

ENSEMBLE SENSITIVITY ANALYSIS AND PREDICTABILITY OF THE EXTREME RAINFALL EVENT OVER NORTHERN TAIWAN ON 2 JUNE 2017

Chung-Chieh Wang¹, Ming-Siang Li¹, Chih-Sheng Chang¹, Pi-Yu Chuang¹,
Shin-Hau Chen¹, Kazuhisa Tsuboki²

¹ Department of Earth Sciences, National Taiwan Normal University, Taipei, Taiwan,

² Institute for Space-Earth Environmental Research, Nagoya University, Nagoya, Japan

ABSTRACT

In the present study, an ensemble-based sensitivity analysis (ESA) on the extreme-rainfall event along the northern coast of Taiwan on 2 June 2017 in the Mei-yu season is performed using the results from 45 forecast members with a grid size of 2.5-5 km. An quasi-stationary rainband associated with the front produced localized rainfall up to 635 mm in 12 h (0000-1200 LST 2 June), causing serious flooding and inundation near the northern tip of Taiwan. With a relatively large spread (i.e., standard deviation or SD), small ensemble mean (~130 mm), and low probability of heavy rainfall in northern Taiwan, the ensemble indicates a lower predictability there, compared to the topographic rainfall over the mountains. However, the ESA allows for identification of several contributing factors to heavy rainfall in northern Taiwan in a quantitative manner as given below.

With their impact given in change of (areal-mean) 6-h rainfall amount per one SD increase, these factors include: (1) surface frontal position and moving speed (-16.00 mm per 5 km h^{-1}), (2) position of 700-hPa wind-shift line ($+12.59$ mm per 0.4° latitude), (3) environmental moisture amount near the surface front ($+11.73$ mm per 0.92 g kg^{-1} in mixing ratio), (4) timing and location of frontal low-pressure disturbance ($+11.03$ mm per 1.38° longitude), and (5) frontal intensity ($+9.58$ mm per 3 K in equivalent potential temperature difference across 0.5° latitude). While many of the factors identified are interconnected, they tend to increase the local rainfall through lengthening the duration and enhancing near-surface convergence along the northwestern coast of Taiwan over the area immediately upstream. The readers are referred to Wang et al. (2021) for further details of this study.

REFERENCES

Wang, C.-C., M.-S. Li, C.-S. Chang, P.-Y. Chuang, S.-H. Chen, and K. Tsuboki, 2021: Ensemble-based sensitivity analysis and predictability of an extreme rainfall event over northern Taiwan in the Mei-yu Season: The 2 June 2017 Case. *Atmos. Res.*, 259, 105684, <https://doi.org/10.1016/j.atmosres.2021.105684>.

Keywords: Ensemble-based sensitivity analysis; ensemble forecast; Mei-yu front; quasi-stationary rainband; Taiwan.