Role of Multi-scale Interaction in Tropical cyclones Eddy Kinetic Energy

CHIH-HUA TSOU[1], HUANG-HSIUNG HSU[2], PANG-CHI HSU[3]

[1]Department of Earth Sciences, National Taiwan Normal University, Taipei, Taiwan
[2]Research Center for Environmental Change, Academia Sinica, Taipei, Taiwan
[3]International Pacific Research Center, University of Hawaii, Honolulu, USA

Heavy precipitation associated with tropical cyclones (TC) usually causes heavy floods over the East Asia. The energy source for TC was investigated by a new three-dimensional eddy kinetic energy equation partitioned into seasonal mean, intraseasonal oscillation (ISO) and synoptic-scale eddies (SSE) in this study. The results showed that mean cyclonic circulation in the lower troposphere consistently provides kinetic energy to SSEs during the ISO westerly and easterly phases. However, energy conversion between ISO to SSE during the ISO westerly and easterly phases differs considerably. During the ISO westerly phase, the enhanced ISO cyclonic flow converts energy to SSEs. The magnitude of the downscale energy conversion from mean and ISO to SSEs is related to the strength of the SSEs. During ISO westerly phase, robust SSE extracts more kinetic energy from mean and ISO circulation. SSE further strengthens and may develop into tropical storms through this positive feedback between SSE-mean and SSE-ISO interaction.

By contrast, upscale energy conversion from SSEs to ISO anticyclonic flow was observed during the ISO easterly phase. From this novel energetic viewpoint, the weaker SSE activity during the ISO easterly phase occurred because the mean circulation provides less energy to SSEs and, at the same time, SSEs upscale convert energy to ISO during the ISO easterly phase. The two-way interaction between the ISO and SSEs has considerable effects on the development of tropical SSEs over the WNP.