Toward and Autonomous Ground-based RF Facility to Monitor Snow and Ice in Remote Regions

Ana P. Barros
Duke University

The ability to acquire quantitative measurements of changes in glaciers and snow accumulation in cold regions and at high elevations is critical to understand current climate. About one billion people across the world depend directly on mountain snow for freshwater resources, including the western US. Besides water resources management, snow and ice information is essential for a wide-range of socio-economic activities from maintenance and operations of lifeline infrastructure at high latitudes, management of ecosystem services in mountainous regions, and disaster preparedness and warning (e.g. avalanches, highway icing, rapid melt flash-floods and ice dams). An autonomous platform consisting of nested wireless networks of RF sensors to monitor the evolution of snow wetness, snow depth and snow bulk density, through accumulation, metamorphosis and melting phases in remote regions is being developed at Duke University. Specifically, a prototype TX-RX L-band sensor (Kang and Barros 2010) demonstrated capacity to detect snow wetness exceeding 25% (well above the 5-8% of current technology). In addition, exploratory tests during snowfall events suggest that the same measurement principle could be useful to monitor solid precipitation accumulation during snow or ice storms at both L and S bands. The new measurement system was deployed for the first time during the GCPEX campaign January-March 2012 in Ontario, Canada. The next phase of development is on scaling, design, fabrication, deployment and testing of a novel sensing system to enable transformative long-term observations of snow and ice at high spatial and temporal resolutions. The ultimate goal is to establish technological and science readiness for large-scale deployment in extreme environments.