Impact of cyclonic eddies and typhoons on biogeochemistry in the oligotrophic ocean based on time-series observation at the western Pacific subtropical station KEO

*Makio Honda[1], Yoshikazu Sasai[1], Eko Siswanto[1], Akira Kuwano-Yoshida[2], Hidenori AIKI[3], Meghan Cronin[4]

1. Japan Agency for Marine-Earth Science and Technology, 2. Disaster Prevention Laboratory, Kyoto University, 3. Nagoya University, 4. NOAA Pacific Marine Environmental Laboratory

In 2014, a sediment trap mooring experiment started adjacent to station Kuroshio Extension Observatory (KEO)' s National Ocean and Atmosphere Administration (NOAA) surface mooring. Two-years long sediment trap data show that biogenic material fluxes at ~ 5000 m increased between late winter (March) and late spring (June). Based on sea surface temperature and upper ocean water temperature profiles, from the NOAA surface buoy, and satellite-based surface chlorophyll-a , this increase was likely due to an increase of ocean productivity in early spring (March) that was supported by nutrients supplied by winter mixing. On the other hand, biogenic material fluxes also increased in October 2014, and between late December 2014 and January 2015 when concentrations of nutrients near the surface typically are low. Sea surface height anomalies and vertical profiles of water temperature in the upper 500 m showed cyclonic eddies passing station KEO and causing upwelling of middle-layer water in late July–early August 2014 and November 2014. It appears that these events supplied nutrients to the upper layer, which then caused ocean productivity in the subsurface layer to temporally increase, resulting in increased deep biogenic material fluxes in autumn and winter. This interpretation of the data is consistent with a simple 3D physical-biological model simulation that shows meso-scale cyclonic eddies can supply nutrient to support new production at KEO. During the 2-year-long sediment trap deployments, several typhoons also passed near station KEO and near-inertial internal waves were observed near the nitracline depth after the typhoons passed. Although turbulent mixing caused by near-inertial internal wave could have possibly supplied nutrient to upper oligotrophic euphotic layer, numerical simulations of the turbulent nutrient supply indicate that enhanced turbulent diffusion across the nutrient concentration gradient did not supply enough nitrate to support the increase in biogenic material flux in autumn.

Keywords: KEO, Oligotrophic, Sediment trap, Cyclonic eddy, Nutrient, Typhoon