Project Summary

Collaborative Research: Gravity Current Entrainment Climate Process Team

We propose to create a pilot Climate Process Team to develop parameterizations of gravity current entrainment for inclusion in ocean general circulation models. Our team comprises observationalists involved in recent field studies of entrainment in overflows: Price (Faroe Bank Channel), Gordon (Antarctic), Peters (Red Sea Overflow); process study modelers examining entrainment processes with high resolution nonhydrostatic simulations (Legg and Ozgokmen); developers of simplified models of entraining gravity currents (Price and Yang); and those using a variety of large scale model architectures (Ezer, Schopf, Chassignet, NCAR and GFDL teams). We propose to (a) closely examine entrainment in observations and process studies; (b) use this knowledge to develop new parameterizations of entrainment; (c) implement and evaluate the new parameterizations in GCMs.

Intellectual merit of the proposed activity: Gravity current entrainment is an important component of the ocean climate circulation, and this study will enhance our understanding of this process and its role in the climate.

Broader impacts of the proposed activity: This study will enhance links between modeling centers and academic institutions; provide concrete products in the form of new parameterizations which can be used by the whole climate modeling community; benefit society by enabling more reliable predictions of climate variability; promote interdisciplinary training through funding of 2 postdocs; disseminate results through annual workshops involving the larger community; promote underrepresented groups (female coordinating PI).

Importance: Better representation of overflow processes is deemed crucial by the climate modeling centers in order to better capture the variability of the thermohaline circulation, including abrupt climate change.

Readiness: Several recent observational programs have examined the entrainment in overflow gravity currents, and many recent laboratory and numerical process studies have elucidated a variety of physical processes contributing to entrainment. Several possible formalisms for including such processes into climate models have been developed.

Likelihood of Payoff: For both isopycnal and z-coordinate GCMs, preliminary parameterizations of gravity currents exist which can be modified to better incorporate new understanding of the physics of entrainment.