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The influence of high resolution wind forcings on the modeled energy of the ocean

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If a wind stress is suddenly imposed on an ocean at rest, inertial oscillations are produced according to the traditional f-plane solution. However, if the inertial period varies with latitude, this is true only for a short time, and the solution is strongly modified after only couple of periods or so because of β-dispersion. Near-inertial waves generated at the surface by wind forcing propagate downward and equatorward away from the region in which they were produced.

Coexistence of a stabile stratification, meridional overturning circulation and meso-scale eddies and their influence on circulation of the ocean still raises complex questions. Oceanic general circulation is almost in total governed by the forcing of the wind field and deep water tides. Ocean circulation appears to be a mechanically forced phenomenon. Its essential energetics are conversion of kinetic energy of the wind and tides into oceanic potential and kinetic energy through the generation of large-scale circulation. Energy needed for the circulation is bound to internal wave field. Direct internal wave generation by the wind field at the sea surface is probably a major source of this energy.

Previous studies using mixed-layer type of models and low frequency wind forcings (06-hourly and daily) left room for an improvement. Using slab type of models it is not possible to assess the distribution of the near-inertial energy into the deep ocean. Also, coarse temporal resolution of wind forcing strongly underestimates wave energy. In our studies we try to answer following questions: How big is the wind kinetic energy input to the near-inertial oscillations under a more realistic setting (with high frequency wind forcings and better model resolution)? Is the kinetic energy input enhanced when high-frequency wind forcings are used? If so, by how much and why (due to higher level of overall wind variability or due to better representation of inertial waves at high-latitudes)? We answer these questions using the Max Planck Institute Ocean model (MPIOM) on a tripolar grid with 45 km horizontal resolution and 40 vertical levels (TP04L40). We start from the same initial conditions and have run the model with two different wind forcings (low versus high horizontal and temporal resolution). Near-inertial oscillations are enhanced in both cases but energy is almost two times stronger for high frequency forcings. Influence on energy mostly depends on time difference between two forcing fields while spatial difference has little influence. We will also show how the results for total energy input from wind using a full GCM differ from results obtained with mixed layer models and with low frequency wind forcings.