

Analyzing Cloud Size Using Weather Radar Data for Improved Flood Disaster Prediction

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Abstract:

Cloud size and rain cell analysis are essential to meteorological research and flood risk prediction, especially in regions vulnerable to heavy rainfall events and flooding. By leveraging weather radar data, which captures reflectivity values indicating precipitation intensity, researchers can derive cloud size and better understand rainfall's spatial and temporal patterns. This paper introduces a comprehensive approach for analyzing cloud size using weather radar data, incorporating a series of systematic steps that enhance the detection and evaluation of rain cells. The process begins with data acquisition, wherein raw radar data is obtained from weather monitoring stations or agencies. Following acquisition, preprocessing techniques are applied to convert dBZ values into reflectivity values, remove non-meteorological noise, and organize data into structured grids. These preprocessing steps ensure data accuracy and facilitate analysis across different spatial regions and time intervals. The next phase involves thresholding and cloud boundary definition, where a reflectivity threshold (e.g., 30 dBZ) is used to create a binary cloud mask, identifying significant rain cells within the radar scans. This binary mask provides a foundation for further analysis, allowing the delineation of cloud boundaries and the isolation of specific rain cell regions. Feature extraction is then performed to quantify critical attributes, such as cloud size, maximum reflectivity, and rain cell movement patterns, which are crucial for accurate flood prediction. Finally, visualization methods, including time series plots, allow for the assessment of rain cell evolution over time, providing real-time insights into rainfall dynamics. Collectively, these steps enhance the predictive accuracy of flood risk models and offer valuable data for disaster mitigation strategies, contributing to more effective and timely responses in flood-prone areas.