International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

Modeling the coastal sediment plume dynamics along Krishna Godavari Basin

Aditi Parmar[1], Dr. M.B.Dholkia[2]

[1] *Water resource management L. D. College of Engineering, Ahmedabad 380015, Gujarat, India*.
[2] *Professor, Water resource management L. D. College of Engineering, Ahmedabad 380015, Gujarat, India*.

Abstract - *The coastal zone is the meeting place of land and sea and is one of the most dynamic areas on earth and is subjected to various cyclic and random processes (both natural as well as anthropogenic) that continuously undergo changing the region. The major scope of the project is to quantify coastal sediment transport along Krishna Godavari Delta of the Eastern Indian coast. Sensor level radiance data of OCM for the year 2017 is downloaded and analysis is carried out. Atmospheric correction is carried out and water leaving radiance at the visible spectrum is estimated, which is used to derived suspended sediment concentration (SSC) using empirical relationship. The derived SSC is analyzed to study the seasonal variations in the sediment plume dispersion and its advection. During the winter monsoon period, the sediment plumes are observed to get advected southerly, while during the spring inter-monsoon (SIM) period the plumes have a northerly advection. The plumes during the SIM protrude out as elongated arms with eddy formation at its head. The changes in the plume dynamics are attributed to the seasonally varying East Indian Coastal Current. To understand the varying coastal current and its influence in sediment plume dynamics, numerical simulations shall be carried out using ECOMSED model, where sediment transport shall be carried out utilizing the SSC maps derived from OCM.*

Key Words: **suspended sediment concentrations1, ocean colour monitor (OCM)2, Sediment transport model3 , KG basin4 ,Seasonal variation5**

1. INTRODUCTION

The term "coastal zone" is a region where the interaction of the sea and land processes occurs. It is the zone where the most dynamic processes (natural as well as anthropogenic) continuously undergo changing. Total coastline of the world is about 35, 6000 km and the region covers 100% of earth surface. More than half of population of world lives near the coast and about thirty fifth of Indian people live near the India's coastline (7517km). Other than that it contains some productive habitats of Estuaries, lagoons, coastal wetlands and fringing coral reefs. Study of sediment movement is very important to understand changes of the coastline, effect on structures, occurrence of scour surrounding areas effecting stability of structures so protective measures can be taken. For this it is necessary to understand sediment movement along the coastal zone.

1.1 Background

The Indian remote sensing satellite-OCEANSAT carries an ocean color monitor (OCM) sensor with a microwave sensor. Using this ocean color sensors, the movement of sediment plumes is found out which mainly depends on the coastal circulation. So, sediment plumes become important for studying circulation patterns. Though high sediment concentration is present all along India's east coast, the off-shoot of the plume is present only at the coast of Kakinada. The presence, extent, orientation, and intensity of this plume have both seasonal and inter-annual variations. To get information of plume and the current pattern that controls its behaviour, it is important to get knowledge of the geostrophic currents over the OCM observations. A semi-anticyclonic circulation (SAC) and a cyclonic circulation are present to the South and North, respectively, of the jet. Analysis of the geostrophic currents reveals that the jet is sandwiched between the cyclonic circulation and semianticyclonic. As the jet turns eastward, it carries along sediment from KGB. The analysis of OCM imagery has distinctly shown the plume trajectory coinciding with the water jet observed in the geo- strophic current pattern. The sediment plume follows the jet of water. The resultant movement and location of the plume are determined by the intensity and width of the circulation patterns.

Along the entire west coast of the Bay of Bengal, this is the only water jet present near Kakinada Bay. In other locations within the study area, the current flow is either parallel to the coast or toward the coast, with no resultant plume present. Hence, unique plumes observed in the Bay of Bengal are mainly because of the presence of water jets flowing away from the Kakinada coast. The characteristics of the jet control the presence, extent, intensity, and direction of the plume.

2. OBJECTIVES AND METHODLOGY

I. Objectives

The broad objective of the present study is to understand the dispersal of the sediment plumes near Krishna Godavari Basin.

- To develop an improved algorithm for estimating sediment concentration from satellite data.

- Understanding the seasonal variation on sediment transportation in the coastal zone.
- To evaluate the existing numerical model such as ECOMSED for their results for sediment transport by providing satellite/in situ derived inputs.
- Simulation of sedimentation transport and find the areas likely to get deposited along the KG Basin.

II. Methodology

- Data collection – satellite images, ancillary data
- Data processing, analysis and interpretation
- Hydrodynamic Simulation
- Process Study

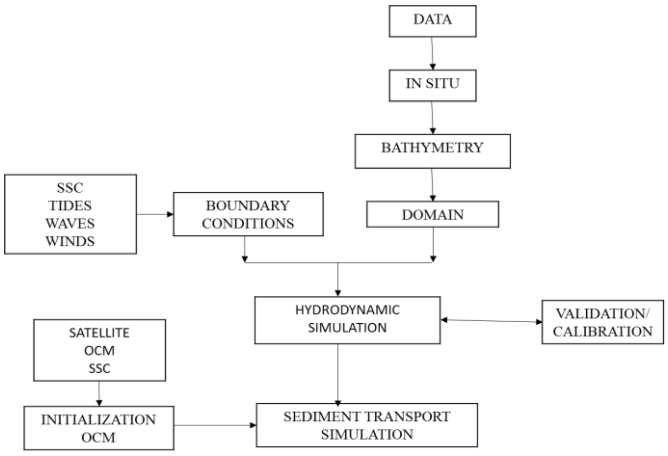

Chart 1 : Flowchart showing methodology

3. STUDY AREA

Krishna-Godavari River Basin (KGB) is located in the central part of the east coast of India between 16°43', 17°00'N and 82°15', 82°22'E. Extensive deltaic plain formed by two large east coast rivers, Krishna and Godavari in the state of Andhra Pradesh and the adjoining areas of Bay of Bengal in which these rivers discharge their water is known as Krishna Godavari Basin. Krishna-Godavari River Basin (KGB) is located in the central part of the east coast of India between 16°43', 17°00'N and 82°15', 82°22'E.The Krishna Godavari Basin is a proven petroliferous basin of continental margin located on the east coast of India It'son land part covers an area of 15000 sq. Km and the offshore part covers an area of 25,000 sq. Km up to 1000 m isobaths.

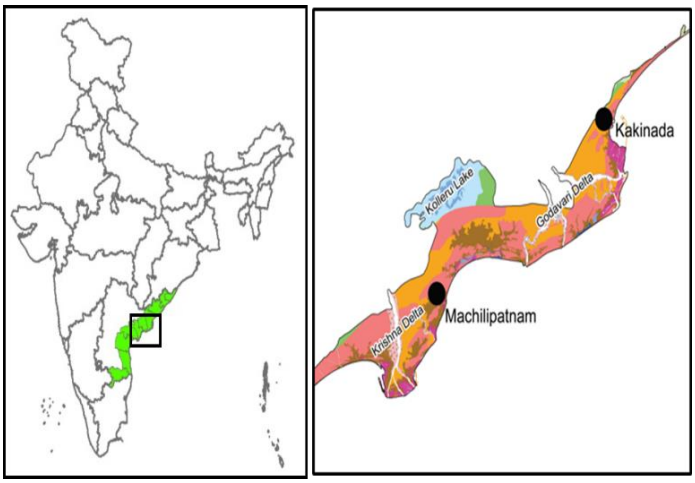

Figure1: KG Basin map

The basin contains about 5 km thick sediments with several cycles of deposition. The maximum thickness of the sediments in Krishna Godavari basin is around 5000 m. controlling factor of the thick pile of sediments is presence of long linear Gondwana rift valley. Palaeontological evidences suggest a period of slow sedimentation and subsidence but changes in water depth during deposition. The major geomorphologic units of the Krishna Godavari basin are Upland plains, Coastal plains, Recent Flood and Delta Plains.

The climate is hot and humid with temperature reaching up to 42˚C during summer. The mean day temperature varies between 35˚C and 40˚C during summer and 25˚C and 30˚C during winter.

4. OCM DATA PROCESSING

Atmospheric correction

Scattering means diffusion of radiation by atmospheric molecules. There are major two types of scattering 1) Rayleigh scattering 2) Mie scattering. (depending upon wavelength) Radiance heavily contaminated by these two scattering molecules that is known as atmospheric path radiance, which constitutes 85% of the total of the atmosphere. So, the procedure of removing atmosphere path radiance from top of the atmosphere radiance is known as "atmospheric correction". Sensors are equipped with few additional channels at wavelength greater than 700nm where ocean is of dark background (due to high absorption of infrared by water). The top of atmosphere (TOA) radiance in OCM channels seven (765nm) and eight (865nm),mainly corresponds to contribution coming only from the atmosphere, since water leaving radiance L_w can be safely assumed to be zero. L_r , Rayleigh scattering is computed along well established theory.

So, from L_r whichis known, L_t is assumed to be equal to L_a, which is aerosol path radiance.An exponential relationship for spectral behaviour of the aerosol optical depth has been used in the atmospheric correction algorithm.

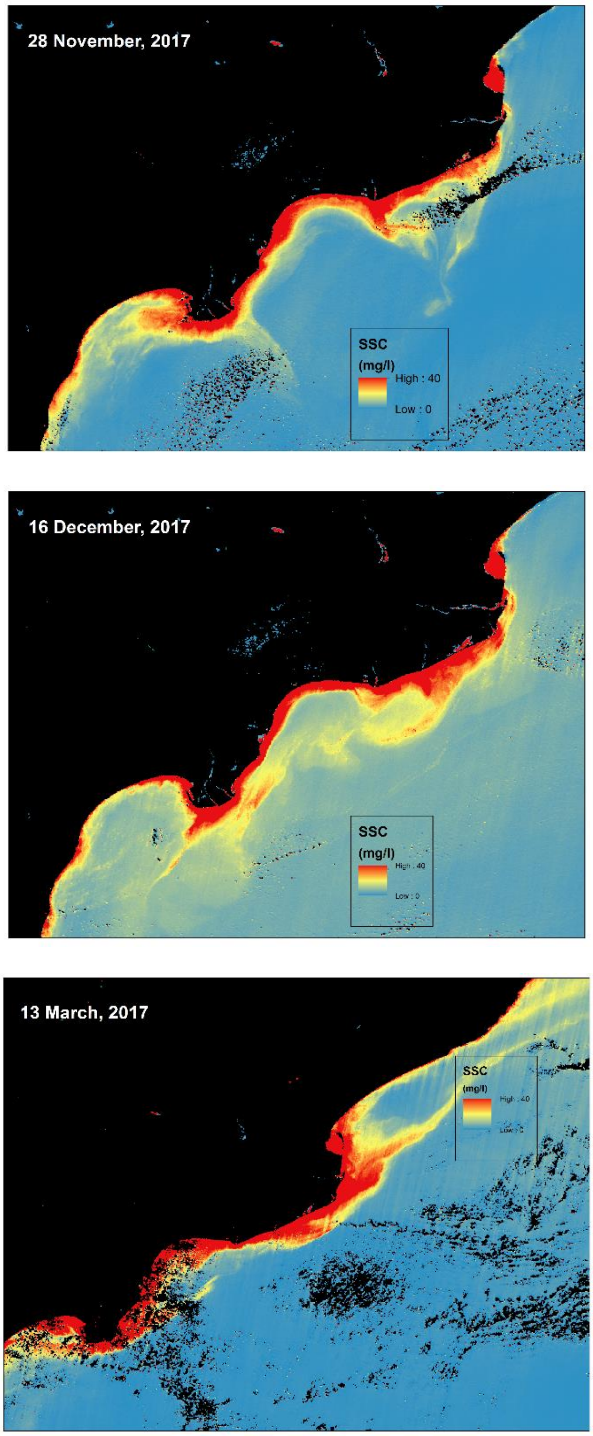

Figure2 : OCM derived SSC

4. CONCLUSION

Bands are retrieved from OCM data and further processed for atmospheric correction. Here is main aim is finding out the suspended sediment concentration and then to compare them with different months and different days of month. So, basic aim is to find out the seasonal variation of sediment transport of KG basin. Further finding possible deposition of sediment plumes so hydrodynamic by generating model we can control this plume deposition. Sediment plume movement with respect to variation of coastal currents have been observed in winter monsoon, Spring inter-monsoon and summer season. The sediment plume concentration is quite evident from above data images by comparing different months. During the winter monsoon period, the sediment plumes are observed to get advected southerly, while during the spring inter-monsoon (SIM) period the plumes have a northerly advection.

ACKNOWLEDGEMENT

This research paper is made possible through the help and support from everyone, including ISRO, parents, teachers, family, friends and in essence, all sentient beings.

REFERENCES

Journal Articles

[1]Babu, M. T., Y. V. B. Sarma, V. S. N. Murty, and P. Vethamony(2003), On the circulation in the Bay of Bengal during northern spring inter- monsoon (March–April 1987), Deep Sea Res., Part II, 50(5), 855–865.

[2]Babu M T, Vethamony P and Desa E 2005 Modeling tide driven currents and residual eddies in the Gulf of Kachchh and their seasonal variability, a marine environmental planning perspective; Ecol. Model. 184299–312.

[3]Chauhan O S, Jayakumar S, Menezes A A A, Rajawat A S and Nayak S R 2006 Anomalous inland influx of the River Indus, Gulf of Kachchh, India; Mar. Geol. 22991–100.

[4]Bentamy, A., Ayina, H. L., Queffeulou, P., Croize-Fillon D and Kerbaol, V., 2007. Improved near real time surface wind resolution over the Mediterranean Sea. Ocean Science 3, 259–271.

[5]Avinash, K., Jayappa, K.S., Vethamony, P., 2011. Evolution of Swarna estuary and its impact on braided islands and estuarine banks, Southwest coast of India. Environ. Earth Sci. 65 (3), 835–848.

[6]Babu, M. T., Vethamony, P., Desa, E., 2005. Modeling tidedriven currents and residual eddies in the Gulf of Kachchh and their seasonal variability, a marine environmental planning perspective. Ecological Modelling 184, 299–312.

[7]Chauhan, P., Shailesh, N., Ramesh, R., Krisnamoorthy, R., Ramachandran, S., 1996. Remote sensing of suspended sediments along the Tamil Nadu coastal waters. J. Ind. Soc. Remote Sens. 24, 105–114.

[8]IRS-P4 OCM\SATCORE PROJECT REPORT