

Observation of enhanced nonlinear interactions after the passage of typhoon in the western South China Sea

*gui ying Chen, chang rong Liang, xiao dong Shang

Typhoon Chanchu passed the subsurface mooring in the western South China Sea (SCS) in June 2004 and the effects of typhoon on the internal wave field and nonlinear interactions were examined. The internal wave field was characterized by diurnal (D_1) and semidiurnal (D_2) tides before typhoon. After the passage of typhoon, the internal wave field was characterized not only by diurnal and semidiurnal tides but also by near-inertial (f) waves, higher harmonic ($fD_2=f+D_2$ and $D_3=D_1+D_2$) frequency internal waves, and enhanced diurnal currents. Analysis on the rotary coefficient and bicoherence suggests that the observed fD_2 waves, D_3 waves, and enhanced diurnal currents were derived from nonlinear interactions of $f+D_2=fD_2$, $D_1+D_2=D_3$, and $f+f=2f$, respectively. Previous researches indicated that nonlinear interactions induced by typhoon mainly occur between near-inertial waves and internal tides ($f+D_1=fD_1$ or $f+D_2=fD_2$). Our observations first indicate that typhoon can also induce the self-interaction of near-inertial waves ($f+f=2f$) and enhance the nonlinear interaction between diurnal tides and semidiurnal tides ($D_1+D_2=D_3$). Critical diurnal latitudes (where $2f \approx D_1$) play an important role in the occurrence of these nonlinear interactions. Typhoon-induced near-inertial waves undergo self-interaction ($f+f=2f$) near the critical diurnal latitudes and transfer energy to diurnal waves. Enhanced diurnal waves further contribute to the nonlinear interaction of $D_1+D_2=D_3$. These nonlinear processes might promote the energy cascade of the typhoon-induced near-inertial waves near the critical diurnal latitudes and play an important role in ocean mixing.

Keywords: typhoon, nonlinear interaction, internal wave, near-inertial wave