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The impact of inertia-gravity waves on the MOC in a high resolution ocean model

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Analysis of high temporal resolution output from integrations of the NEMO ORCA025 ocean model reveals a field of inertia-gravity waves (IGWs) which propagate according to the beta dispersion relation. These waves have a significant impact on the Atlantic meridional overturning circulation (MOC) on timescales from a few hours to a few days. Changes in the Atlantic MOC at 26.5 °N can exceed 50 Sv within one day. In addition to the IGW-driven MOC variability, enhanced MOC variability of up to 200 Sv, with a dominant period of 5 days is seen close to the Equator in all ocean basins. Both the IGW-driven and the large equatorial MOC variability are a consequence of temporally variable wind forcing. Applying temporally constant wind forcing leads to a gradual removal of the IGW-driven MOC variability (within a few weeks) and eventually also to removal of the equatorial MOC variability (after about 6 months). We decompose the Atlantic MOC into Ekman, barotropic and geostrophic components and an ageostrophic residual, and show that the latter contains a dominant high frequency signal, with period constrained by the local inertial period. It is not clear yet whether the IGW-driven and equatorial MOC variability found in our simulations is realistic. However, our results suggest that the IGW-driven MOC variability waves would be invisible to observing systems such as the RAPID MOC system at 26.5 °N in the Atlantic.