DISCLAIMER

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Global Ocean Circulation Modeling with an Isopycnic Coordinate Model
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Project Directors: Dr. Rainer Bleck / Dr. Claes Rooth
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DOE Patent Clearance Granted
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Final Report

The overall aim of this project was to continue development of a global version of the Miami Isopycnic Coordinate Ocean Model (MICOM) with the intent of turning it into a full-fledged oceanic component of an earth system model. Specific tasks envisioned at the time the proposal was written were

- rigorous experiments isolating the effect of horizontal mesh size on poleward heat transport;
- detailed comparison of the modeled thermohaline overturning and water mass formation rates against observational evidence;
- grid extension to the North Pole and incorporation of an ice model;
- development and evaluation of alternative surface boundary layer schemes (coupling schemes between the model mixed layer and interior domain);
- initiation of coupled ocean-atmosphere experiments using an "off-the-shelf" atmospheric circulation model;
- transition from one class of supercomputers (CM5) to the next (SGI Origin 2000)

These issues, as well as a host of related ones, were resolved satisfactorily. The team was able to demonstrate that MICOM is a viable component in global climate models. Perhaps most importantly, experience gained in this project with MICOM was a major factor in the development of MICOM's hybrid coordinate cousin HYCOM, which has since then taken the lead due to its greater versatility.

The Ph.D. work of three University of Miami students -- Wei Cheng, Aixue Hu, and Shan Sun -- was funded by this project. The following refereed publications resulted, directly or indirectly, from this work:

Bleck R., 1998: Ocean modeling in isopycnic coordinates. Ocean Modeling and Parameterization, E. P. Chassignet and J. Verron, Eds., NATO Science Series, Kluwer, Dordrecht, 423-448.

Sun, S., R. Bleck, C. Rooth, J. Dukowicz, E. Chassignet, P. Killworth, 1999: Inclusion of thermobaricity in isopycnic-coordinate ocean models. J. Phys.

Oceanogr., 29, 2719-2729.

Sun, S., and R. Bleck, 2001: Thermohaline circulation studies with an isopycnic coordinate ocean model. J. Phys. Oceanogr., 31, 2761-2782.

Sun, S., and R. Bleck, 2001: Atlantic thermohaline circulation and its response to increasing CO_2 in a coupled atmosphere-ocean model. Geophy.Res.Ltrs., 28, 4223-4226.

Hu, A., C. Rooth, R. Bleck, C. Deser, 2001: NAO influence on sea ice extent in the Eurasian coastal region. Gephys.Res.Lett, 29, 10-1 - 10-4.

Bleck, R., 2002: An oceanic general circulation model framed in hybrid isopycnic-Cartesian coordinates. Ocean Modelling, 4, 55-88.

Bleck, R., and S. Sun, 2003: Diagnostics of the oceanic thermohaline circulation in a coupled climate model. Global and Planet. Change, 40, 233-248.

Cheng, W., R. Bleck, and C. Rooth, 2004: Multi-decadal thermohaline variability in an ocean-atmosphere general circulation model. Climate Dynamics, DOI 10.1007/s00382-004-0400-6.

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