Influence of eddies on the migratory routes of the sea turtles in the Bay of Bengal

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Abstract

Tracking turtles at sea not alone helps understanding the migratory behavior of the animal, but also the composition of associated environment at large. Some of the sea turtle off the Orissa coast in the northwestern Bay of Bengal tracked during the year 2001 were studied using satellite based ARGOS tracking system. Of the four turtles attached with Platform Terminal Transmitter (PPT) released in the middle of April 2001 tracked for a few weeks. Itinerancy of the turtles indicated their dependency on the local dynamics. The anti-clockwise movement of the turtles till the end of June 2001 restricted the animals to northwestern Bay. Three of the PPTs lost by end of June 2001, leaving the fourth tracked till 10th August 2001 to the east coast of Sri Lanka. The altimeter data corresponding to the period of tracking indicated influence of dynamics on the movement of these turtles in the Bay of Bengal.

Received

1. Introduction

[2] Sea turtles, one of the ancient species of Triassic period in Mesozoic era extending from 248 to 213 million year ago, were known to mankind in several of their utilities from food to ornamental archives. However, a little is known on their site selection for hatching and migration over hundreds and thousands of kilometers in the ocean for their feeding grounds. Several propositions have been made that controls their migratory behavior from earth's magnetic fields to genetic and olfactory reasons (Lohmann *et al*, 1999). The migration often resemblance with that of salmon, the adult females migrate to natal beaches to lay eggs in the sand. Even the birds, those migrate to accommodate the changes in weather. However, the feat that accomplished by sea turtles often puzzled scientists for not alone maintaining the migratory routes over several million years, but also identifying the hatchling location in precision. The Orissa coast in the northwestern part of the Bay of Bengal is well known for the Olive Ridley, the species declared as one of the endangered wild life, congregate for breeding in the late winter months (Shanker *et al.*1999). In the year 2001, a few of the sea turtles tracked in the Bay of Bengal using PPTs through satellite based Argo system. The tracks of the turtle's monitored over several months were studied with reference to sea surface height information of the Bay of Bengal derived from the altimeter data. MODIS derived sea surface temperature and chlorophyll products were also used to understand the influence of local dynamics on the migratory routes of sea turtles in the area.

2. Data and analysis

[3] The Bay of Bengal, the eastern arm of the north Indian Ocean is one of the areas known for sea turtle, Olive Ridley, one of the endangered species, inhabiting from time unmemorable. They migrate from the feeding beaches of southeast Asian countries to breeding grounds along the northeastern coastal belt of India. One of the turtle (PTT 14577) tracked during April to August 2001 moved south along the east coast and turned eastward off the Sri Lanka coast before lost (Fig.1). The Wildlife Institute of India, Dehradun map is the source of turtles tracked in year 2001. Three more turtles (PTTs 14580, 14581 and 14582) also tracked but lost in a short duration off the coast of Orissa. Most of them remained in the offshore waters till the end of June 2001 being caught in the local eddy. To examine the local dynamics,

satellite data products on sea surface height (SSH), sea surface temperature (SST) and surface chlorophyll maps were used. The SSH anomaly data extracted from the western Bay of Bengal from the AVISO data base mapped for 17 April 2004 and middle of the months of May to August 2001. Similarly MODIS data on weekly SST and chlorophyll data collected for the area was also extracted from the DAAC archives and mapped (Fig.2).

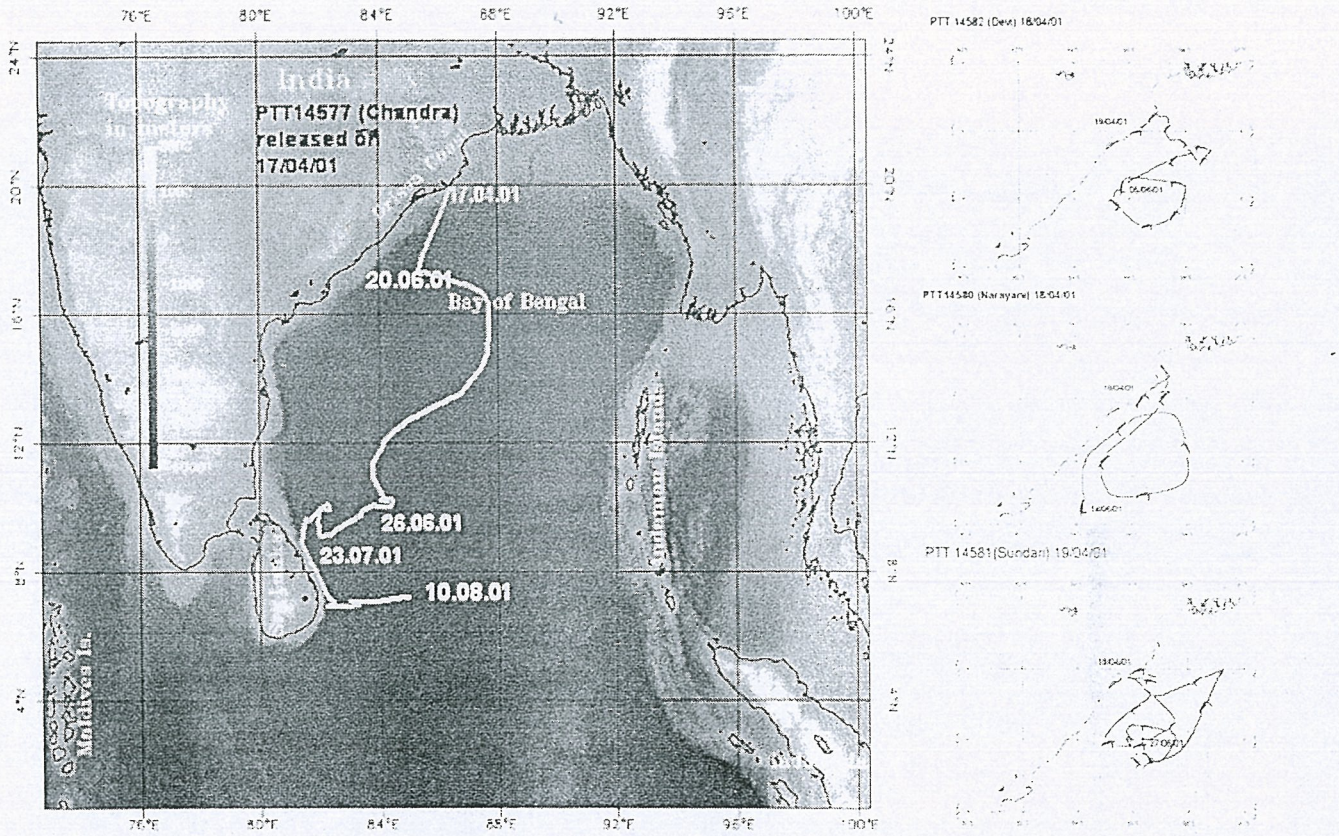

Figure 1: Map shows the study area and its surrounding with a sea turtle tracked during April to August 2001 satellite based Argos system as reported by WII, Dehradun.

3. The Bay during April 2001

The SSH anomaly map of April 2001 showed two ridges in the offshore waters along the east coast indicating presence of anti-cyclonic eddies around 19N, 88E and 17E, 85E. A cyclonic eddy is also seen around 14N, 85E and further south a relatively minor anti-cyclonic eddy is observed off the northeast coast of Sri Lanka around 10N, 84E. The coastal water of northeast was observed to have negative anomalies of SSH. The turtle released in the third week of April 2001 are seen trapped between the two anti-cyclonic eddies of the area. However, one has been lucky to overcome the front and migrate as far s the east coast of Sri Lanka before being lost in the Bay. The chlorophyll-a map corresponding to SSH on 17 April 2001 show a jet of water with high concentration of chlorophyll. This is found in the frontal region that separates the ridges apart along the east coast around 18N. A similar jet is also seen further north along 20N. The intermittent low concentration zone can be associated with the high SSHA in the area. The anti-clockwise rotational features associated with the chlorophyll-a plumes are associated with negative SSH anomalies in the area. Further south, the chlorophyll concentration remained low (<0.3 $mg.m^{-3}$) indicating

difficulty in interpretation of dynamics in the region. The SST field in the same area also support the dynamical features observed with SSHA and chlorophyll-a map of the area. The coastal water are around 27-28°C are associated with high chlorophyll concentration areas of the region. The thermal features are found relatively more complex than corresponding chlorophyll maps of the area. However, the SSHA features were encouraging for interpretation and analysis of turtle migration in the region.

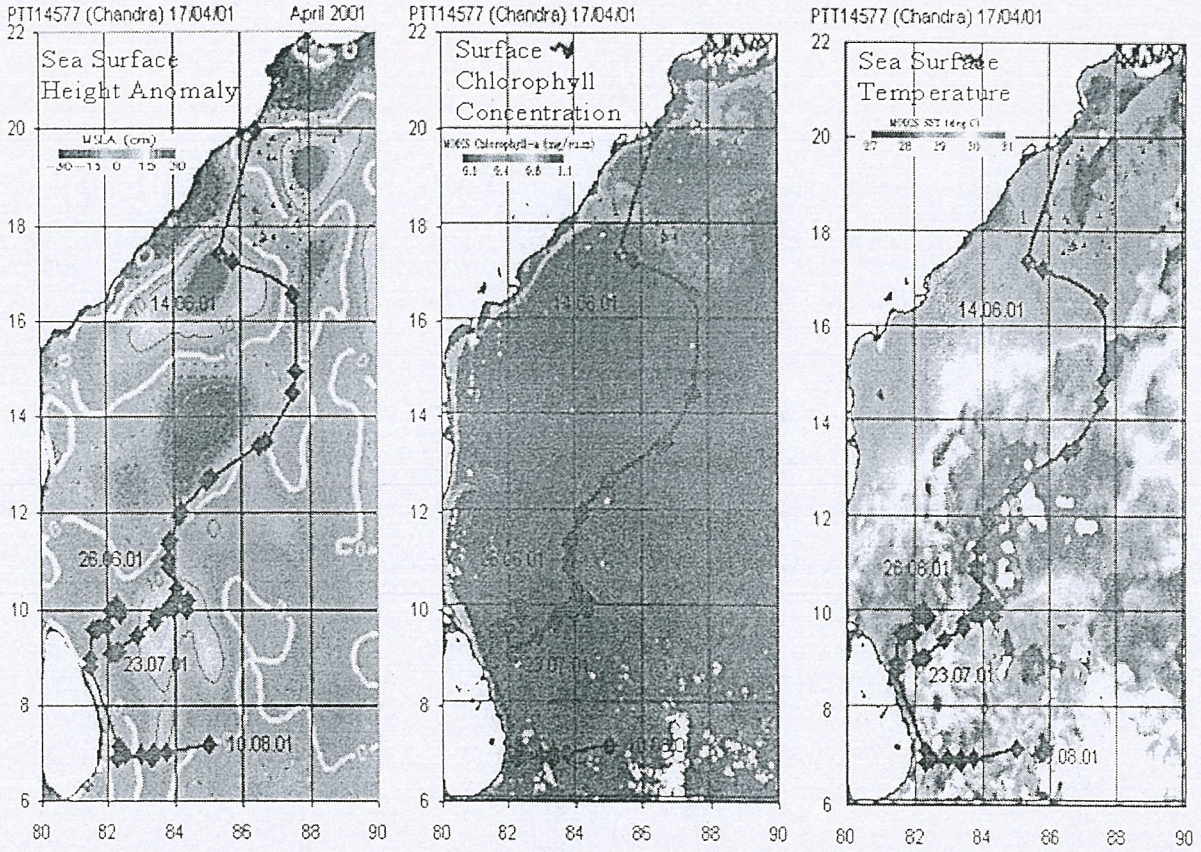

Figure 2: Sea Surface Height Anomaly, MODIS derived Chlorophyll-a and SST maps of the western Bay of Bengal on 17 April 2001.

4. The SSH during April to August 2001

The SSHA maps of the western Bay of Bengal during April 2001 to August 2001 show the change in regional dynamics of the area (fig.3). In April 2001, two ridges representing anti-cyclonic eddies in the offshore waters of western Bay around 19°N, 88°E and 17°E, 85°E observed with an interleaved low connected to the negative anomalies along the coast around 18°N,84°E and in offshore region around 17°N,86°E. In May 2001, the northern eddy is seen loosing its intensity and the gain in negative anomalies is observed to its south. In June 2001, the belt of negative anomaly split into two distinct cyclonic eddies around 18°N, 86°E and 15°N, 89°E. An anti-cyclonic eddy around 18°N, 99°E developed, while the southern ant-cyclonic eddy seen shifting further south and loosing its intensity. In July 2001, the cyclonic eddy around 16°N, 88°E intensified and the southern anti-cyclonic eddy reduced its intensity and the center of the eddy shifted further south. The northern anti-cyclonic eddy is seen getting elongated and shifting towards the coast. In