Background

Data of NOAA-7, 9, 11, 12, and 14 AVHRR/2s and NOAA-15, 16, 17, 18, and 19 AVHRR/3s, suitable for SST retrievals from bands 3, 3b, and 4 (centered at 3.7, 8.6, and 12.0 µm) have been available since Sep 1981. This allows creation of long-term global SST records (1-7). At NOAA, such activity is conducted under the AVHRR GAC Reanalysis (RAN) project. Earlier, the RAN1 dataset has covered a period from 2002-2015 (1). The ongoing second phase of this project (RAN2) will cover the full period 1981-2018. NOAA operational Advanced Clear-Sky Processor for Ocean (ACSP) SST system is used in both RANs. As of May 2020, the initial “beta” version of the RAN2 dataset (RAN2 B01) has been produced by reprocessing AVHRR GAC data from NOAA-7, 9, 11, 12, 14, and 16 for a period from Sep 1981 – Dec 2003.

Objectives

We compare performance of RAN2 B01 SST with two other available data sets for this period: the NOAA-NASA Pathfinder v5.3 (PF) [2-4] and ESA Climate Change Initiative v2.1 (CCI) [5-6]. All SST products are uniformly validated against drifters and tropical moorings from the NOAA in situ SST Quality Monitor (iQuam; [8]). Time series of monthly biases and standard deviations of retrieved SSTs minus in situ SSTs, and clear-sky ratio (CR; fraction of clear-sky ocean pixels to the total ice-free ocean) are monitored in another NOAA dataset, SST Quality Monitor (SQiSM; [9]).

Data

RAN2 beta 01 AVHRR SST dataset for 1981-2003 (This study and (7))

- QVHRR GAC SST RAN L2P/3U dataset was produced at NOAA STAR in 2015 (Ignatov et al., 2016). It covered 2002-2015.
- RAN1 is currently under development.
- Initial RAN2vB01 dataset was produced from NOAA-07,09,11,12,14,15,16 covering 1 Sep 1981 – 31 Dec 2003.

NOAA Advanced Clear Sky Processor for Ocean (ACSP) data, modified for the historical reprocessing of AVHRR GAC.

CCI and PF CR is up to 12%, and RAN2 CR up to 20%, respectively.

"Skin" SST is only reported in CCI and RAN and not available in PF.

Pathfinder (PF) v5.3 (Kilpatrick, Podesta and Evans, JGR, 2001):

Available from 1 Sep 1981 – 31 Dec 2020 (periodically updated). Only G1&G3 are used in this analysis as recommended.

"Skin" LIC SST (0.1ºF was subtracted from satellite trained against in situ SST in this pr, yrt 1.7ºC was added back)

Background productivity is decreased in both bands 3 and 4 (17.0 µm band is biased around 0.1ºC).

Regression coefficients are calculated on a monthly basis and stratified in terms of BT1-5 and BT1-6.

Limited swath -5VS9+VSS = "depth" SST available and no sensitivity estimates are provided.

All data are aggregated in 0.04º (4 km) LIC version overlaps collated, into 2 files/day – Month and Night.

Climate Change Initiative (CCI) L2P v2.1 (CCI - Merchant et al., 2014, 2019):

Available from 1 Sep 1981 – 31 Dec 2020. L2P and 0.05º/3U LC data are available. Only L2P data are analyzed here.

"Skin" SST derived by Optimal Estimation (in this pr, ±1.7ºC was added back to facilitate comparisons with RAN).

Estimated sensitivity of "Skin" SST is close to 1

"Depth" SST derived from "Skin" SST using model of near-surface SST stratification

Limited swath in situ SST as much as possible (near-surface mooring), trend to W20 where available/possible

Used bands: Daytime, 520-570; 520-620; 570-620; nighttime, 620-720; 620-720; 720-820; biomass

Quality levels: QL2 for 1981-07, QL3 for 1982-12, QL4 for 2015-03

Global Monthly Mean Biases

"Sub-skin" SST vs. iQuam in situ SSTs: Monthly Bias:

- 0.17 K was added to PF and CCI SST to facilitate comparisons with RAN "Sub-Skin" SST

"Depth" SST vs. iQuam in situ SSTs: Monthly Bias:

- "Depth" SST is only reported in CCI and RAN and not available in PF

References


Acknowledgement

The project is aimed at creating long-term SST record consistent with JPSST. The views, opinions, and findings in this report are those of the authors and should not be construed as an official NOAA or U.S. government position or policy.