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Observed Upper Ocean Response to Super Typhoon Megi (2010) in the Northern South China Sea

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Super typhoon Megi passed between two subsurface moorings in the northern South China Sea (SCS) in October 2010. Upper-ocean response with strong internal tides present was examined in detail. The two moorings measured continuous upper-ocean current and temperature profiles 25 km to the right of the track and current profiles 30 km to the left. The whole observed water column (60-360 m) was cooled due to strong Megi-Ekman-pumped upwelling (up to 50 m in the thermocline); maximum cooling of 4.7 °C occurred in the upper thermocline. The near-inertial oscillations (NIO) in the mixed layer were relatively weak (max amplitude 0.4 m/s) and quickly damped (e-folding timescale 2 inertial periods). An energy peak (up to 0.2 m/s) appeared at the sum frequency fD1 of NIO (f) and diurnal tide (D1), indicating enhanced nonlinear wave-wave interaction between f and D1 after Megi. Numerical experiments suggest that the energy transfer to fD1 from NIO via nonlinear wave-wave interaction between f and D1 may limit the growth and speed up the damping of mixed layer NIO generated by Megi. Occurrence of fD1 correlated well with NIO; the vertical nonlinear momentum terms, associated with the vertical shear of NIO and vertical velocity of D1 or vertical shear of D1 and vertical velocity of NIO, were more than 10 times larger than the horizontal terms and were responsible for forcing fD1. After the passage of Megi, surface layer diurnal energy was enhanced by up to 100%, attributed to the combined effect of increased surface layer stratification and additional Megi-forced diurnal current.