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Biases in the diurnal temperature range in Central Europe in an ensemble of regional climate models and their possible causes

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We examine how the diurnal temperature range (DTR) is reproduced by current regional climate models (RCMs) over Central Europe. We evaluate the control simulations of an ensemble of RCMs with 25-km resolution from the ENSEMBLES project. Runs driven by the ERA40 reanalysis and a global climate model (ECHAM5) are compared also with respect to the driving data. The models' performance is validated against the dataset gridded from a high-density stations network. We find that DTR is underestimated by all RCMs in all seasons, notwithstanding whether driven by ERA40 or ECHAM5. Underestimation is largest in summer and smallest in winter in most RCMs. We discuss the relationship of the models' errors to indices of atmospheric circulation and cloud cover to reveal possible causes of the biases. Underestimation of DTR is larger under anticyclonic circulation and becomes smaller or negligible for cyclonic circulation in all seasons and all simulations driven by ERA40 and ECHAM5. While underestimation does not depend on flow direction in winter, it tends to be largest for the southeast to south flow (associated with warm advection) in summer and transition seasons. We show that the biases in DTR are also related to cloud cover simulation. Our results suggest that errors in simulating heat and moisture fluxes between land surface and atmosphere probably contribute to the biases in DTR as well.

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