The impact of resolving the Rossby radius at mid-latitudes in the ocean: results from a high-resolution version of the Met Office GC2 coupled model

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There is mounting evidence that resolving mesoscale eddies and boundary currents in the surface ocean field can play an important role in air-sea interaction associated with vertical and lateral transports of heat and salt. Here we describe the development of the Met Office Global Coupled Model version 2 (GC2) with increased resolution relative to the standard model: the ocean resolution is increased from 1/4° to 1/12° (28 km to 9 km at the Equator), the atmosphere resolution increased from 60 km (N216) to 25 km (N512) and the coupling frequency increased from 3-hourly to hourly. The technical developments that were required to build a version of the model at higher resolution are described as well as results from a 20 year simulation. The results demonstrate the key role played by the enhanced resolution of the ocean model: reduced Sea Surface Temperature biases, improved ocean heat transports, deeper and stronger overturning circulation and a stronger Antarctic Circumpolar Current. Our results suggest that the improvements seen here require high resolution in both atmosphere and ocean components as well as high frequency coupling. These results add to the body of evidence suggesting that ocean resolution is an important consideration when developing coupled models for weather and climate applications.