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# A New Grid-point AGCM Using a Semi-implicit Scheme with exact quadratic conservations

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An atmospheric general circulation model (AGCM) has been developed and tested in the State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics (LASG), Institute of Atmospheric Physics (IAP), Chinese Academy of Sciences (CAS). This model is named Grid-point Atmospheric Model of IAP LASG (GAMIL). The model used a newly designed grid-point dynamical core that adopted a weighted equal-area mesh to mitigate computational instability in the Polar Regions[1]. A weighted perturbation equation of temperature and two weighted equations of momentum replace the corresponding original equations, solved by using a semi-implicit scheme with exact quadratic conservation. The numerical scheme combines the implicit conservation scheme with respect to surface gravity-wave propagation along the zonal parallels and an explicit scheme with quadratic conservation for the other forms of the primitive hydrostatic baroclinic atmospheric motion. Both exactly conserve the total effective energy with the 'standard' stratification approximation and the total mass.

The dynamical core was tested using the idealized Held-Suarez[2] forcing with horizontal resolution $2.8125^0 \times 2.8125^0$ (approximately T42) on a uniform mesh and 26 sigma levels in vertical. The results are compared to those obtained from the spectral dynamical core, truncated at T63[3]. Important integrals such as the total energy and the total mass yielded by the present dynamical core are shown.

To demonstrate the feasibility of this scheme, a 20-year-integration started from 1979 was conducted by using GAMIL incorporating the physical parameterization schemes of NCAR CAM2, following the AMIP-2 standards. Results were compared to the observations and NCEP/NCAR reanalysis data as well as the corresponding simulation of NCAR CAM2 with the same resolutions.

Keywords: GAMIL; semi-implicit; quadratic conservation; AMIP-2.

## References

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