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Title: Development of Typhoon Vamei near the Equator

Abstract: (Session OA-8) One of the generally accepted conditions for tropical cyclone formation has been "away from the equator". This condition was based on the lack of Coriolis effect at the equator, and supported by observations over a century that show most tropical cyclogenesis to occur poleward of five degrees latitude. Typhoon Vamei formed at 1.5°N in the South China Sea at 00 UTC 27 December 2001, a latitude that most textbooks ruled out. The cyclone was named by the Japan Meteorological Agency, which initially identified it as a tropical storm with estimated winds of 21 m s⁻¹. It was upgraded to a typhoon by the Joint Typhoon Warning Center (JTWC) in Hawaii, which benefited from the observations of several U. S. Navy ships within the small eyewall, with reports of sustained winds of 39 m s⁻¹ and gusts up to 54 m s⁻¹. During the short period of 12 h as a typhoon and another 12 h as a tropical storm, Vamei caused damages to two U.S. Navy ships, including a carrier, and flooding and mudslides in the southern Peninsular Malaysia's Johor and Pahang states. More than 17,000 people were evacuated and five lives were lost. Observational evidence suggested that Vamei formed as a result of an interaction between two well-known features of the Asian winter monsoon: A weak Borneo vortex that drifted into, and remained in, the southern tip of the South China Sea; and a strong and persistent cold surge that created the large background cyclonic vorticity at the equator. This talk will present graphics of the historical event and discuss two related papers. Lim and Chang (1981, J Atmos. Sci.) proposed two decades ago that an equatorial cyclongenesis process can be demonstrated using the equatorial wave theory. In the theory, geostrophic adjustment and potential vorticity conservation following a cross-equatorial surge spin up counterclockwise rotation to the east of the surge axis, where in the real world the Borneo vortex is located. Chang et al. (2003, Geophys. Res. Lett.) postulated that Vamei developed because the durations of the intense cold surge in the equatorial South China Sea and the Borneo circulation remaining over water were both significantly longer than normal, which allowed the interaction to continue for nearly a week until the storm is formed. They estimated the probability for an equatorial development from similar conditions to be about once in a century or longer. This estimate appears consistent with the history of observations. However, it is not known whether other near-equatorial developments have occurred but were not observed during the pre-satellite era.

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