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Two passive microwave prototype methods for hail detection

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During previous decades, relationships between many geophysical variables and the radiometric measurements in the microwave bands were translated into several satellite-based algorithms. Recently, several studies have revealed a high correlation between the occurrence of hail and the microwave brightness temperature depression in convective clouds. In this work, we propose two independent prototype methods for the detection of hail on the basis of the AMSU-B/MHS brightness temperature variation.
The first method was developed through the use of collocated satellite and surface hail reports over the continental US for a 10-year period (2000–2009). Compared with the surface observations, the algorithm detects approximately nearly 40% of hail occurrences. The simple threshold algorithms are then used to generate a hail climatology based on all available AMSU observations during 2000–2011 and stratified in several ways, including total hail occurrence on a daily (diurnal cycle), monthly, and total annual basis.
The second hail detection algorithm is an improvement of the preexistent MicroWave Cloud Classification (MWCC) method, which exploits the properties of the water vapor channels on board the AMSU-B/MHS to classify the cloud type (stratiform/convection) by estimating the cloud top altitude. Using the results of the MWCC, deep convections were correlated with selected hailstorm events over Europe, South America and the US. The 10-year AMSU-B/MHS observations used for the first method were also employed to refine the algorithm criteria. The hail detector of the MWCC is based on a probabilistic model, which calculates the probability associated with each pixel by following the growth law of the hailstones.
The validation results over the US have demonstrated the high correlation between the two methods and the surface hail reports showing a remarkable agreement in terms of POD and FAR.

Reference

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