

Shipboard Tilt Corrections for More Accurate Broadband Radiation Data

C. Long^{1,2}, J. Wendell², M. Reynolds³ and H. Powers⁴

¹Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309; 303-497-6056, E-mail: chuck.long@noaa.gov

²NOAA Earth System Research Laboratory, Global Monitoring Division (GMD), Boulder, CO 80305

³Remote Measurements & Research Co., Seattle, WA 98122

⁴Los Alamos National Laboratory, Los Alamos, NM 87545

Tilt from horizontal on moving platforms can result in substantial downwelling shortwave (SW) and longwave (LW) errors. In collaboration with the Department of Energy Atmospheric Radiation Measurement (ARM) Program ship-board radiation packages (ShipRad) have been developed similar to that collaboratively designed for the ARM Aerial Facility G-1 aircraft. The ShipRad set of instruments provides all the information that is needed to apply the correction for tilt from horizontal orientation developed by Long et al. (2010) to the downwelling SW measurements, as well as screen the longwave measurements for data likely contaminated by too large tilt. Three ShipRad systems were assembled, affording one each on the starboard and port sides of the ship, and one spare system in case of failures. The three systems were subsequently tested including determining the angular offsets of each radiometer from that system's navigation "level" at NOAA in Boulder, CO. Having one system on each side of the ship allows for mitigation of instrument shadowing by ship structure and other obstructions. This poster will present information on the systems and tilt correction method, plus examples from their maiden deployment as part of the Measurements of Aerosols, Radiation, and Clouds over the Southern Ocean (MARCUS) campaign.

Example of tilt correction, Dec. 14, 2017:

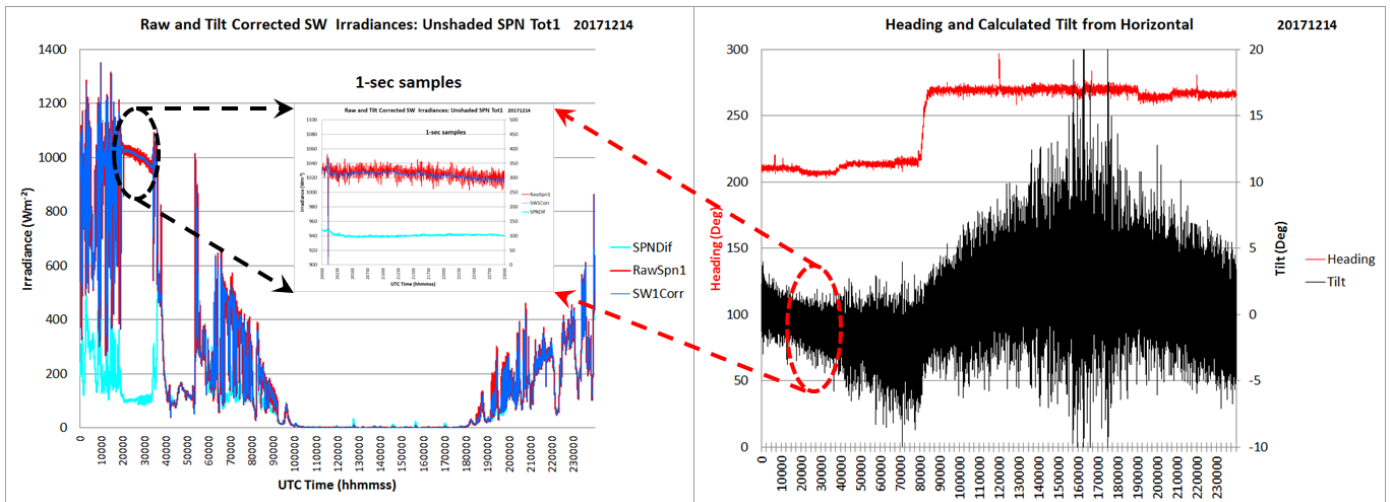


Figure 1. A brief nearly clear-sky period (dashed circle) shows the effectiveness of the preliminary tilt correction. As the zoom plot shows, even without refined detector angular offset from navigation correction, the noise in the 1-second samples is decreased from a spread of 30–40 Wm⁻² to only a few Wm⁻². This despite the rapidly-changing tilt from horizontal (black) shown in the right hand plot.