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Uncertainty of Tropical Cyclone Wind Radii on Sea Surface Temperature Cooling

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The sea surface temperature (SST) beneath a tropical cyclone (TC) is of great importance to its dynamics; therefore, understanding and accurately estimating the magnitude of SST cooling is of vital importance. Existing studies have explored important influences on SST such as TC translation speed, maximum surface winds, ocean thermal condition and ocean stratification. But the influence of the TC wind radii (or collectively called the TC size) on SST has been largely overlooked. In this study we assess the influence of wind radii uncertainty on SST cooling by a total of 15,983 numerical simulations for the western North Pacific during the 2014-2018 seasons. Results show a 6-20% SST cooling error induced using wind radii from the Joint Typhoon Warning Center official forecast and a 35-40% SST cooling error using wind radii from the operational runs of the Hurricane Weather Research and Forecasting (HWRF) model. Our results indicate that SST cooling is most sensitive to the radius of 64 kt winds. The correlation between SST cooling induced by the TC and its size is 0.49, which is highest among all the parameters tested. This suggests that it is extremely important to get TC size correct in order to predict the SST cooling response, which then impacts TC evolution in numerical weather prediction models.