National Meteorological Operations Centre (NMOC)

The following Analysis and Prediction Operations Bulletin provides a description of a major operational change at the National Meteorological Operations Centre, Melbourne, Australia.
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SEA SURFACE TEMPERATURE ANALYSIS

A new global sea surface temperature (SST) analysis had been developed jointly by NMC and BMRC. Charts of the analysis and anomalies from the climatological mean will be distributed on DIFACS.

INTRODUCTION

Sea surface temperature influences the atmosphere on many space and time scales. Accurate sea surface temperature analyses are important to provide

1. **information of the current SST in the Australian region as part of the public weather role.**
1. **lower boundary conditions for the atmospheric prediction models; and**
1. **information about oceanic changes for climate monitoring purposes.**

As a first attempt to satisfy all these requirements a weekly global analysis on a 1o latitude/longitude grid has been developed.

DATA

The new SST analysis uses *in situ* and satellite data received on the Global Telecommunications system (GTS). The *in situ* data is obtained from ships, buoys (fixed and drifting) and expendable bathythermographs (XBTs). Satellite data is derived from measurements taken by the Advanced Very High Resolution Radiometer (AVHRR) instrument carried out by the US polar orbiting NOAA series of satellites.

The distribution of *in situ* data is not uniform over the globe (Fig 1). Most of the data is confined to the main shipping routes, particularly in the northern hemisphere, supplemented by the space drifting buoy network in the Southern Ocean.

The spatial coverage of satellite data (fig 2) is more uniform even though the AVHRR cannot retrieve SSTs in cloud covered regions. Although the algorithms used to derive satellite SST data are tuned by regression against selected high quality buoy data there can still be bias. This becomes a problem especially when the atmosphere is contaminated by aerosols such s those produced by volcanic eruptions.

Thus neither source of data by itself is ideal for obtaining an accurate global analysis. The *in situ* data is essential for removing bias for climate applications while satellite data provide the spatial structure not obtainable from the in situ network.

Before being passed to the analysis some crude quality control checks are made on the data. These include checking message content for reasonable values, eliminating duplicates and in, the case of ships and buoys, checking the course and eliminating observations where position changes are excessive.

ANALYSIS SCHEME

The analysis scheme used is an optimum interpolation analysis based on the BMRC ocean sub-surface analysis scheme (Smith et al., 1991; Smith, 1994a).

An improvement made to this scheme is the attempt to 'forecast' the first guess field for the analysis based on a combination of the previous analysis and climatology (Smith, 1994b). The climatology used is

interpolation from the monthly 2o resolution Reynolds climatology (described in Reynolds, 1988). The relative weighting given to each field is dependent on the age of the last analysis.

Error characteristics associated with climatology and various observation types were initially allocated intuitively. They have since been adjusted using information available from a statistical evaluation of the analysis over a six month period.

SATELLITE CORRECTION SCHEME

Because of possible bias in the satellite data as mentioned above, a scheme to correct these data has been implemented.

Firstly, separate coarse analysis of *in situ* and satellite data is performed. These coarse analyses are performed on a 2.5o grid and use broad correlation scales (of the order of 800km). At these scales it is assumed that there are sufficient *in situ* data to perform an accurate analysis. The statistical parameters are adjusted to reflect the slower evolution of the broad scale pattern.

A difference field is calculated from these two analyses. The difference field is interpolated to the location of every satellite observation and used to correct the original observation.

RESULTS

An example of the new SST analysis is shown in Fig. 3 for the seven day period from 31 January 1994 to 6 February 1994. All major currents (eg. The Gulf Stream) are depicted by tight gradients in the analysis. Of more interest is the anomaly pattern (Fig. 4). This is the analysed SST minus climatology.

The scheme has been running in approximately its current form for over six months. Comparison over this period against observations show little if any bias and rsm differences over various regions of the globe of less than 0.75oC.

Over the same period of time weekly analyses from NMC, Washington have been received. A description of this analysis is given in Reynolds and Smith (1993). Fig. 5 shows the averaged difference between these analyses and the new scheme over the period and Fig. 6 the rms differences. Overall differences are less than 1oC but some regions require further comments.

1. **In major currents (especially the Gulf Stream) where temperature gradients are tight there can be differences in the position and intensity of the maximum gradient.**

1. **The lack of *in situ* data in the southern oceans appears to result in different corrections.**

1. **The Washington analyses consistently show a sharper, slightly colder equatorial current in the equatorial Pacific.**

The cause of these differences is being investigated.

MONTHLY ANALYSES

In the last week of each month and the first week of the next month a monthly analysis will be constructed based on an average of the weekly analyses. Monthly analyses are useful for climate monitoring purposes. Charts of this analysis and anomalies from the monthly mean will also be distributed on DIFACS.

FUTURE DEVELOPMENTS

It is hoped to introduce sea-ice data to the scheme to improve the analysis where both *in situ* and satellite data are sparse. This should also help anchor the coarse *in situ* analysis giving more reasonable corrections to satellite data at high latitudes.

Locally retrieved AVHRR data are available at much higher resolution than is available on the GTS. It is hoped to use this data in a higher resolution analysis of the Australian region.

DISSEMINATION

Weekly charts of sea surface temperature analysis and sea surface temperature anomaly will be distributed on DIFACS at about 2330 UTC each Sunday (Monday morning local time). On the last week of the month

monthly analysis and anomaly charts will also be available. These will be updated on the first Monday of the next month.

REFERENCES

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G.R. Warren

SROS

NMC Melbourne

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The above was kindly typed by Pauline McDowall
For queries: Paul Stewart
Address: *P.Stewart@BoM.GOV.AU*