

# C-RISe Overview

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### National Oceanography Centre and SatOC

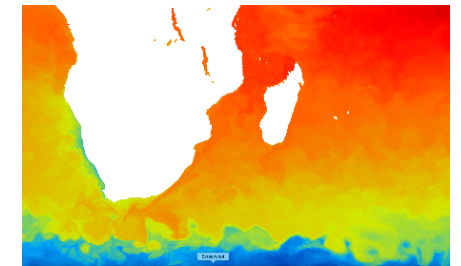
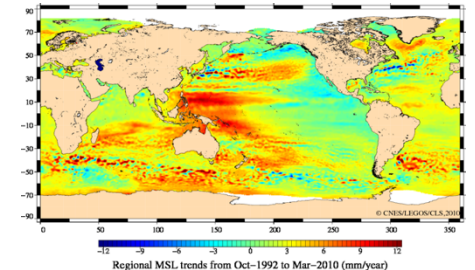
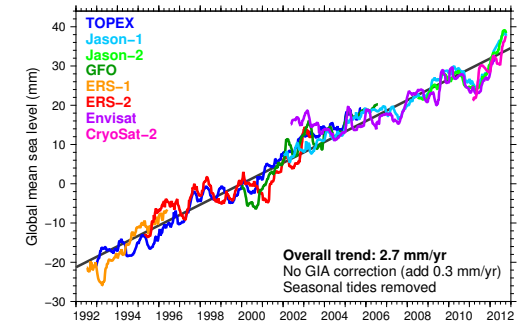
11<sup>th</sup> and 12<sup>th</sup> February 2020, Antananarivo, Madagascar

# The C-RISe Project

- C-RISe: A three year project to develop, deliver and evaluate a Coastal Risk Information Service to South Africa, Mozambique, Madagascar and Mauritius
- Funded by the UK Space Agency: International Partnership Programme

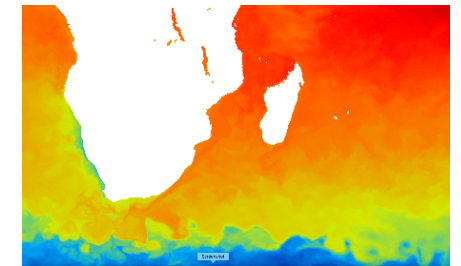
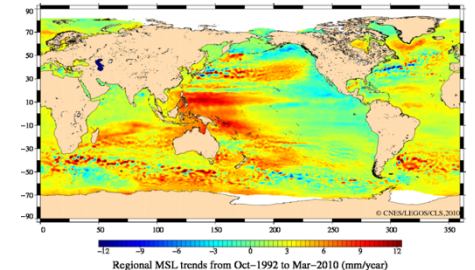
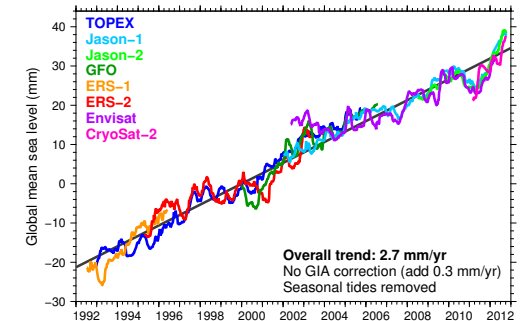
# C-RISe Objectives

- Deliver a Coastal Risk Information service, **providing satellite-derived information about sea level, wind and waves** to support coastal vulnerability assessment and hazard management efforts.
- Apply and evaluate the C-RISe service through a set of **Use Cases**, applying the C-RISe products to end use **applications that address local priorities**.
- Build **local capacity** to use satellite data to provide **scientific decision support** for strategy development and management of coastal areas to increase resilience to coastal hazards



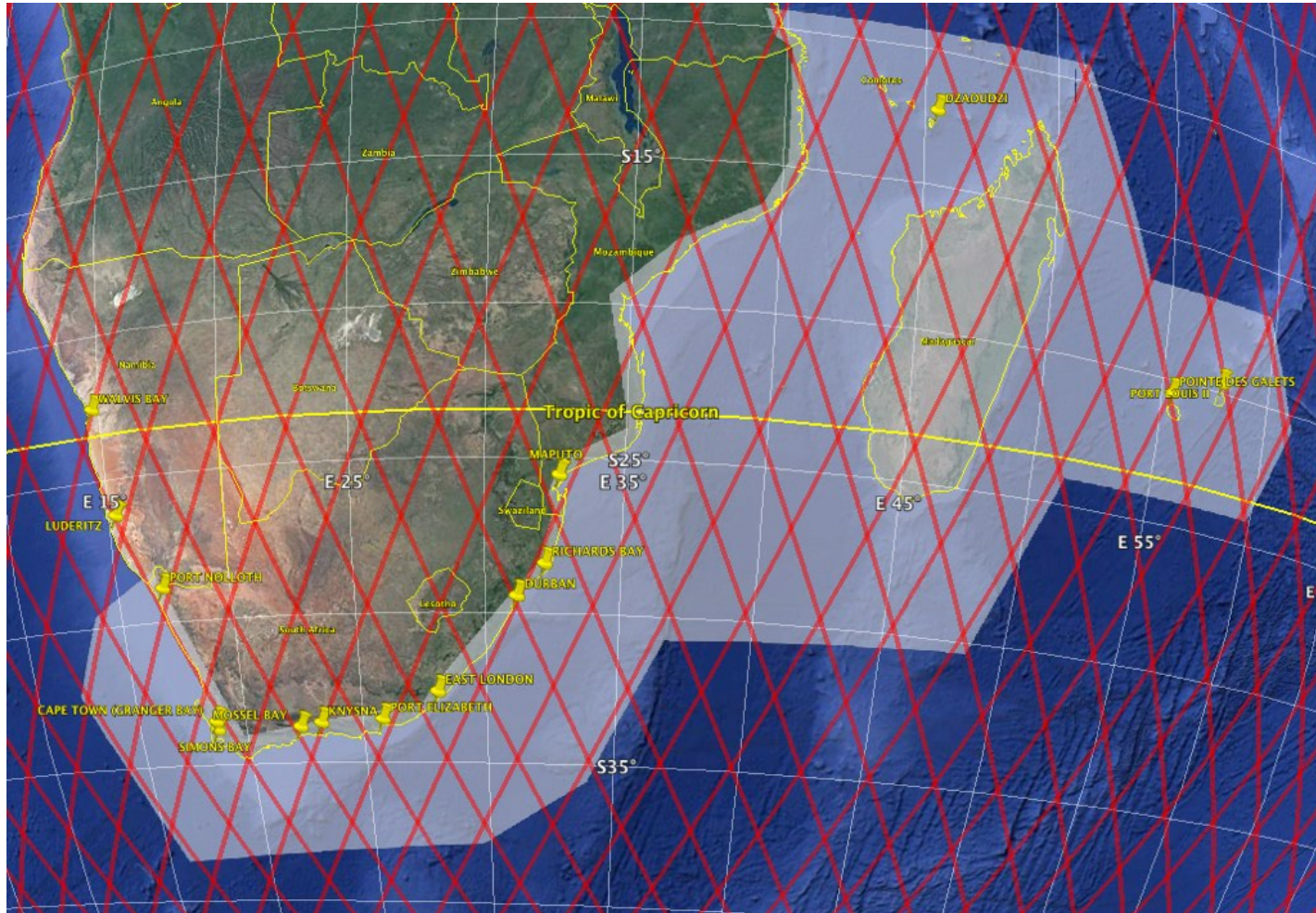
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# C-RISe Coverage



- Coverage of C-RISe Products.
- Red lines mark the Jason satellite tracks, indicating where sea level data are available.
- Yellow “pins” mark the location of long term tide gauges.

# C-RISe products

Parameter	Description	Time	Satellites
Total Water Level Envelope, significant wave height, surface radar backscatter	Along track data from the NOC coastal processor	2002-2018	Jason-1, Jason-2, Jason-3
Significant Wave Height Climatology	Monthly, 1° x 1° gridded climatology, ESA Globwave	1992-2018	ERS-1, ERS-2, Envisat, Topex, Jason-1, 2,3
Wind Speed and Direction Climatology	Monthly, 0.25° x 0.25°, from Copernicus	2007-2018	ASCAT
Total surface current (geostrophic + Eckmann)	Daily, 0.25° x 0.25°, from ESA Globcurrent	1993-2019	Envisat, Jason-1, 2,3
Significant Wave Height, wind speed	Near Real Time along track data	Daily updated	Jason-2, Jason-3, AltiKa, Sentinel-3
Wind speed and wind direction	Near Real Time data across scatterometer swath (25km resolution)	Daily updated	Metop/ ASCAT-A
Total surface current (geostrophic + Eckmann)	Near Real Time data, 0.25° x 0.25°	Weekly updated	Jason-2, Jason-3

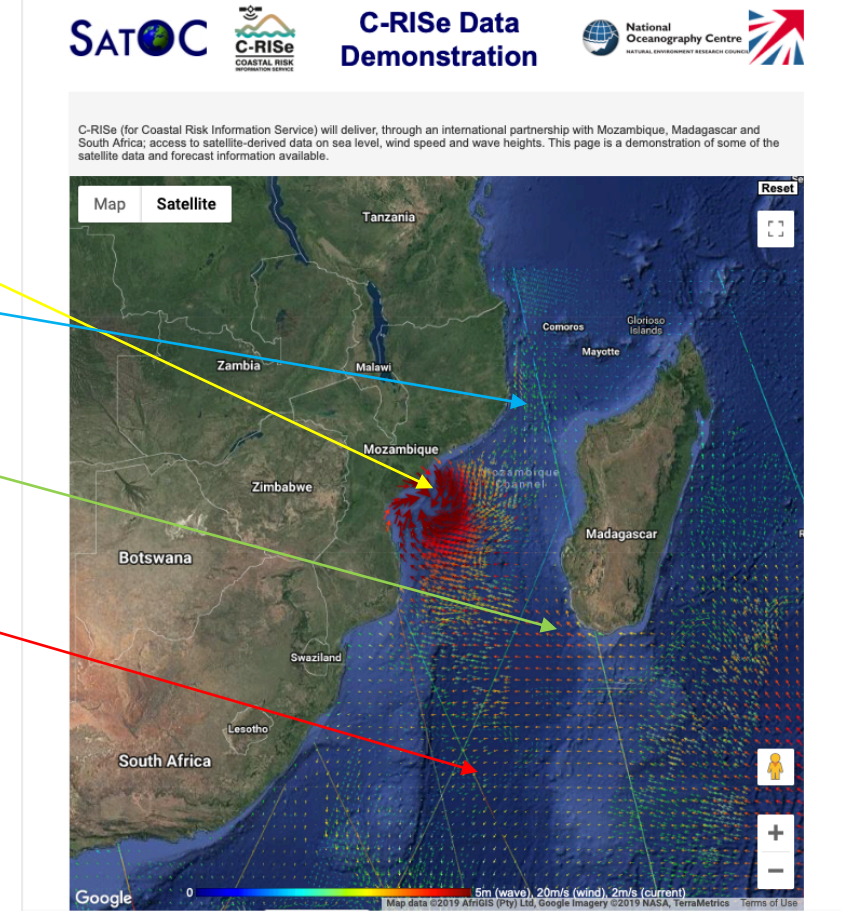


# C-RISe Near Real Time Data

- Wind speed and direction from satellite scatterometer (ASCAT)
- Daily average surface currents from ESA Globcurrent project
- Forecast winds and waves from US NOAA model
- Along track wind speed and wave height data from satellite altimeter, most recent passes (Jason-2, Jason-3, AltiKa, Sentinel-3)

<http://www.satoc.eu/projects/c-rise/demo.html>

Screenshot from 14 March 2019: *Tropical Cyclone Idai*



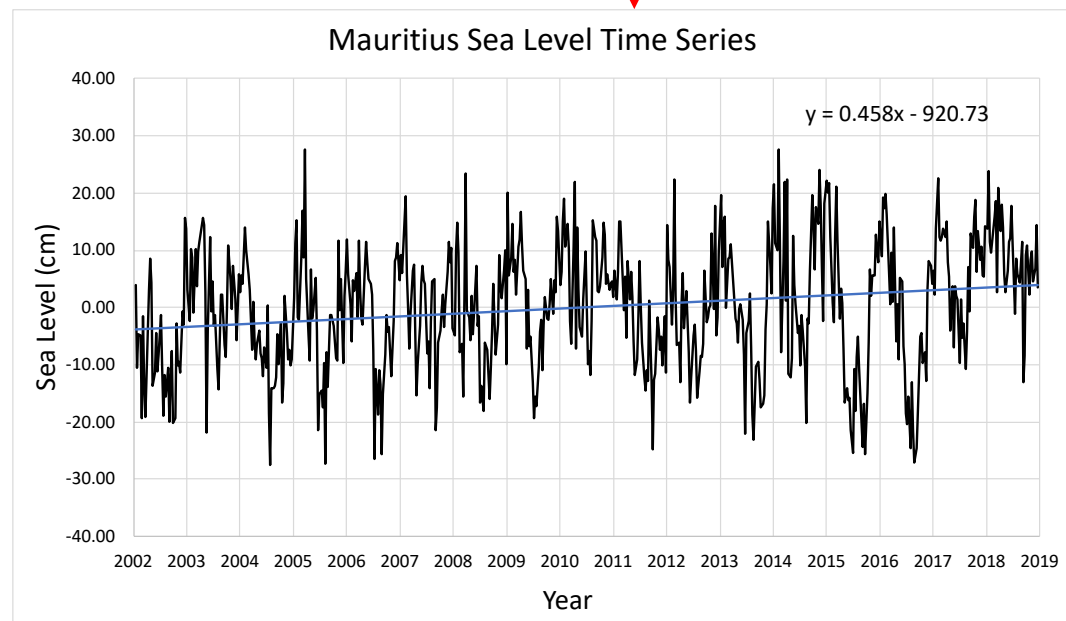
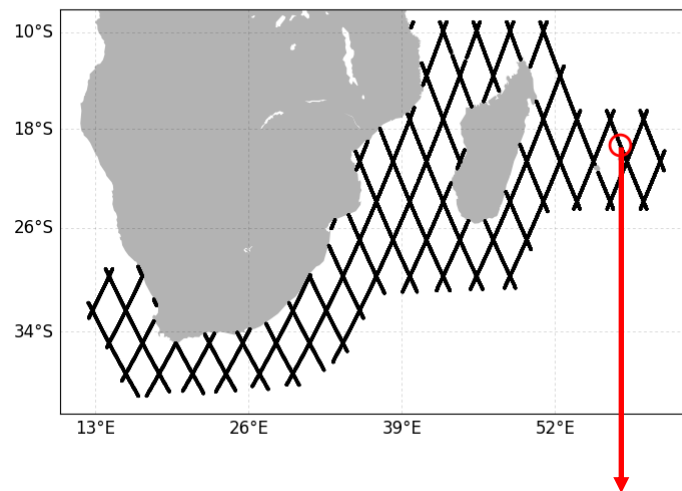
# C-RISe Products and Questions

EO data and analysis tools provided by C-RISe can help provide regional information on key issues on marine climate:

- What **sea level rise** can be expected in the region by 2100?
  - Is the nature of extreme sea level events changing?
- Are there any changes in the characteristics of the **windy season**?
  - Is the start of the windy season coming later or earlier?
  - Is it lasting longer?
- What time of year can we expect the biggest **sea states** in a given location?
- What is the **impact of climate change** (sea level, winds, waves, sea surface temperature) on **marine ecosystems**?
  - Is there a link to recorded drop off in fisheries catches?
  - Is there a link to measured changes in important marine ecosystems (reefs, mangroves)?

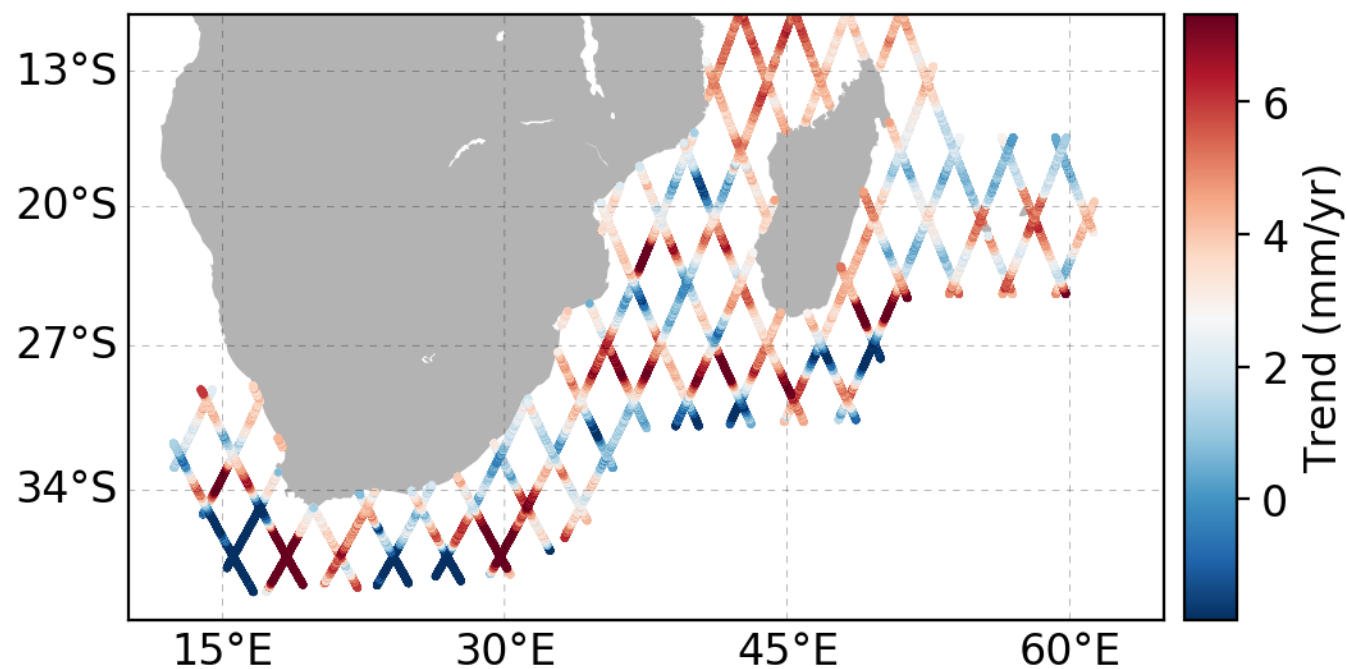


# Sea Level Variability



Sea Level Time Series: 2002-2018

Sea Level Trend (mm/yr): 2002-2018

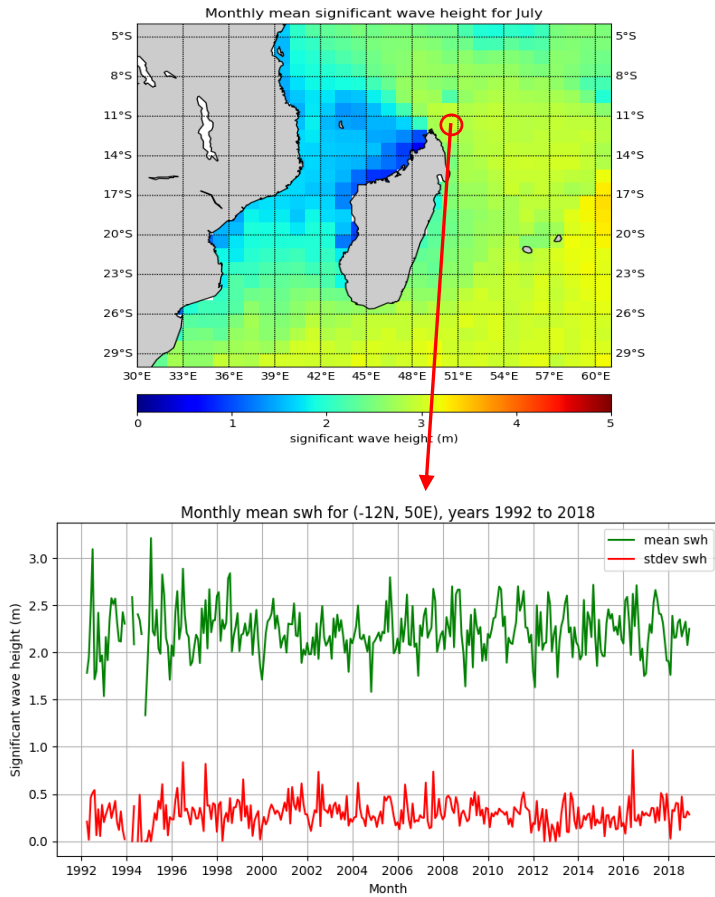




# C-RISe Climatological Products

## Waves

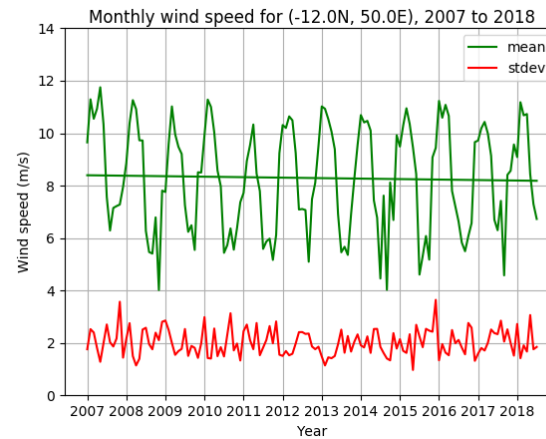
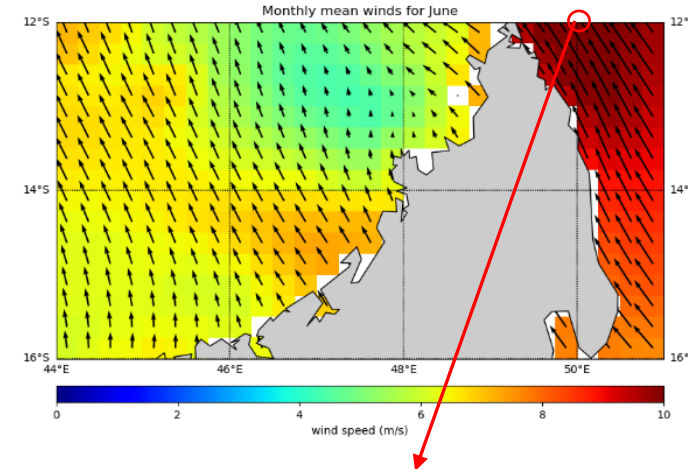
July mean SWH



NE Madagascar SWH 1992-2018

## Winds

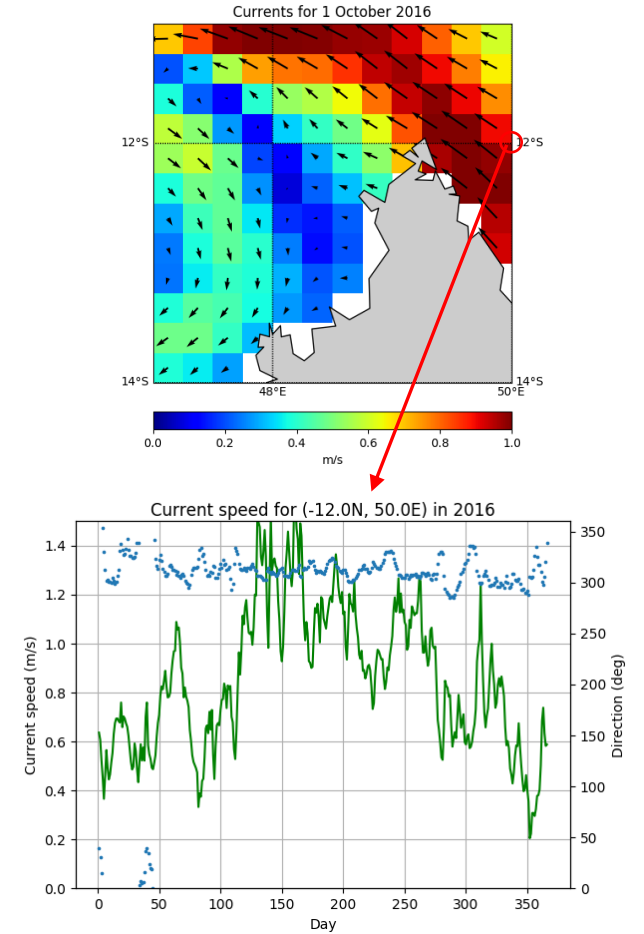
June mean wind speed and direction



NE Madagascar winds 2007-2018

## Surface Currents

Mean surface current 01/10/16



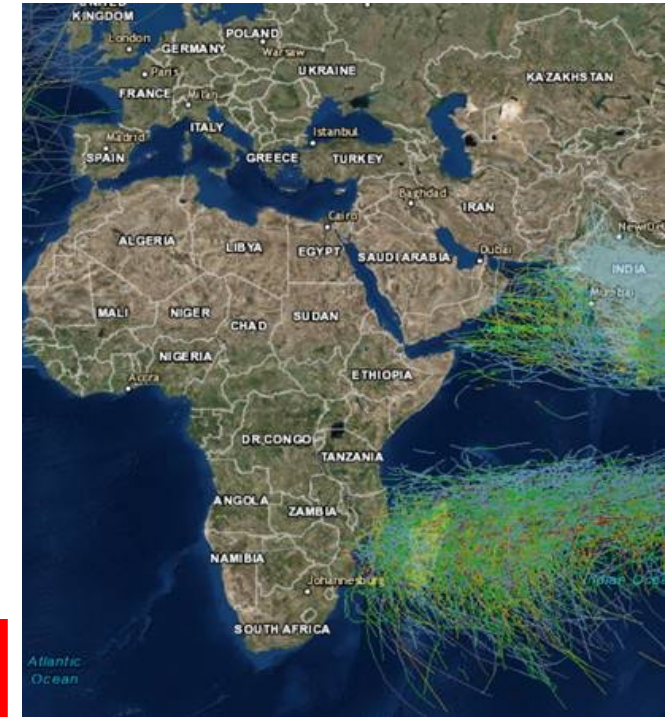
NE Madagascar currents 2006

# Building Capacity to Access and Process Satellite Data

11<sup>th</sup> and 12<sup>th</sup> February 2020, Antananarivo, Madagascar

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Historical hurricane tracks (courtesy of <https://coast.noaa.gov/hurricanes/>).

# Capacity Building

To ensure a sustained impact:

- Software for sea level validation/ analysis, wind/wave climatology statistical analyses
- Workshops, to develop local capacity to access, analyse and apply oceanographic satellite data sets in applications to increase resilience to coastal hazards.

**Workshop 1 (Nov, Dec 2017): "Wind, wave and sea level information from satellites"**

**Workshop 2 (Oct 2018): "Tools to apply satellite data to coastal risk."**





# Preparation Phase

- Identified local delivery partners



- Data identification and acquisition
- Conducted fact-finding missions ('kick-off' workshops) to establish development needs
- Prepared targeted training workshops



# Delivery Phase

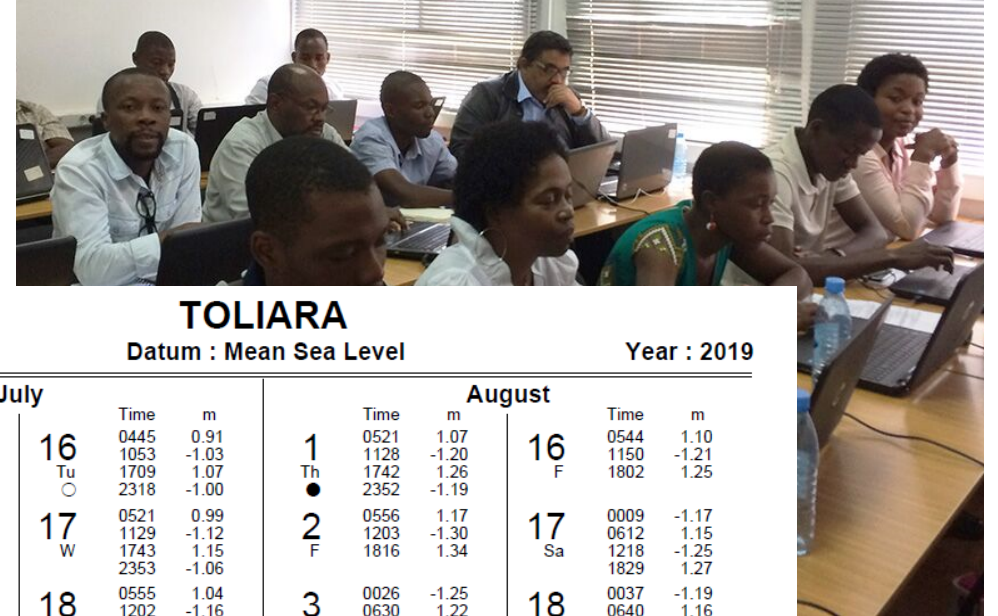
- Delivered a series of targeted training workshops
- Hosted by local partners:
- Universidade Eduardo Mondlane
- Meteo Madagascar
- CNRO



# Delivery Phase

Training workshops covered:

- Using BILKO software to acquire and manipulate satellite images
- Using C-RISe coastal satellite altimetry products, wind and wave data
- Using tide gauge data to validate altimetry and to produce tide tables



TOLIARA

Time Zone: -0300

Datum : Mean Sea Level

Year : 2019

July				August							
	Time	m			Time	m			Time	m	
1	0412	0.87	16	0445	0.91	1	0521	1.07	16	0544	1.10
M	1022	-0.97	Tu	1053	-1.03	Th	1128	-1.20	F	1150	-1.21
	1636	1.00		1709	1.07		1742	1.26		1802	1.25
	2245	-0.96	○	2318	-1.00	●	2352	-1.19			
2	0451	0.98	17	0521	0.99	2	0556	1.17	17	0009	-1.17
Tu	1059	-1.09	W	1129	-1.12	F	1203	-1.30	Sa	0612	1.15
●	1713	1.12		1743	1.15		1816	1.34		1218	-1.25
	2323	-1.06		2353	-1.06					1829	1.27
3	0527	1.06	18	0555	1.04	3	0026	-1.25	18	0037	-1.19
W	1135	-1.17	Th	1202	-1.16	Sa	0630	1.22	Su	0640	1.16
	1749	1.20		1816	1.19		1236	-1.33		1245	-1.24
	2359	-1.12					1849	1.36		1856	1.25
4	0603	1.10	19	0025	-1.08	4	0100	-1.25	19	0104	-1.17
Th	1211	-1.21	F	0627	1.05		0703	1.21		0707	1.13
	1825	1.24		1234	-1.16	Su	1311	-1.30	M	1313	-1.18
				1848	1.17		1924	1.31		1922	1.18
5	0036	-1.13	20	0057	-1.06	5	0133	-1.20	20	0131	-1.10
F	0639	1.10	Sa	0659	1.02		0738	1.14	Tu	0734	1.05
	1247	-1.20		1306	-1.12	M	1345	-1.20		1341	-1.07
	1902	1.22		1918	1.12		1958	1.19		1950	1.06
6	0113	-1.10	21	0128	-1.01	6	0209	-1.08	21	0159	-0.99
Sa	0717	1.05	Su	0730	0.96		0813	1.02	W	0803	0.93
	1325	-1.14		1336	-1.04	Tu	1422	-1.05		1410	-0.92
	1940	1.15		1949	1.03		2035	1.02		2018	0.91
7	0153	-1.02	22	0200	-0.92	7	0247	-0.92	22	0230	-0.84
Su	0756	0.95	M	0802	0.87		0853	0.84	Th	0835	0.76
	1405	-1.04		1409	-0.92	W	1503	-0.84		1442	-0.74
	2021	1.04		2021	0.91	○	2115	0.81		2051	0.71



# Delivery Phase

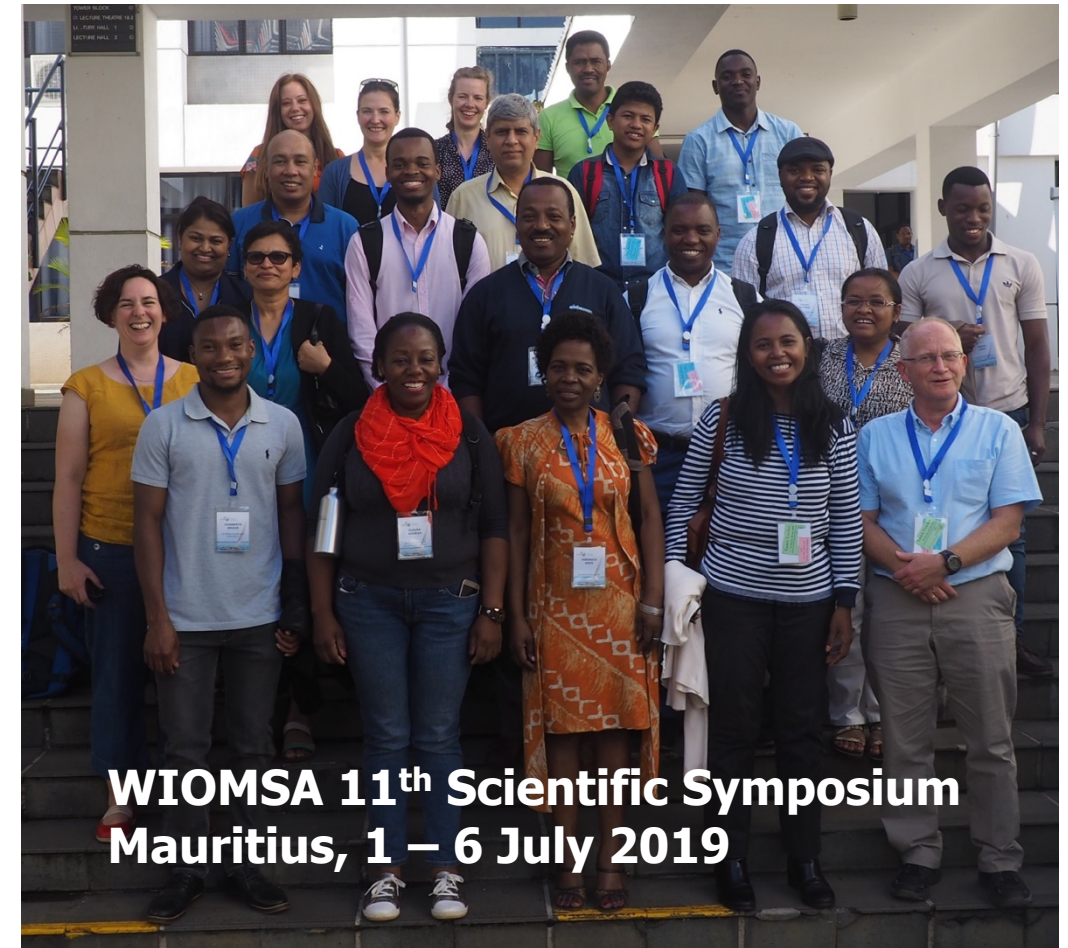
- Training workshops - devised bespoke use cases for local delegates to apply learned techniques, co-supervised by local delivery partners





# Delivery Phase

Sponsored international conference attendance for some partners





# Delivery Phase

Follow-up workshops to refresh training and focus on Use Cases





# Review Phase

Evaluation and review use cases  
Regional showcase of project (WIOMSA)  
Local showcase  
Future roadmap  
review ongoing take up with partners.

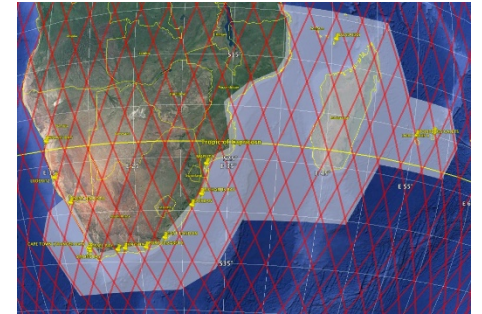


# Application of satellite data to coastal risk: introduction to Use Cases

11<sup>th</sup> and 12<sup>th</sup> February 2020, Antananarivo, Madagascar

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# C-RISe Impact

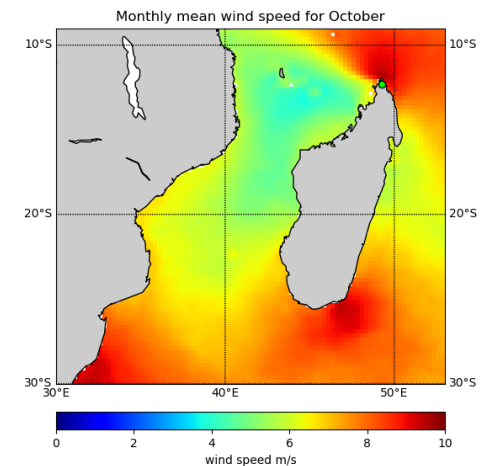
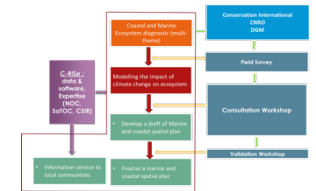
Improve resilience in vulnerable coastal areas by ensuring that C-RISe data is used:

- in decision making processes
- in climate adaptation strategy documents or management plans
- to mitigate and prevent impacts from coastal inundation
- to reduce risks to marine traffic and offshore activities



# Use Case concept

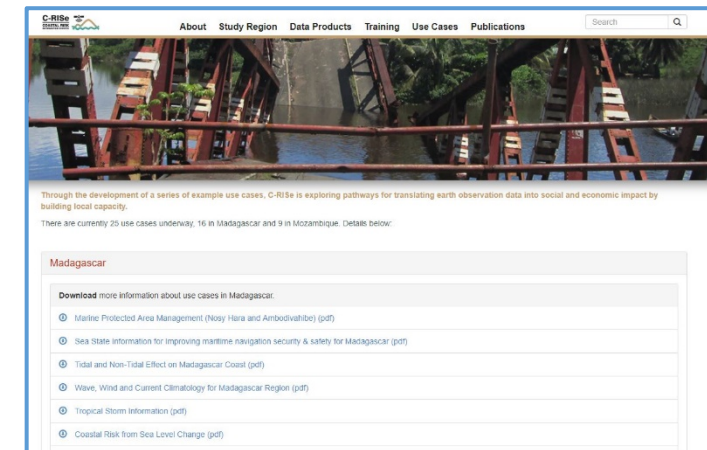
- Use Cases provide the basis for practical implementation of the C-RISe service in each partner country – testing the usefulness and benefits of the service in real life applications.
- Focus on developing national and regional capability in accessing and applying EO data.
- Generate project impact.





# Use Case concept (dual purpose)

1. To generate knowledge and evidence to support action
  - Stronger knowledge integration, translation and integration to inform
  - What evidence and information is needed by whom, in what form and for what?
  - Stakeholder and end-user engagement to enhance quality and impact of outputs
2. Provide an example/template as to how the knowledge and evidence can be generated
  - Co-generation of research and co-production of outputs
  - Passes on skills/knowledge
  - Provides examples of how data can be applied



# Use Case timeline

- Topics identified by partners in discussion with C-RISe UK team – 2017 training (Oct/Nov); 2018 visit (Mar/Apr); 2018 training (Oct); 2019 visit (Feb)
- Partners supported during training, visits and by email
- Final reports delivered March to May 2019
- Reviewed May to July 2019





# Use Case Applications

- Marine Protected Area Management
- Near Real Time Sea State Information
  - Maritime safety, search and rescue support
  - Operational Planning: illegal logging, smuggling, pollution
  - Improved tropical storm information
- Sea Level Analyses
  - Tidal Analyses, extreme events, inter-annual variability
  - Understanding changing coastal risk
  - Port development, coastal defences
- Wave and Wind (and current) climatologies
  - Operational planning
  - Coastal and Marine Atlas
  - Wind and wave energy resource
  - Infrastructure planning and developments
- Climate change impact on marine ecosystems
  - Mangroves, coral reefs, shrimp fisheries



# Summary

- C-RISe has provided climatological and near real time, sea level, surface current, wind and wave data to partners in the South West Indian Ocean
  - Also Sea Surface Temperature, Chlorophyll-A, high res optical data.
- These products have been applied in 23 Use Cases over a wide range of applications, addressing five SDGs
- Benefits to local population generally over the longer term – Impacts from development of coastal management strategies will be felt in 5-10 year timescale
- Development of local capability through knowledge transfer and training
- Training element has been very important and well received.
- Next steps are to develop applications and sustainable capability.

**[www.c-rise.info](http://www.c-rise.info)**



*C-RISe is funded by the UK Space Agency under the International Partnership Programme (IPP), a five-year, £152 million programme designed to partner UK space expertise with overseas governments and organisations. It is funded from the UK Department for Business, Energy and Industrial Strategy's Global Challenges Research Fund (GCRF)*