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Could the Plume of Tuxpan River Influence the Norther Reefs of the Reef Corridor of The Southwestern Gulf of Mexico?

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Abstract

For 2005 summer season, the period of maximum rain, surface satellite data: Sea Surface Temperature and geostrophic currents measured with the altimeter radar were used to show the Tuxpan river plume influence over the Tuxpan reef matrix. The analysis showed Tuxpan river plume influence over Tuxpan reef matrix when it has shapes, like a crest form, a bell shape.

Keywords: Tuxpan river plume; Shape of the plume; Tuxpan reef matrix; Sea surface temperature; Geostrophic currents

Introduction

River discharges are strongly influenced by rainfall, which, when increasing, is directly proportional to the expenses of the rivers, which are direct fertilizers for the sea [1]. The Tuxpan river is located in the northern coastal area of the state of Veracruz and is located 10 km from the Tuxpan reef and 15 km from the Enmedio and Tanhujio reefs, which are part of the Lobos-Tuxpan (LT) reef matrix located in the north part of the southwestern reef corridor from the Gulf of Mexico [2,3] (Figure 1). The study area is irrigated by the Common Gulf of México Water (CGMW) recirculated by a diurnal tide and dominated by a mesoscale and wind induced circulation [3-5]. It has been a matter of debate by specialists in the study of corals, whether the plume of the Tuxpan river affect the Tuxpan´s reefs with sandy and mud type sediments which had been found there (Jordán-Garza, personal communication).

River Tuxpan have a summer discharge associated to the rainfall season >139 m^3/s, which is greater than the Jamapa and Coatzacoalcos rivers, located in front of the Parque Nacional Sistema Arrecifal Veracruzano (PNSAV) and los Tuxtlas reefs (TR), respectively [6,7]. The rain in the year of 2005 in the reef corridor of the southwestern Gulf of Mexico 2005, was higher than in 24 hrs. than the general reported average monthly accumulation rain in the study area, inducing strong river discharges of the most important rivers (Tuxpan, Jamapa and Coatzacoalcos rivers) of the coastal zone of the Veracruz state [3,6-8]. There aren´t previous studies which focuses to study the Tuxpan plume River and its influence over the reefs, so in this study, satellite data will be used to study the plume of the Tuxpan River: sea surface temperature, extension, and geometry and its influence on the reef system of the same name (Figure 1).

Results

Rainfall

The rains originate from the arrival of tropical air masses to this region, as well as from the interaction with the orography, their season occurs in summer, a season dominated by the passage of tropical atmospheric systems in the Gulf of Mexico and in the South Pacific, mainly in the Gulf of Tehuantepec. Tropical cyclones are frequent in the rainy season until reaching their maximum in September, before descending to minimum values in November [7,8]. The study was doing on summer of 2005, the rainy season, which was a year of maximum rainfall (117 mm-357 mm) in the reef corridor of the southwestern Gulf of Mexico. So, the rainfall analysis in this study focuses only in those days of maximum rain, which guaranties days of maximum river discharge of the Tuxpan

river in the study area (Figure 1), and of course a major river waters influence on Lobos-Tuxpan coral reef matrix. In June of 2005 there were four days of maximum rain, the values of the rain lesser than to 30 mm/day take place on days 15 and 22.

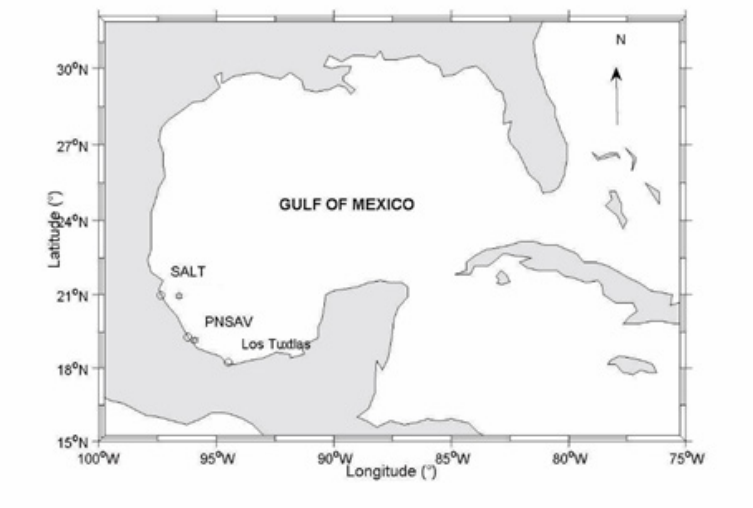

Figure 1: Reef corridor of the southwestern Gulf of Mexico. There are observed the three major reef system in the reef corridor: To the north, Sistema Arrecifal Lobos-Tuxpan (SALT), Parque Nacional Sistema Arrecifal Veracruzano (PNSAV), middle part of the corridor, and to the south Los Tuxtlas reefs.

SST images

Sea Surface Temperature of June 15 of 2005, with values between 28.5°C and 28.6°C, showed the Tuxpan river plume elongated to the north, irrigating the coral reefs of Tanhuijo and En medio, the Tuxpan reef there was not influenced by Tuxpan river discharge, the surface geostrophic currents observed with altimeter satellite had a predominant westward direction (Figure 2). On June 22, the surface current remains with the westward direction and the river Tuxpan plume had an extension to the east, with SST values of 28.92°C and 28.93°C, without an influence of its waters on Tanhuijo reef (Figure 3).

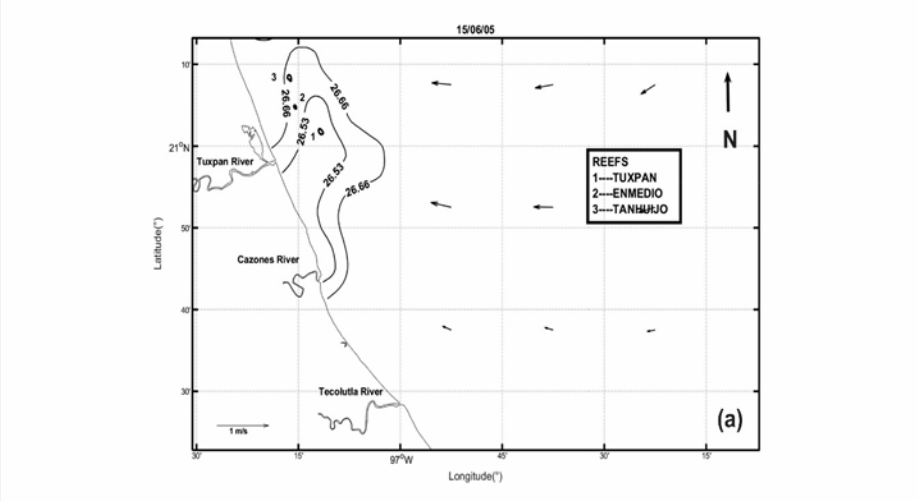

Figure 2: Sea Surface Temperature contour of the Tuxpan River plume plus geostrophic currents for 15 of June of 2005. The numbers indicate the Tuxpan reefs matrix: 1) Tuxpan reef, 2) En Medio reef, 3) Tanhuijo reef.

Discussion

The coastal zone of the study area is irrigated by the Common Gulf of Mexico Water (CGMW) which have mean values of temperature and salinity of 26°C and 36.5 ups [4]. The river plume of the Tuxpan River influences with its discharges the coastal CGMW, increasing the water temperature and reducing the salinity values

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[3]. Moreover, rivers plumes, around the world coastal zones, introducing to the sea sediments, mainly sandy and mud type [1]. Coral reefs of the world, to maintaining healthy must have marine waters without sediments [2]. However, the reef corridor of the southwestern Gulf of Mexico, is highly influenced by river discharges, with high content of sandy and mud type [6], particularly the reefs in front of the Parque Nacional Sistema Arrecifal Veracruzano (PNSAV) and los Tuxtlas reefs, both located at the middle and the south of the study area, respectively. They suffered the influence of the Jamapa and Coatzacoalcos Rivers by their proximity of the reefs in those study areas [1,3,6].

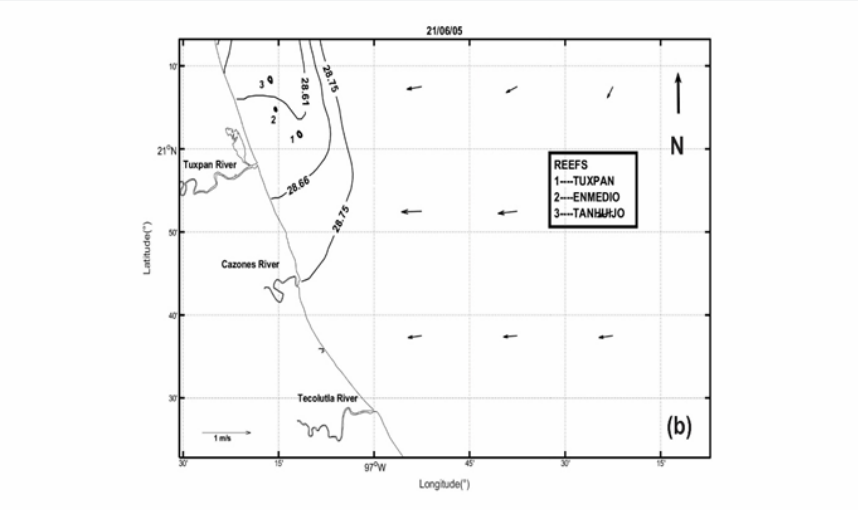

Figure 3: Sea Surface Temperature contour of the Tuxpan River plume plus geostrophic currents for 22 of June of 2005. The numbers indicate the Tuxpan reefs matrix: 1) Tuxpan reef, 2) En Medio reef, 3) Tanhuijo reef.

However, the Lobos-Tuxpan reef matrix, until this study has been in debate by the distance, 10 to 15 km of the Tuxpan River plume to the reef matrix [3]. Our analysis showed the influence of the water discharge of the River Tuxpan plume over the reefs, only in summer season, which is the period of rain, at this period the maximum year (2005) of rain in the reef corridor of the southwestern Gulf of Mexico [8], with a rainfall interval of 25 mm/day to more than 120 mm/day, associated with a river Tuxpan discharge >139 m^3/s. The results analyzed previously, showed that surface mesoscale currents when going from the open sea to the mouth of the river, there could be more influence of it in the Tuxpan reef matrix. The river Tuxpan plume have impact with its water, with shapes: concave and in a form of a crest wave.

Conclusion

The surface satellite data (SST and geostrophic currents), analyzed in this study, showed that the Tuxpan river plume, has influence over the Tuxpan matrix in summer season, the period of maximum rain. The Tuxpan river plume influenced the Tuxpan reef matrix when it has shapes, like a concave form, and in a form of a crest wave.

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