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Polarimetric Radar Quantitative Precipitation Estimation Using Convolutional Neural Networks and Explainability

Abstract

A polarimetric weather radar is the main operational instrument used for quantitative precipitation estimation (QPE). However, conventional parametric radar QPE algorithms such as the radar reflectivity (Z) and rain rate (R) relations cannot fully represent clouds and precipitation dynamics due to their dependence on local raindrop size distributions and the inherent parameterization errors. This article develops four CNN(Convolutional Neural Network) models for polarimetric radar QPE using different core building blocks. In particular, multidimensional polarimetric radar observations are utilized as input, and surface gauge measurements are used as training labels.

The black-box and turn-key characteristics of DL models make it difficult for researchers to understand the model decision-making process and cast doubt on the reliability of the model results. This study also introduces a physically explainable polarization radar-based quantitative precipitation estimation (QPE) system built on DL technology that can explain the causes of the precipitation estimates provided by deep learning models under different rainfall amounts.

Keyword

QPE (Quantitative Precipitation Estimate) CNN (Convolutional Neural Network)

Reference

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