways (SSPs) with 8 models. Four SSPs are used in this study: SSP126, SSP246, SSP370 and SSP585. To evaluate these two periods, we used the correlation coefficient and the root mean square error coefficient (RMSE). The results show a significant correlation with EObs data for the estimation of very heavy and heavy precipitation indices during the 1981-2010 period. On average, the GCM ensemble's correlation coefficient was about 0.7, with many models exceeding 0.8. The RMSE was higher by R10mm than by R20mm. In the case of CWD, the model ensemble correlates around 0.5 while in the case of CDD, it correlates around 0.3. SSP evaluation results for 2015-2021 show that the correlation coefficients have decreased for all indices compared to the historical period 1981-2010. The correlation and RMSE between the various SSPs for R20mm and R10mm are not greatly different. For these two indices, SSP126 is the most accurate estimator. However, we observe a significant variation between the SSPs for estimating CWD and CDD. SSP585 is the best estimator for these two indices. As part of our effort to obtain more robust results, we are currently working to evaluate all available models.

## Data and methodology

The study area covers Central Europe (Lon 6°, 24°, Lat 45°, 55°). CMIP6 database downloaded from (WCRP-CORDEX). EObs datasets with a spatial resolution of 0.25° downloaded from ECA&D database (<https://www.ecad.eu>).

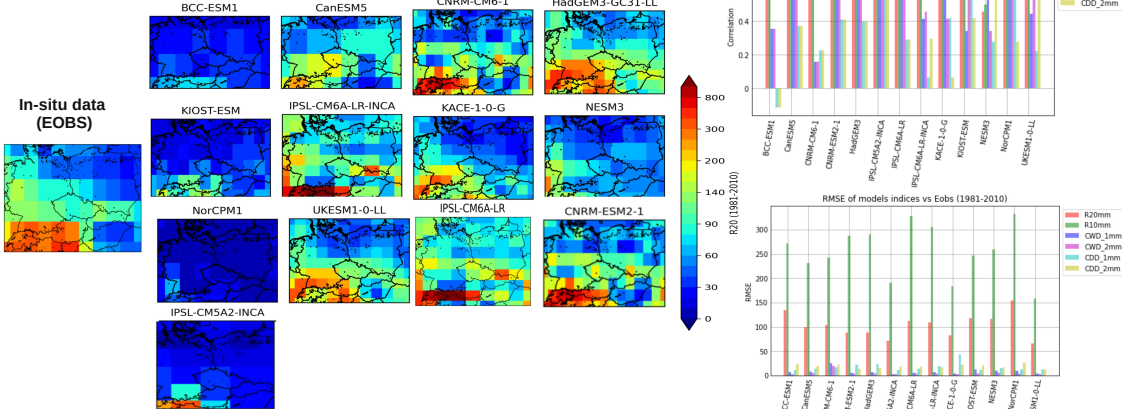
Four recommended indices for extreme precipitation (<http://www.knmi.nl/samenw/eoca>) were selected for this study:

- 1 • **Very heavy precipitation days (R20mm)** Number of days per year where rainfall (R) ≥ 20mm.
- 2 • **Heavy precipitation days (R10mm)** Number of days per year where rainfall (R) ≥ 10mm.
- 3 • **CWD** (days) the longest period in year with consecutive wet days, when daily precipitation > 1 mm (CWD\_1), daily precipitation > 2 mm (CWD\_2).
- 4 • **CDD** (days) the longest period in year with consecutive dry days, when daily precipitation < 1 mm (CDD\_1), daily precipitation < 2 mm (CDD\_2).

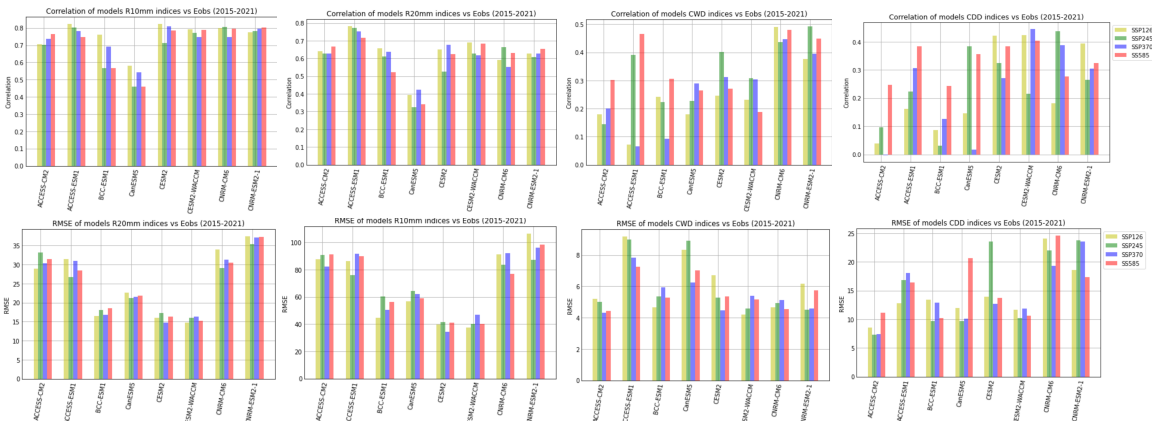
## Results

### Evaluation of the first period (1981-2010)

#### Very heavy precipitation days (R20mm) for 1981-2010 (EOBS data vs 13 GCM models)



### Evaluation of the second period (Eobs with SSPs 2015-2021)



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