Typhoon-induced strong currents

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Abstract

Surface Velocity Program (SVP) drifters drogued at 15 m depth were deployed in the Taiwan Strait (TS) and Luzon Strait in 2005 and 2006. Several drifters in the TS and the Pacific were fortuitously overrun by the typhoon Hai-Tang (July 2005) and Shan-Shan (September 2006), respectively. The drifter and QuikSCAT wind data clearly demonstrate that the surface current over the TS and the Pacific can change dramatically for a period of about two days due to the strong winds of a typhoon during its passage. Our results show that the area of storm-affected surface currents is considerably smaller for a weaker typhoon (category 2 Shan-Shan), about 300~400 km in radius, than for a stronger typhoon (category 5 Hai-Tang), about 800 km in radius. The maximum observed current speed in the TS was 1.7 ms^{-1} (or 2.2 ms^{-1} in net speed change) under the influence of Hai-Tang, and 2 ms^{-1} in the Pacific under the influence of Shan-Shan. Drifter observations revealed the unusual phenomenon of flow reversal in the surface layer of TS and the Kuroshio induced by the typhoon passage. The effect of a typhoon on surface flows is amplified by the long, narrow geometry of the TS. Surface currents generated by wind forcing along the passage of a traveling typhoon can be explained by the Ekman drift.

Historical data from SVP drifter observations and typhoons during 1985~2008 were analyzed to display a two-dimensional view of strong currents under category-4 and -5 typhoons in the northwestern Pacific. Observed current speeds in excess of 2.0 ms^{-1} were measured under several typhoons. The strongest mean current of 1.0 ms^{-1} was present to the right of the storm center. The distribution of current vectors was asymmetric. The rightward bias of surface current enhancement may be attributed to the northward mean background flows and to the stronger winds that were present on the right side of the storm due to storm motion.

Key word: SVP drifter, typhoon, current, Pacific, Taiwan Strait