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Kinetic Energy Conversion in A Wind-forced Submesoscale Flow

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Despite recent progress in measuring the ocean eddy field with satellite missions at the mesoscale (order of 100 km), containing the major fraction of ocean kinetic energy, many questions still remain regarding the generation, conversion and dissipation mechanisms of eddy kinetic energy (K_e). In this work, we use the output from an idealized 500-m resolution ocean numerical simulation to study the conversion of K_e in the absence and presence of wind stress forcing. In contrast to the result of the unforced run, K_e increased approximately nine times in the mixed layer and considerably in the pycnocline in the forced run. Eddies and filaments were seen to re-stratify the mixed layer and wind-induced turbulence at the base of the mixed layer promoted its deepening and therefore dramatically enhanced the exchange between K_e and eddy available potential energy (P_e). The wind stress forcing additionally affected the conversion processes between P_e and mean kinetic energy (K_m). The wind also excited inertial and superinertial motions throughout almost the whole water column. Although those motions played a major role in the conversion between P_e and K_e, the net effect by inertial and superinertial flows was almost null. In addition, we found an asymmetric character in kinetic energy conversion in eddies. Cyclonic and anti-cyclonic eddies showed different behaviour regarding conversion from P_e and K_e, which was positive on the high K_e part in the anti-cyclonic eddy but negative in the cyclonic eddy.