Validation and Application of Altimetry-derived Upper Ocean Thermal Structure in the Western North Pacific Ocean for Typhoon Intensity Forecast

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Abstract

This work uses more than 5000 co-located and near-coincident *in situ* profiles from the NOAA/GTSPP database spanning over 2002 to 2005 to systematically validate the satellite altimetry-derived upper ocean thermal structure in the western North Pacific ocean as such ocean thermal structure information is critical in typhoon's intensity change. It is found that this satellite-derived information is applicable in the central and the southern western North Pacific (covering 122-170ºE, 9-25ºN), but not in the northern part (130-170ºE, 25-40ºN). However, since > 80% of the typhoons are found to intensify in this central and southern part, this regional dependence should not pose a serious constraint in studying typhoon's intensification. Further comparison with the U.S. Naval Research Laboratory's NPACNFS hydrodynamic ocean model shows similar regional applicability but NPACNFS is found to have a general underestimation in the upper ocean thermal structure and causes a large underestimation of Tropical Cyclone Heat Potential (TCHP) by up to 60 kJ/cm^2. After validation, the derived upper ocean thermal profiles are used to study the intensity change of supertyphoon Dianmu (2004). It is found that the two upper ocean parameters, i.e., typhoon's self-induced cooling and the during-typhoon TCHP, are the most sensitive parameters (with R^2 ~0.7) to the 6h intensity change of Dianmu during the study period covering Dianmu's rapid intensification to category-5 and its subsequent decay to category-4. This work suggests the usefulness in using the satellite-based upper ocean thermal information in future research and operation related to typhoon's intensity change in the western North Pacific.