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# Decadal variability of the midlatitude ocean circulation: the role of mesoscale eddies

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A midlatitude coupled ocean-atmosphere model is used to investigate low-frequency (decadal) variability of the wind-driven ocean circulation. This model uses an idealised geometry (compared to many ocean models), yet the rich and complicated dynamic flow regimes which arise in this model ocean exceeds that found in many ocean models, and is due to the explicit simulation of geostrophic turbulence. We conduct a series of experiments in which viscosity is varied as a free parameter; at low viscosity mesoscale eddies dominate the circulation, while at high viscosity these eddies are damped.

An interdecadal mode of ocean variability is found only when viscosity is low (and hence the mesoscale eddy field strong). The characteristics of this mode are viscosity-dependent, from which we infer that eddies either directly, or indirectly (by modifying the mean flow) control low frequency variability.

By comparison of coupled results with simulations in which the atmosphere and ocean are uncoupled (or partially coupled), we find that the low-frequency oceanic mode described above projects onto existing atmospheric modes of variability, thereby controlling the timescale of the atmospheric modes. It is also shown that ocean circulation controls the timescale of the SST response to wind forcing, and that coupled feedback mechanisms thus modify variability of the atmospheric circulation. We conclude that ocean-atmosphere coupling in the midlatitudes is unlikely to produce new modes of variability, but may control the temporal behaviour of modes that exist in uncoupled systems.