Impact of explosive cyclones on the deep ocean in the North Pacific: Simulations and observations

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The Northwestern Pacific Ocean is the deepest ocean above which explosive cyclones frequently develop in winter. Composite analysis using eddy-resolving 34 year hindcast simulation of quasi-global ocean by OFES shows that explosive cyclones induce large horizontal divergence within the surface-mixed layer and upward flow that reaches 2000 m depth. In addition, interannual variability of explosive cyclone activity affects the amplitude of vertical motion and the daily-scale temperature variations in the deep ocean. However, normal observations of ocean cannot capture the oceanic response to explosive cyclones. Sea-surface temperature observations from satellite are not sensitive to explosive cyclones because of deep mixed layer in winter. The time interval of ARGO floats, usually 10 days, is too long to observe rapid change associated with explosive cyclones within 1 day. To observe the oceanic response, high-frequency observations using ARGO floats has been conducted in two winters in 2015/2016 and 2016/2017 in the Northwestern Pacific. The ARGO floats used for the special observations allow real-time change of observation mission including time interval and depth of profile observation through satellite communication. The mission change was operated based on medium-range ensemble forecast data by Japan Meteorological Agency. When an explosive cyclone was predicted with high probability by the forecast, 6-hourly observations with 650 m depth were conducted. Otherwise daily observations with 2000 m depth were conducted between November and March in each winter. 859 profiles were observed until December 2016 under the region where explosive cyclones were active.

References: Kuwano-Yoshida, A., H. Sasaki, and Y. Sasai, *Geophys. Res. Lett*, 44, 320-329 (2017).

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