A thick yellow curved line starts from the left edge of the slide and curves upwards and to the right, ending near the top center.

Decision-support systems for managing ocean risks/opportunities and earthquake impacts

Ocean state forecasting and advisories
Tsunami potential loss estimation
Rapid earthquake potential damage estimation

A thick yellow curved line starts from the left edge of the slide and curves upwards and to the right, ending near the top center.

Ocean state forecasting and advisories

Ocean Information



"No surf?"

Is it a good time for yachting?
Can my boat withstand the waves?



Is it an ideal time for
offshore
reconnaissance
survey?



Is it the best time for
fishing?



Ocean Services

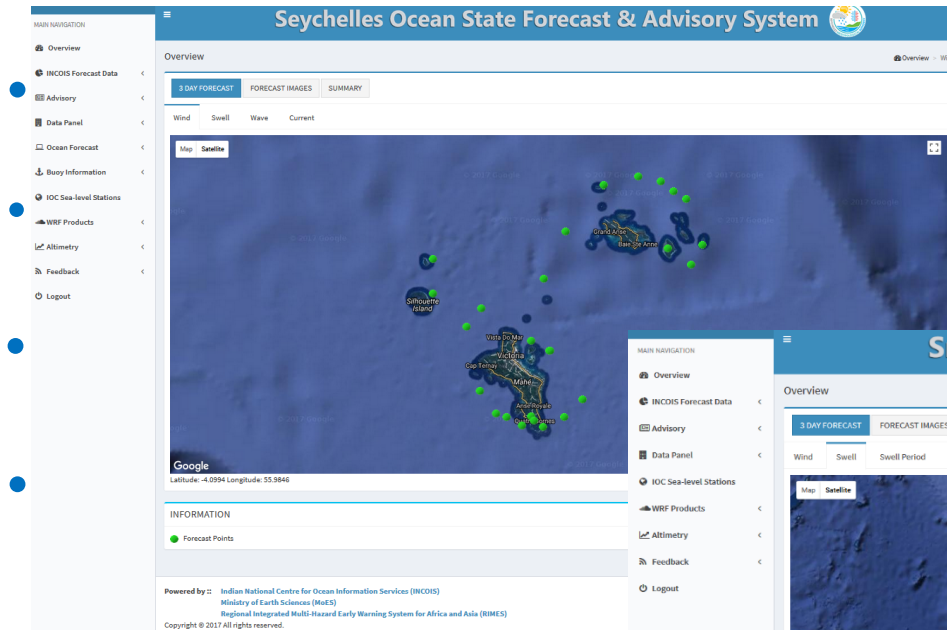
- ❖ Ocean information is *critical for effective management of maritime activities* e.g. maritime recreations, fisheries, disaster preparedness, etc.
- ❖ Access to such information is limited to global/regional scales

Objective: To strengthen capacities in the region by providing operational customized ocean forecast information through RIMES in collaboration with INCOIS, as well as real-time/near-real-time observation data, on local ocean/marine conditions

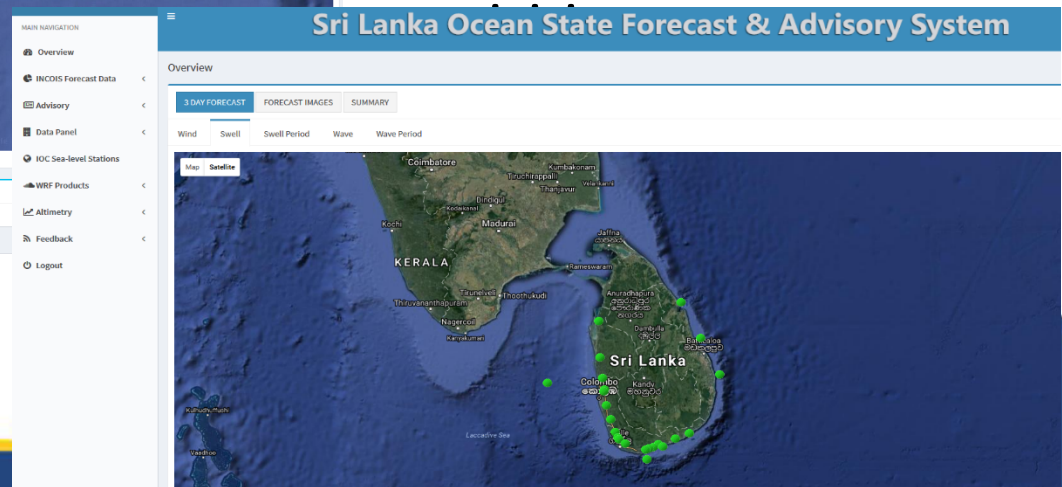
Ocean Services

Ocean state forecasting and advisory system (OSFAS)

- Customizable system and user-friendly interface



ific marine forecast information



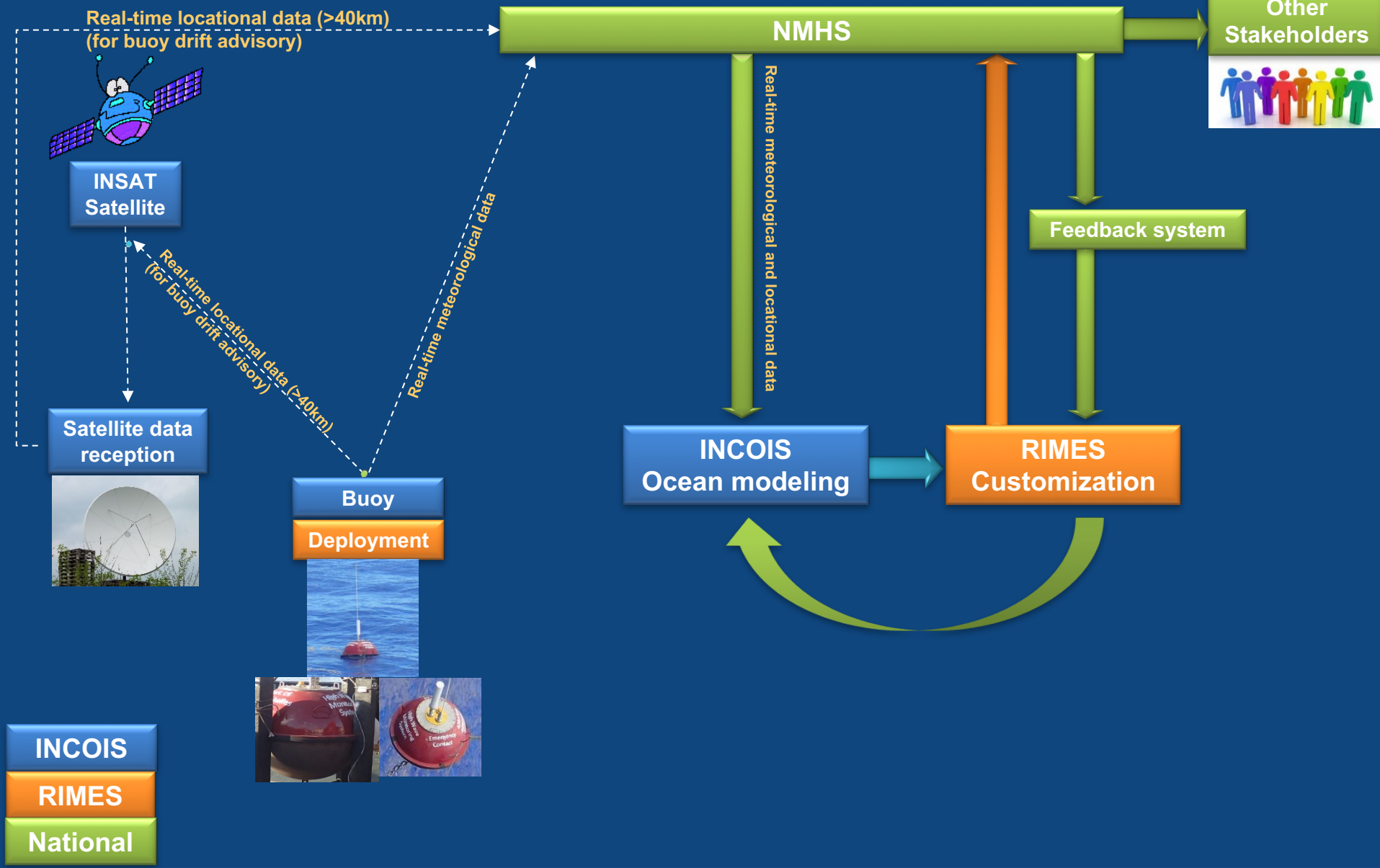
Ocean Services

Ocean state forecasting and advisory system (OSFAS)

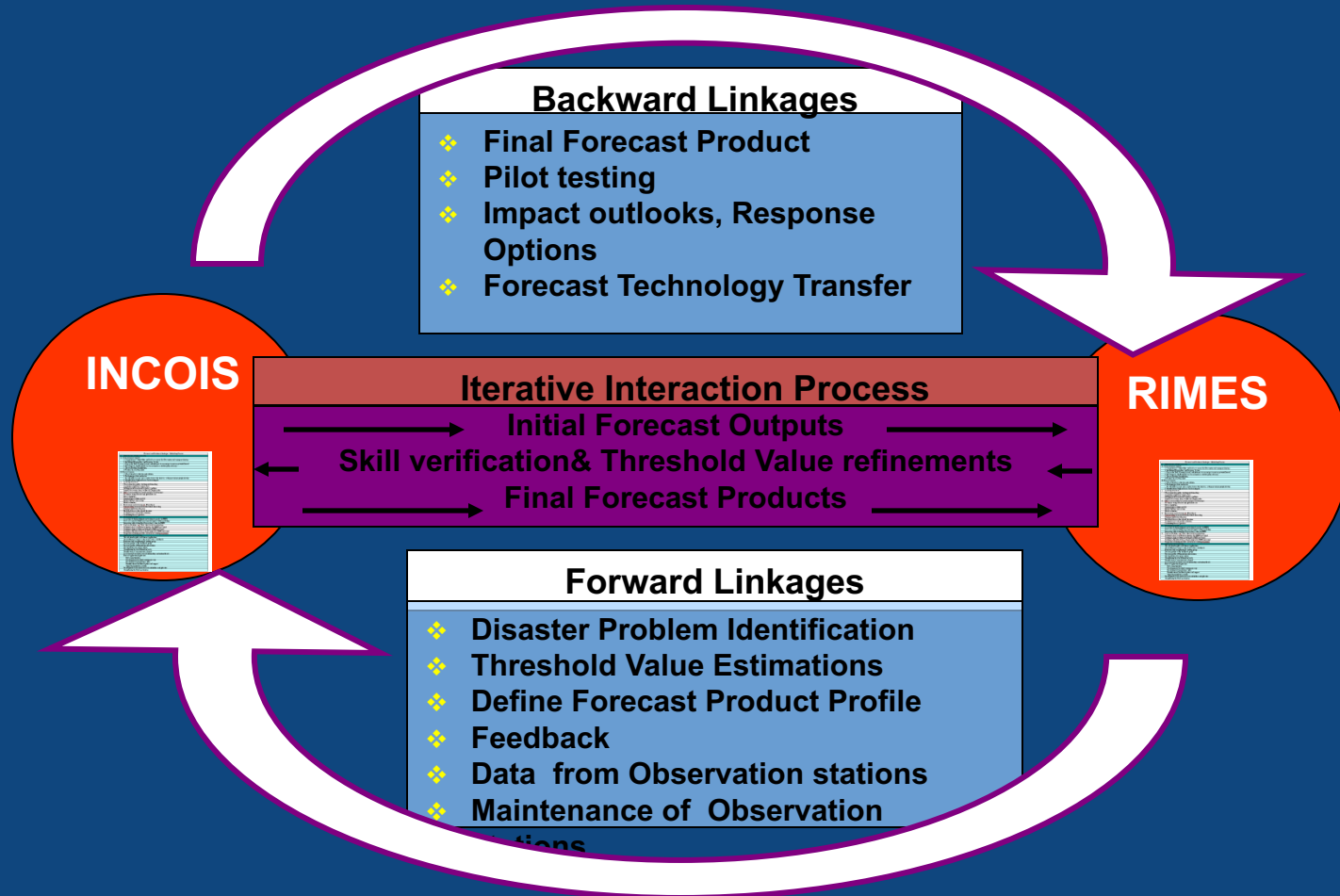
- Provision of real-time sea level data (IOC)
- Provision of weather forecast products e.g. precipitation, temperature, etc.
- Provision of near-real time satellite data e.g. altimetry, sea surface current, etc.
- User feedback system for allowing users to upload real-time data
- Formulation of warning bulletins for provision of advisories on 3-day ocean/marine forecast
- Warning dissemination through email, sms

Ocean Services

Coast guard,
Ports authority,
Maritime safety,
Fishermen groups,
Tourism,
Oil exploration, etc.



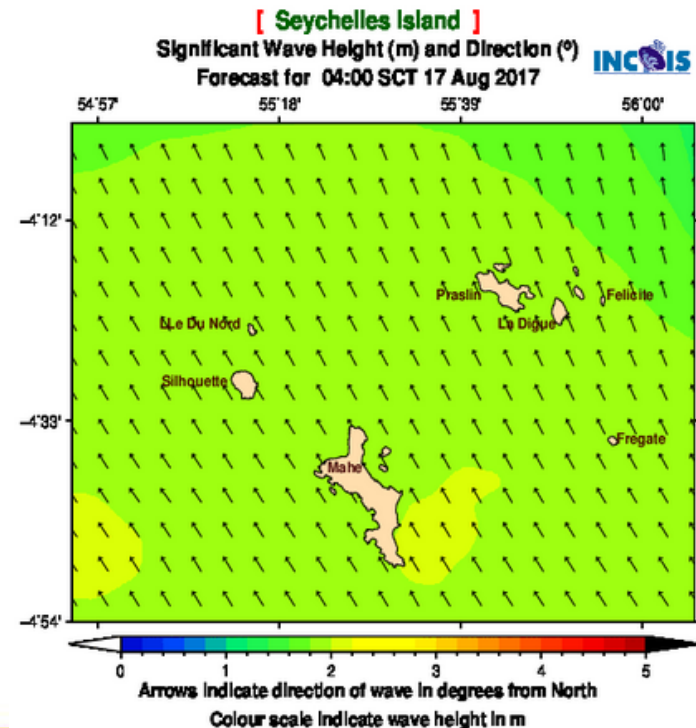
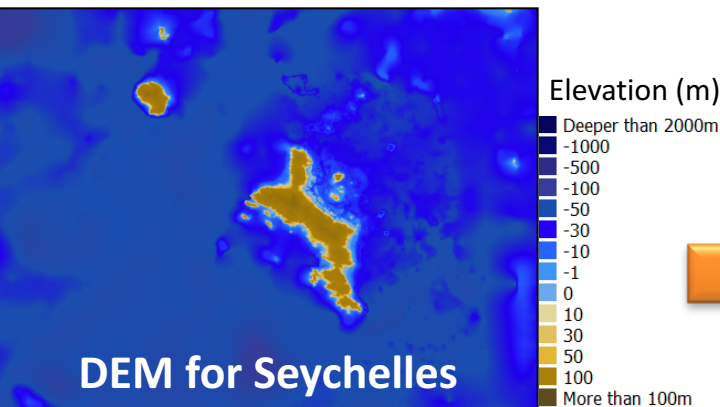
INCOIS and RIMES Interaction Process



Ocean Services

Customization process

- Integration of existing local bathymetric and topographic data by INCOIS into its forecasting system to generate customized ocean forecast products: 3-day wave, swell, wind and current forecasts







































Ocean Services

Customization process

- Customizable location-specific marine forecast information

Landing Sites

LANDING SITES

Name	Region	Latitude	Longitude	Edit/Delete
Consolation	PSW	-4.4085	55.8813	 
Air Strip	PSW	-4.3287	55.5759	 
Anse Government	PNE	-4.2071	55.8086	 
Anse Boudin	PNE	-4.1958	55.7531	 
Anse La Mouche	SW	-4.7782	55.4327	 
Anse Boileau	SW	4.7689	55.4062	 
Anse Royale	SE	-4.7785	55.5726	 
Baie Lazare	SW	-4.7977	55.4697	 
Anse Aux Pins	SE	-4.7359	55.617	 
Providence	NE	-4.618	55.5375	 
Anse Etoile	NE	-4.4436	55.5227	 
Beau Vallon	NW	-4.5596	55.3346	 
Victoria	NE	-4.5937	55.4927	 
Port Glaud	SW	-4.7143	55.3669	 
Baie St Anne Praslin	LD	-4.2313	55.8391	 
La Passe	LD	-4.25	55.8689	 
Anse Fourmi	LD	-4.3607	55.9095	 
Glacis	NW	-4.5151	55.3697	 

Forecast Point

ADD LANDING SITE

Name

Latitude

Longitude

Submit

Back

*Drag marker to select location.

-4.0827

56.1641

Select



Show Depth Contour: 50m

Measure Distance:

Start

Stop

Forecast Points

Ocean Services



























Customization process

- Customization of alert categories to match existing alert definitions (e.g. 4 levels)

Wind Speed Alert

Data Panel > Wind Speed Alert

Parameter: Wind Speed (km/h)

Description	Minimum	Maximum	Alert-level	Edit/Delete
Calm	0.0	1.1	White	 
Light Air	1.1	5.4	White	 
Light Breeze	5.4	11.9	White	 
Gentle Breeze	11.9	19.8	White	 
Moderate Breeze	19.8	28.8	Yellow	 
Fresh Breeze	28.8	38.9	Yellow	 
Strong Breeze	38.9	50.0	Yellow	 
High Wind, Moderate gale	50.0	61.9	Orange	 
Gale, Fresh gale	61.9	74.5	Orange	 
Strong gale	74.5	88.2	Red	 
Storm, whole gale	88.2	102.2	Red	 
Violent Storm	102.2	117.4	Red	 
Hurricane force	117.4	1000000.0	Red	 



















+

Customized Beaufort scale for wind speed alert

High Wave Alert

Data Panel > High Wave Alert

Parameter: Significant Wave Height (m)

Description	Minimum	Maximum	Alert-level	Edit/Delete
Calm	0.0	0.1	White	 
Smooth	0.1	0.5	White	 
Slight	0.5	1.5	Yellow	 
Moderate	1.5	2.5	Orange	 
Rough	2.5	4.0	Red	 
Very Rough	4.0	6.0	Red	 
High	6.0	9.0	Red	 
Very High	9.0	14.0	Red	 
Phenomenal	14.0	10000000.0	Red	 

+


Customized Douglas scale for high wave alert

Ocean Services

Customization process

- Integration of user feedback system – users can upload real-time

Beaufort



Calm
Flat. Sea like a mirror.
Wind speed: $< 0.3 \text{ m/s}$
Wave height: 0 m

Date & Time*

yyyy-mm-dd mm:ss

Location*

Latitude

Longitude

Upload Photo

Comment

Submit Feedback

Ocean Services

Customization process

- Formulation of warning bulletins for provision of advisories on 3-day ocean/marine forecast
- Warning dissemination through email, sms

Create Advisory

Select Forecast Point: Consolation
Select Forecast Product: Wind Speed
Select Date: 2017-01-31 Submit

Email Subject: [Advisory] 2017-01-31 - Consolation

Contact Group: Test

Email: j.elaine@rimes.int

Mobile: 66875486852

Weather Update: Test

Advisory: Test

Filename: [2017-01-31] Consolation-ws.pdf

Attach file: ☒ [2017-01-31] Consolation-ws.pdf

Send Email Send SMS Cancel Generate Bulletin

Contact Groups

Data Panel > Contact Groups

CONTACT GROUPS

Group Name	Group Code	Emails	Edit/Delete
Meteo Dept	MET	jeiann@rimes.int jeiannermac@gmail.com	✎ ✖
Group 2	GRP2	jeiann@rimes.int	✎ ✖

Mail Setting

Data Panel > Mail Setting

UPDATE MAIL SETTING

Email Account: rimes.shakecast@gmail.com

Email Name: SMA Advisory

Password: *****

Mail Server: smtp.gmail.com

SMTP Port: 465

Send To: jeiann@rimes.int

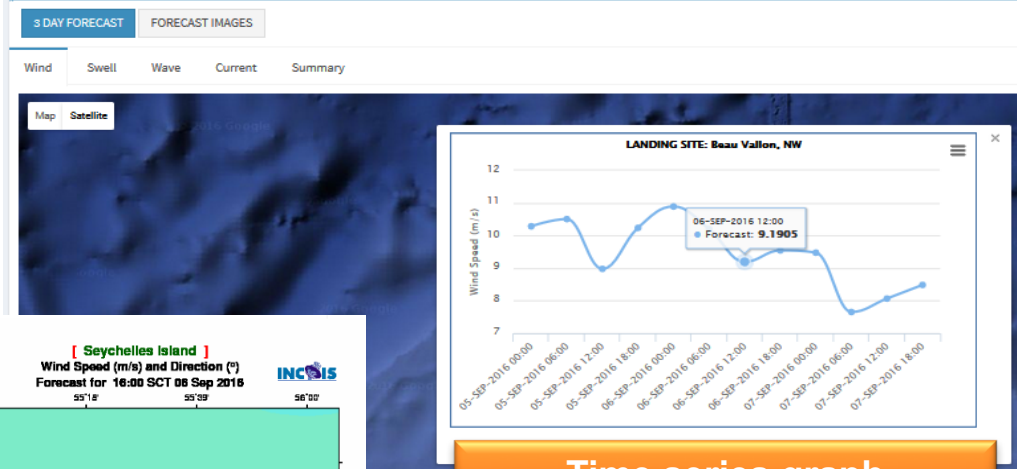
Update Back

Ocean Services

Products

- 3-day ocean forecast on wind, wave, swell and current generated by INCOIS

Overview



Time series graph

Summary table

Day 1 Day 2 Day 3

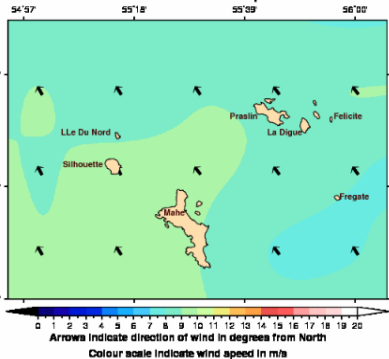
Significant Wave Height (m)

Forecast Points	16-DEC-2016 00:00	16-DEC-2016 06:00	16-DEC-2016 12:00	16-DEC-2016 18:00
Consolation	1.2	1.2	1.2	1.3
Air Strip	1.2	1.2	1.2	1.3
Anse Government	1.2	1.2	1.2	1.2
Anse Boudin	1.2	1.2	1.2	1.2
Anse La Mouche	1.2	1.3	1.3	1.3
Anse Boileau	1.2	1.3	1.3	1.3
Anse Royale	1.2	1.3	1.3	1.3
Baie Lazare	1.2	1.3	1.3	1.3
Anse Aux Pins	1.2	1.3	1.3	1.3
Providence	1.2	1.2	1.3	1.3
Anse Etoile	1.2	1.2	1.2	1.3
Beau Vallon	1.2	1.2	1.2	1.3
Victoria	1.2	1.2	1.3	1.3
Port Glaud	1.2	1.2	1.2	1.3
Baie St Anne Praslin	1.2	1.2	1.2	1.2
La Passe	1.2	1.2	1.2	1.2
Anse Fourmi	1.2	1.2	1.2	1.3
Glacis	1.2	1.2	1.2	1.3

☐ Calm - Smooth (0.0 - 0.5)
☐ Slight (0.5 - 1.3)
☐ Moderate (1.3 - 2.5)
☐ Rough - Phenomenal (≥ 2.5)

[Seychelles Island]
Wind Speed (m/s) and Direction (°)
Forecast for 16:00 SCT 06 Sep 2016

INCOIS



Forecast image

Products

- Advisory

Web advisory

Advisory for Consolation, Wind Speed (m/s)

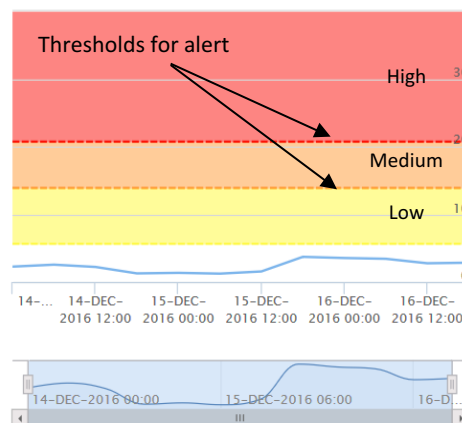
Location Consolation

The expected Wind Speed for the period of 14-DEC-2016 is going to be Light Breeze, Light Air.

The expected Wind Speed for the period of 15-DEC-2016 is going to be Light Air, Light Breeze, Gentle Breeze.

The expected Wind Speed for the period of 16-DEC-2016 is going to be Gentle Breeze, Light Breeze.

Time Series Graph



Ocean Forecast Information Bulletin

Issued at 1253LT on Thu 17 Aug 2017

Advisory

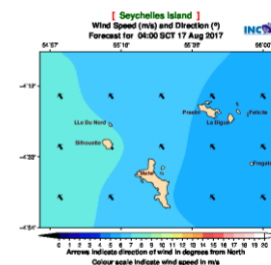
3-Day Forecast for Consolation

The expected Wind Speed for the period of 17-AUG-2017 is going to be Gentle Breeze, Moderate Breeze

The expected Wind Speed for the period of 18-AUG-2017 is going to be Moderate Breeze, Fresh Breeze

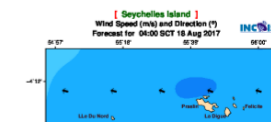
The expected Wind Speed for the period of 19-AUG-2017 is going to be Fresh Breeze

Day 1



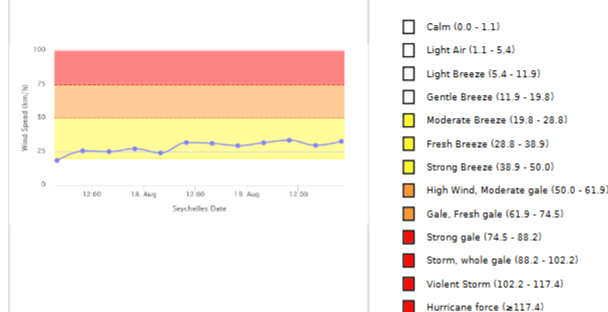
Date Time	Value	Forecast
2017-08-17 04:00	18.4 km/h	Gentle Breeze
2017-08-17 10:00	25.5 km/h	Moderate Breeze
2017-08-17 16:00	25 km/h	Moderate Breeze
2017-08-17 22:00	27.1 km/h	Moderate Breeze

Day 2



Date Time	Value	Forecast
2017-08-18 04:00	24 km/h	Moderate Breeze
2017-08-18 10:00	31.7 km/h	Fresh Breeze
2017-08-18 16:00	31.1 km/h	Fresh Breeze
2017-08-18 22:00	29.4 km/h	Fresh Breeze

Times Series Graph



In an effort to improve our delivery and validation services please report any abnormal events to this telephone number: 4384349 as soon as possible.

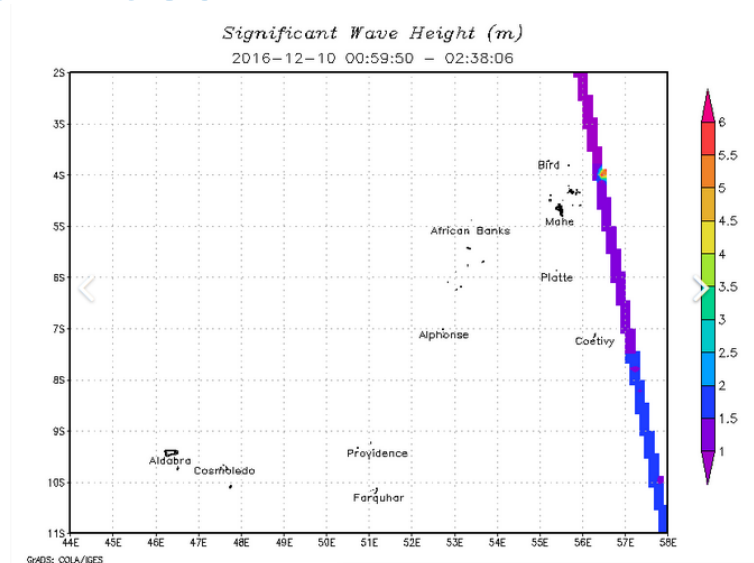
Powered by ::
Indian National Centre for Ocean Information Services (INCOIS)
Ministry of Earth Sciences (MoES)
Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES)

All rights reserved.

Ocean Services

Products

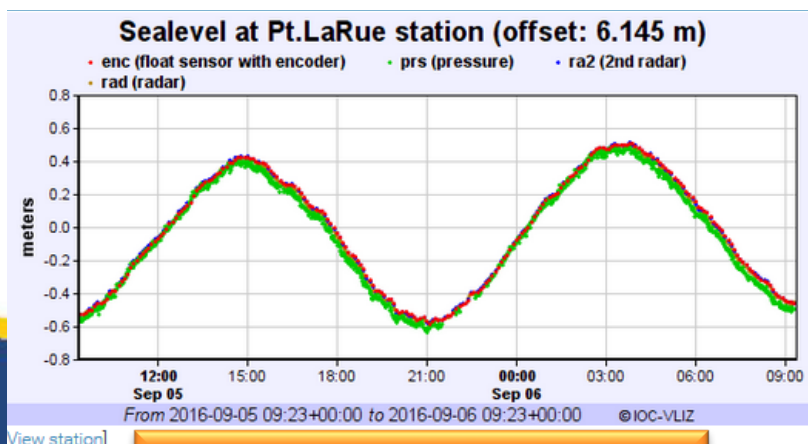
- WRF products e.g. precipitation, temperature, MSL pressure)
- Near-real-time satellite data (e.g. altimetry, etc.)
- Real-time sea level data (IOC)



* Source: Aviso+ CNES Data Center -- [Link](#)

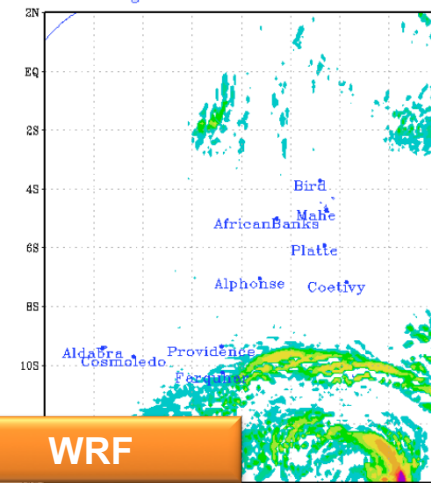
* SARAL/AltiKa Products Handbook

Near real-time altimetry data



Real-time sea level data

Six Hourly Accumulated RainFall(in mm)
Forecast Length in Hours : 2017012912+66 Hours.



WRF



Ocean Se

Real-time monitoring system

- Real-time ocean information
- Near-real time tracking of buoy location and alert messaging service in case of buoy drift

Alert!!! Seychelles Wave Rider Buoy drift

Inbox x

RIMES Buoy Watch <webmaster@rimes.int> Mar 28 ☆

to buoy.watch ▾

Report of Seychelles Wave Rider Buoy drift, Kindly act soon.
Time: 2017-03-28 10:00:00 UTC
Location: Seychelles

Drifted distance of INSAT: 15302m
Drifted direction of INSAT:
Current position of INSAT-lat: -4.6367025 lon: 55.7345867
Deployed position lat: -4.6446204 lon: 55.8724308

For more information about the buoy location, access <http://ois.rimes.int/index.php/buoy/location>, using the following log-in credentials:
username: guest
password: guest

--
For questions regarding this alert, please contact buoy.watch@rimes.int

Buoy Location

Show/Hide
Last Observ

Map Satellite

Google

Latitude: -4.6421 Longitude: 55.8710

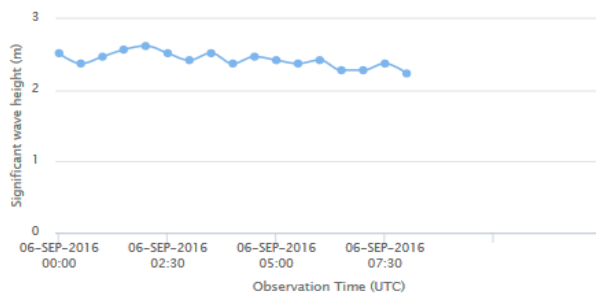
◆ Seychelles wave rider buoy
▲ Observed location (<300m)
▲ Observed location (≥300m)
Map data ©2016 50 m Terms of Use

Buoy Data

From 2016-09-08 To 2016-09-08 Show Download

hm0 ti t1 tz tc tp qp dir spr nu eps ss

Significant wave height



Date & Time (UTC)	Latitude	Longitude	hm0
06-SEP-2016 08:00	-4.6447062	55.8723235	2.2345674
06-SEP-2016 07:30	-4.6447062	55.8723879	2.3732347
06-SEP-2016 07:00	-4.6447170	55.8723879	2.2800695
06-SEP-2016 06:30	-4.6447170	55.8724093	2.2800695
06-SEP-2016 06:00	-4.6447277	55.8723879	2.4209204
06-SEP-2016 05:30	-4.6447277	55.8723450	2.3732347
06-SEP-2016 05:00	-4.6447492	55.8723235	2.4209204
06-SEP-2016 04:30	-4.6447814	55.8723021	2.4693572
06-SEP-2016 04:00	-4.6447814	55.8722162	2.3732347
06-SEP-2016 03:30	-4.6448135	55.8721948	2.5185566
06-SEP-2016 03:00	-4.6448243	55.8721089	2.4209204
06-SEP-2016 02:30	-4.6448886	55.8720875	2.5185566




Ocean Services

Status

- ❖ Customizing for Comoros, Madagascar, Maldives, Mozambique, Seychelles, Sri Lanka
- ❖ Countries interested: Cambodia, Myanmar, Philippines, Vietnam
- ❖ Feedback system for validation of ocean information
- ❖ Dissemination through sms

Future Plan

- ❖ Mobile application

A thick yellow curved line starts from the left edge of the slide and curves upwards and to the right, ending near the top center.

Tsunami potential loss estimation



Tsunami Potential Loss Estimation

- ❖ There is a need for emergency managers of operational tools that will provide accurate tsunami forecast as guidance for rapid, critical decisions when lives and property are at risk
- ❖ The use of a GPGPU system can enable the provision of real-time tsunami loss estimates by reducing processing time

Objective: To strengthen capacities in the region by providing operational tsunami potential loss estimation through RIMES with support from INCOIS, as per Service Level 3 requirements

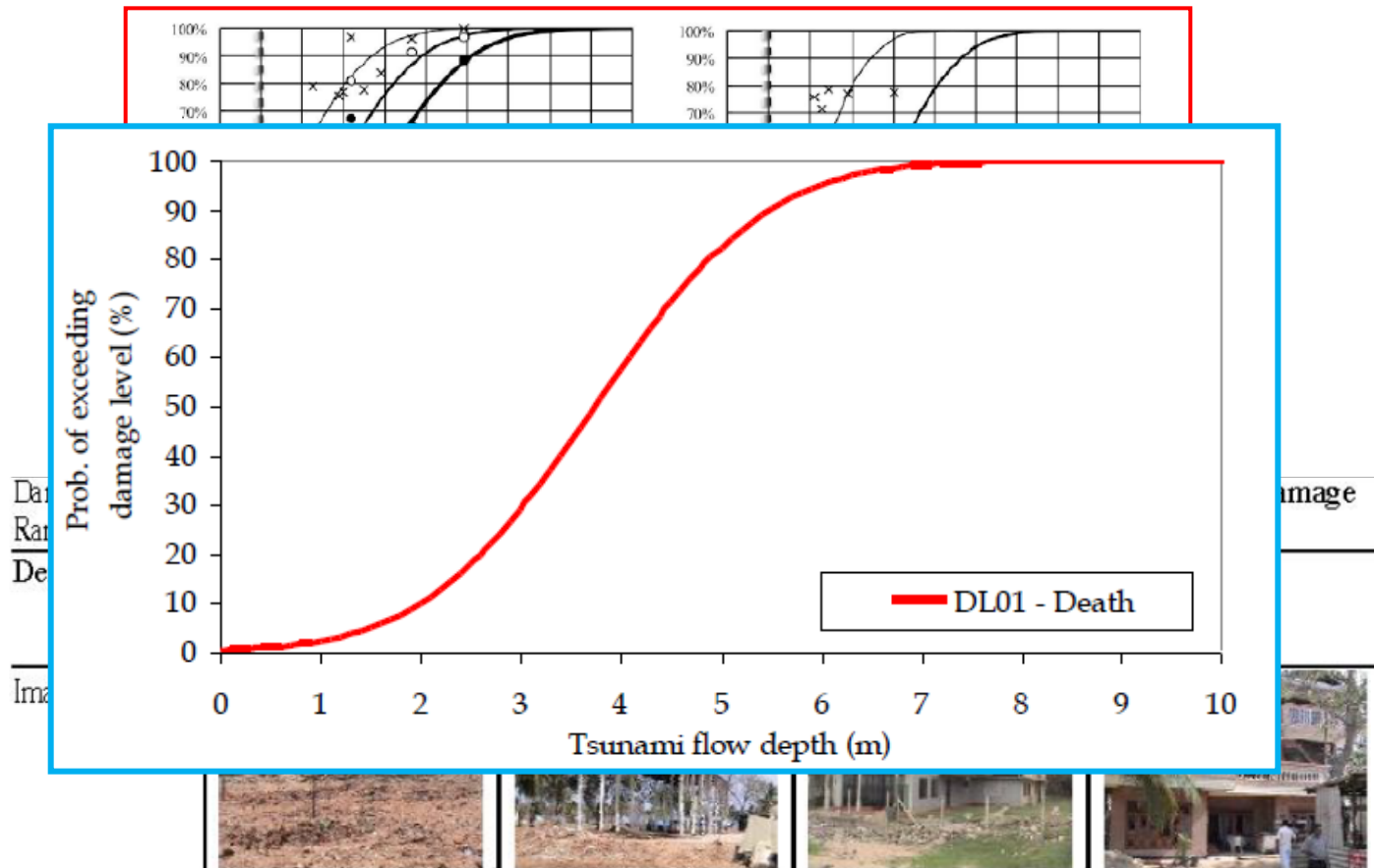
Tsunami Potential Loss Estimation

- ❖ Provides tsunami Service Level 3 products within 20 minutes at the nearest pilot site in Sri Lanka
- ❖ Pilot sites: Comoros, Mozambique, Seychelles, Sri Lanka
- ❖ Integration of high resolution DEM for quality inundation outputs
- ❖ Integration of detailed population and building inventory (e.g. RC, wood)

Type	Non-solid buildings	Solid buildings
Structure (material)	Brick-built, block-built, or wooden	Reinforced concrete, steel
The number of floors	One or two	Two or more
Usage	Housing (commercial)	Public, commercial, or office
Image		

Tsunami Potential Loss Estimation

- Integration of tsunami vulnerability curves for estimation of potential loss of life and damage to buildings




Tsunami Potential Loss Estimation

Products

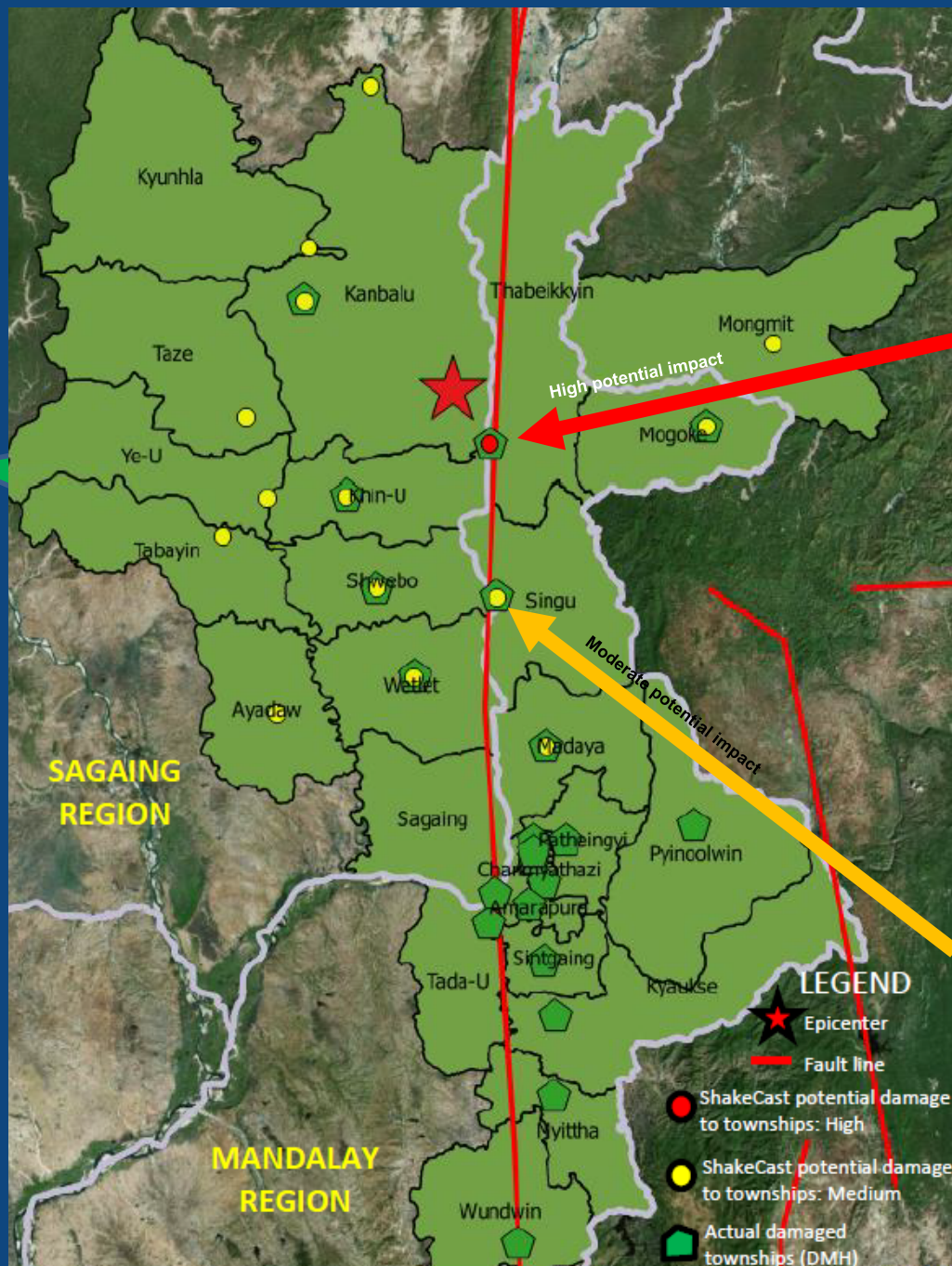
- Uses the loss estimation component of the RIMES' INSPIRE tool to generate probabilities of casualties and damages to buildings

Select Loss Estimation

Zone No.	Total Population (person) %	Survival (person) %	Casualty (person) %
1	0	0	0
1	100	0	0
2	14072	13606	466
2	100	97	3
3	4	4	0
3	100	100	0
4	2240	2236	4
4	100	100	0
5	0	0	0
5	100	0	0
6	4548	4473	75
6	100	98	2
7	0	0	0
7	100	0	0

A thick yellow curved line starts from the left edge of the slide and curves upwards and to the right, ending near the top center.

Rapid earthquake potential damage estimation



Cast

potential damage

first responders, policy makers

minutes after to estimate risks of critical facilities

information is sent to registered users by sms, and email

Summary report

Description	Facility Name	Location		POTENTIAL IMPACT	MMI
AGE	Kya Ku Ni, Mong Koe	Tachileik	99.9927, 20.6787	High	9.27
AGE	Law Hkar, Nar Yawng	Tachileik	99.9998, 20.7065	High	9.27
AGE	Nar Hpet (1), Nam Pang	Monghpyak	99.6268, 20.9307	Medium	6.26

	POTENTIAL IMPACT	MMI
2474, 22.7021	Medium	5.44
2383, 22.7089	Medium	5.43
0968, 22.0235	Low	4.85
1014, 22.0309	Low	4.85



POPULATION	Kathmandu (Pop. 1,000,000)	10,000	10,000	10,000	10,000
POPULATION	Moscow (Pop. 1,000,000)	10,000	10,000	10,000	10,000
POPULATION	Kathmandu (Pop. 1,000,000)	10,000	10,000	10,000	10,000
POPULATION	Kathmandu (Pop. 1,000,000)	10,000	10,000	10,000	10,000

Earthquake Services: ShakeCast

SHAKEMAP WEB SERVERS



SHAKEMAP DATA & MAPS

RSS Feed

USER'S DATABASES

FACILITIES		NOTIFICATIONS	
Bridge A	Location	Jane Doe	303 273 8123
Overpass 1	Location	Bill Jones	jone@email
Overpass 2	Location		smith@mail
Overpass 3	Location		smith@cell
Overpass 4	Location		jim@pager

FRAGILITIES	
Bridge A	0.3/0.6g
Overpass 1	0.2/0.5g
Overpass 2	0.2/0.5g
Overpass 3	0.2/0.5g
Overpass 4	25/50 cm/s

USER'S SHAKECAST SYSTEM



Internal Web Page & User Interface



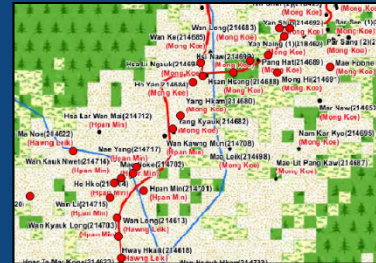
ESTIMATED DAMAGE	
Bridge A	Damage Likely
Overpass 1	Damage Likely
Overpass 2	Damage Likely
Overpass 3	Damage Poss.
Overpass 4	Damage Poss.

Notifications

Email, PDA, Cell



- Levels of customization
 - Population (smallest administrative unit)
 - Building (location and usage)
 - Building properties (structure, material, etc.)
 - Country-based damage threshold



Population customized up to village level

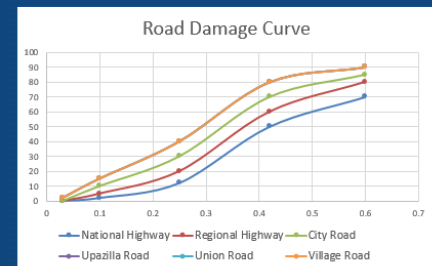


Buildings customized for building usage from Google Earth

Attribute table - UN Habitat_rev_Oct20 :: Features L...

	FACILITY_T	EXTERNAL_F	FACILITY_N	DESCRIPTIO	LAT_MIN	LON_MIN
0	STRUCTURE	1298482_1	S3	RES1	21.8743...	95.9779...
1	STRUCTURE	1298482_2	S3	RES1	21.8776...	95.9849...
2	STRUCTURE	1298482_3	W1	RES1	21.8775...	95.9848...
3	STRUCTURE	1298482_4	W1	RES1	21.8776...	95.9847...
4	STRUCTURE	1298482_5	C1L	RES1	21.8775...	95.9846...
5	STRUCTURE	1298482_6	W1	RES1	21.8777...	95.9846...
6	STRUCTURE	1298482_7	S3	COM10	21.8775...	95.9846...
7	STRUCTURE	1298482_8	W1	RES2	21.8774...	95.9845...
8	STRUCTURE	1298482_9	W1	RES1	21.8775...	95.9844...
9	STRUCTURE	1298482_10	W1	RES2	21.8775...	95.9843...
10	STRUCTURE	1298482_11	S3	COM1	21.8776...	95.9841...
11	STRUCTURE	1298482_12	W1	RES1	21.8776...	95.9842...
12	STRUCTURE	1298482_13	U1M1	RES1	21.8778...	95.9842...

Buildings customized for building structure from field survey

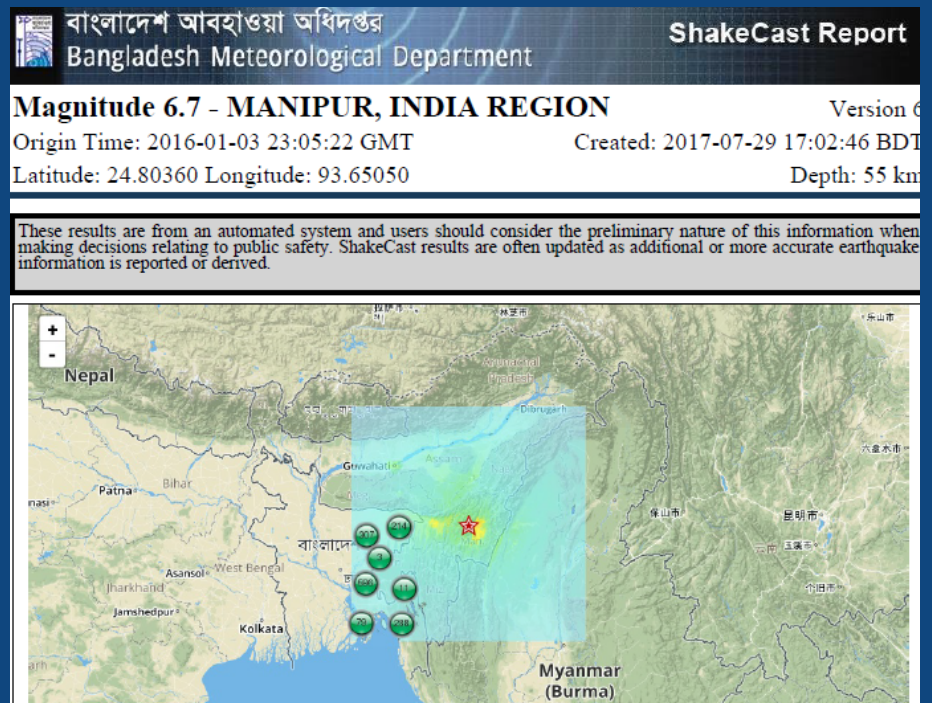
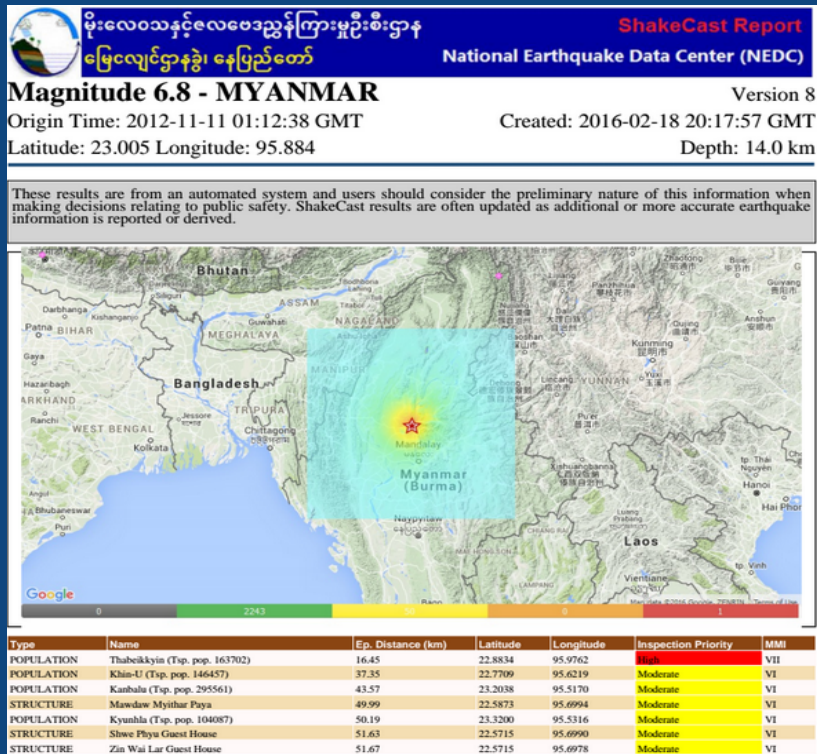


Country-based damage threshold

Earthquake Services: ShakeCast

Status

- ❖ Installed and customized for Myanmar
- ❖ Installed and ongoing customization for Bangladesh





Thank you for your attention

Seychelles Meteorological Authority