

Influence of explosive cyclones on ocean in OGCMs

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Extratropical cyclones, whose central sea-level pressure deepening rates are larger than 24 hPa/24 h normalized sine of the latitudes, are called as “explosive cyclones”. Explosive cyclones can affect ocean because they are accompanied with strong winds as large as typhoons. To understand influence of explosive cyclone on ocean, ocean responses to explosive cyclones over the North Pacific in 0.1-degree simulations by the OGCM for the Earth Simulator (OFES) are investigated. When an explosive cyclone develops on 21 March 2000, large barotropic divergence occurs under the cyclone associated with positive wind stress curl in OFES simulation forced by daily NCEP (Fig. 1). Under the divergence, upwelling appears from surface to 3000 m depth (Fig. 2). These oceanic responses are not found for a non-explosive cyclone. The upwelling associated with explosive cyclones is found in observations by The NOAA Kuroshio Extension Observatory (KEO) buoy. When the other explosive cyclone passes over the KEO buoy on 14 January 2013, mooring sensors are lifted up about 100 m. The lifting is as large as that by Typhoon Choiwan in 2009.

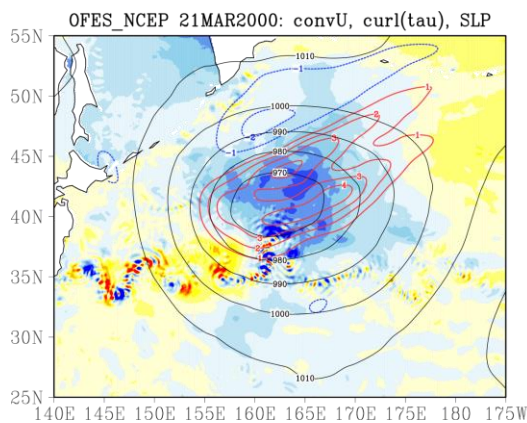


Fig. 1. Barotropic convergence (10^{-4} cm s⁻¹, color), curl tau (10^{-4} N m⁻², red contour) and sea-level pressure (hPa, black contour) on 21 Mar 2000.

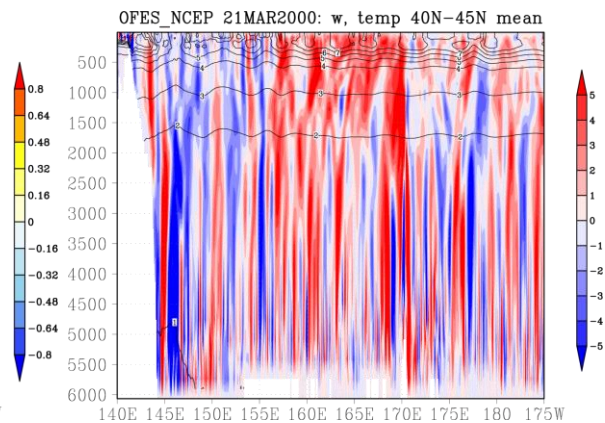


Fig. 2. Vertical velocity (10^{-3} cm s⁻¹, color) and temperature (degree C, contour).