Introduction

Accurate fields of Arctic surface air temperature (SAT) are needed for climate studies, but a robust gridded data set of SAT of sufficient length is not available over the entire Arctic. The ACIA (2004) report exhibits a “data void” over the Arctic Ocean (Fig. 1).

Over the Arctic Ocean, the SAT data sets with wide spatial coverage begin in 1979 with buoy observations (Fig. 2) and satellite-derived surface temperatures.

We plan to produce authoritative SAT data sets covering the Arctic Ocean from 1901 to present, which will be used to better understand Arctic climate change.

Problem

However, there are discrepancies between the in situ, satellite-derived, and reanalysis data, e.g. the satellite estimates of trends show cooling over the Arctic during winter where the in situ estimates show warming (Fig. 3).

The Plan

• Reconcile the differences between the various SAT data sets obtained from in situ observations (Fig. 4), reanalysis, and satellites. These data will be filtered and bias-adjusted as appropriate.

• Produce an objectively analyzed, gridded field of SAT observations with error variances established through careful cross-validation, resulting in a “best estimate” field of SAT that minimizes the errors and biases in the original input data sets (e.g. Figs. 5 & 6).

• Produce a reconstructed gridded field of SAT from 1901 to present, using long-term records from “super-stations” and EOF reconstruction techniques (Fig. 7). We will conduct a careful error analysis on the reconstructed fields to provide error bars that vary in time and space to guide future climate analysis on this data set.

Some Questions We Hope to Answer

• Are the increases in Arctic SAT the primary driver of decreases in sea ice extent (SIE)? If so, then why isn’t there a comparable decrease in SIE over the longer record?

• How does Arctic SAT vary on multi-decadal time scales? Are changes in Arctic SAT related to large-scale modes of variability (e.g. Arctic Oscillation) over the longer record?

• Do Global Climate Models correctly represent SAT variability over the Arctic Ocean?

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