Pushing the time and space resolution for historical marine data: new datasets of sea-surface temperature and marine air temperature

Agnieszka Faulkner, Richard Cornes, Steven Chan, Joseph Siddons, and Elizabeth Kent
National Oceanography Centre, Southampton, United Kingdom of Great Britain – England, Scotland, Wales

Sea Surface Temperature (SST) and Marine Air Temperature (MAT) are essential climate variables (ECVs) and gridded datasets of these variables are used in many applications including global climate monitoring, evaluation of climate model simulations, providing boundary conditions for reanalysis datasets (in the case of SST) and for understanding air-sea interactions. While surface marine observations of MAT and SST extend back over 200 years, existing global high-resolution in-filled SST datasets span mostly from the early 1980s, which marks the start of satellite observations. Prior to that period, global datasets consist of monthly temperature values at a lower spatial resolution or areas limited to the location of observations without in-filling of grid-cells not covered by data.

This work presents new global, in-filled datasets of SST and MAT. The SST dataset is provided at a sub-monthly, one-degree spatial resolution back to 1850, whereas the MAT dataset is generated at a monthly five-degree spatial resolution and extends back to the 1790s. As such it is the longest spanning in-filled air temperature record for the global ocean.

The principal source of data used in these gridded datasets is the International Comprehensive Ocean-Atmosphere Data Set (ICOADS, https://icoads.noaa.gov/). Those data have been supplemented by newly recovered sources for certain regions and periods. The MAT dataset has been constructed solely using ship-based observations of air temperature whereas the SST dataset uses a combination of ship-based measurements and buoy data. The ship data in both datasets have undergone a new processing procedure, with improved Quality Control (QC) flags, duplicate detection, improved work on the mis-positioning and mis-dating of some of the data sources and newly developed ship tracking method. For the SST dataset improved bias estimates for the measurements have been developed and have applied to the data. Gridded fields have been constructed from these quality-controlled/bias-adjusted values using ordinary kriging. Uncertainty values are provided with the datasets, and the derivation of these estimates will be described.