SUMMARY OF NCAR OCEAN MODELING ACTIVITIES

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Over the past 1.5 years, our efforts have primarily focused on the setup, integration, analysis and documentation of the Community Climate System Model version 4 (CCSM4) simulations and particularly of its ocean component. These CCSM4 integrations represent NCAR's contributions to the IPCC AR5.

We are continuing to pursue our investigation of Atlantic Meridional Overturning Circulation (AMOC) decadal variability and its mechanisms, using long CCSM4 control simulations. To aid in the explanation of possible AMOC variability mechanisms, we have recently completed sets of ocean-only and ocean – sea-ice coupled hindcast simulations forced with the Coordinated Ocean-ice Reference Experiments (CORE) interannually varying air-sea flux data sets. Some of these simulations are made available to the outside community through the Earth System Grid. In addition, we are leading the decadal prediction efforts at NCAR. The hindcast ocean – sea-ice simulations are being used to provide ocean and sea-ice initial conditions for decadal prediction experiments. To provide an alternative set of initial conditions for decadal prediction experiments, we have been collaborating with the Data Assimilation Research Testbed (DART) group at NCAR. As a result, we have now our own ocean data assimilation system. We are working towards creating a fully-coupled data assimilation capability.

During the past year we finished embedding of a high-resolution regional ocean model (ROMS – Regional Ocean Modeling System) within the CCSM framework. Though the implementation is generic, our first test case is the upwelling system in the northeast Pacific ocean (California Current System). Plans are to develop embedded domains in the Peru-Chile and Benguela upwelling systems. Further development is going on to couple the biogeochemistry modules of the global and regional oceans and to update the implementation to an Earth System Model.

We continue to study sensitivity of ocean model solutions to various subgrid scale parameterizations (e.g., anisotropic isopycnal transport parameterization) and their parameter choices. Several studies that plan to use eddy-permitting ocean model resolution are also underway. In addition, we are actively participating in the two new Climate Process Team

(CPT) projects. These concern internal wave driven ocean mixing and ocean mixing processes associated with high spatial heterogeneity of sea-ice. In both CPTs, the ultimate goal is to assess the climate impacts of any resulting parameterizations.

We plan to start using the Model for Prediction Across Scales (MPAS) ocean model within the next year. MPAS is an unstructured grid approach to climate system modeling. It offers the potential to explore regional high resolution within a global model. This model will eventually replace the current ocean component of the CCSM.