



Long-Term Record of Arctic and Antarctic Sea and Ice Surface Temperatures from Thermal Infrared Satellite Sensors

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Surface temperature is among the most important variables in the surface energy balance equation and it significantly affects the atmospheric boundary layer structure, the turbulent heat exchange and, over ice, the ice growth rate. Here we measure the surface temperature using thermal infrared sensors from 10-12 μm wavelength, a method whose primary limitation over sea ice is the detection of clouds. However, in the Arctic and around Antarctica there are very few conventional observations of surface temperature from buoys, and it is sometimes difficult to determine if the temperature is measured at the surface or within the snowpack, the latter of which often results in a warm bias. To reduce this bias, much interest is being paid to alternative remote sensing methods for monitoring high latitude surface temperature. We used Advanced Very High Resolution Radiometer (AVHRR) global area coverage (GAC) data to produce a high latitude sea surface temperature (SST), ice surface temperature (IST) and ice cap skin temperature dataset spanning 27 years (1982-2009). This long-term climate record is the first of its kind for IST.

In this project we used brightness temperatures from the infrared channels of AVHRR sensors aboard NOAA and Metop polar-orbiting satellites. Surface temperatures were calculated using separate split window algorithms for day SST, night SST, and IST. The snow surface emissivity across all angles of the swath were simulated specifically for all sensors using an emission model. Additionally, all algorithms were tuned to the Arctic using simulated brightness temperatures from a radiative transfer model with atmospheric profiles and skin temperatures from European Centre for Medium-Range Forecasts (ECMWF) re-analysis data (ERA-Interim). Here we present the results of product quality as compared to in situ measurements from buoys and infrared radiometers, as well as a preliminary analysis of climate trends revealed by the record.