Review of Yilan Experiment of Severe Rainfall in 2020 (YESR2020)/TAHOPE2020-Winter and briefing of the machine learning based data calibration system of "Storm tracker" mini-radiosonde

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ABSTRACT

We introduce a recent field experiment investigating the multi-scale terrain-circulation-precipitation interactions. When the synoptic-scale northeasterly wind prevails under the active East Asian winter monsoon, stratocumulus cloud decks with severe rainfall exceeding 100 mm·d-1 frequently occur in the northeastern plain area and adjacent mountains in Yilan, Taiwan. Yilan Experiment of Severe Rainfall (YESR2020)/TAHOPE 2020-winter was a field campaign from 20 November 2020 to 24 November 2020 to survey the physical processes leading to severe wintertime rainfall. High temporal and spatial resolution sounding observations can identify the three-dimensional structure of the wind field and the atmospheric environment, which is empowered by the novel “Storm Tracker (ST)” mini-radiosonde. During YESR2020, the continuously collected meteorological data of two northeasterly episodes captured the variability of local-scale wind patterns and the features of the severe rainfall induced by stratocumulus. A preliminary analysis indicated that a local-scale convergence line could appear over the plain area of Yilan under the northeasterly environmental condition. Moreover, the severe rainfall of the two northeasterly episodes spotlighted shallow cumulus under stratus with pure warm rain processes. The results of YESR2020 inspire the arrangement of future field observations to explore detailed mechanisms of heavily-precipitating stratocumulus over complex topography.

In YESR2020, we also established a two-step machine-learning (ML) based radiosonde calibration model for the " Storm Tracker (ST)" mini-radiosonde data correction. Due to the relatively low cost of a single launching, it has advantages for high-density/high-frequency boundary layer observations. The general linear model (GLM) and the gradient boosting machine model (GBM) showed excellent performance in sounding data correction. The statistical characteristics are consistent with the Vaisala RS41 observations as the reference dataset. Overall, after the calibration process, the ST sounding has a similar performance to the

reference sounding and has reached the level required for environmental sampling and scientific research.

REFERENCES

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Keywords: heavily precipitating stratocumulus; terrain-circulation-precipitation interactions; Yilan Experiment of Severe Rainfall; Storm Tracker mini-radiosonde; machine-learning (ML) based radiosonde calibration model