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Transferability: Advancing the science of hydrometeorology

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Regional climate models, used in ensembles and applied to many different domains around the globe, can advance understanding of global water cycle and energy budget processes through transferability experiments. Transferability experiments are similar to, but go beyond, the limited-area model intercomparison projects (MIPs) that have successfully improved climate modeling for a variety of spatial scales and applications. While limited-area MIPs typically apply multiple models to a single domain (MM/SD) and individual modeling groups typically apply single models to multiple domains (SM/MD), transferability experiments apply multiple models to multiple domains (MM/MD). Furthermore, transferability experiments are designed to take advantage of coordinated experimental observing periods (CEOPs) under GEWEX continental-scale experiments (CSEs) for model validation and hypothesis testing.

Both global and regional climate models require better parameterizations of cloud, radiation, and surface energy and water cycle characteristics to recover some of their first-principles generality. Increased resolution of motions and processes provides at least a small step toward this goal. Isolation of processes from confounding external influences allows more detailed study of physical behaviors of individual processes. Limited-area models allow for enhanced resolution and elimination of distance forcing that may obscure local effects of local forcing. Careful selection of domain location and size can reduce climatic heterogeneity by isolating regions having specific characteristics (e.g., regions of monsoons, low-level jets, frozen soils, nocturnal precipitation, high surface-based static stability). Intercomparison of simulations on multiple common-climate domains allows for sampling a wider range of variability. Use of multiple models exposes consequences of a wider range of modeling approximations.

By these means, limited-area models can advance the science of climate modeling on all scales by promoting discovery of parameterizations and modeling strategies that more faithfully represent first-principles behavior over a wide range of climates. This is particularly important for models used for future scenarios that may require simulations of conditions beyond the range of previously observed climates.

The Transferability Working Group of the GEWEX Hydrometeorology Panel is establishing the framework for transferability experiments and will be coordinating their execution. Specific hypotheses focusing on scientific questions and modeling strategies relating to the water cycle and energy budget will determine the specific regions, time periods, and processes to be studied. Participation of additional regional climate modeling groups is being sought.