Topical Cyclone Convection Structure Evolution during Rapid Intensification using Himawari-8 Satellite

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Rapid intensification process (RI) still challenges the tropical cyclone (TC) intensity prediction. The convective structure evolution during RI process were explored by using the Himawari-8 satellite data in the western North Pacific. 39 TCs underwent at least one RI process during 2015-2017 and the RI-onset, RI-continue, and RI-end episodes were identified in each one of the RI events based on JTWC best track data.

The differences between the infrared channel and water vapor channel brightness temperature (IRWV) were calculated and the negative pixel values of IRWV were considered as deep convection areas. The radial and azimuthal profiles and the morphological features were extracted from 3-hour interval images and several key patterns and the rules considering the location, shapes, and magnitude of the IRWV were identified through the whole RI process. The composite analysis shows that each TC appears negative IRWV during the RI process, however, not all TCs demonstrate significant changes either in areas nor patterns, which indicate that the deep convection may not be a necessary condition for RI occurrence. Compared with the Non-RI cases, the development and maintenance of a good spin structure of the negative IRWV were considered as a crucial condition for the TC intensification. The RI-onset periods were mostly connected with the sudden change of IRWV and the inward movement to the inner-core area. The pinhole eye features were normally a sign of continue RI, while the appearance of big eye features, indicates the ending of RI process. It was suggested that the IRWV feature combined with the TC structure feature can be utilized to skillfully predict the episodes of RI. More RI events are expected to involved in the current study and a CART4.5 decision tree algorithm with the aforementioned rules was also under explored.
