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Intense inertia-gravity waves during the POMME experiment: mechanisms of generation and nonlinear dynamics

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The purpose of this work is to isolate the mechanisms of generation of inertia-gravity waves (IGW) in the upper ocean and to characterize energy transfers at fine-scale. To this aim we analyzed eulerian measurements of horizontal currents and temperature collected over one year during POMME experiment. We first focused on the two main frequency components of the IGW spectrum, namely the inertial frequency f and the semi-diurnal frequency $M2$. Time evolution of the relative energy of these two components gave evidence of isolated events of high intensity. We performed a detailed analysis of these events and identified mechanisms of generation in relationship with atmospheric forcing, barotropic tides and the mesoscale eddy field. During winter-time, spots of intense, almost inertial, IGW were observed suggesting a local generation. For one of these events this local generation is driven by strong downward vertical motions induced by the deepening of the mixed layer. Instead, after the onset of the mixed layer shallowing, strong slightly subinertial IGW are being trapped within sub-mesoscale anticyclonic eddies. In contrast a downward energy propagation down to about $500m$ below the mixed layer was isolated after a stormy period. Eventually internal tidal beams, possibly generated at a nearby sea-mount, intermittently cross the mooring, though less energetic than the previous events. Next we estimated the eddy diffusivity from the vertical shear. Large variations were obtained, from $10^{-6}m^2/s$ up to $10^{-3}m^2/s$, consistently with the intense events previously isolated. We eventually investigated the different routes of energy transfers depending on the near-inertial and semi-diurnal energy levels and on the background IGW field.