Initial Results of the SGMIP-2
(Stretched-Grid Model Intercomparison Project, phase-2)

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Variable-resolution GCMs using a global stretched grid (SG) with enhanced resolution over the region(s) of interest have proven to be an established approach to regional climate modeling providing an efficient means for regional down-scaling to mesoscales. This approach has been used since the early-mid 90s by the French, U.S., Canadian, Australian and other climate modeling groups along with, or as an alternative to, the current widely-used nested-grid approach. Stretched-grid GCMs are used for continuous/autonomous climate simulations as usual GCMs, with the only difference that variable-resolution grids are used instead of more traditional uniform grids. The important advantages of variable-resolution SG-GCMs are that they do not require any lateral boundary conditions/forcing and are free of the associated undesirable computational problems. As a result, SG-GCMs provide self-consistent interactions between global and regional scales of motion and their associated phenomena, while a high quality of global circulation is preserved, as in uniform grid GCMs.

The first stage of the international project, SGMIP-1 (Stretched-Grid Model Intercomparison Project, phase-1), using variable-resolution SG-GCMs developed at the major centers/groups in Australia, Canada, France, and the U.S., has been successfully completed in 2005. The results of the 12-year (1989-1998) SGMIP-1 simulations are described by Fox-Rabinovitz et al. (2006a-c). The next stage of the international project, SGMIP-2 (phase-2) includes simulations for the extended period of 25 years (1979-2003). The major SGMIP-2 effort includes performing the experiments with: (a) SG-GCMs with the prime area of interest over the major part of North America and for an additional area of interest over Europe (both with 0.5° × 0.5° regional resolution); (b) intermediate uniform grid (UG) GCMs at 1° × 1° resolution, with the same number of global grid points as in the stretched grids; (c) fine uniform (0.5° × 0.5°) resolution UG-GCMs, with the same global resolution as that of over the region of interest for the stretched grids (some model simulations are done for shorter periods due to computer resources available). The SGs for SG-SGMs (the SG-versions of the corresponding basic GCMs) are shown in Fig. 1.

These SGMIP-2 experiments provide the possibility for a comprehensive analysis of enhanced variable and uniform resolution GCMs and their unique high resolution multi-modes ensembles (MMEs) against observations and reanalyses. In-depth comparisons of enhanced variable and uniform (intermediate and fine) resolution GCMs are important for conducting a comprehensive investigation on the diversified impacts on decadal climate simulations due to enhanced regional and/or global model resolution, with the emphasis on the North American regional climate. The initial results of the SGMIP-2 climate simulations for the global domain and a major part of North America are available at the SGMIP web site: http://essic.umd.edu/~foxrab/sgmip.html

The SGMIP-2 products constitute a basis for collaboration with the NARCCAP (North American Regional Climate Change Assessment Program) and for potential collaboration with other regional model intercomparison projects (e.g. relevant European projects). The possibility of creating joint regional MMEs for nested and stretched grid models may be beneficial for the national and international regional climate modeling communities.

We conclude that over the region of interest: (a) SG-GCMs have overall smaller errors, than those of the intermediate (1° × 1°) UG-GCMs; and (b) SG-GCMs and fine (0.5° × 0.5°) UG-GCMs have overall similar errors. Also, SG-GCMs produce high quality global simulations.

SGMIP-2 was endorsed by the WMO/WCRP/WGNE at its annual meetings in October 2004, November 2005, and October 2006.

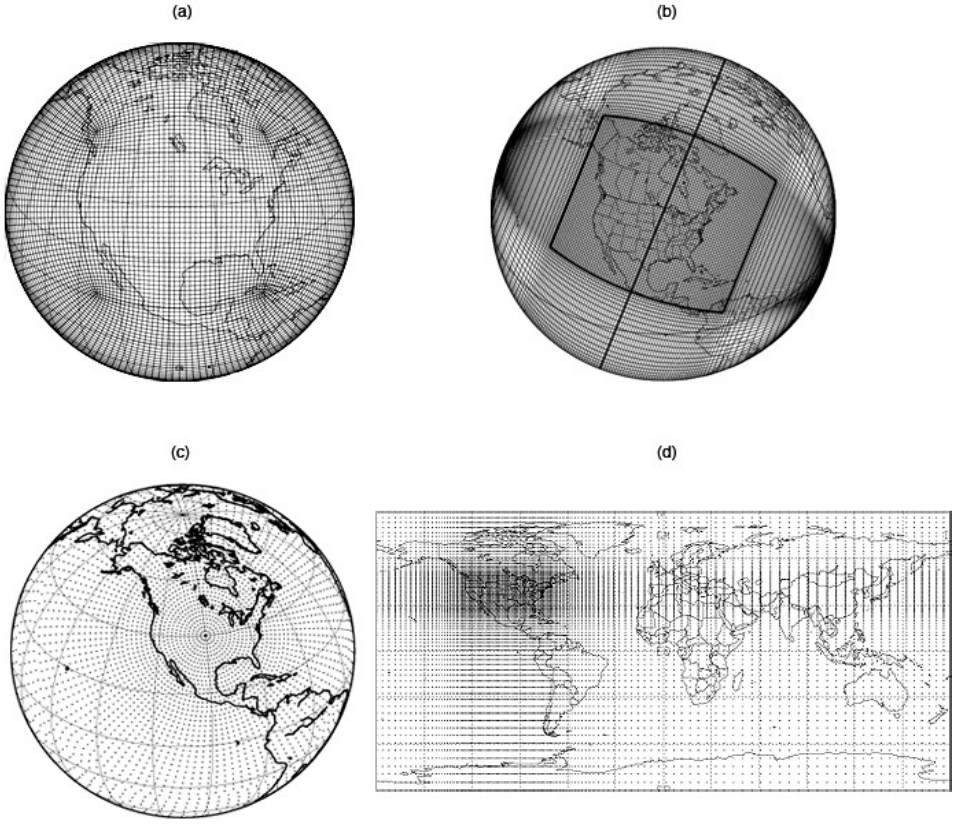

Fig. 1 SGMIP stretched grids with the area of interest over the major part of North America used in the following SG-GCMs: (a) C-CAM, CSIRO, Australia; (b) GEM, Environment Canada; (c) ARPEGE, Meteo-France; (d) GEOS, NASA/GSFC/UMD, U.S. Every other grid-line is shown.

References

1. Fox-Rabinovitz, M.S., J. Côté, B. Dugas, M. Déqué, and J.L. McGregor, 2006a: Variable resolution general circulation models: Stretched-grid model intercomparison project (SGMIP), *J. Geophys. Res.,* 111, D16104, doi:10.1029/2005JD006520.
2. Fox-Rabinovitz, M.S., J. Côté, B. Dugas, M. Déqué, J.L. McGregor, 2006b: Variable-Resolution GCMs for Regional Climate Modeling: Stretched-Grid Model Intercomparison Project (SGMIP), AGU Joint Assembly, Conference on Dynamical Regional Climate Modeling, May 22-26, 2006, Baltimore, MD.
3. Fox-Rabinovitz, M.S., J. Côté, B. Dugas, M. Déqué, J.L. McGregor, 2006c: Regional modeling with variable-resolution GCMs: Stretched-Grid Model Intercomparison Project (SGMIP), 2006 Workshop on the Solution of Partial Differential Equations on the Sphere, June 26-29 2006, Monterey CA.