

## **Microwave Remote Sensing of Snow: Advances over Ice Sheet, Land, and Sea Ice**

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### **ABSTRACT**

Satellite microwave radiometers have enabled us to observe the cryosphere and its changes. A variety of algorithms have been developed since the late 1970s. These convert observed microwave radiation into geophysical, glaciological properties relevant to study ice sheets' snow accumulation and melt, terrestrial snow water equivalent and freeze/thaw state, and various sea ice cover characteristics like extent, concentration, and thickness. In spite of the continuous availability of satellite microwave radiometers for the past 40 years, potential for advancing our understanding of the relationship between microwave radiation and snow/ice properties still exists. Original empirical algorithms have matured and are becoming more physically based. This presentation offers insights into some advances made during the past 10 years in monitoring ice sheet, terrestrial snow, and sea ice. These advances made it possible to provide new, more reliable climate-related variables to the community for the satellite era using the typical 18-37 GHz frequency range (e.g., retrievals of grain size profiles in Antarctica, snow cover stratification, and therefore accumulation with applications to climate studies). Recent NASA instruments have recorded low microwave frequencies (at 1.4 GHz). These observations have a large penetration depth, they emanate from deep into the ice, where properties including temperature are very stable. Nonetheless, it has been found at both Dome C, Antarctica and Summit, Greenland that changes in surface snow properties significantly influence these observations. Compared to ice sheets, terrestrial snow and sea ice present higher spatial heterogeneities. Over land, presence of canopy and lakes, though with known locations, add ambiguities in the retrievals of snow properties. Over sea ice, ridges, leads, changes in salinity, and sea ice drift augment further the level of difficulty in obtaining robust geophysical properties. Assessing the quality of satellite retrievals, often requiring field activities, is a necessary step in designing the next generation of microwave algorithms to monitor changes in the cryosphere.

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