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Comparison of Machine Learning Based Quantitative Precipitation Estimation Between Widely Different Climatic Regimes

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Quantitative precipitation estimation (QPE) from weather radar is a challenging problem. The accurate rainfall estimation is important since it helps warn and prevent severe weather precipitation events such as flash flood and drought. In recent years, machine learning approach has emerged as a viable technique for accurate QPE. Ground based rain gauge measurements are used to train machine learning models. The availability and resolution of gauge data varied widely, from 1 minute resolution to 1 hour or sometimes even 1 day. In this paper we evaluate the ability of the machine learning techniques to adjust to various data resolutions of the gauge observations. Being a more modern device, weather radars have typically put out radar observations at 5 minute resolution or better. Rainfall has wide variability at different temporal and spatial scales and this paper examines the ability of the machine learning QPE system to generate rainfall estimates with the various data resolutions. In this paper, we present the comparison of machine learning based QPE in different geographic regions. We examined the performance of machine learning models trained with different spatial and temporal resolution of gauge data and different frequency band radar data that were collected in different climates. First, we used KMLB Next Generation Radar (NEXRAD) data collected in Florida. KMLB radar was operating in S-band frequency collecting the data every 5 minutes. In 100km range of the KMLB radar, 110 rain gauges were collecting the data with 1 minute temporal resolution. Then, we compared the performance of machine learning model trained in Florida data to the machine learning model trained in United Aram Emirates (UAE). UAE region contains 6 C-band radars that were collecting the data every 5 minutes. 76 rain gauges were recording the data every 15 minutes inside the 6 C-band radar domains. The radar data was gridded to align the spatial resolution to the gauge data and the temporal resolution of the radar data and the gauge data were aligned. The vertical profile of radar moment was used as an input to the machine learning model using the gauge data as a ground truth. The comparison of machine learning model trained in Florida has been analyzed to the UAE data proposed in [1]. The performance of machine learning model was compared to the in-situ ground measurements and evaluated using the metrics.

References

[1] EunYeol Kim, V.Chandrasekar, Chandrasekar Radhakrishnan, Luca Delle Monache, and Duncan Axisa, “Radar Based Quantitative Precipitation Estimation Using Deep Learning over the UAE region”, 104th American Meteorological Society Annual Meeting, 2024