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Analysis of the Indian summer monsoon system in the regional climate model COSMO-CLM

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The Indian summer monsoon (ISM) influences daily lives and economies in many countries in the South Asian region. This study analyzes the representation of the ISM system in the regional climate model COSMO-CLM. Simulations driven by ERA40 reanalysis and present-day (1960-2000) data from the global climate mode l ECHAM5 are investigated. The ability of the COSMO-CLM to reproduce the ISM better than the coarser-grid driving models is tested using a set of well established, complementary monsoon indices: the all-India monsoon rainfall, vertical wind shear indices and an outgoing longwave radiation (OLR) index. The results show that regarding these large-scale indices the COSMO-CLM simulations are not more accurate than the driving models. Considering the spatial distribution of rainfall, the ERA40-driven COSMO-CLM simulations show major overestimations (about 100%) for the west coast of India, and underestimations (about 50%) for the Himalayan foothills. Large biases occur in the OLR data over the Arabian Sea and the Bay of Bengal where the COSMO-CLM shows high convective activity (OLR $<$ 180 W m $^{-2}$) at about three times as many days as observed in the monsoon season. In the ECHAM5-driven simulation underestimations of rainfall appear at the Himalayan foothills, too. Nevertheless, the application of COSMO-CLM to ECHAM5 improves the temporal correlations of the modeled ISM indices, and the spatial patterns are better simulated in the COSMO-CLM with 0.44° horizontal grid-spacing than in the large-scale ECHAM5 data.