

## Seasonal occurrence of unique sediment plume in the Bay of Bengal

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Movement of sediment plumes, detectable from ocean colour sensors (Klemas et al, 1975, Khorram, 1981, Nezlin and DiGiacomo, 2005), primarily depends on coastal circulation (Fong, et al 2002). Hence, sediment plumes, become tracers for studying circulation patterns. Indian remote sensing satellite, Oceansat-1, carries ocean colour monitor [OCM] sensor. Using these data, we studied the suspended sediment concentrations [SSC] during 1999-2006 and observed a unique plume off Krishna-Godavari river Basin (KGB). The KGB is located in the central part of east coast of India between 16° 43' and 17° 00' N, and 82° 15' and 82° 22' E [Figure-1a]. Though high sediment concentration is present all along the east coast of India, the offshoot of the plume is present only at Kakinada Coast. The presence, extent, orientation and intensity of this plume have both seasonal and inter annual variations. We superimposed the geostrophic currents available in website [www.aoml.noaa.gov/phod/dataphod/work/trinanes/INTERFACE](http://www.aoml.noaa.gov/phod/dataphod/work/trinanes/INTERFACE) over the OCM observations to delineate this plume and the current pattern that controls its behaviour. These geostrophic currents were estimated using sea surface height anomalies from the available altimeters and a climatological mean dynamic height fields from the OCCAM (ocean circulation climate advanced modeling). The details of this ocean model are available in Fox et al. (2000).

Highest sediment concentration of 55 mg/l is present (Figure -1b) along east coast of India on 2 March 2003. The sediment plume near the Kakinada bay has extended eastward to a distance of about 300 km from the coast. Babu et al. (2003) analysed temperature-salinity, altimeter sea surface height anomaly, wind stress curl and AVHRR temperature data, and observed a Western Boundary Current (WBC) in the Bay of Bengal during spring inter monsoon period (February- April) . Flowing northward along the western boundary of the Bay of Bengal as meandering current, WBC leaves the coast at around 16.25 N and 82.0 E and flows eastward as a strong jet. A semi anticyclonic circulation (SAC) is present to the east of the WBC and a cyclonic circulation (CC) to the north of the jet. Analysis of the geostrophic currents reveals

that the jet is sandwiched between the northern CC and the southern SAC (Figure 1b). As the current turns eastward, it carries along with it the sediment from KGB. The analysis of OCM imagery has distinctly showed the plume trajectory coinciding with the water jet observed in the geostrophic current pattern... The sediment plume follows the jet of water as seen in the 12 March 2003 OCM data (Figure 1c). The resultant movement and location of the plume are determined by the intensity and width of the circulation patterns. During 1 January 2003, the current moved southwestward along the coast. Since no offshore jet is present during this time, the sediment plume is absent (Figure 1d).

In the entire Bay of Bengal, only in the Kakinada Bay such a water jet is present. In other locations, the currents are either parallel or towards the coast due to which no plume is present. Babu et al. (1991), while analyzing the Svedrup transport, observed a strong jet almost at the same location. The plume started on 26 February 2003, fully developed during 12 March 2003 and continued up to 19 May 2003. Presence of an anticyclonic circulation during June 1999 [Fig 1e] pushed the plume in the northeast direction up to a distance of about 200 km. However, around 28 April 2005 (Fig. 1f), a prominent cyclonic circulation was present in the central part of the study area, due to which the plume has moved southward and dissipated after 15 days.

The river discharge is less during northeast monsoon (October – December) compared with southwest monsoon (June - September). Both the northeast and southwest monsoon currents do not favour the growth and elongation of the plume towards deep waters, as it disperses due to strong turbulent and vertical mixing at the source itself. The river discharge is minimal during the non-monsoon season (February - May) when the turbulent and vertical mixing is less. However, the presence of strong coastal and geostrophic currents causes the formation of these plumes even if the river discharge is less. When the current flows from South to North, the plume deflects offshore towards east due to the coastal topography near the study area. From this preliminary analysis, we conclude that the unique plumes observed in the Bay of Bengal is primarily due to the presence of water jet flowing away from the Kakinada coast. The characteristics of the jet control the presence, extent, intensity and the direction of the plume. Due to lack of observations, we could not analyse the chemical composition and

particulate matter concentrations to understand how these plumes evolve as they propagate. This information could help to establish the conditions that are likely to change due to the changes in agricultural practices, increase in human population and climatic change. These studies require a detailed experimental planning that also helps in understanding the origin of the sediments, characteristics of the SSC and features of the plume.

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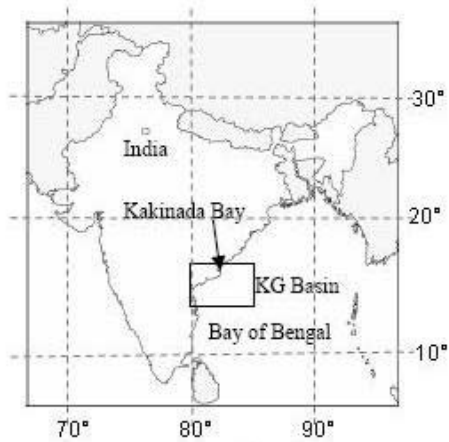
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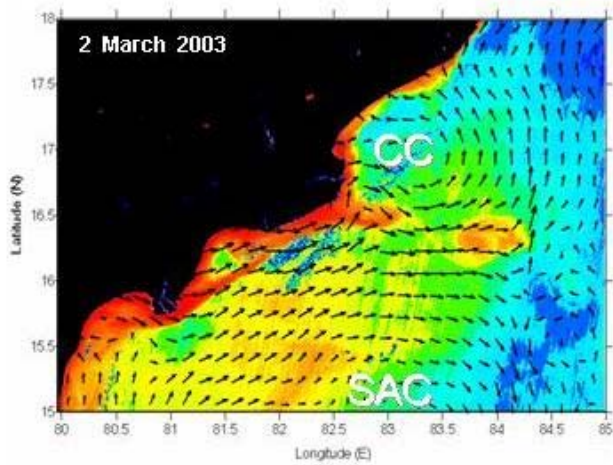
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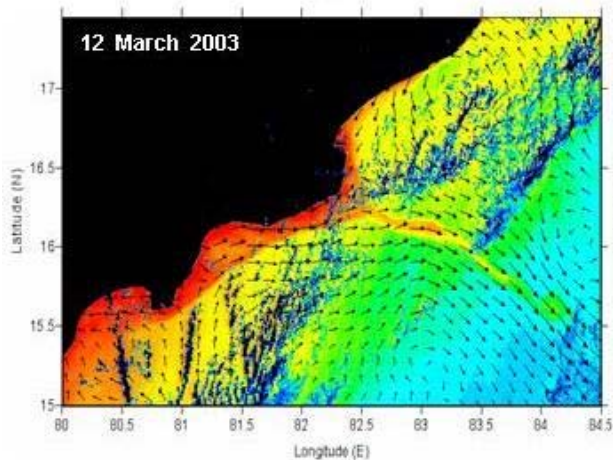
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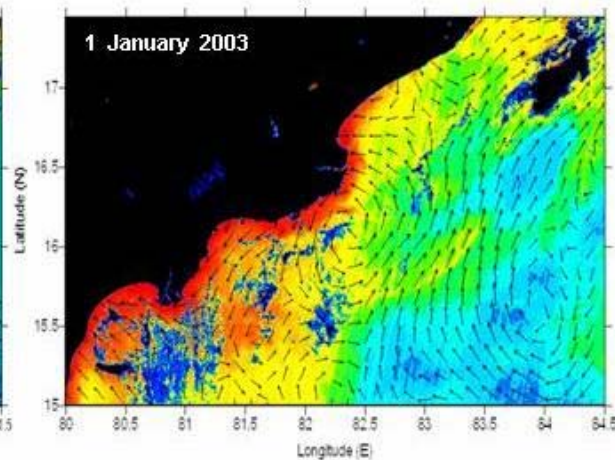
**a**



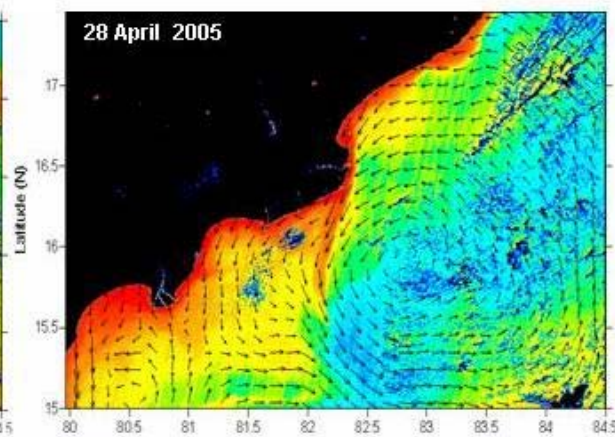
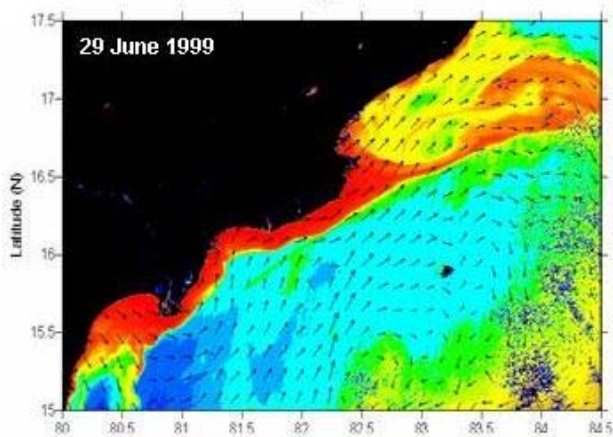
**b**



**c**



**d**



<math>< 1 \text{ mg/l}</math>

> 50 mg/l

**Figure 1: Sediment plume and geostrophic currents in the study area (1a) on 2 March, 2003 (1b), 12 March, 2003 (1c), 1 January 2003 (1d), 29 June, 1999 (1e), 28 April, 2005(1f).**