Challenging Work: Observing in the Arctic

Research Highlight

The Arctic is showing increased sensitivity to human-influenced climate changes. Scientists investigated the unique challenges in making surface radiation measurements at Barrow, Alaska, and in Canada at Alert and Eureka to evaluate how to effectively measure surface radiation. The surface radiation budget affects weather and climate, as the Earth's surface transforms about 60% of solar radiation absorbed by the planet into heat. The extent of sea-ice, permafrost active layer temperatures, seasonal snow cover and depth, glacier advance/retreat rates, and vegetation also influence Arctic surface processes. Three significant sources of erroneous surface radiative energy budget data in the Arctic include solar tracker malfunctions, rime/frost/snow deposition on the protective glass domes and windows of the radiometers, and operational problems due to limited operator access in extreme weather conditions. The researchers suggest solutions for these operational problems that utilize measurement redundancy, more sophisticated heating and ventilation strategies, and a more systematic program of operational support and subsequent data quality protocols.

High-quality surface radiation measurements require striking a balance between locating stations in a pristine undisturbed setting free of artificial blockage, such as from buildings and towers, and providing access so that operators may clean and maintain the instruments with minimal risk due to the harsh environmental conditions. Researchers found that this balance might be achieved by a carefully designed solar tracker operation strategy, having adequate and well-designed radiometer heating and ventilation, and the use of redundant radiometers for better data quality control, along with the addition of a new heated radiometer that simultaneously measures both total and diffuse solar radiation with no moving parts, while having excellent resistance to frost, snow, and rime contamination.

Establishing viable data quality control, strict dome cleaning schedules, homogenization of the data, and consistent calibration procedures are also necessary for the success of the radiation measurements in the Arctic. These valuable additions, in turn, would give modelers of Arctic surface processes they need to improve their models and ultimately lead to better understanding and predictions.

Reference(s)

Matsui N, CN Long, J Augustine, D Halliwell, T Uttal, D Longenecker, O Niebergall, J Wendell, and R Albee. 2012. "Evaluation of Arctic broadband surface radiation measurements." Atmospheric Measurement Techniques, 5, doi:10.5194/amt-5-429-2012.

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Working Group(s)

Cloud Life Cycle