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Experimental SST Statistics using Adaptive QC

1. Introduction

A new experimental set of sea surface temperature (SST) statistics for 2° latitude x 2° longitude boxes has been completed using a new "adaptive" quality control (QC) procedure. An initial stage of the new procedure was to define the large-scale SST signal over a 1961-90 base period, when the data are relatively dense and homogeneous. The procedure improves over the existing ICOADS climatological "trimming" (Wolter, 1997) by incorporating large time and space climate signals (e.g., El Niño and La Niña) into the QC.

This procedure (Smith and Reynolds, 2003) was adapted for ICOADS production, and applied to the entire 1784-1997 period of Release 2.0 observations (LMRF format). A flag (SQZ) was output for each extant SST observation within LMRF defining the relationship of the SST to the QC limits in 0.5 standard-deviation (sigma) increments. Data outside 3.0 sigma limits were rejected; however, because the SQZ values were rounded to the nearest 0.5 sigma, this actually represents a slightly broader (3.25 sigma) cutoff. If SST data were missing, or outside broad physical limits (-5 to 40C), SQZ was output but left blank.

2. Product description

These experimental data are available at [NCAR](#) in the standard Monthly Summary Groups (MSG) format (10 statistics for SST) for access and subsetting. Later they may also be made available in netCDF format. Only MSG group 3 (SST, air temperature, and specific and relative humidity) was produced, and only the SST statistics are extant (the other three variables are missing).

The data mixture input for this product is the same as that for the "enhanced" ICOADS statistics (ships plus other platform types). This contrasts with the "standard" statistics (ship data only). A further difference should be noted: data outside 4.5 sigma (3.5 sigma) trimming limits are rejected from the existing enhanced (standard) statistics.

We hope that the new product represents an improvement over the existing standard and enhanced statistics for SST (e.g., in better preserving climate extremes, and by providing new coverage over areas that lacked the old limits and thus were automatically trimmed). However, at this stage we consider the product to be experimental. Users should be aware that it may be replaced.

3. Comparison results

For each LMRF report, [Table 1](#) shows the relationship between the old trimming flag (SF) and the new adaptive flag (SQZ).

The following figures provide a variety of information about the new flags and comparisons with other existing products:

Figures showing the distributions of the old and new QC flags:

[Figure 1](#). Distribution of 1784-1997 old trimming (SF) flags.

[Figure 2](#). Distribution of 1784-1997 new adaptive (SQZ) flags.

Discussion: For the enhanced statistics, 1.56% of the SST data were trimming for being outside 4.5 sigma limits. For the new adaptive QC, 1.34% of the SST data were rejected for being outside 3 sigma limits. (The sigma values are not comparable across the two procedures--tighter limits can be used with the adaptive procedure because the large-scale climate signal is removed from the data.)

January gif animations over selected 30-year periods (and a shorter 18-year period at the end), showing the global spatial coverage of the old enhanced trimming (top) versus the new adaptive QC (bottom). The color/greyscale bar shows the ratio of QC'd over untrimmed observations. Thus red indicates that all observations were removed by QC, blue indicates that few or none were, and greyscale values fall in between:

[Figure 3a](#). 1830-1859.

[Figure 3b](#). 1860-1889.

[Figure 3c](#). 1890-1919.

[Figure 3d](#). 1920-1949.

[Figure 3e](#). 1950-1979.

[Figure 3f](#). 1980-1997.

Discussion: Systematic data problems (possible mislocated data), such as in January 1972 off Madagascar in some cases were resolved by both procedures. The new adaptive QC shows coverage improvements over areas without the old trimming limits, e.g., east of Cape Horn.

El Niño examples. For a Pacific region, the three panels compare resultant SST December monthly mean values for the old enhanced trimming (top), and the new adaptive QC (middle). The bottom panel is a comparison with the Smith and Reynolds Extended Reconstructed SST (ERSST; Smith and Reynolds, 2003):

[Figure 4a](#). 1972.

[Figure 5b](#). 1975.

[Figure 5c](#). 1988.

Discussion: For each example event, the new procedure generally fills in some boxes that were missing in the enhanced product, possibly due to rejection by the old trimming of genuine extreme values. The analyzed ERSST product is much smoother and preserves less detail.

4. Status and future plans

LMRF observations were recently converted into a new International Maritime Meteorological Archive (IMMA) format. During this process the SQZ flag associated with each SST observation was stored in IMMA, together with an accompanying SQA flag that provides a measure of the reliability of the QC (SQA has a roughly inverse relationship with the number of observations available nearby, such that smaller alpha values indicate more data). This will allow the new QC flags to be made widely available to observational users and to be more readily utilized for production of ICOADS statistics.

As resources permit, additional work is also planned to extend the QC procedure to other major observed variables: air and dew point temperatures, sea level pressure, and wind.

References

Smith, T.M. and R.W. Reynolds, 2003: Extended reconstruction of global sea surface temperatures based on COADS data (1854-1997). *J. Climate*, **16**, 1495-1510.

Wolter, K., 1997: Trimming problems and remedies in COADS. *J. Climate*, **10**, 1,980-1,997.

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