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Assessment of CMIP5 global model simulations over the sub-set of CORDEX domains used in the Phase I CREMA

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We present an assessment of the CMIP5 global model simulations over a sub-set of CORDEX domains used in the Phase I CREMA (CORDEX RegCM hyper-MAtrix) experiment (Africa, HYMEX-MED (Mediterranean), South America, Central America and West Asia) using three variants of the transformed Mielke measure to assess 1) the model skill in simulating surface temperature and precipitation historical climatology, 2) the degree of surface temperature and precipitation change occurring under greenhouse gas forcing, and 3) the consistency of a model's projected change with that of the Multi Model Ensemble (MME) mean. For precipitation, the highest model skill is found over Africa, and the lowest over Central and South America. Overall, the skill is higher and less variable for temperature than for precipitation. In addition, we find that resolution improves the model skill in the majority of regional and seasonal cases. The largest GHG-induced changes in precipitation occurs over the Mediterranean region, in particular during the summer. The Mediterranean also stands out as having the highest variability in model skill. The least precipitation change occurs over Africa and west Asia. Overall, there is less variability in projected changes of temperature among the models than for precipitation. The greatest temperature changes occur in Central America and the Mediterranean region, while the smallest change occurs in west Asia during winter. Resolution does not have a statistically significant impact on the models' response to GHG forcing which indicates that model biases do not play a primary role in affecting the model response to GHG forcing. All of the UKMO, NOR and NCAR models project precipitation changes which are most similar to the MME, while for temperature this is the case for the NCAR, MPI, CSIRO.AC13 and BCC models. We also assess the three selected models for the CREMA Phase I experiment, HADGEM2ES, MPI-ESMMR and GFDL-ESM2M and find that they are characterized by a relatively good level of performance, a range of high to low climate sensitivities and a good consistency with the MME changes, thereby providing a reasonably representative sample of the CMIP5 ensemble.