A New Technique for Estimation of Sea surface Salinity in the Tropical Indian Ocean from OLR

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Abstract

Salinity is one of the three state variables (along with temperature and pressure) that determine the density of seawater and is missing from direct measurements of space-borne satellites. It is the key parameter that determines the hydrological cycle over the oceans and hence has the climatic implications. This study provides a new technique to determine the Sea Surface Salinity (SSS) in the tropical Indian Ocean based on the algorithms developed using the satellite measured Outgoing Longwave Radiation (OLR). The algorithms are the statistical relationships between the OLR and an oceanic parameter, the Effective Oceanic Layer (EOL), and between EOL and climatological (World Ocean Atlas 1998) SSS. The SSS product as derived from space-borne satellite measurements of OLR, based on the algorithms developed by Murty et al. [2003], is discussed for the tropical Indian Ocean (TIO) during the period 1979-2000.

Method

This study addresses this new method for deriving the SSS from OLR in the Indian Ocean wherein the convection over the ocean is a regular seasonal phenomenon in association with the summer monsoon and the Intertropical Convergence Zone (ITCZ). Murty et al. [2002] describes this new method with a preliminary assessment of estimation of SSS over the Bay of Bengal using the OLR. The OLR measures the cloud top temperature and represents the measure of convection over the oceans and land areas. The intense convection will have the lowest cloud top temperature and hence the lowest OLR. Therefore, the zones of the lowest OLR could be the regions of intense convection over the tropical Oceans. Conversely, the zones of the highest OLR (say, 220 W/m^2) could be regions of little convection or cloud-free skies. This new technique is explained in Murty et al. [2003] with more details.

Results

The SSS anomalies relative to Levtius climatology during 1995 are shown for the months of January, April, July and October (Figs. 1a-d). The deviations of the estimated SSS from the WOA98 SSS for each month are within ±1.0 psu in a larger area of the tropical Indian Ocean. The deviations are typically large in the Bay of Bengal during July and October where the river run off and intensive convection lead precipitation control the SSS. The largest deviation in the SSS in July and October are the artifact of contouring near the coastal boundary of the Bay of Bengal. The deviations between the estimated and WOA98 SSS are more or less in the same range from one year to the other. We have shown comparison of this new product with WOCE sections and individual cruise hydrographic observations in Murty et al. [2003].

Conclusions

In this study we have shown a better way of obtaining daily SSS information from satellite observations of OLR. The daily SSS product is also useful for studying the impact of tropical cyclones on the upper ocean and study the air-sea coupling during the tropical cyclones [Subrahmanyam et al. 2003]. This study also boosts the coupled models, ENSO forecast models as well as ocean global circulation models (or regional scale circulation models). We envisage that this way of obtaining daily SSS would be very helpful until the space born satellite measurements are available.

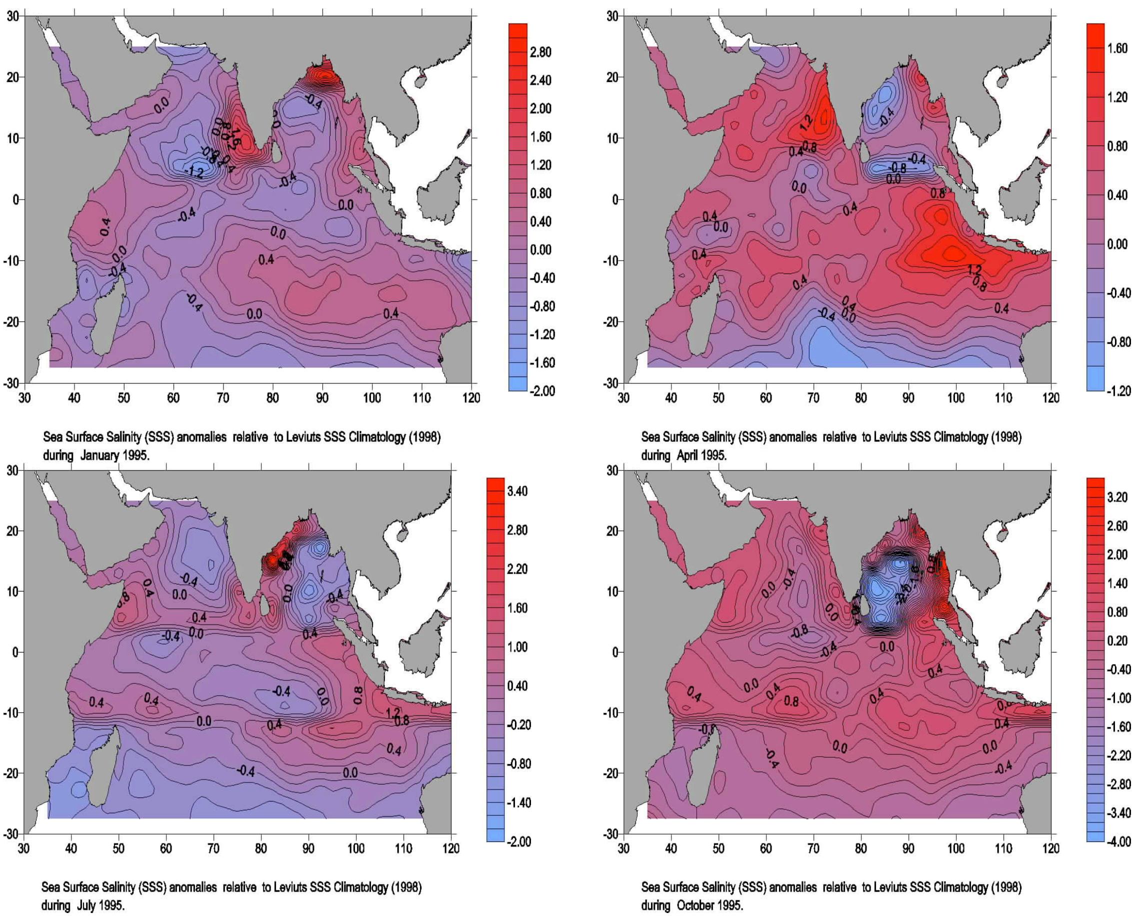

Fig. 4. Difference between estimated SSS and WOA98 SSS climatology in 1995 during a) January, b) April, c) July and d) October.

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