



International Committee on
Global Navigation Satellite Systems



Dissemination and Testing of Rip current forecasting system with NavIC/GNSS enabled devices

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- About 60% of world's population lives along the coast.
- “Rip Current” is a rare known fact but results in drowning around 40 people yearly along the Indian coast.
- Many drownings are underreported due to lack of awareness and less attention.
- No dedicated lifeguarding system exists in India to safeguard these innocent lives.
- No regular water quality checks in the beaches – risk of harmful pollutants to beachgoers.
- The existing methods are expensive and risky.



What are Rip Currents?



- They are strong, narrow, seaward flow of waters usually found in surfzone of many beaches worldwide.

- Typical speed range: 0.5-3 m/s

- Sometimes, speed can be >5 m/s

- It can drown even the strongest Olympic swimmers.

- Important for transport and cross-offshore mixing of heat, pollutants and nutrients.

- They are Silent killers



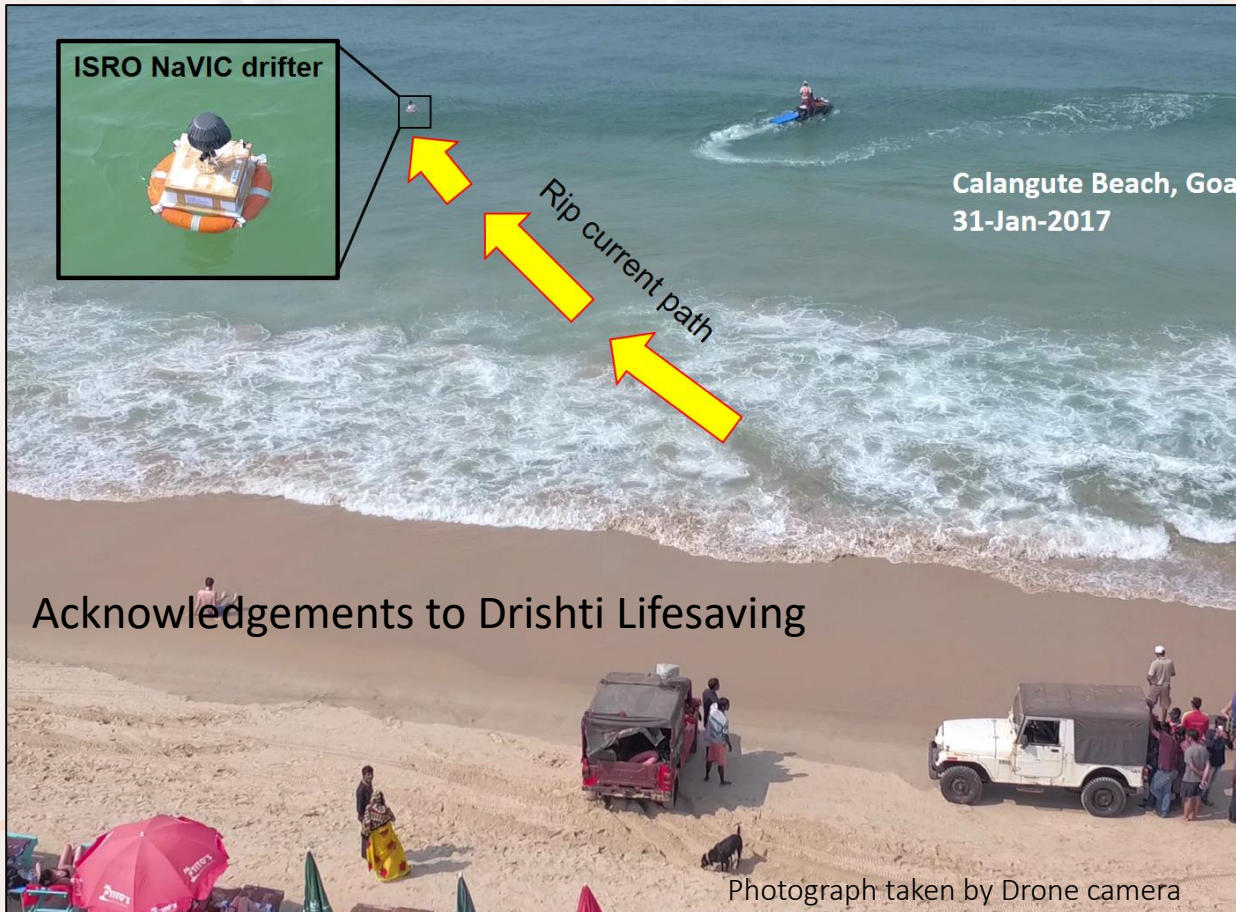
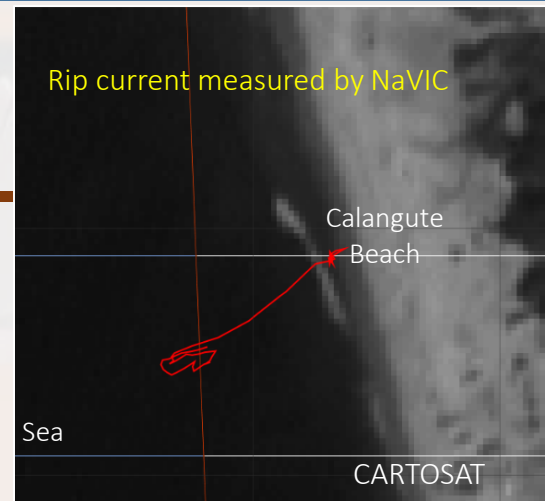
Major Activities include

- ❖ Monitoring using satellite RS & video
- ❖ Development of GNSS/NaVIC Drifters
- ❖ Safe Beach App/Web for Rip current reporting and dissemination.
- ❖ Rip current Forecasting & Dissemination System

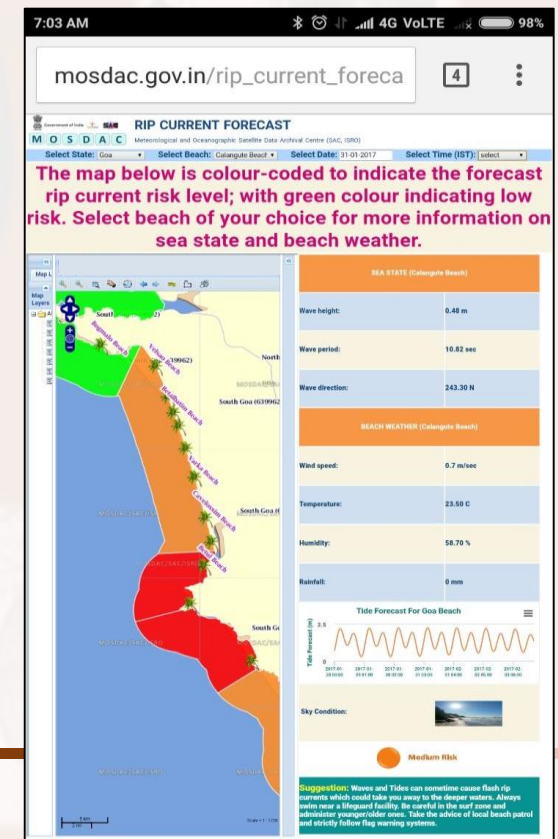


Testing NavIC drifter – v1

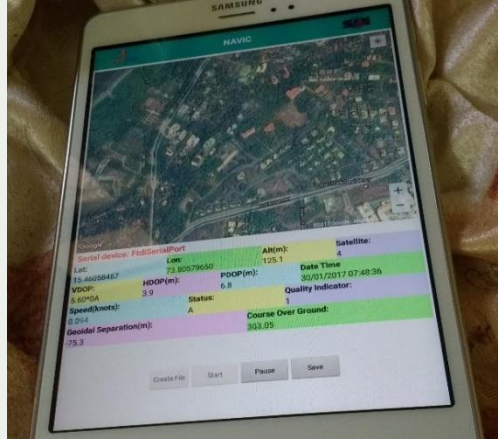
- ❖ SAC/ISRO has demonstrated the use of IRNSS: NavIC receiver for the first time in India to measure the strength, direction and structure of rip current.
- ❖ The rip current forecast on MOSDAC has been validated with the in-situ data obtained from NavIC receiver .



Rip current Forecast on 31-Jan-2017



NavIC Android App



Developed by SAC Team

Inside the drifter



Android mobiles are used to record the data

Installation of NavIC drifter



Red flag indicates Rip current zone



Deployment



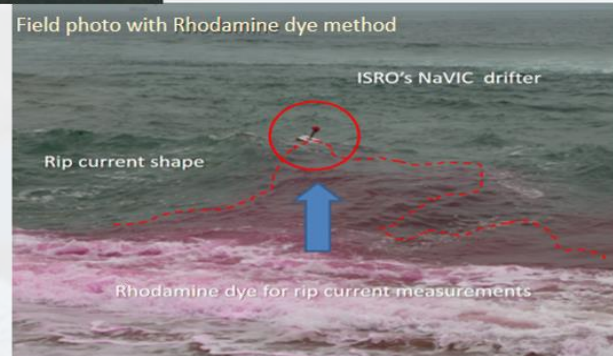
Drone shooting the experiment



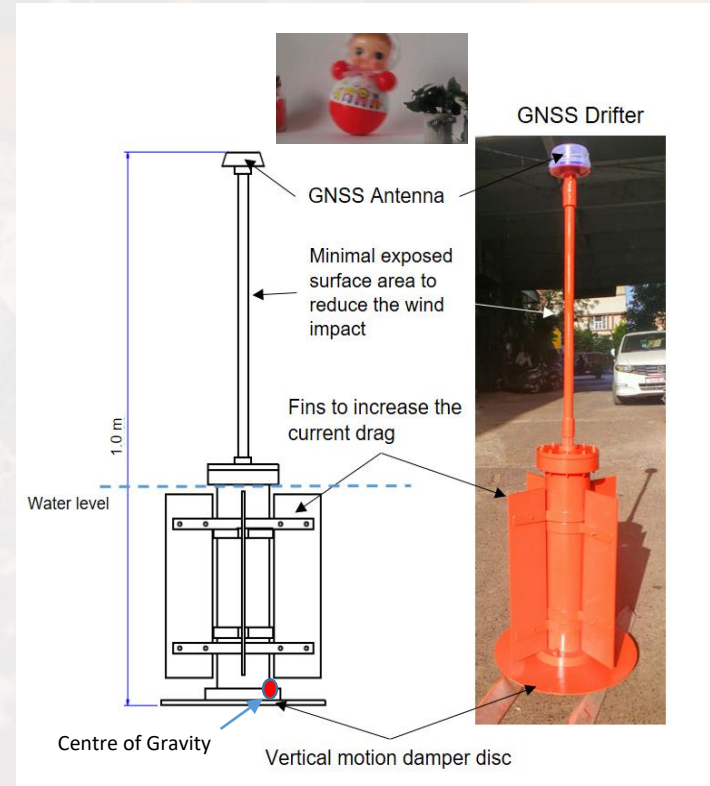
ISRO NavIC Drifter Experiments conducted at RK Beach, Vizag



ISRO NaVIC drifter



- ✓ Design was inspired from a **Roly-poly toy**.
- ✓ Drifter was made from off-the-shelf PVC parts and low-cost GNSS receiver (EMLID Reach®).
- ✓ GNSS receiver stores raw carrier phase and pseudo range internally from GPS, GLONASS, GALILEO, Beidou, SBAS etc.
- ✓ Flanges were introduced to increase the current drag and bottom circular disc to reduce the wave impact.
- ✓ Minimum surface area above sea surface to reduce the wind impact.
- ✓ Very simple design but efficient at sea..!



(Arun Kumar et al. 2019, Current Science)

Item	Price in US\$
EMLID Reach L1 GNSS receiver module	\$200
Tallysman Antenna	\$60
PVC Pipe and other connectors	\$30
20,000 mAh Power bank	\$10
Manufacturing cost	\$100
Total cost	\$400



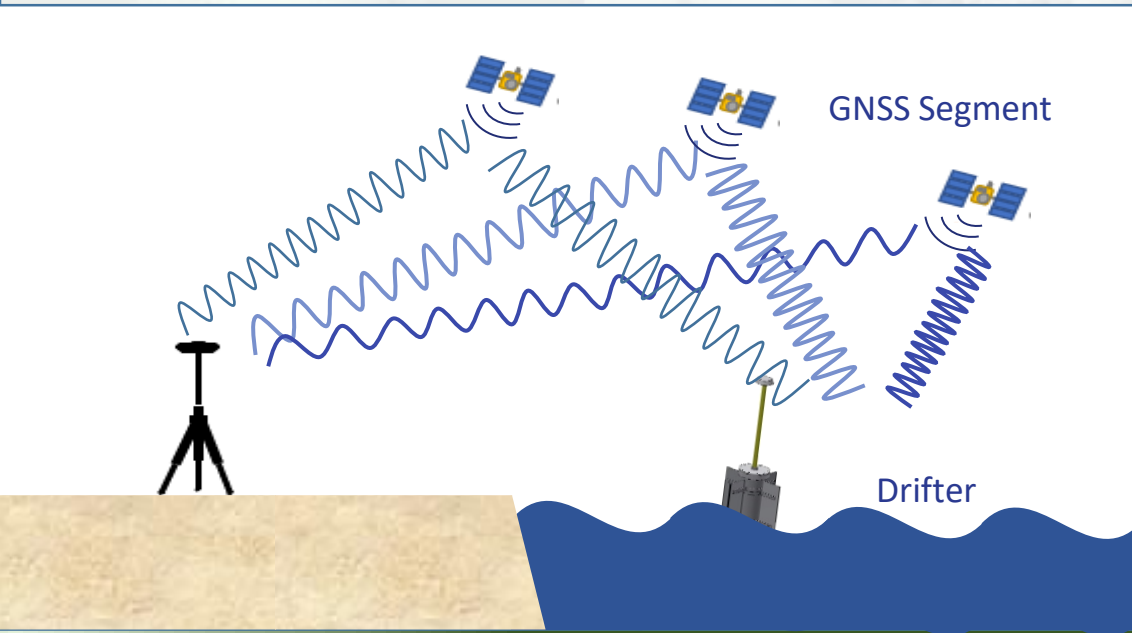
Multi-GNSS Antenna



Emlid Reach® M Module

4GB Memory
Intel Edison Processor
Ublox receiver
WiFi, Bluetooth
USB powered

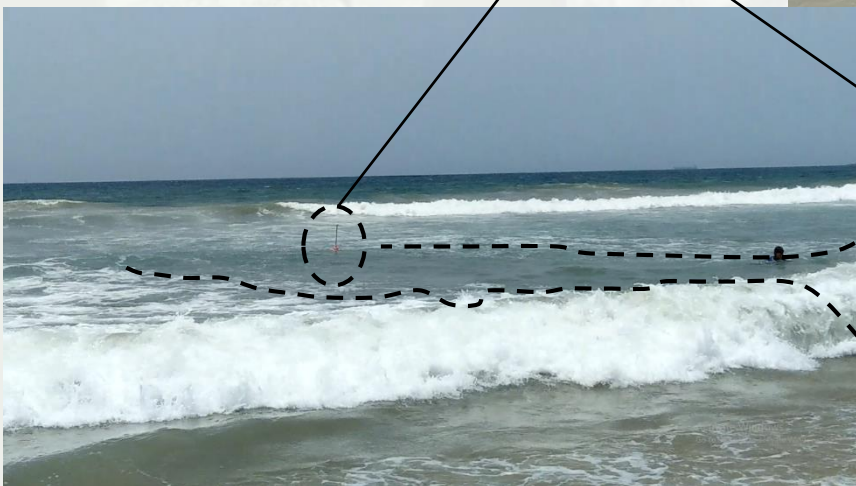
- In order to get precise position, we have used Reach RS (\$700) as a base station (stationary) and recorded the raw logs.
- Drifter and base were simultaneously operated and both the datasets were post processed in RTKLib open source software to get a differential solution (PPK).



Drifter and Dye Experiments

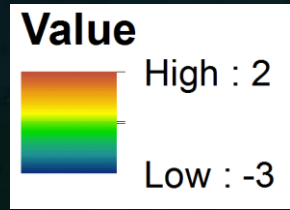


Drifters

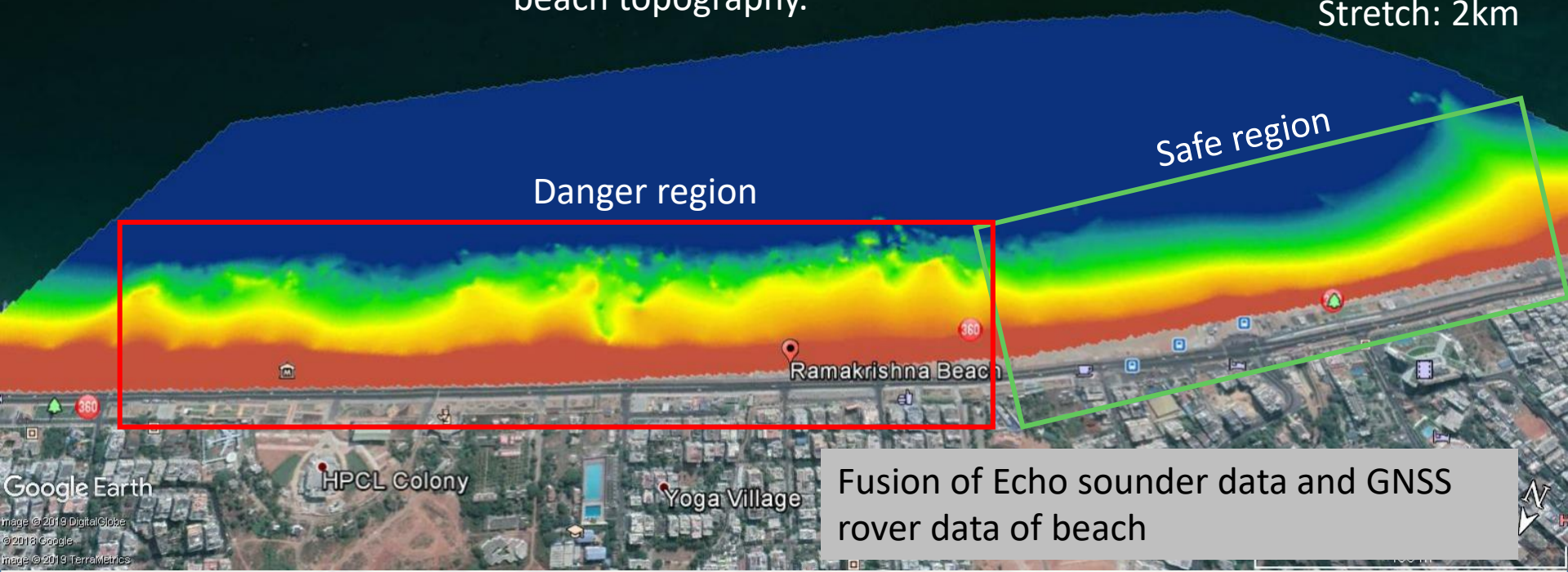




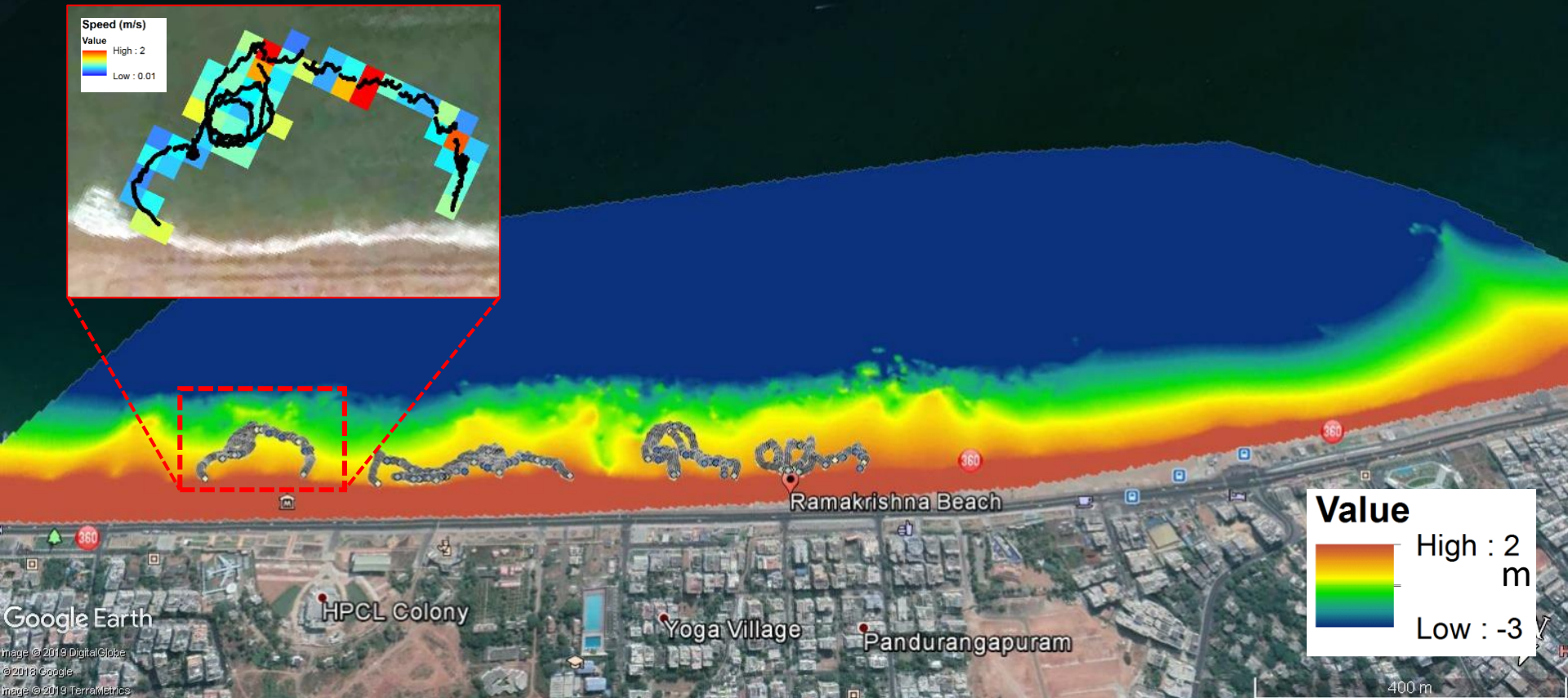
- Surf zone bathymetry was measured using Jet ski along RK Beach.
- Southern section has gentle bathymetry, whereas northern section has natural discontinuities.
- Probability of Rips is **high** in an undulated beach topography.



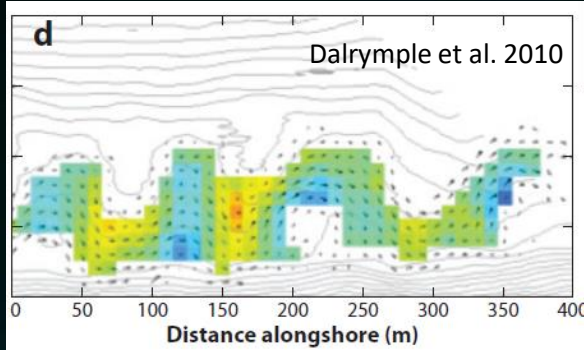
Stretch: 2km



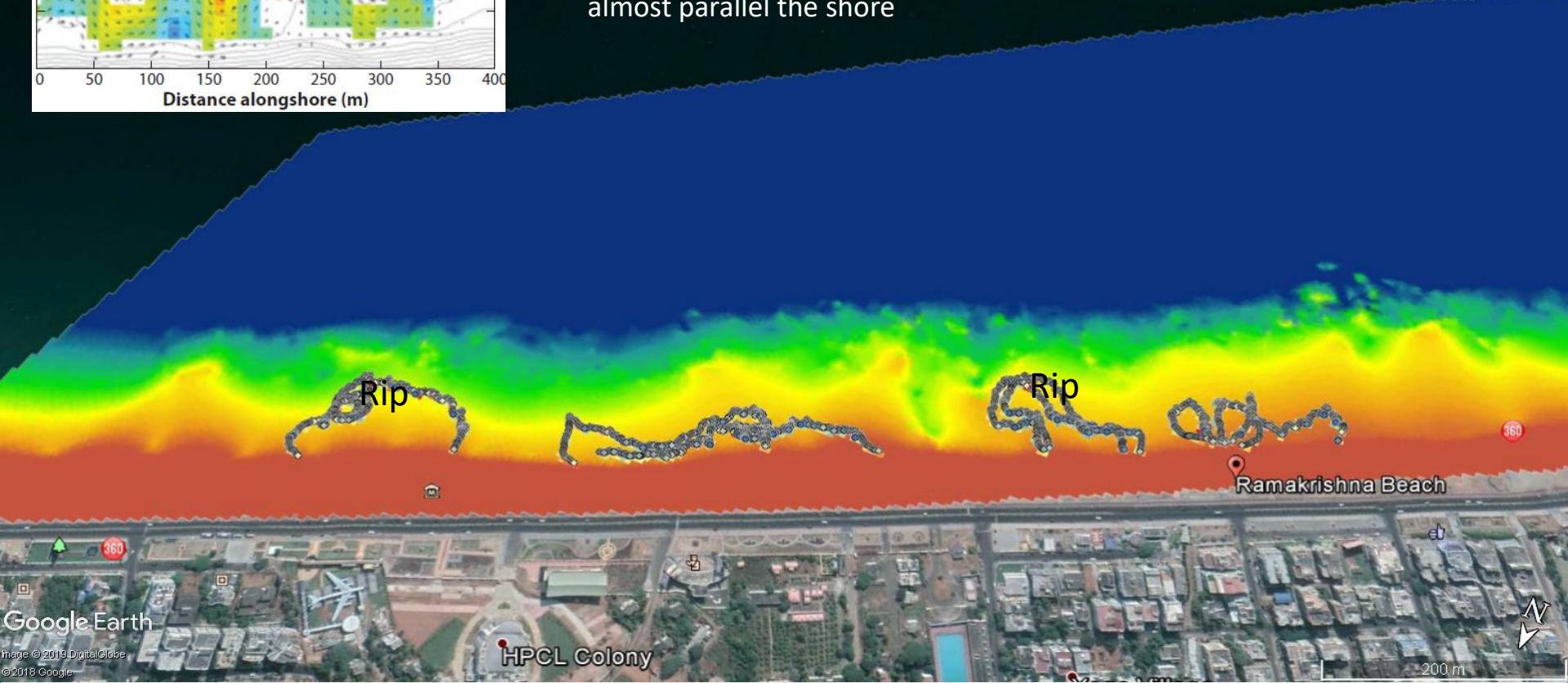
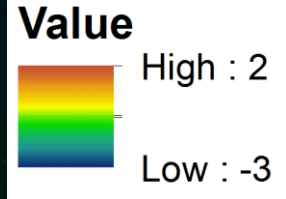
- Two drifters were released in the surf zone to observe the current pattern
- Surfzone (rip current) eddies were observed first time.
- GNSS drifters are capable to resolve its motion and dynamics.

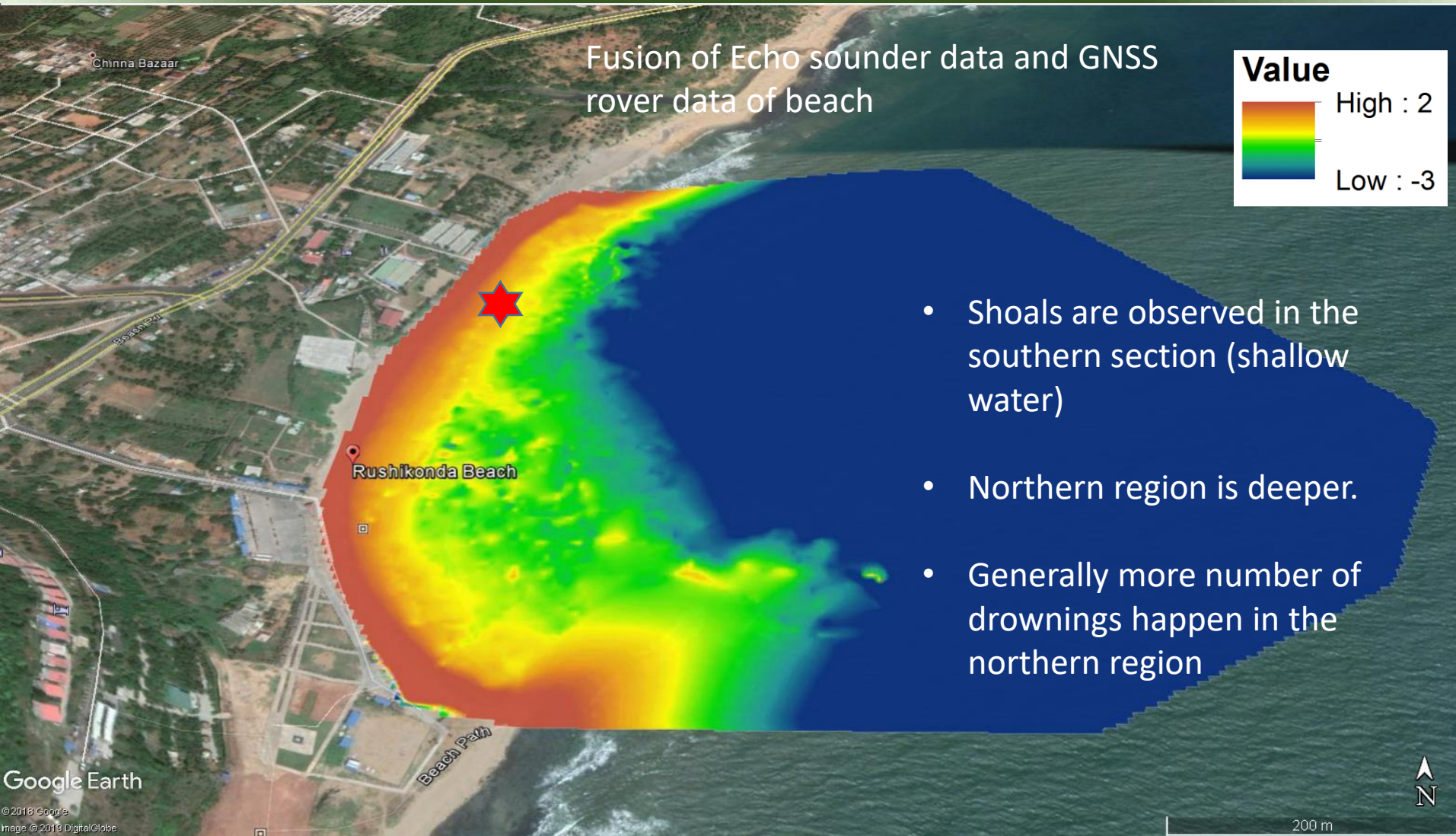


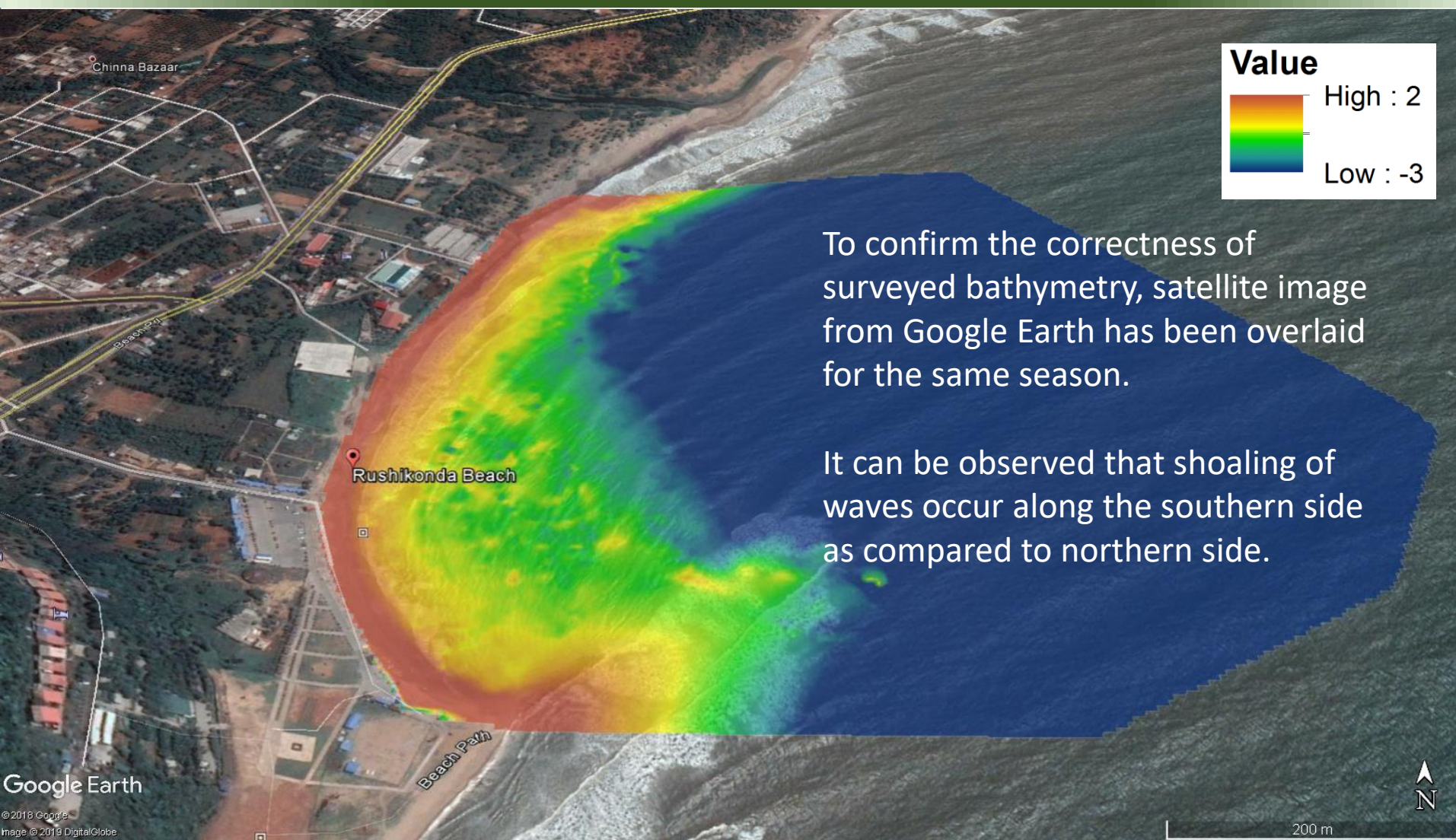
Rip Currents



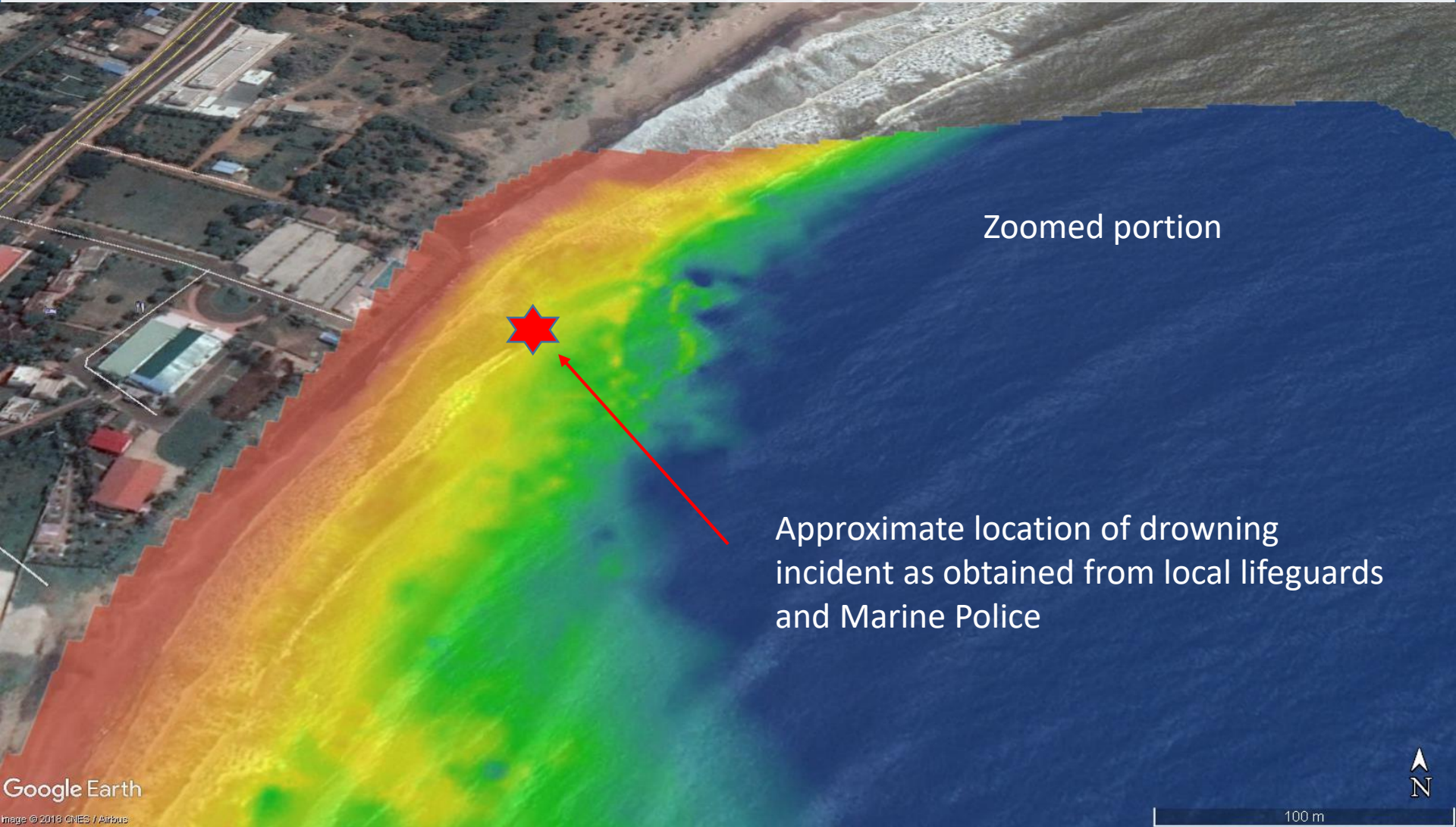
- Drifters (currents) followed bathymetric contours
- Unless they caught in the rip current, the current is almost parallel the shore

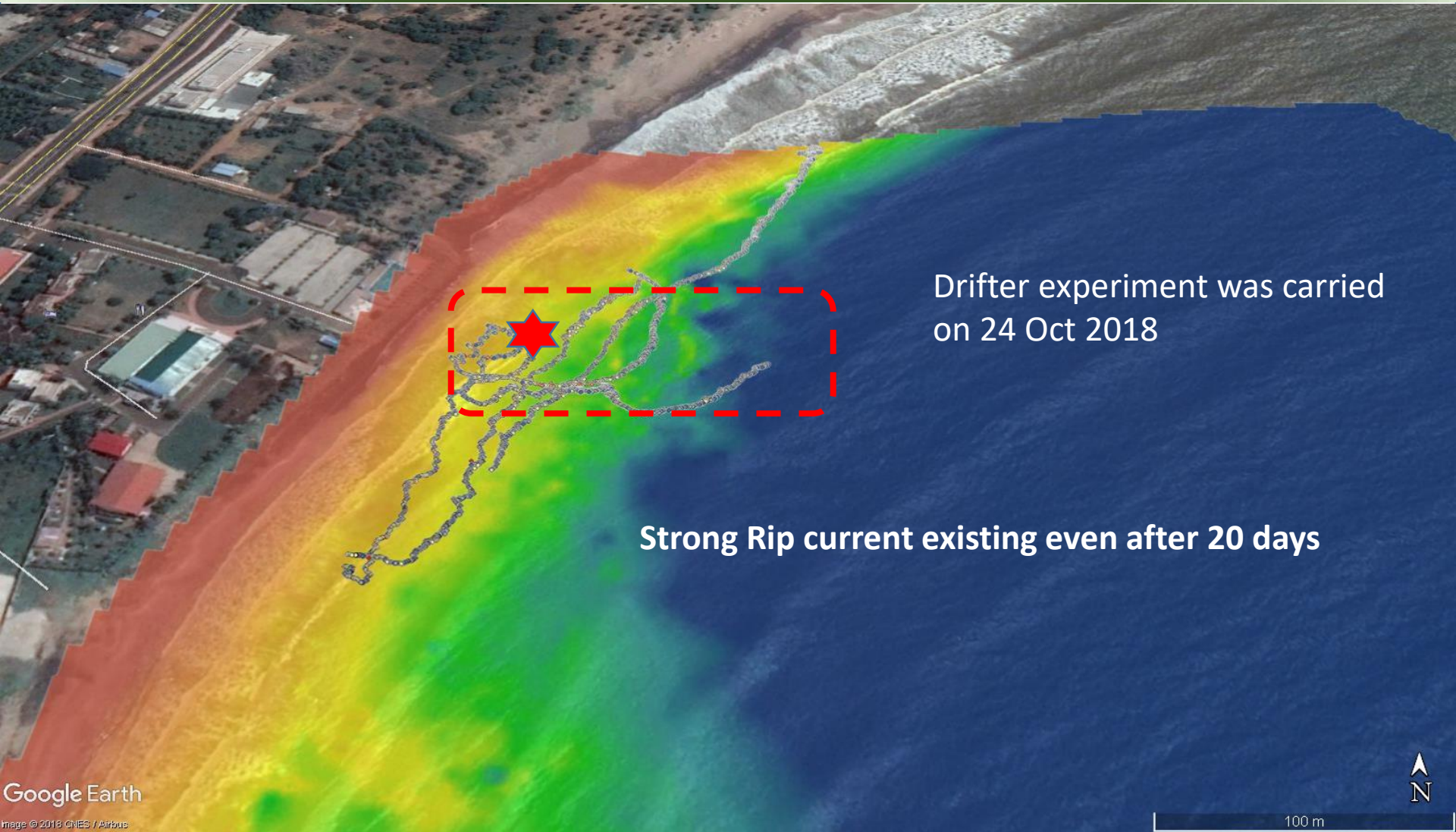




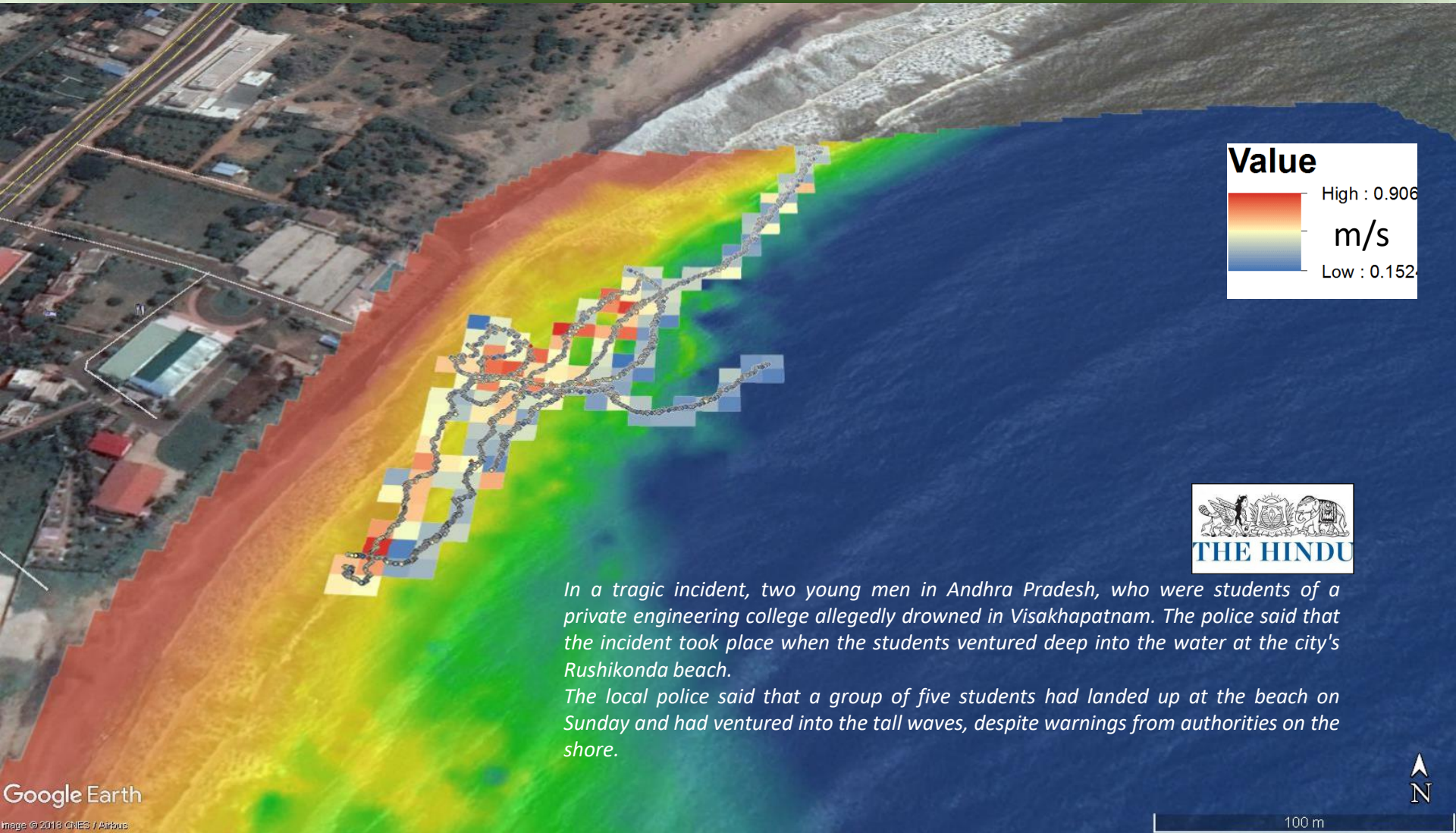


Ground truth after drowning event





Rip Current pattern



In a tragic incident, two young men in Andhra Pradesh, who were students of a private engineering college allegedly drowned in Visakhapatnam. The police said that the incident took place when the students ventured deep into the water at the city's Rushikonda beach.

The local police said that a group of five students had landed up at the beach on Sunday and had ventured into the tall waves, despite warnings from authorities on the shore.



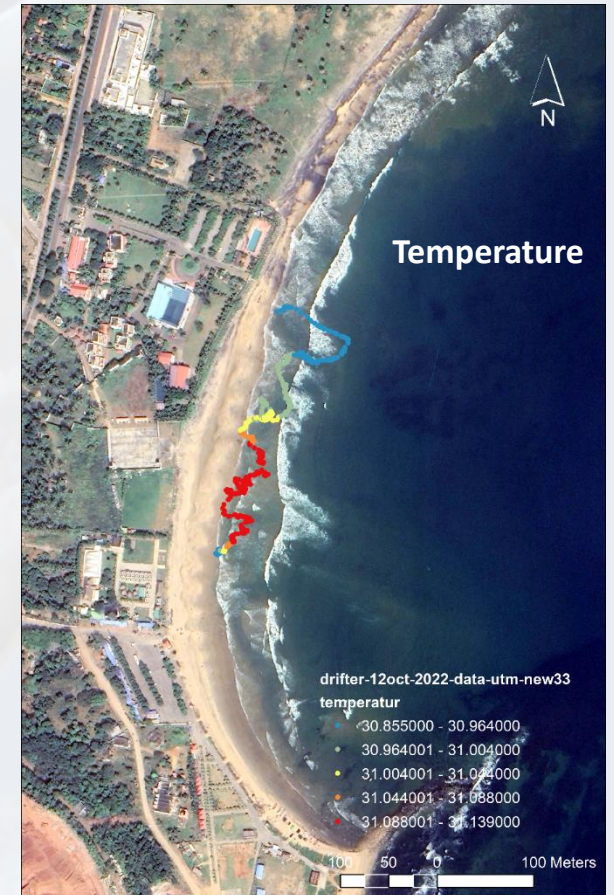
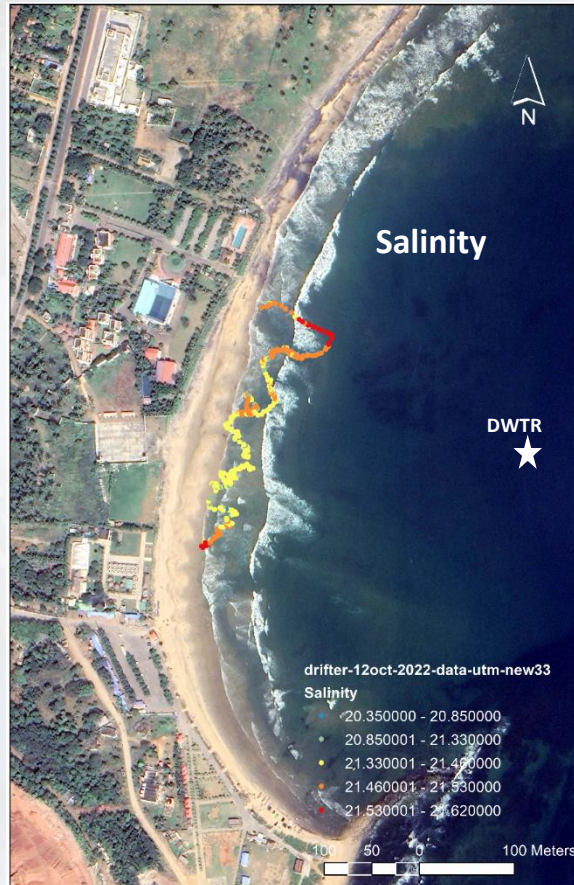
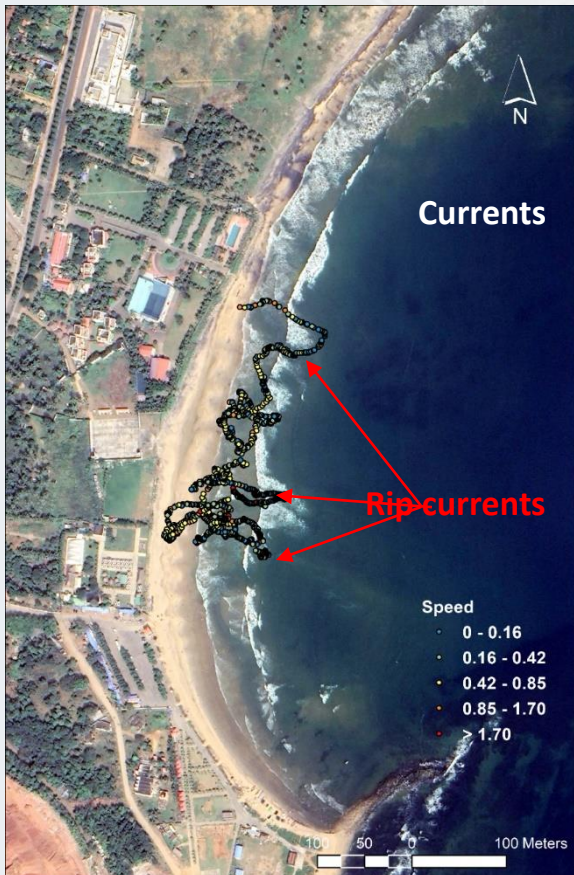
NEMo (NavIC based Environmental Monitoring) drifter

- Currents
- Temperature
- Salinity/Conductivity
- TDS
- Specific Gravity
- pH
- Dissolved Oxygen

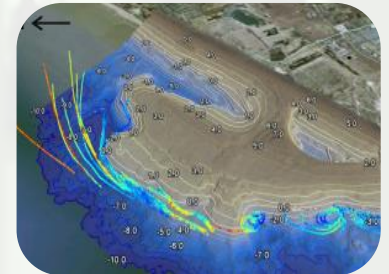
Operated in the beaches at fortnightly interval

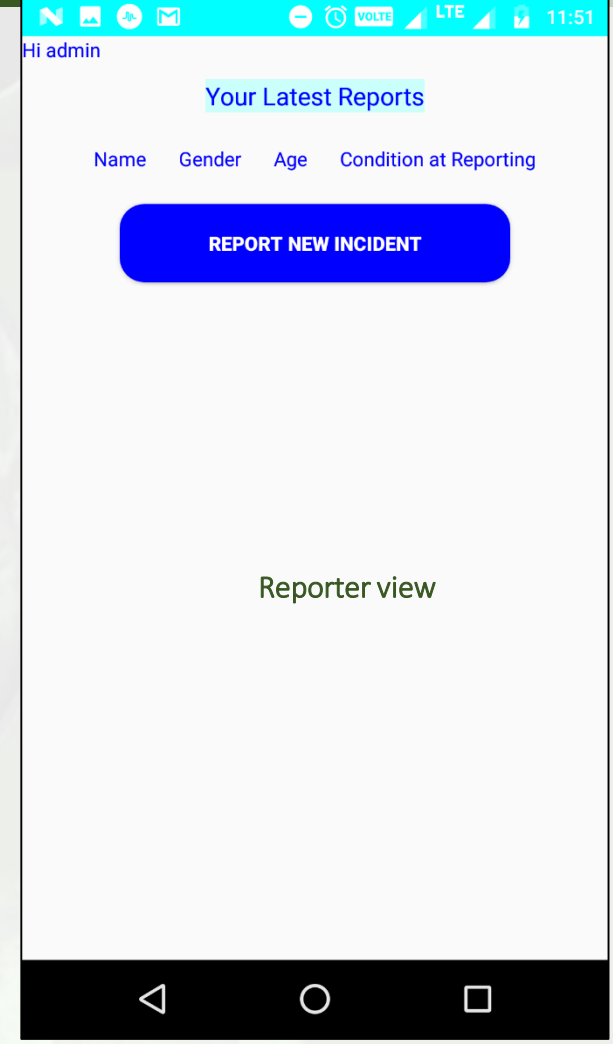
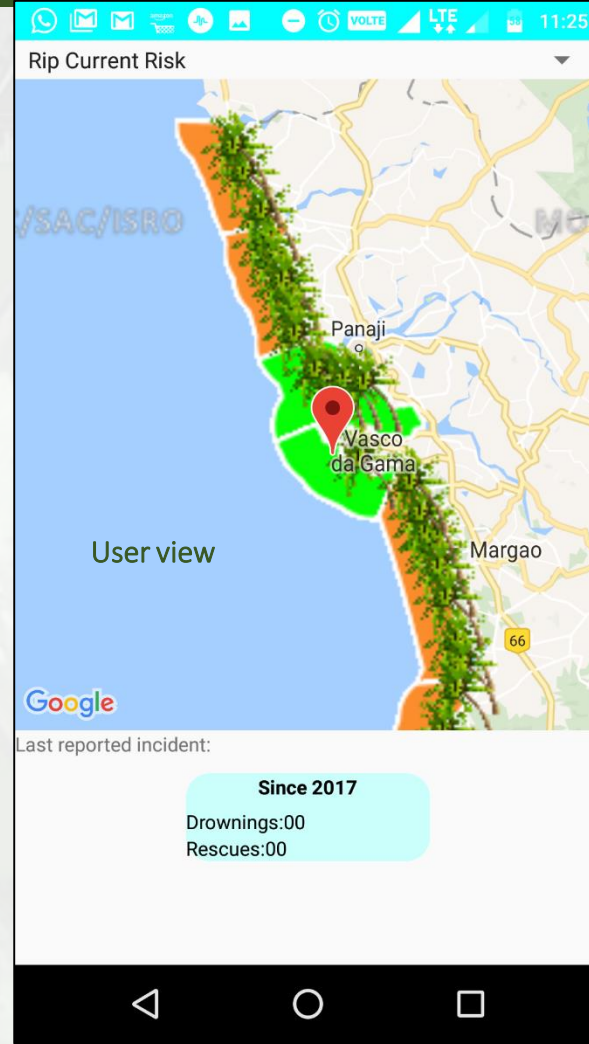
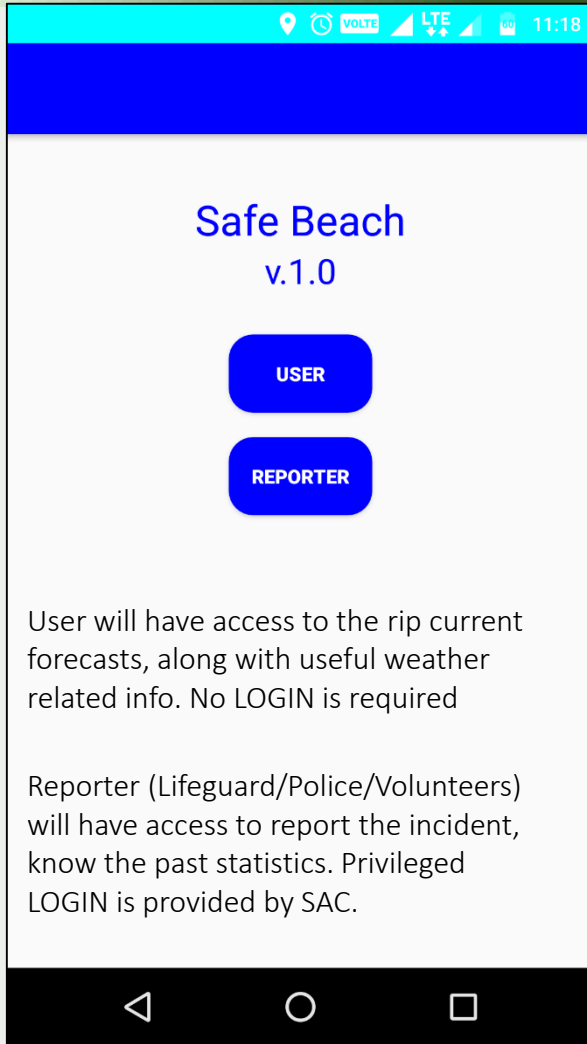
NEMO Drifter Observations

12, 13, 19 Oct 2022



- ✓ Rip current dynamics (spatial & temporal structure)
- ✓ Search and Rescue
- ✓ Oil spill monitoring
- ✓ Bloom tracking
- ✓ Pollution dispersion monitoring in the surf zone
- ✓ Bathymetry mapping
- ✓ Nourishment effects
- ✓ River and estuarine flood monitoring
- ✓ Forensic investigation
- ✓ Military and Naval Coast Guard application





Safe Beach app is the India's first Rip current reporting app, primarily designed to know a safe beach for recreation. It has 2 modes: User and Reporter

Reporter View

Beach Details(Part I)

Beach Name:

Position (latitude, longitude):
Location Not Found

Allow **SafeBeachPro** to access this device's location?

DENY ALLOW

Incident Category:
A-Rescued and Saved

Beach Condition At The Incident:
Eroding

Beach Material At Incident:
Coarse

Beach Details(Part I)

Beach Name:

Position (latitude, longitude):
23.04,72.46

Nearest Beach Station:

Zone:
Swimming Zone

Incident Category:
A-Rescued and Saved

Beach Condition At The Incident:
Eroding

Beach Material At Incident:
Coarse

Weather Report(Part II)

Date:

Start Time of Incident:
11:52

End Time of Incident:
11:52

Weather:
Hot/Warm

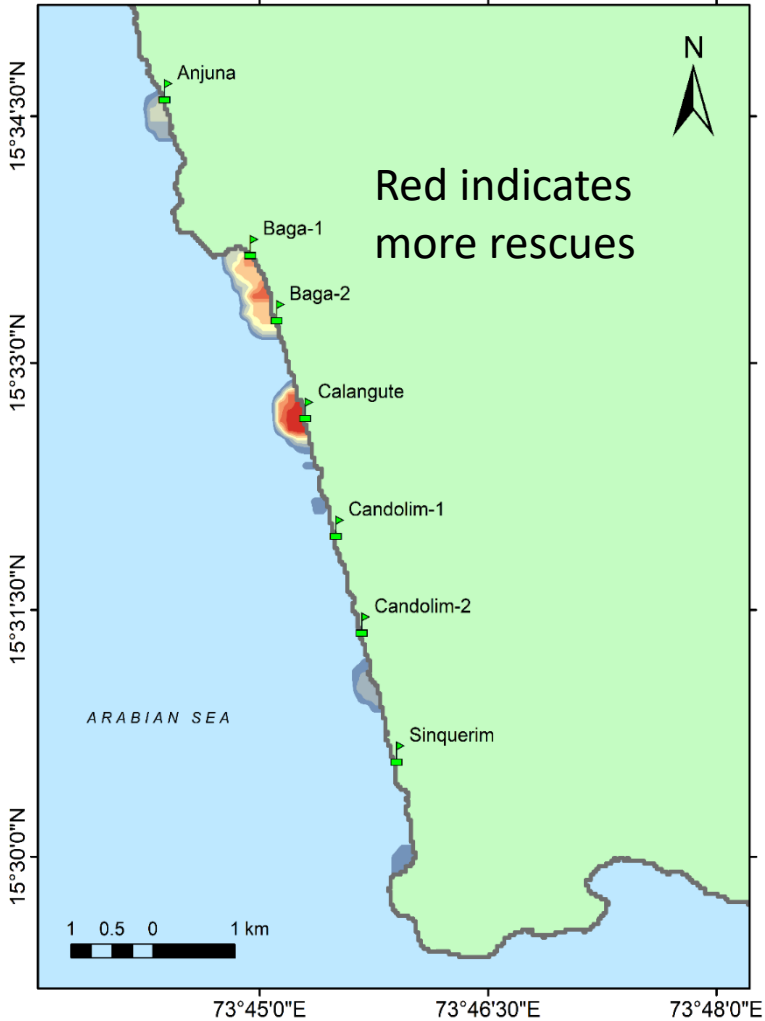
Wind Force:
 Gentle Normal Gusty


Tide:
High(mts): 0 Time(IST): 11:52
Low(mts): 0 Time(IST): 11:52

Crowd Density:
100

This data would be very helpful to validate our rip current forecast, to understand the factors (waves, beach, tide etc.) responsible for the cause of the event, to develop/fine tune our probabilistic models.

Heat map of Rip current rescues



	Doc. No- DLPL-OPS-007
	Incident Report No: Page 1 of 2
	Rev: 0

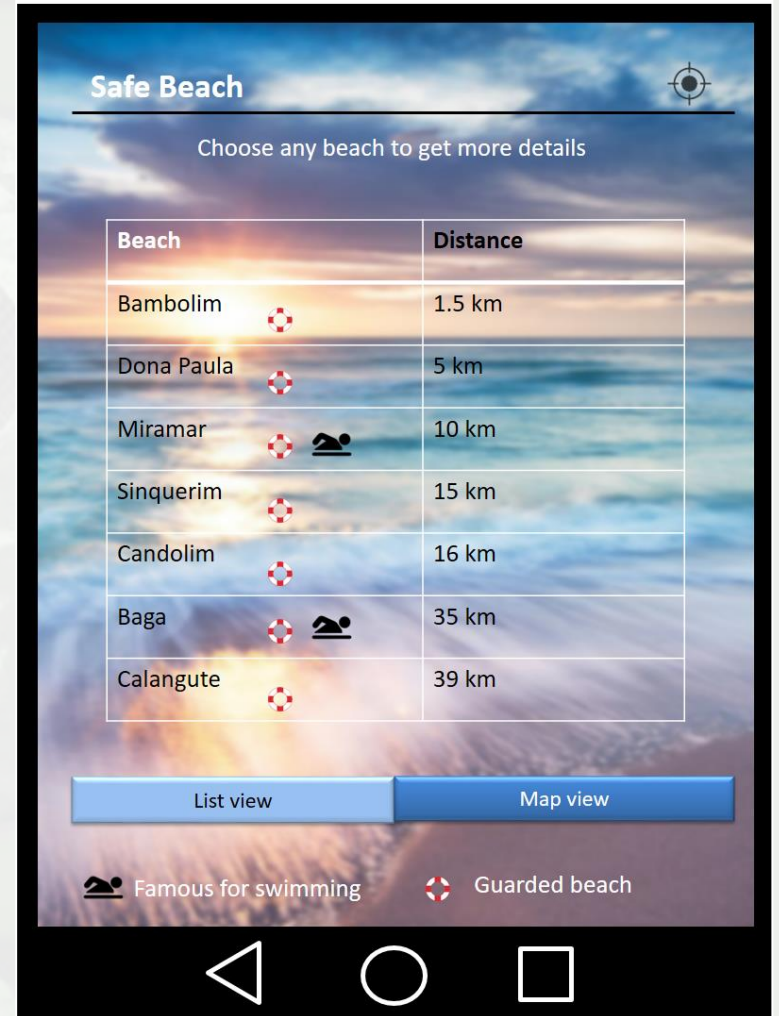
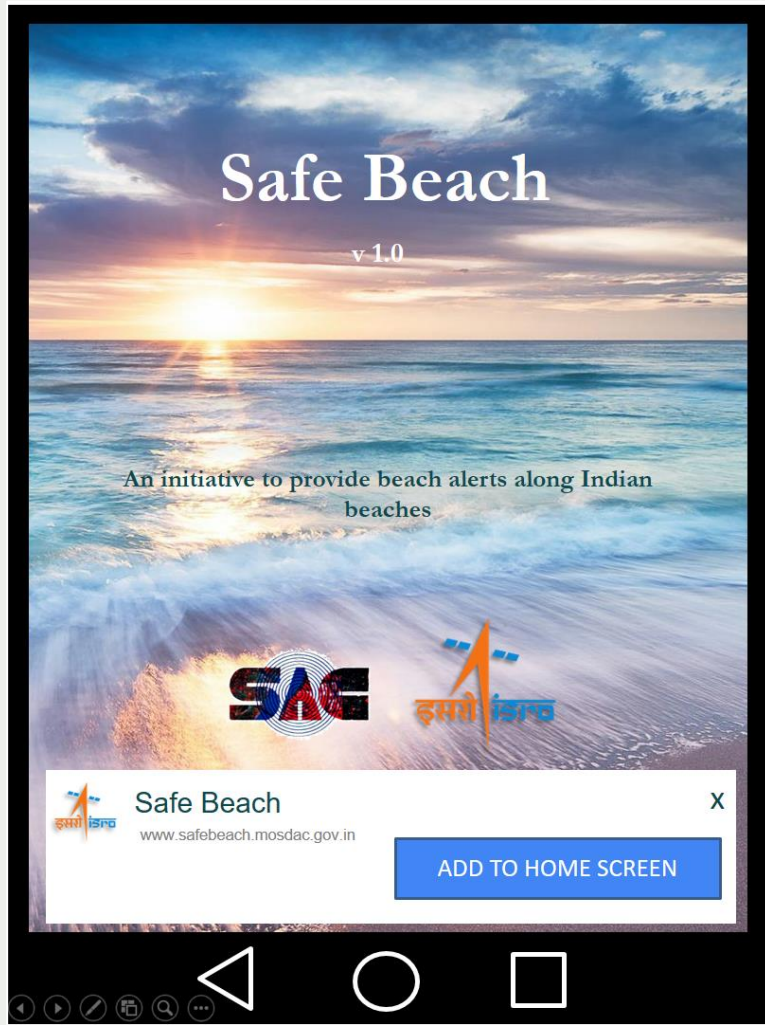
Incident Report			
Beach Name	Mobor	Nearest Beach Station	Mobor
Incident Category	C	Tide status (incoming/outgoing)	Incoming
		Whether under DLPL Jurisdiction /LG hours	Yes
		Zone	Non swim zone

TO BE COMPLETED ON ALL OCCASIONS AND RETURNED DIRECTLY TO ZONE INCHARGE

Date of Incident	23 rd Jan 2018	Start time of Incident	1309 hrs	End time of Incident	1311 hrs
Conditions during incident. Please delete item or tick box as appropriate					
WEATHER	Hot	WIND FORCE	Gentle	Tide: High	1.4 mtrs
				Low	0.5 mtrs
CROWD DENSITY	50-60	WIND Direction	NW to SE	SWELL / SURF	0.5 ft.

Nature of Incident	Single rescue
Equipment Used	Rescue tube
First Aid & Outcome	Nil
Services Involved	DLPL

- Details of Incident and Casualty Type:**
- On 23rd Jan 2018 at about 1309 hrs approx 70-80 mtrs in front of Mobor tower lifeguard Govind Gaonkar was manning a crowd of 10-15 people enjoying in the water.
 - Lifeguard Nitesh noticed one group of 05 guest was trying to swim in the deeper level therefore he was whistling and was requesting them to stay closer and enjoy in the water. Suddenly of them, 30 yrs old male was caught into a rip current and drifted seawards.
 - Lifeguard spotted the same and rushed to his aid after relaying a rescue message to the tower. Victim was secured with rescue tube and brought ashore safely.
 - Upon recovery victim vitals were checked since all found to be normal he was released immediately.





Calangute

A 45 minute bus ride from Panjim , Calangute is Goa's busiest and most commercialized beach of the Goa. The beach is walking distance from the market center. The beach comprises of steep sand shelves and is large enough to accommodate the large number of high season visitors.

Sea State – November to March
 Morning : Calm
 Post Afternoon : Moderate

Sea State – April to October
 Morning : Calm / Moderate
 Post Afternoon: Rough to Very Rough

Lifeguard Beach Station
 Located to the right of Main Entrance


Beach Timings
 7:30 am to Sunset

Beach Popular For
 The beach is popular for huge showrooms filled with exquisite handicrafts from Kashmir, Tibet, Indonesia, Rajasthan and other exotic places, line up the main road running towards Anjuna.

Point of Contact in case of Emergency
 1-800-833-1511

[Know the weather forecast and Rip current danger](#)

Rip current Risk Wave height Wave period Winds

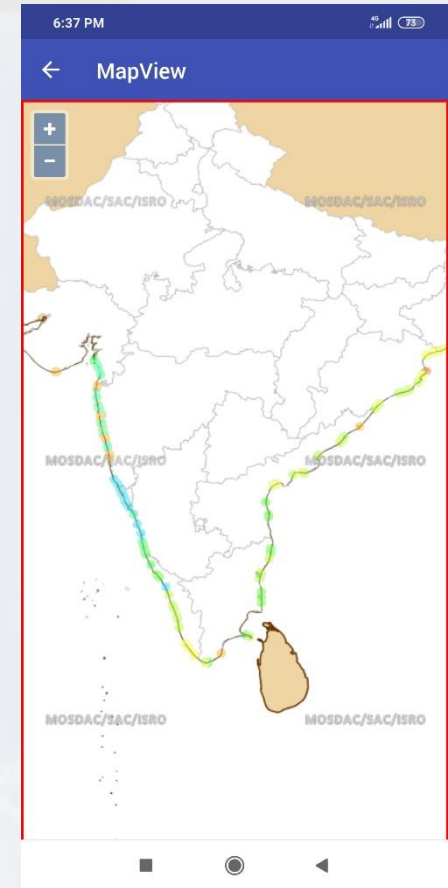
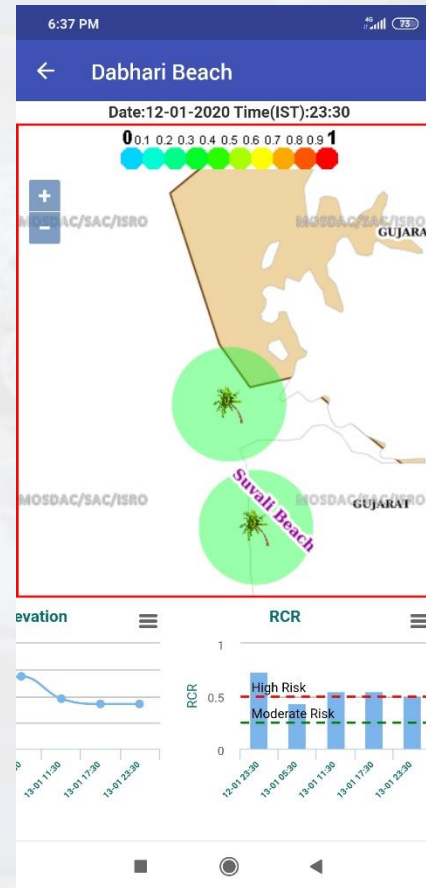
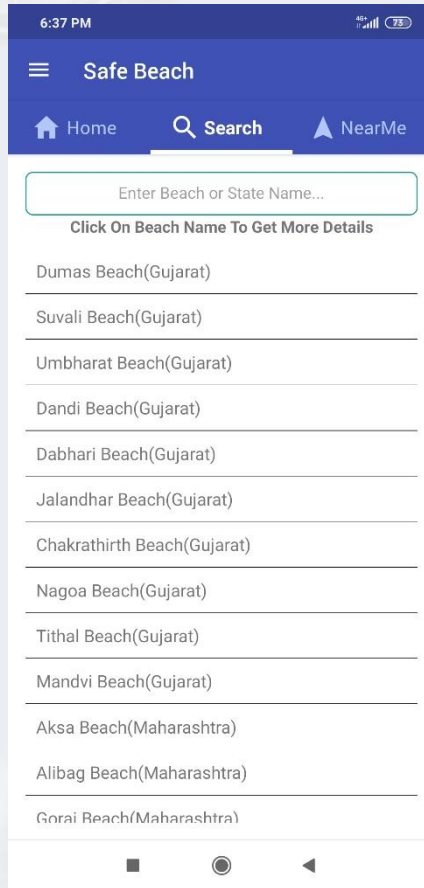


Last reported incident: 11 Jan 2018 at this beach

Since 2017
 Drownings: 50
 Rescues: 105

[Click to view drownings on map](#)

- Android version of **Safe Beach app** is designed with the help of MOSDAC Team.
- Available rip current likelihood forecasts for 175 beaches in India

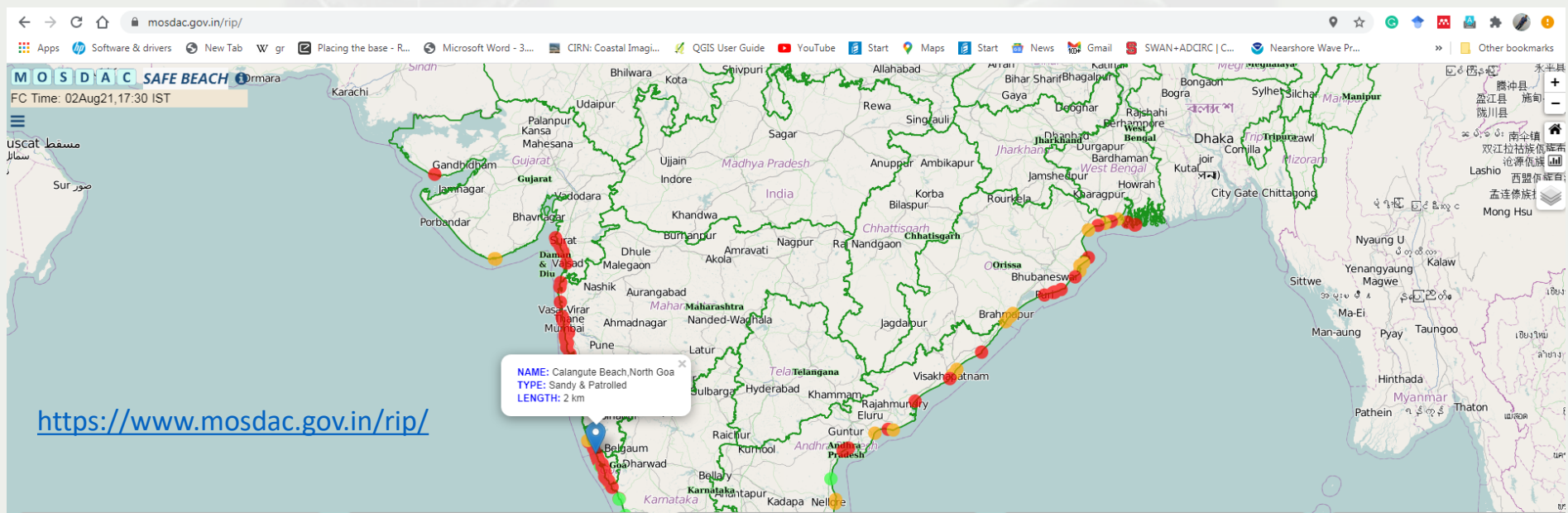


EXPERIMENTAL RIP CURRENT FORECASTING SYSTEM

mosdac.gov.in/rip/

M O S D A C SAFE BEACH

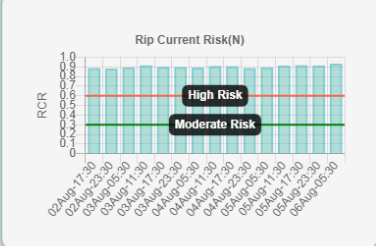
FC Time: 02Aug21,17:30 IST



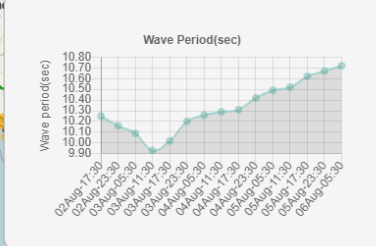
<https://www.mosdac.gov.in/rip/>

Risk at Calangute Beach		
02-Aug-21 17:30	High	
02-Aug-21 23:30	High	
03-Aug-21 05:30	High	
03-Aug-21 11:30	High	
03-Aug-21 17:30	High	
03-Aug-21 23:30	High	
04-Aug-21 05:30	High	
04-Aug-21 11:30	High	
04-Aug-21 17:30	High	

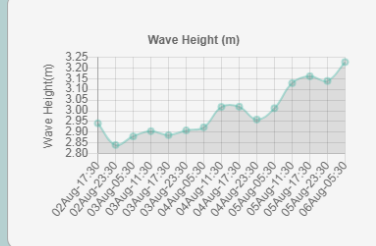
Rip Current Risk(N)



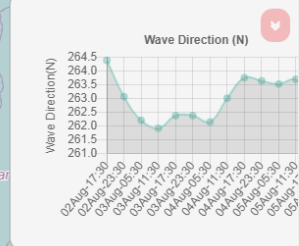
Wave Period(sec)



Wave Height (m)



Wave Direction (N)



200 km / 100 mi

Camera Installation

VBMS Tower

Thanks to AP
Tourism & Vizag
Collector



Video Monitoring and Processing System



View of Beach from Tower

Salient features:

- ✓ First on east coast of India
- ✓ 24x7 monitoring
- ✓ 5MP Full HD video
- ✓ Night vision
- ✓ Enhances safety
- ✓ Multi-purpose research

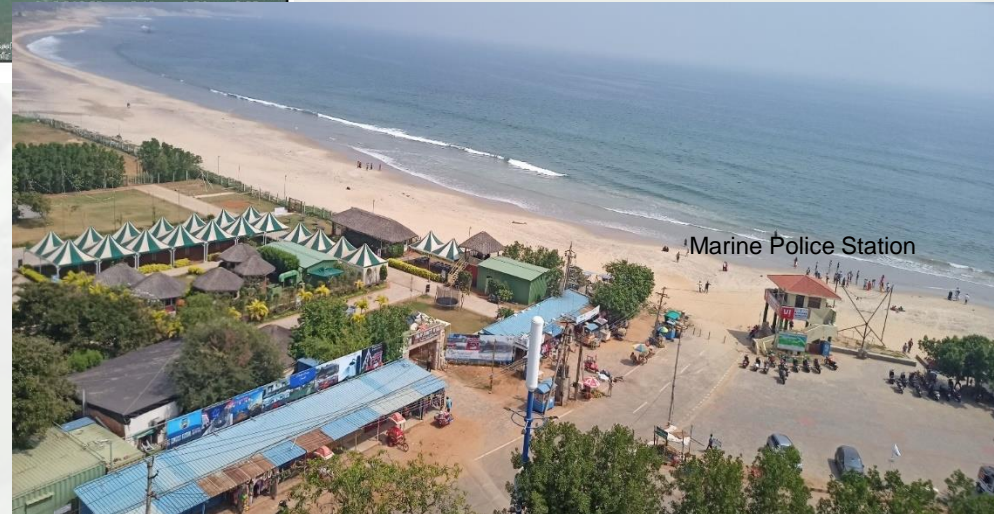
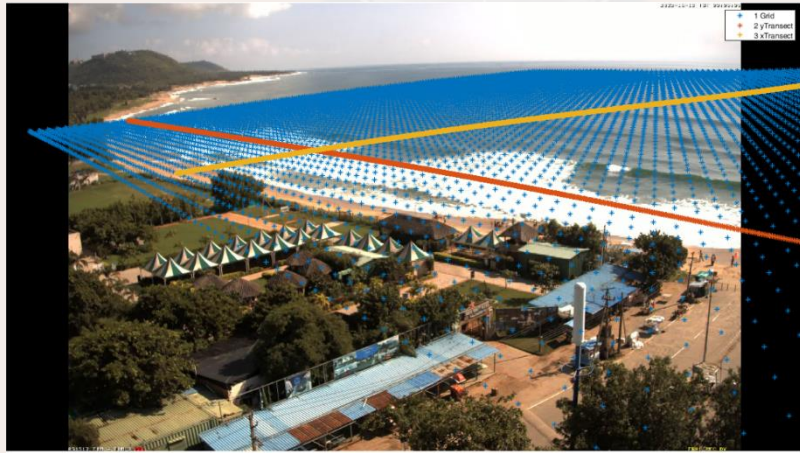


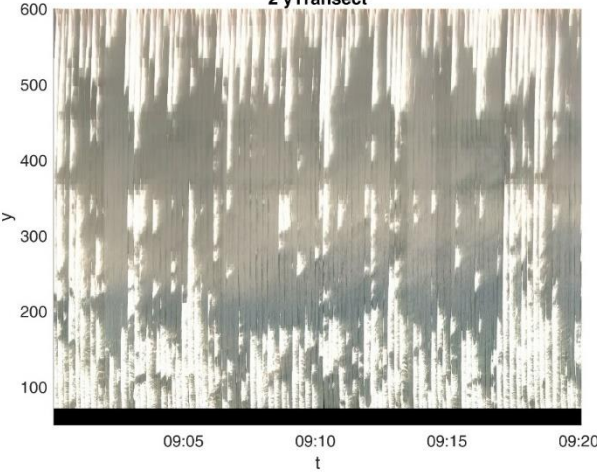
Image generation using GNSS survey



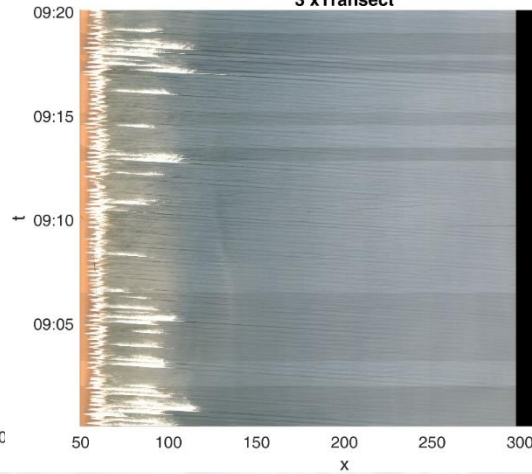
GCP collection



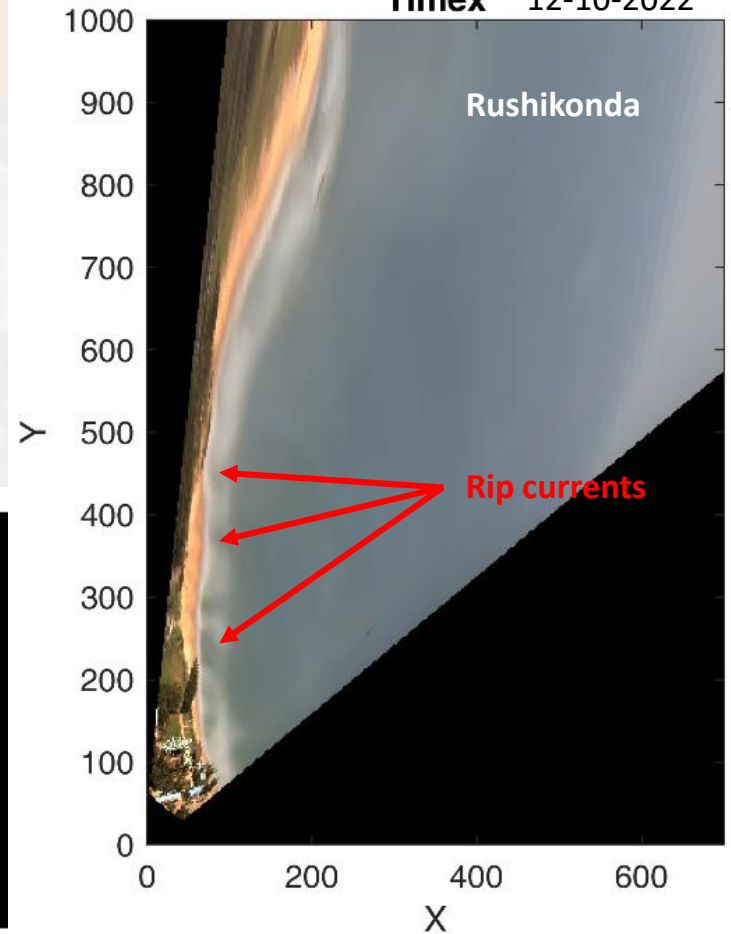
2 yTransect



3 xTransect



Timex 12-10-2022



India's first Rip Current Warning Dissemination System

- Fully-automated Rip current warning (**High risk – Red**, **Moderate Risk – Orange** and **Low Risk – Green**)
- Installed at Rushikonda, AP (Blue Flag certified beach).
- Supported by Police Department, AP Tourism department, Govt. of AP.





Smart lifeguard system to make Vizag beaches safer

Tens Die Every Year On City's Beaches

VIBMS AT RUSHIKONDA BEACH

ISRO has developed an intelligent beach monitoring system (VIBMS) to make the city's beaches safer. The system is a video-based lifeguard system that can detect and alert lifeguards about rip currents and other dangers. It is being installed at Rushikonda Beach, one of the city's most popular beaches. The system is expected to be operational by May 14.

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Alert system now at Vizag beach

People Institutions, video beach monitoring System station set up at Rushikonda beach on May 14

National Centre for Earth Sciences (NCES), through its video-based lifeguard system (VIBMS) at Rushikonda Beach, has set up a video-based lifeguard system (VIBMS) at Rushikonda Beach, one of the city's most popular beaches. The system is expected to be operational by May 14.

The system is a video-based lifeguard system that can detect and alert lifeguards about rip currents and other dangers. It is being installed at Rushikonda Beach, one of the city's most popular beaches. The system is expected to be operational by May 14.

ISRO, AU, NCES study for avoid drowning deaths in Vizag beaches

City from drowning death incidents, the authorities are now conducting research about the rip current zones, which are considered death trap zones. The Indian Space and Research Organization (ISRO), Andhra University (AU) and National Centre for Earth Sciences (NCES) are now jointly conducting research. They chose Rushikonda Beach as a pilot project and the beach is one of the seven beaches chosen for the study by the central ministry.



Visakhapatnam: To safeguard the tourists and the visitors of the beaches in Port City from drowning death incidents, the authorities are now conducting research about the rip current zones, which are considered death trap zones. The Indian Space and Research Organization (ISRO), Andhra University (AU) and National Centre for Earth Sciences (NCES) are now jointly conducting research. They chose Rushikonda Beach as a pilot project and the beach is one of the seven beaches chosen for the study by the central ministry.

గంజీవ్ సముద్ర ప్రాజెక్టు

పరిశోధనా పనులు ప్రారంభం

పరిశోధనా పనులు ప్రారంభం

పరిశోధనా పనులు ప్రారంభం

పరిశోధనా పనులు ప్రారంభం

Awareness through Press & Media


THE HINDU

Visakhapatnam: SAM programme to develop automated rip current alert system at Rushikonda Beach

NATION: CURRENT AFFAIRS

ISRO, Andhra University to use AI for preventing drowning in sea

Updated: Nov 23, 2022, 7:56 am IST



Visakhapatnam: Serious efforts are being made to prevent deaths, particularly of youngsters who are drowning in sea off Visakhapatnam

అదిగో.. రిప్ కరెంట్

అదిగో.. రిప్ కరెంట్

అదిగో.. రిప్ కరెంట్

అదిగో.. రిప్ కరెంట్

THE TIMES OF INDIA

Deadly rip currents present at Vizag beaches


SIVA G / TNN / Updated: Nov 30, 2022, 07:45 IST

Deadly rip currents present at Vizag beaches

Healthcare Management by ISB: How to create a trustworthy...

Andhra Pradesh: Govt to sanction housing for poor in their own plot...

Andhra Pradesh: Vizag gears up for spectacular glimpse on Navy...



Around 60 people drowned at RK beach alone in the last six years.

VISAKHAPATNAM: A research by the Indian Space and Research Organisation (ISRO), National Centre for Earth Sciences (NCES), and the Andhra University (AU) has revealed that constant rip current zones at blue flag-certified Rushikonda beach and RK Beach have become a danger to the beach visitors. The research commenced in March this year. Experts have identified the rip current zones which are the main reason for drowning deaths at various beaches in the city.

సప్టెంబర్ వైజాగ్

సప్టెంబర్ వైజాగ్

సప్టెంబర్ వైజాగ్

సప్టెంబర్ వైజాగ్

