Investigation Of Impact Of Rain On C-band SAR Images

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Abstract:

Rain is one common phenomenon usually observed on SAR images. Its signatures on C-band images are often composed of very bright patches and adjacent dark patches. It is caused by the radar backscattering or attenuation from rain-induced structures on the sea surface (ring waves, splash products and turbulence) and the hydrometeors in the atmosphere (liquid water or ice). Although some models have been developed and laboratory experiments have been conducted to explain rain impact at C-band, the vertical non-uniform distribution of raindrops and the presence of ice aloft are often ignored. In this study, we co-analyze Sentinel-1 C-band SAR data together with high temporal and spatial resolution weather radar NEXRAD. NEXRAD provide different precipitation products, including rain rate (1 hour/0.25 km), basic reflectivity (less than 5 min /0.5 km) and hydrometeor classification (less than 5 min/0.25 km). More than 747 SAR images in both co- and cross-polarization have been collocated to provide statistics of NRCS under rain, at 1 km resolution and less than 5 min between SAR and NEXRAD. Our results evidence that NRCS at both VV and VH increase with rain rate, for low to moderate wind regimes. In addition, the very bright patches obtained at both polarizations are found to be in relation with melting ice particles in the atmosphere, by examining the NEXRAD hydrometeor classification. Our analysis also reveals the possible importance of rain impact after the rainfall, with a decrease of the backscatter observed after intense rainfall. This indicates the need to analyze the rain event history to take into account rain effect persistency after the rain event. Finally, examples in the specific case of hurricane are discussed.