Evaluation of Broadband Arctic Radiation Measurements: Introducing Tiksi Observatory

N. Matsui[1], C. Long[2], V. Kustov[3], D. Halliwell[4], J. Augustine[5], T. Uttal[5], R. Albee[6], D. Longenecker[1], O. Niebergale[4], J. Wendell[5] and A. Makshtas[3]

[1]Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO 80309; 303-497-6500, E-mail: nobuki.matsui@noaa.gov
[2]Pacific Northwest National Laboratory, Richland, WA 99352
[3]Arctic and Antarctic Research Institute, St. Petersburg 199397, Russian Federation
[4]Environment Canada, Toronto, Ontario M3H 5T4, Canada
[5]NOAA Earth System Research Laboratory, Boulder, CO 80305
[6]Science and Technology Corporation, Boulder, CO 80305

The Arctic is a challenging environment for making *in situ* measurements and broadband surface radiation measurements are no exception. A standard suite of radiation sensors is typically designed to measure the total, direct and diffuse components of incoming and outgoing long-wave (LW) and short-wave (SW) radiation and enhancements can include various sensors for measuring radiation in various narrower bandwidths. Many radiation sensors utilize protective glass domes and some are mounted on complex mechanical platforms (solar trackers) that rotate sensors and shading devices that track the sun. High-quality measurements require striking a balance between locating sensors in a pristine undisturbed location free of artificial blockage (such as buildings and towers) and providing accessibility to allow operators to clean and maintain instruments. Three significant sources of erroneous data include solar tracker malfunctions, riming of the instruments and operational problems due to limited operator access in extreme weather conditions. In this study, a comparison is made between the Global Shortwave (GSW) measurements and the component sum (cosine corrected direct + diffuse) SW measurements. The differences between these two quantities (that theoretically should be equivalent) are used to illustrate the magnitude and seasonality of radiation measurement problems. The problem of riming is investigated in more detail for one case study utilizing both SW and LW measurements. Solutions to these operational problems are proposed that would utilize measurement redundancy, more sophisticated heating and ventilation strategies and a more systemized program of operational support and subsequent data quality protocols.

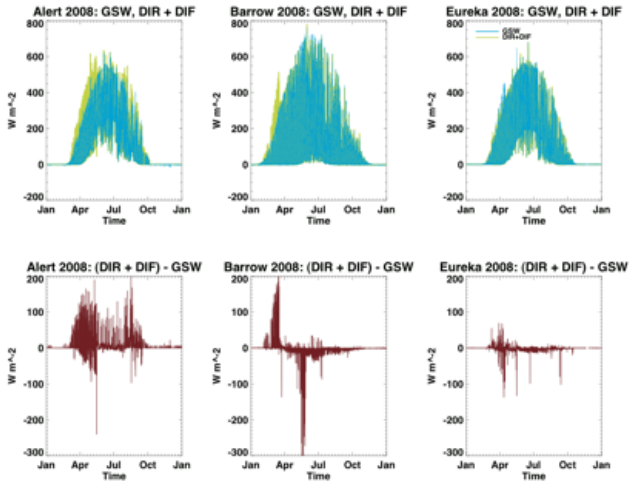

Figure 1. Global SW and DIF+DIR: Comparison of a) Alert, b) Barrow, and c) Eureka in 2008. The top panels show GSW and the component sum. The bottom panels show the difference between the component sum and GSW.

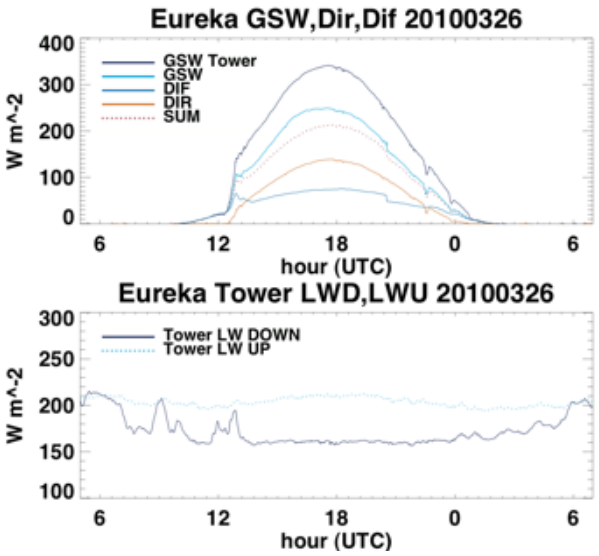

Figure 2. Clear sky example with flux tower (LW and GSW) and DIF and DIR from SAFIRE in Eureka, Canada: March 26, 2010.