

Upper ocean response to typhoon Kalmaegi (2014)

Han Zhang (1), Dake Chen (1), Lei Zhou (2), Xiaohui Liu (1), Tao Ding (1), and Beifeng Zhou (1)

(1) Second Institute of Oceanography, State Oceanic Administration, State Key Laboratory of Satellite Ocean Environment Dynamics, China (zhanghan@sio.org.cn), (2) Institute of Oceanography, Shanghai Jiao Tong University, Shanghai, China

Air-sea interaction between tropical cyclone and ocean is a hot research topic in equatorial to mid-latitude region. In September 2014, Typhoon Kalmaegi passed over an array of five buoys and four moorings in the northern South China Sea, leaving a rare set of observations on typhoon-induced dynamical and thermohaline responses in the upper ocean. The dynamical response was characterized by strong near-inertial currents with opposite phases in the surface mixed layer and in the thermocline, indicating the dominance of the response by the excitation of the first baroclinic mode. The thermohaline response showed considerable changes in the mean fields in addition to a near-inertial oscillation. In particular, temperature and salinity anomalies generally exhibited a three-layer vertical structure, with the surface layer becoming cooler and saltier, the subsurface layer warmer and fresher, and the lower layer cooler and saltier again. The response in the surface and subsurface layers was much stronger to the right of the typhoon track, while that in the lower layer was stronger along the track and to the left. These features of the upper ocean response were grossly reproduced by a three-dimensional numerical model. A model-based heat budget analysis suggests that vertical mixing was mainly responsible for the surface cooling and subsurface warming, while upwelling was the cause of cooling from below. Both observations and model results indicate that the whole upper ocean experienced an overall cooling in the wake of typhoon Kalmaegi.