A WORKSHOP IN INDIA EMPHASIZED THE IMPORTANCE OF SATELLITE DERIVED OCEANIC HEAT CONTENT IN CYCLONE PREDICTIONS.

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Recognizing the important role played by satellite-derived sea surface height anomalies (SSHAs) and upper ocean heat content (UOHC) in the cyclone track and intensity prediction (CTIP), the National Remote Sensing Center (NRSC) of the Indian Space Research Organization (ISRO), Hyderabad, India, organized a first-of-its-kind two-day workshop on "Utilization of satellite derived oceanic heat content for cyclone studies", during 25-26 March 2010. Discussions at this workshop aimed at highlighting the importance of altimeter derived upper ocean heat content (UOHC) in cyclone track and intensity prediction (CTIP) in the North Indian Ocean (NIO) and how these fields are being used in other basins to improve the forecast. The workshop concluded that the UOHC (upto the depth of the 26^{o} C isotherm) could be estimated from remote sensing observations with a fair degree of accuracy (Figure 1) with a correlation coefficient of 0.66 and RMS error of 17 kj/cm^2, therefore allowing the use of altimetry as a proxy to estimate the UOHC to the depth of this isotherm. While the UOHC is being operationally used in CTIP in other ocean basins, only a few case studies (e.g. Figure 2) exist in NIO. Only sea surface temperature is currently being used in analyses in this region, although it usually does not properly represent the UHOC.

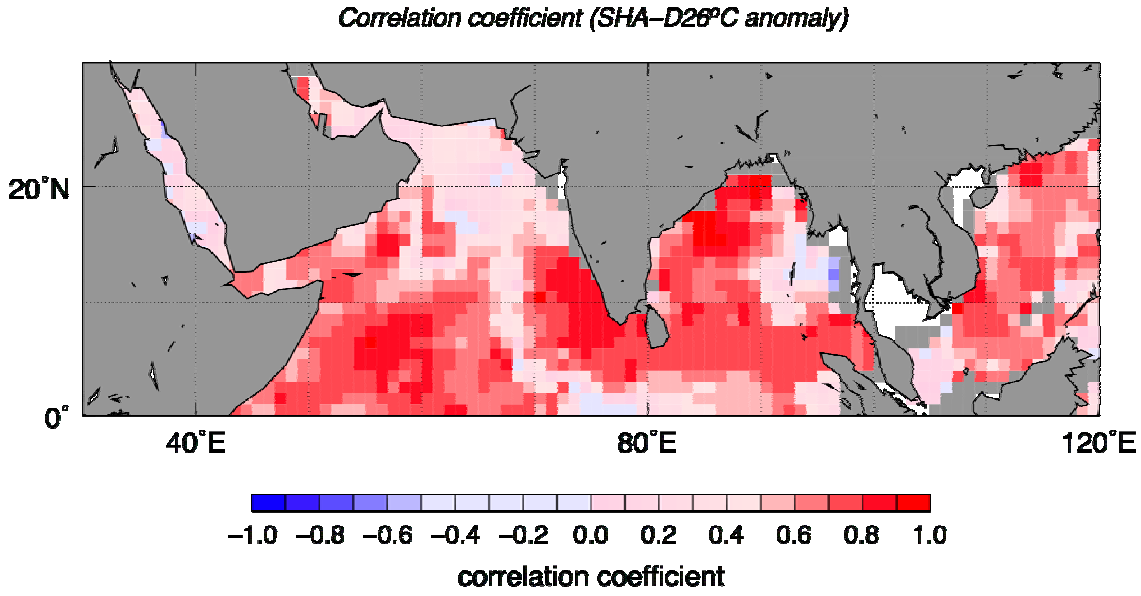

Figure 1. Correlation coefficient between altimetry-derived sea surface height anomalies and depth of the 26°C isotherm in the NIO.

To emphasize the importance of oceanic eddies and the dynamic topography on cyclone intensification and dissipation, several cases of intensification in the NIO were presented and discussed. Shown here (Figure 2) are two examples of cyclones over the Bay of Bengal during 10-19 May 2003 and 15-22 December 2005. Both cyclones intensified while their tracks were over regions of high SSHAs (Figures 2a and 2b) representing regions of high UOHC. A nearly one-to-one correspondence is present between SSHA and the cyclone intensity (CI) (Figure 2c). No such correspondence is present between CI and SST: The cyclone intensity increased after passing over a cooler SST region and decreased after travelling over a region of warmer SST [Figure 2d]. Similarly, the 15-22 December 2005 Bay of Bengal cyclone dissipated after traveling over a cold-core eddy with less UOHC (Figure 2e).

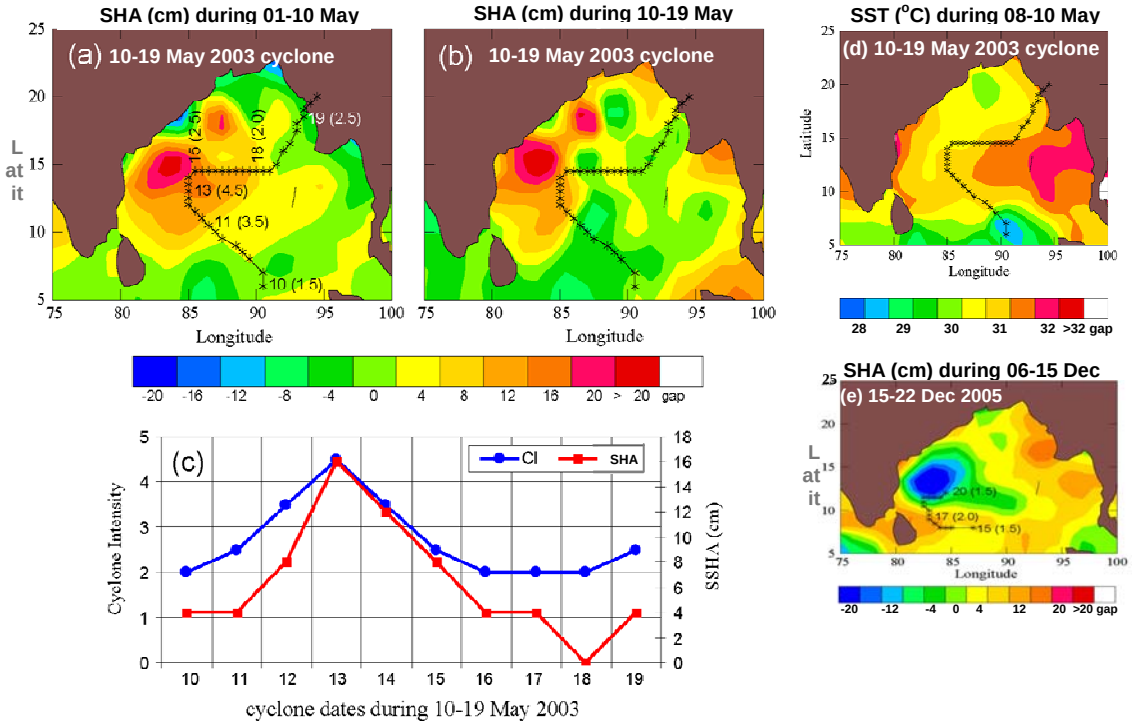

Figure 2: Impact of sea surface height anomaly (SSHA) and sea surface temperature (SST) on cyclone intensity (CI): (a) Bay of Bengal cyclone track during 10-19 May 2003 superimposed on the SSHA during 1–10 May 2003 and (b) during 10-19 May 2003, (c) comparison of SSHA and CI of the same cyclone, (d) three day composite Tropical Rainfall Monitoring Mission Microwave Imager SST during 8-10 May 2003 and (e) cyclone track of 15-22 December 2005 superimposed on SSHA during 6-15 December 2005. Time of observations (intensity) at selected locations for both the cyclones is superimposed in Figure 3a and 3e. (Figures compiled from Ali et al. EOS, 2007).

Discussions at the workshop included (i) the present status of the operational forecasting of the cyclones at Indian Meteorological Department (IMD) vis a vis the global scenario, and its future plans in using the UOHC on operational basis in CTIP (ii) the requirements of the National Institute of Oceanography, (iii) the impact of remote sensing data on different tropical cyclone simulations (iv) the operational requirements at the Satish Dawan Space Centre of ISRO during launching of rockets and (v) the role of fresh water at the surface in the Bay of Bengal, from river runoff and rain, which creates a barrier layer inhibiting mixing with waters below the thermocline. It was concluded that more modeling studies and statistical analysis need to be performed to assess if the depth to the 26°C isotherm is the best reference depth for tropical cyclone intensification studies in the NIO. At this moment, the UOHC to the depth of 26^{o}C isotherm is being used as it is readily available at AOML on a real-time basis.