Surface radiation budget data in a bipolar perspective: observations, comparison and exploiting for products.

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Clouds modulate the net radiative flux interacting with both shortwave and longwave radiation, but the uncertainties regarding their effect in polar regions are especially high, because ground observations are lacking and evaluation through satellites is made difficult by the high surface reflectance. In this work, the radiative regimes and sky conditions for five different stations, two in the Arctic (Ny-Ålesund, 78.92°N, 11.93°E, Barrow, 71.32°N, 156.61° W) and four in Antarctica (Neumayer, 70.68°S, 8.27°W; Syowa, 69.01°S, 39.58°E; South Pole, 90°S, 0°E ; DomeC, 75.01°S, 123.33°E) will be presented, considering the decade between 2010 and 2020. Measurements of broadband shortwave and longwave radiation components (both downwelling and upwelling) are collected within the frame of the Baseline Surface Radiation Network (BSRN) (Driemel et al. 2018). Observations, together with identification of the clear sky and overcast conditions will be compared with ERA5 reanalysis (Herschbach et al., 2023). Furthermore, the identified conditions based on estimated cloud fraction will serve as labels for a machine learning classification task, leveraging algorithms such as Random Forest and Long Short-Term Memory (LSTM) networks (i.e. Zeng et al., 2021; Sedlar et al., 2021). These models incorporate features including global and diffuse shortwave radiation, downward longwave radiation, solar zenith angle, surface air temperature, relative humidity, and the ratio of water vapor pressure to surface temperature. The Random Forest model will also compute feature importance, identifying the most influential variables in predicting sky conditions and providing insights into the relationships between these meteorological factors.

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