

Upper Ocean Thermal Structure, Rapid Intensification, and Supercyclones – Satellite Observations and Numerical Simulations

I-I Lin* (iilin@as.ntu.edu.tw), Iam-Fei Pun*, W. Timothy Liu#, Chun-Chieh Wu*, and Dong-San Ko~

*Dept. of Atmospheric Sciences, National Taiwan University, Taipei, Taiwan
#Jet Propulsion Lab., NASA, California Institute of Technology, Pasadena, USA
~Naval Research Lab. USA

Category- 4 and 5 tropical cyclones, Hurricane Katrina (2005), and Supertyphoon Maemi (2003) for instance, are the most intense and destructive cyclones on earth. Though for long it is known that not only sea surface temperature (SST), the subsurface upper ocean thermal structure (UOTS) is also critical in the intensification of these ‘super cyclones’, the lack of ocean subsurface observations has hinders the research and much remains unknown. With the advancement in remote sensing (e.g., satellite altimetry) and *in situ* ocean measurements (e.g., ARGO floats), it is now possible to take a fresh look at the situation using more reliable new observations. In this work, the role UOTS played in the intensification of the western North Pacific category-5 typhoons and the most catastrophic cyclone on earth in 2008 (i.e., Cyclone Nargis (2008) in the Bay of Bengal) is studied. It is found that: (1) 30% of the western North Pacific category-5 typhoons are fueled by the warm ocean features (e.g., mesoscale eddies) and without encountering these features, these typhoons could not have made to the category-5 (i.e., the highest) intensity (Lin et al. 2008). (2) The subsurface requirement (i.e., the thickness of the subsurface warm layer and upper ocean heat content) for intensification is a very sensitive function to cyclone’s translation speed. Faster-moving typhoons can afford to intensify to category-5 over shallow layer of subsurface warm water while a much thicker subsurface warm layer is required for slow-moving typhoons (Lin et al. 2009b). (3) Due to encountering of the pre-existing warm ocean feature, Nargis rapidly intensified (RI) from a weak category-1 cyclone to an intense category-4 cyclone within 24h (Lin et al. 2009a). As the RI too place just prior to landfall, the impact was catastrophic and more than 130,000 lives were claimed.

Lin, I I, C. C. Wu, I. F. Pun, and D. S. Ko, 2008: Upper Ocean Thermal Structure and the Western North Pacific Category-5 Typhoons, Part I: Ocean Features and Category-5 Typhoon's Intensification, *Mon. Wea. Rev.*, 136, 3288-3306.

Lin, I I, C. H. Chen, I. F. Pun, W. T. Liu, and C. C. Wu, 2009a: Warm ocean anomaly, air-sea fluxes, and the rapid intensification of tropical cyclone Nargis (2008). *Geophys. Res. Lett.*, 36, L03817, doi:10.1029/2008GL035815, February 2009.

Lin, I I, I. F. Pun, and C. C. Wu, 2009b: Upper Ocean Thermal Structure and the Western North Pacific Category-5 Typhoons, Part II: Dependence on Translation Speed, in press, *Mon. Wea. Rev.*, 137, 3744-3757.