Project: **1340**

Project title: **Long-term simulations with improved and extended REMO versions**

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Report period: **2027-01-01 to 2027-12-31**

Thanks to the DKRZ resources for 2026, we were able to run the regional climate model REMO2020 for WAS-11 (see figure below) effectively, yielding significant insights into South Asian climate. We also tested irrigation sensitivity runs and will continue before running a long simulation with the irrigation module. These findings not only improve our understanding of regional climate dynamics but also support ongoing improvements to REMO, for which we ran simulations using different soil datasets, parametrizations, soil hydrological schemes, and a first test with a new vegetation module.

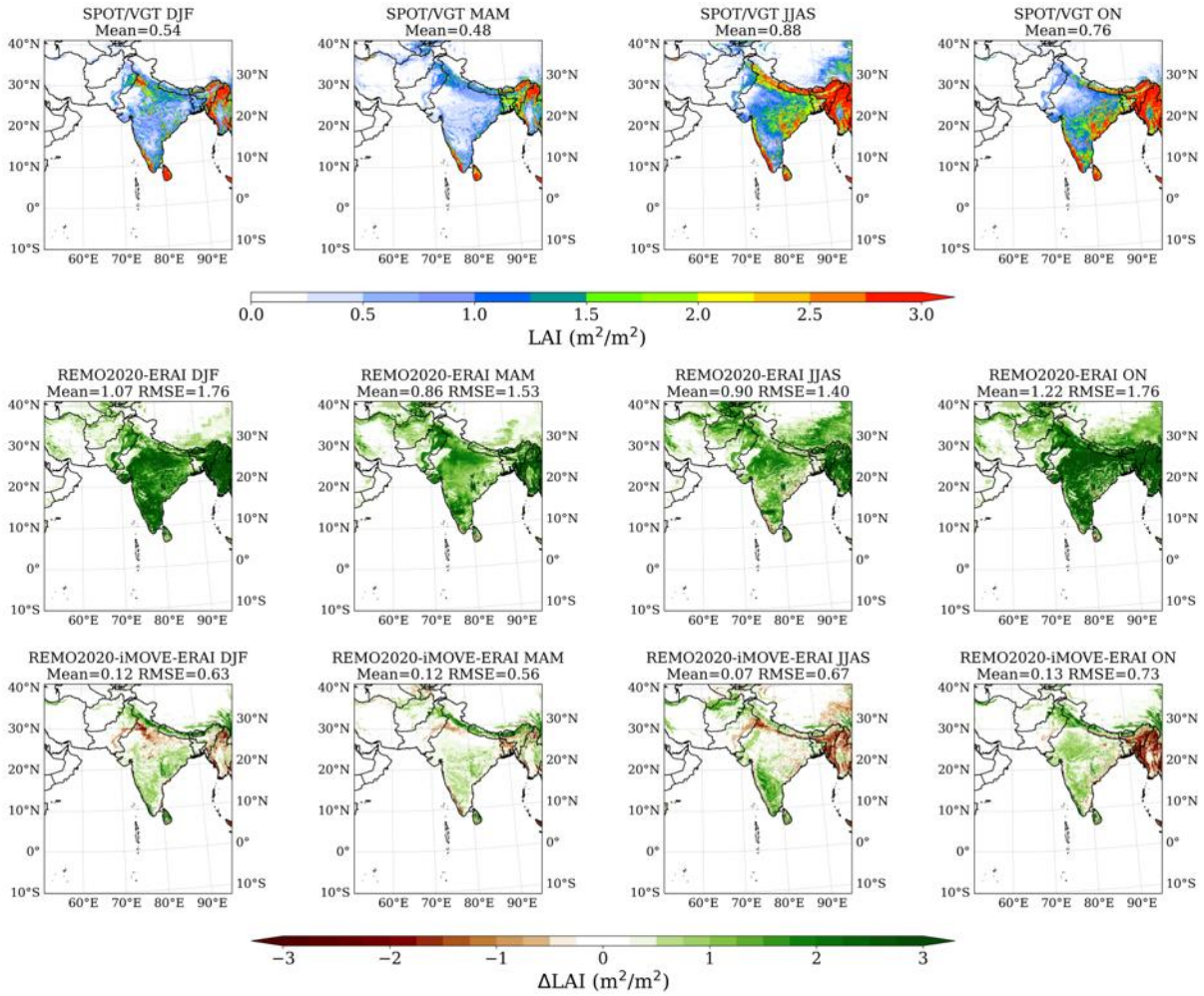


Figure 1. *Time-averaged leaf-area index (m^2/m^2), masked over land areas, from the SPOT/VGT dataset, along with the respective biases for two different model versions for the period 2000-2016.*

Figure 1 shows that the standard REMO2020 version, with static vegetation climatology, overestimates LAI across the entire domain, with a higher mean (~0.86-1.22 m^2/m^2) and correspondingly higher RMSE (1.40-1.76 m^2/m^2) across seasons. This overestimation is strongest in winter and autumn, although the eastern domain exhibits a larger LAI bias year-round. After introducing interactive vegetation, biases decrease significantly across the domain, with mean values dropping sharply (~0.07-0.13 m2/m2) and RMSE falling by almost 60% (0.56-0.73 m^2/m^2).

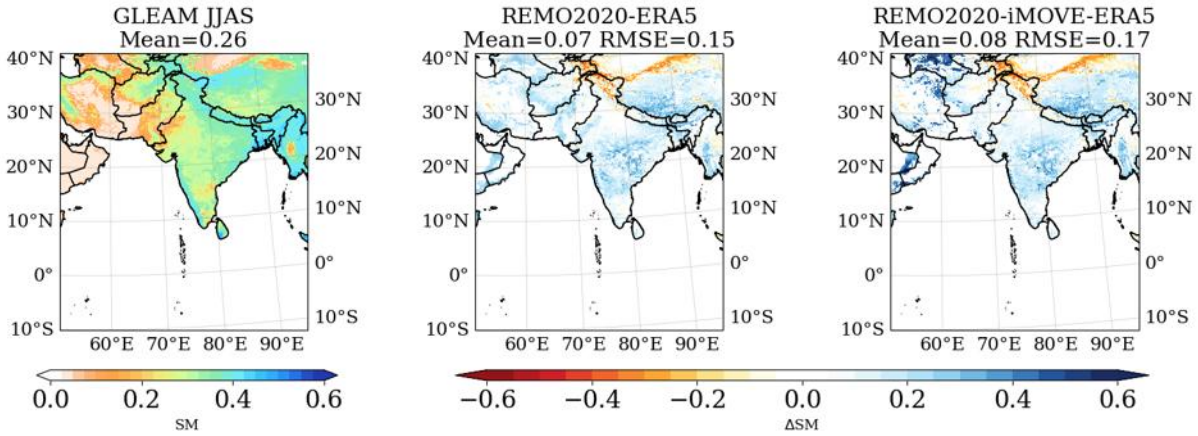


Figure 2. Mean monthly JJAS Soil Moisture, masked over land areas, from the GLEAM dataset, along with the respective biases for REMO2020 and REMO2020-iMOVE forced with ERA5, for the 2000-2016 period.

The soil moisture (SM) biases shown in Figure 2 show uniform overestimation across most of the domain, with slight underestimation in the northern and northwestern arid regions. This SM pattern indicates that underestimated evapotranspiration consumes too little soil moisture and favors sensible heat fluxes in the model, which, combined with lower cloud cover, leads to higher T2m air temperature, particularly in the South Asian region.

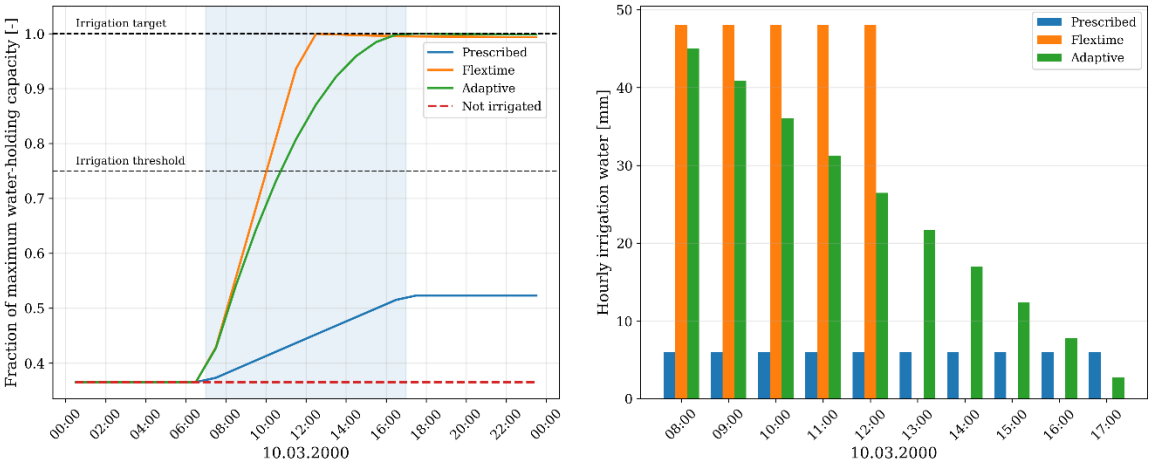


Figure 3. Testing different irrigation schemes.