COMPARISONS OF DAILY SEA SURFACE TEMPERATURE ANALYSES FOR 2007-08.

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1. INTRODUCTION

Sea surface temperature (SST) analyses have increased in recent years along with an increase in the number of satellite instruments. Many of these analyses are part of the Group for High-Resolution Sea Surface Temperature (GHRSST) (1, and http://www.ghrsst-pp.org/, see in particular "Data Access"). The analyses use in situ and remotely sensed data from a variety of geostationary and polar satellites and are computed over different regions and time periods with different spatial and temporal resolutions. Most of these products tend to cover roughly the last five years when satellite instruments such as the microwave (MW) Advanced Microwave Scanning Radiometer (AMSR) and the infrared (IR) Moderate Resolution Imaging Spectroradiometer (MODIS), joined two longer time series of IR instruments: the Advanced Very High Resolution Radiometer (AVHRR), since November 1981, and the Along Track Scanning Radiometer (ATSR), since August 1991, as sources of global SST observations.

2. ANALYSES

Analyses were selected that were global with at least daily resolution and available for a two year period, 2007-08. Analyses from GHRSST Jet Propulsion laboratory (JPL) web site were preferred (see table at http://ghrsst.jpl.nasa.gov/GHRSST_product_table.html). These selection criteria resulted in 5 analyses. One additional analysis from the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Prediction (NCEP) was added because it is used at two forecast centers. The analyses are discussed by increasing grid resolution.

Analyses 1 and 2: Two of the analyses are produced daily on a 1/4° grid at NOAA's National Climatic Data Center and described by (2). One analysis (AVHRR-only) uses in situ and AVHRR data, the second analysis (AMSR+AVHRR) adds AMSR data.

Analysis 3: The US Navy Coupled Ocean Data Assimilation (NCODA) analysis (3) is computed operationally using in situ data and AVHRR, AMSR, and Geostationary Orbiting Environmental Satellite (GOES) data. The analysis is performed on a 1/9° grid on the equator with gradual reductions in latitudinal intervals to keep the size of the grid boxes nearly square between 80°S and 80°N.

Analysis 4: The Remote Sensing System (RSS) analysis is computed on a ~1/11° grid using AMSR, Tropical Rainfall Measuring Mission Microwave Imager (TMI) and MODIS data. This analysis is unpublished, although some details are available at http://www.ssmi.com/sst/microwave_oi_sst_browse.html. The RSS is the only analysis that does not use in situ data directly.

Analysis 5: The NCEP Real Time Global High Resolution (RTG-HR) is operationally computed daily using in situ and AVHRR data on a 1/12° grid (4). Only the most recent year of analyses is available for download at ftp://polar.ncep.noaa.gov/pub/history/sst/ophi/. Analyses are not available on the JPL GHRSST data web site.

Analysis 6: The UK Met Office has a 1/20° Operational SST and Sea Ice Analysis (OSTIA) analysis on a 1/20° grid that uses in situ, AVHRR, AMSR, TMI, Advanced ATSR (AATSR), and geostationary Spinning Enhanced Visible and Infrared Imager (SEVIRI) data. A paper is under preparation. Further details can be found at http://ghrsst-pp.metoffice.com/pages/latest_analysis/ostia.html.

3. COMPARISONS

Figure 1 shows a region in the western tropical Pacific for 1 January 2007. The results show that the features are smoothest in the RTG-HR analysis. The RSS analysis has considerable small-scale detail that is derived from MODIS 1 km data. However, because MODIS data are limited by swath width and clouds, they are not available every day for the region shown in the figure. Thus, some of the RSS small scale details may be several days old or older.

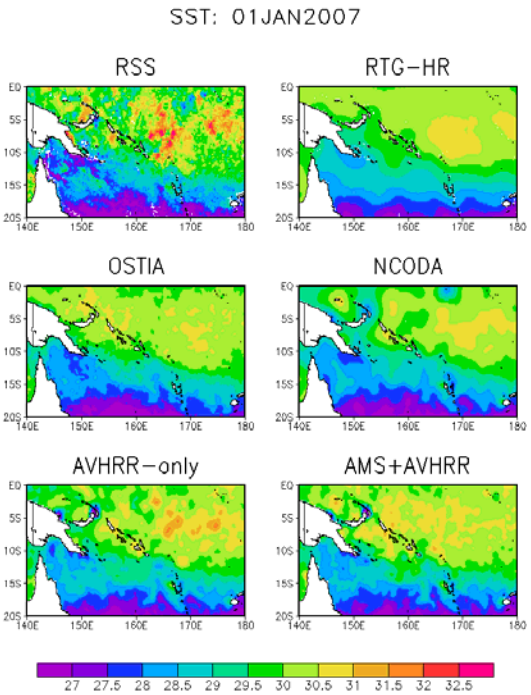

Figure 1. Six daily SST analyses for 1 January 2007. Highest details are evident in RSS, lowest in RTG-HR.

Six different SST analyses have now been compared with each other and with buoy data for the period: 2007-08. To help determine SST analysis resolution, wavenumber spectra were computed at several locations. These results suggested that the RSS is too noisy and the RTG-HR analysis is too smooth. Further comparisons were made using collocated buoys for ten regions using time series, auto-spectra and low and high pass filtered correlations between the buoy data and the analyses. These result showed that RSS is too noisy in the tropics and that RTG-HR had winter biases in the Aleutians Region during January and February 2007. The correlation results showed that analysis-to-buoy correlations at high frequencies (> 0.2 cpd) were best with the NCODA and OSTIA analyses and worst with the RTG-HR and RSS analyses. The high correlation indicates that NCODA, and to a somewhat lesser extent, OSTIA were strongly tuned locally to buoy data, where they exist. The AVHRR-only analysis is useful for climate studies because it is the only daily SST analysis that extends back to September 1981. Further discussion of the comparisons with accompanying figures can be found in (5).

4. CONCLUSIONS

The grid resolution is a lower limit of the final analysis resolution. A grid scale that is consistently smaller than the actual analysis resolution becomes computationally inefficient. The expected analysis resolution is determined by analysis parameters such as error correlation scales. However, the actual analysis resolution is limited by input observation resolution and coverage over the temporal period of the analysis. In the examples shown here the OSTIA analysis has the smallest grid size and yet does not show the smallest analysis scales. If the analysis resolution was made too small, as it was for the RSS analysis, the analysis will appear to have high resolution, but the features will represent noise rather than signal. Consider for example a region with 1 km IR data and 50 km MW data. During cloudy periods the IR data will be limited while the MW data will not be impacted. Thus, any analysis which attempts to obtain the highest resolution possible based on IR data must reduce this resolution in regions where the IR data are missing or the coverage is reduced. This change in IR coverage can result in apparent temporal inhomogeneity in the small-scale variance that could wrongly be interpreted as real and may be problematic for some applications.

5. REFERENCES

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