CGD SEMINAR

NCAR

DATE: Tuesday, 14 February 2017

TIME: 11 a.m.

LOCATION: NCAR, 1850 Table Mesa Drive
Mesa Lab, Main Seminar Room

TITLE: Muddied waters: Large-scale ocean eddy closures for CMIP6 and beyond

SPEAKER: Scott Bachman, University of Cambridge

ABSTRACT:

Many ocean simulations being conducted as part of OMIP and CMIP6 will utilize a grid fine enough to permit mesoscale eddies throughout much of the world ocean. These eddy-permitting models offer potential for realism and novel dynamics but also require greater care. The title of this talk, "muddied waters", alludes to a variety of new eddy parameterizations which have been developed for these models (known as mesoscale ocean large eddy simulations, or MOLES), and the general uncertainty about which of these offers the best way forward. Here I will discuss two such parameterizations which show promise. The first of these is inspired by techniques traditionally used in LES for the forward energy cascade in 3D, homogeneous, isotropic turbulence, but are here applied to the forward QG potential enstrophy cascade. The resulting "QG Leith" parameterization is shown to be successful at cleanly truncating the cascades in idealized models, with the added bonus that it specifies the Gent-McWilliams (GM) transport coefficient as well. Results are also shown from a successful 0.1 degree global simulation using QG Leith in the POP model. The second parameterization I will present utilizes the geometric framework of Marshall et al. (2012) to write the GM coefficient as a function of the eddy energy. To test the skill of this technique, an ensemble of passive tracers is used to directly diagnose the GM coefficient in a baroclinic spindown simulation. Excellent agreement is found between the diagnosed coefficient and the prediction from the geometric framework. Lastly, the problem of developing skillful eddy closures applies to submesoscale turbulence as well. To this end, I conclude with new results from a realistic, submesoscale-resolving simulation of the Drake Passage region, which is used to inform how a submesoscale parameterization might depend on the mesoscale flow.

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