Development and Evaluation of a Global Version of the Miami Isopycnic-Coordinate Ocean Model

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FY 1997 $162K
FY 1996 $156K
FY 1995 $0K

DOE Program Manager: Patrick Crowley

KEYWORDS: global ocean modeling, isopycnic coordinates, climate dynamics

OBJECTIVE: To test the ability of the Miami Isopycnic-Coordinate Ocean Model (MICOM) to simulate the global ocean circulation, setting the stage for the model’s incorporation into coupled global climate models.

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RESULTS TO DATE: MICOM’s seven time-dependent forcing functions characterizing the atmospheric state were generated for the global domain by reanalyzing COADS ship observations with emphasis on the high southern latitudes and by adaptation of global precipitation fields from NOAA’s
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microwave sounder. The algorithm for detraining mixed-layer water into discrete isopycnic layers was improved to cover situations where the mixed layer shoals because of freshwater input (ice melt) rather than warming. The scheme for converting diapycnal mixing processes into interlayer mass fluxes was replaced by a more efficient scheme. The temperature effect on compressibility was incorporated to correctly model the interaction of bottom water generated at high northern and southern latitudes. The Los Alamos sea-ice model was adapted for use in MICOM and has been found to produce satisfactory results in 10-year test runs. A near-global coarse mesh version of MICOM [mesh size 1.4 deg x 1.4 deg cos(lat.) ] was run for 600 years to study transients in the global thermohaline circulation and poleward heat fluxes; the model climate proved to be remarkably stable. An eddy-resolving version of MICOM [mesh size 0.225 deg x 0.225 deg x cos(lat.) ], initialized with spun-up fields from the coarse-mesh run, was integrated for 11 years. A limited-area model, driven by time-varying lateral mass fluxes from the global run, was successfully run to study the Loop Current eddy-shedding process in the Gulf of Mexico. A 2-deg near-global version of MICOM (not yet including the polar grid and the ice model) was coupled to a T21 version of NCAR's CCM3. After 15 years of integration starting from Levitus climatology, the coupled system shows negligible drift as far as oceanic surface and subsurface properties are concerned. However, deficiencies in the geographic distribution of precipitation generated by the atmospheric model may affect the steadiness of the coupled system state.


COLLABORATIONS: This project is carried out in cooperation with Los Alamos National Laboratory. Principal Investigators on the LANL side are Dr. Len Margolin and Sumner Dean.

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