Session: C9 Poster: M170B

The role of ocean mesoscale eddies in the response of the climate system to increasing greenhouse gases

Frank Bryan[†]; Peter Gent; Cecilia Bitz; Ben Kirtman; James Kinter; Robert Tomas
[†] NCAR, USA
Leading author: bryan@ucar.edu

The objective of this study is to determine if explicitly resolving the highly energetic mesoscale eddy field in the ocean quantitatively alters projections of future climate change compared to projections obtained with ocean component models in which the effects of mesoscale eddies are parameterized. We address this question by comparing two transient climate experiments with version 3.5 of the Community Climate System Model forced by a 1% per annum increase in the concentration of CO2. The atmosphere and land surface component models are identical in the two experiments, but the ocean and sea ice component models differ in their resolution and parameterization of subgrid scale processes. In the first experiment, the ocean component model has a nominal resolution of 1 degree, typical of contemporary coupled climate system models and includes a parameterization of mesoscale eddy mixing processes. In the second experiment the ocean component model has a resolution of 0.1 degree, thereby explicitly resolving the most energetic mesoscale eddies. In addition to the standard measures of the response of the climate system to greenhouse gas forcing, such as the transient climate response in surface temperature, we focus our analysis on two aspects of the simulation. The first is the response of the Antarctic Circumpolar Current, where mesoscale eddies are know to play a first order role in the dynamical and thermodynamic balances. The second is the rate of ocean heat uptake, where the role of mesoscale eddies is less clear from prior work.