



## Effects of Drake Passage on a strongly eddying global ocean

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During the past 65 Million (Ma) years, Earth's climate has undergone a major change from warm "greenhouse" to colder "icehouse" conditions with extensive ice sheets in the polar regions of both hemispheres. The Eocene-Oligocene (~34 Ma) and Oligocene-Miocene (~23 Ma) boundaries reflect major transitions in Cenozoic global climate change. Proposed mechanisms of these transitions include reorganization of ocean circulation due to critical gateway opening/deepening, changes in atmospheric CO<sub>2</sub>-concentration, and feedback mechanisms related to land-ice formation. Drake Passage (DP) is an intensively studied gateway because it plays a central role in closing the transport pathways of heat and chemicals in the ocean. The climate response to a closed DP has been explored with a variety of general circulation models, however, all of these models employ low model-grid resolutions such that the effects of subgrid-scale fluctuations ("eddies") are parameterized. We present results of the first high-resolution (0.1° horizontally) realistic global ocean model simulation with a closed DP in which the eddy field is largely resolved. The simulation extends over more than 200 years such that the strong transient adjustment process is passed and a near-equilibrium ocean state is reached. The effects of DP are diagnosed by comparing with both an open DP high-resolution control simulation (of same length) and corresponding low-resolution simulations. By focussing on the heat/tracer transports we demonstrate that the results are twofold: Considering spatially integrated transports the overall response to a closed DP is well captured by low-resolution simulations. However, looking at the actual spatial distributions drastic differences appear between far-scattered high-resolution and laminar-uniform low-resolution fields. We conclude that sparse and highly localized tracer proxy observations have to be interpreted carefully with the help of high-resolution model simulations.