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Do regional climate models perform better on their home domains? A transferability intercomparison

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Assumptions and approximations used in regional climate models may improve accuracy on a particular domain but also may lead to degraded accuracy in other climatic regions. This issue becomes particularly acute for when using regional models to assess regional consequences of global climate change, because a particular region assessed may experience a quite different climate in the future from that used for calibrating the model. We assert that opportunities for improving regional climate models will emerge from intercomparison of results of several regional climate models that are run for different climatic regions on different continents. We use regional climate models to test the following hypothesis: Models show no superior performance on domains of origin as evaluated by accuracy in reproducing diurnal cycles of key surface hydrometeorological variables. As a preliminary test of this hypothesis, we have evaluated the diurnal cycles of sensible and latent heat flux, temperature, and relative humidity within two domains (Continental US and Baltex region) simulated by five regional climate models (RSM, RegCM3, CLM, RCA-3, and GEM-LAM). Surface observations from two GEWEX Continental-Scale Experiment reference sites (Bondville, IL USA and Cabauw, the Netherlands) in the CEOP-1 archive were compared with results of models for which 3-hourly values were available. Quality of model results was judged on the basis of climatologies of magnitudes and timing of daily maximum and minimum values. Preliminary conclusions drawn from these results and from comparisons of quartiles and extremes from box and whisker plots, suggest a weak "home-domain advantage" for RCMs. Most models determine quite well the timing of climatological daily extremes, even though the observation sites

have different peak times. Variability of latent heat flux seems overestimated for the warmer and drier climate site (Bondville) and underestimated for the cooler and more moist climate site (Cabauw), whereas, variability of sensible heat flux has opposite tendencies. As is frequently observed in other model intercomparisons, the ensemble mean seems superior to any individual model in reproducing observed values. These examples are shown to illustrate the method; by engaging more models and comparing data from other CSE reference sites within these and other domains and by evaluating other hydrometeorological parameters we will be able to draw more definitive and general conclusions. However, this limited example illustrates how transferability intercomparisons can be used, not only to detect biases in parameterization schemes widely used in regional models (and global models) but to develop and improve parameterizations that are robust across a wide range of climatic conditions.