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SEASAT SMMR-DERIVED SEA SURFACE TEMPERATURES[1]

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ABSTRACT

The sea surface temperature (SST) data set derived from the Seasat multichannel microwave radiometer (SMMR) measurements, has been corrected with a single parameter: the difference between the sampling time and the time of sunrise (for ascending passes), or sunset (for descending passes). The corrected data set of SMMR SST are then analyzed for a time series of 6-day mean Pacific SST for the period July 7-Oct 10, 1978. Either the 6-day mean or the semi-monthly mean SMMR SST analyses are considered an improvement over the earlier analyses of Seasat SMMR SST. Besides, the spatial and temporal variations of the SMMR SST analyses are more reliable than the semi-monthly mean SST analyses derived solely from the surface SST reports. The monthly and especially the weekly analyses of SST will be greatly enhanced in its reliability and accuracy, if the microwave-derived SSTs are regularly available in the cloudy regions and in the region far away from shipping lanes.

INTRODUCTION

The Scanning Multichannel Microwave Radiometers (SMMR) installed on board both the Seasat (Fig. 1) and Nimbus-7 satellite have 10 data channels, vertical and horizontal polarizations for each of the five frequencies: 6.6, 10.7, 18, 21, and 37 GHz. The SMMR is capable of detecting the surface thermal radiation at all times, even in the cloudy regions. This all-weatherness, along with its repetitive and uniform coverage of the world oceans, allows the mapping of global sea surface temperature (SST) with unsurpassed repetition rate - one global SST map every six days. The SMMR data are unfortunately handicapped by the less than satisfactory pre-flight calibration, and by the polarization mix in the received microwave energy. These are caused by the scanning motion of the antenna's reflector (Fig. 2), and by the dielectric property of ionosphere as the surface-emitted microwave radiation passing through it. This phenomenon is called the Faraday rotation. Earlier studies, e.g. Bernstein and Morris (B&M, 1983), adopted an empirical table for correcting SMMR-derived sea surface temperatures (SST) of various latitude bands and time periods for each of the four viewing angles. The result is a set of uniformly distributed SST data set with accuracy comparable to or better than the ship injection temperatures. As compared to the SSTs derived from thermal infrared (IR) satellite images, (1) the SMMR images have the advantage of all-weather coverage of the ocean, while the satellite IR images always fail inside of or at the vicinity of the cloudy regions, (2) the satellite IR data may have spatial resolution of 1.1 km, which is much better than the 150 km resolution for SMMR data.

The Faraday rotation effect varys with the sun spot activity, the latitude, the scan angle of remote sensing instrument as they view the earth system, and the microwave

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