International Stretched-Grid Model Intercomparison Project (SGMIP): Initial Results on 12-year Regional Climate Simulations with Variable-Resolution GCMs

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The international Stretched-Grid Model Intercomparison Project (SGMIP) has been initiated for studying the new emerging global variable-resolution/stretched-grid approach to regional climate modeling.

The variable-resolution stretched-grid (SG) GCMs have been developed and successfully tested in the straightforward simulation mode (like that used for a typical atmospheric GCM) during the mid-late 90s. The SG-GCMs are the variable-resolution versions of the basic GCMs of the following four major meteorological centers/groups: the Meteo-France, ARPEGE model, the RPN/Canadian Meteorological Centre, GEM model, the Australian CSIRO C-CAM model, and the U.S. NASA/GSFC GEOS model. The regional climate simulation results obtained with the SG-GCMs have shown the maturity of the SG-approach. There is a consensus among the groups involved in the SG-GCM developments on the necessity of the model intercomparison at this stage of experimentation with the models. The intercomparison is focused on the following major scientific and computational issues: stretching strategies; approximations of model dynamics; treatment of model physics including its calculation on intermediate uniform resolution or directly on stretched grids; multi-model ensemble calculations; consistent regional-to-global scale interactions; optimal performance on parallel supercomputers.

The total number of global grid points for the SG-GCMs is (or close to) that of the 1º x 1º uniform grid. The area of interest is (or close to) the major part of North America: 20º – 60º N and 130º – 60º W. The regional resolution is about 0.5º. The surface boundary forcing (SST and sea ice) is used at 2º x 2.5º or 1º x 1º resolution. The 12-year period chosen for model simulations includes the recent ENSO cycles.

The existing reanalysis data as well as independent data like high-resolution gauge precipitation and high-resolution satellite data, are used for the SG-GCMs validation.

The 12-year SG-GCM simulations are analyzed in terms of studying: the impact of resolution on efficient/realistic downscaling to mesoscales; ENSO related and other anomalous regional climate events (floods, droughts, etc.) and major monsoonal circulations at mesoscale resolution; water and energy cycles; and global impacts.

The SG-approach allows studying not only downscaling but also up-scaling effects. Analyzing multi-model ensemble integrations is one of the focal points of SGMIP. The multi-model ensemble results for global and regional fields are presented at: http://essic.umd.edu/~foxrab/sgmip.html

The experience obtained with SGMIP will allow us to make a meaningful connection to AMIP-2 in terms of consistent regional-to-global scale climate studies.

Our joint SGMIP effort, focused on a better understanding of the SG-approach, is beneficial to all the participants as well as to a broader regional and global climate modeling community.