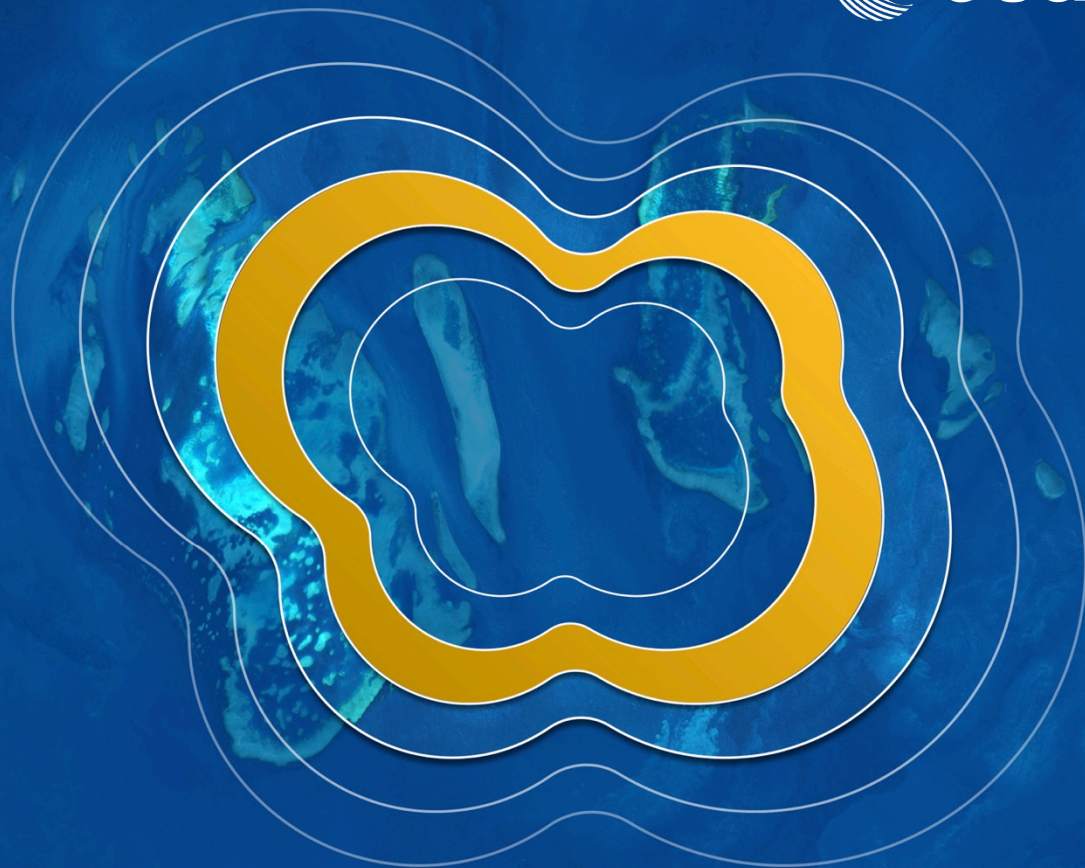


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European Space Agency

C-RISe – Application of satellite data as a tool for managing coastal risk and sustainable development in the South-West Indian Ocean



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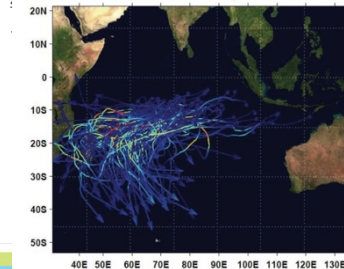
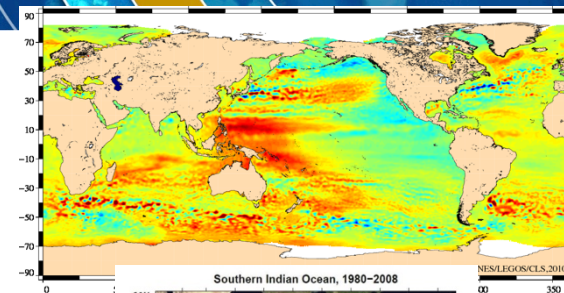
- **C-RISe:** A 3 year project to develop, deliver and evaluate a Coastal Risk Information Service to South Africa, Mozambique, Madagascar and Mauritius
- Funded by the UK Space Agency: International Partnership Programme
- Project Objectives:
 - Deliver a **Coastal Risk Information Service**, providing sea level, wind, waves and surface currents information to support coastal vulnerability assessment.
 - 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** to increase resilience to coastal hazards

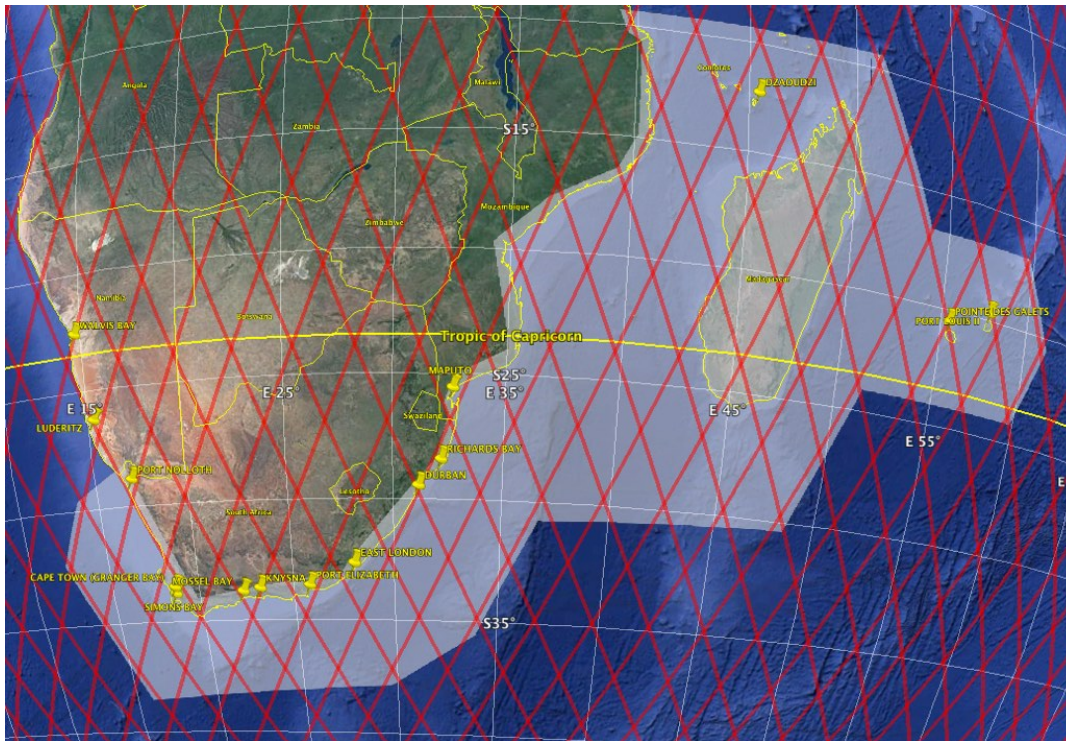


Directed primarily at SDG 1.5: *"...build the resilience of the poor and those in vulnerable situations, and reduce their exposure and vulnerability to climate-related extreme events..."*



- Global sea level is increasing, and large-scale weather patterns are changing.
- C-RISe partner countries in the South West Indian Ocean (Mozambique, Madagascar, Mauritius, South Africa) have significant coastal populations highly vulnerable to the consequences of climate variability and change.
- With access to improved regional information on coastal risk factors (sea level, wave and wind extremes) plans to protect coastal communities and safeguard economic activity can be improved.
- Will also contribute to improving industrial and commercial competitiveness in the maritime sector, heavily dependent on access to accurate relevant oceanographic information.



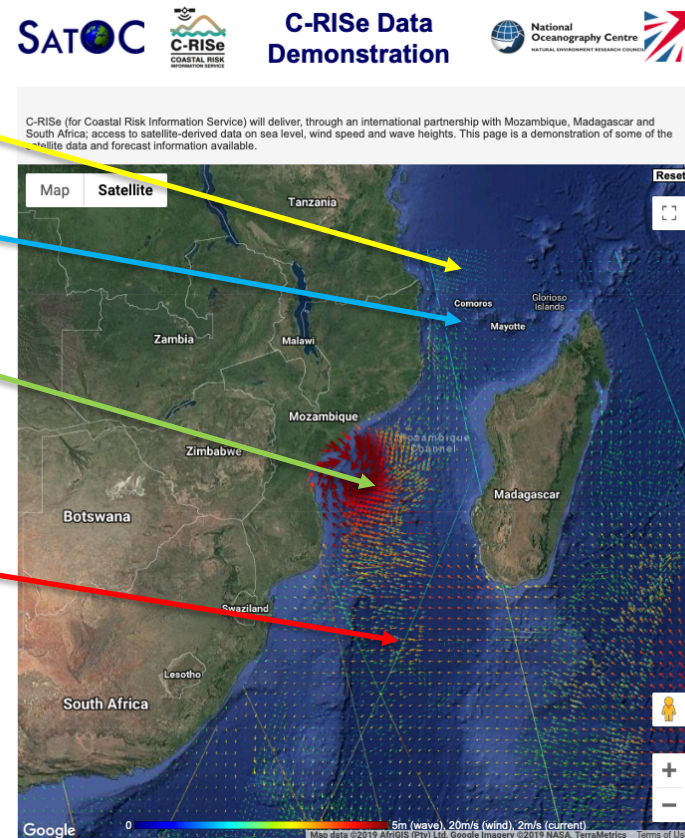


Parameter	Description	Time	Satellites
Total Water Level Envelope, significant wave height, surface radar backscatter	Along track data from the NOC coastal processor	2002-2016	Jason-1, Jason-2, Jason-3
Significant Wave Height Climatology	Monthly, 1° x 1° gridded climatology, ESA Globwave	1992-2014	ERS-1, ERS-2, Envisat, Topex, Jason-1, 2,3
Wind Speed and Direction Climatology	Monthly, 0.25° x 0.25°, from Copernicus	2007-2017	ASCAT
Total surface current (geostrophic + Eckmann)	Daily, 0.25° x 0.25°, from ESA Globcurrent	1993-2015	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

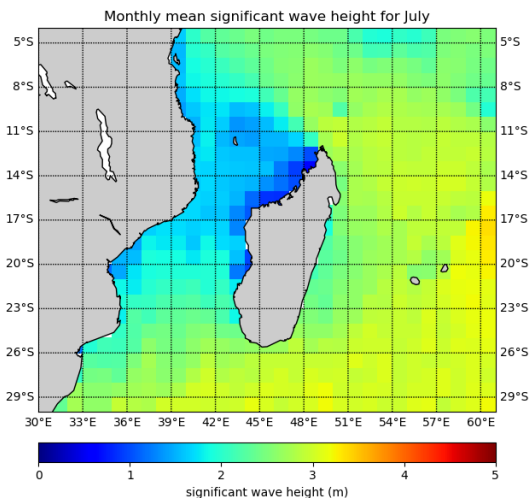
- Wind speed and direction from satellite scatterometer (ASCAT)
- Daily average surface currents from ESA Globcurrent project
- Forecast winds and waves from US NOAA model
- Along track wind speed and wave height data from satellite altimeter, most recent passes (Jason-2, Jason-3, AltiKa, Sentinel-3)

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

Screenshot from 14 March 2019: *Tropical Cyclone Idai*

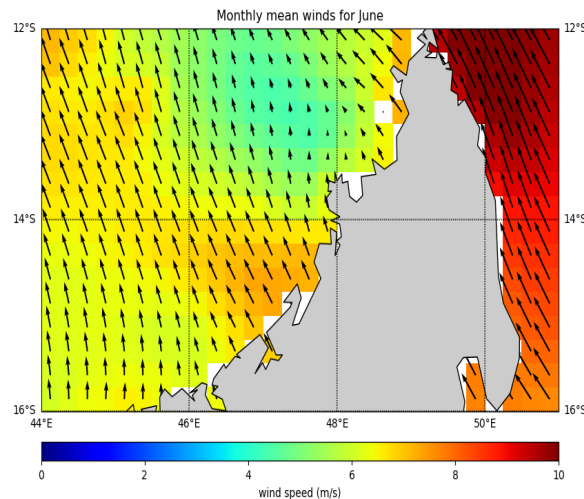


Waves



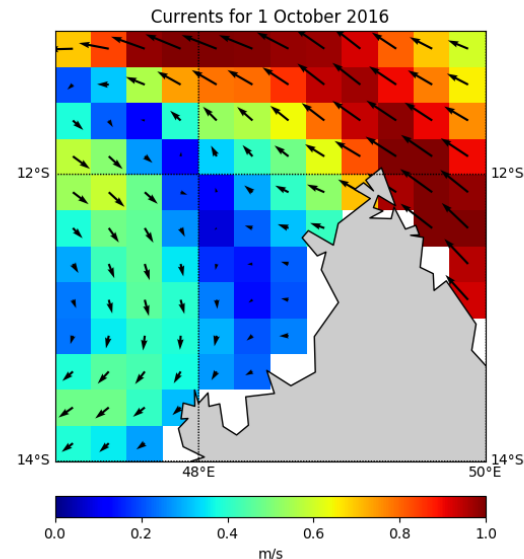
July mean SWH

Winds

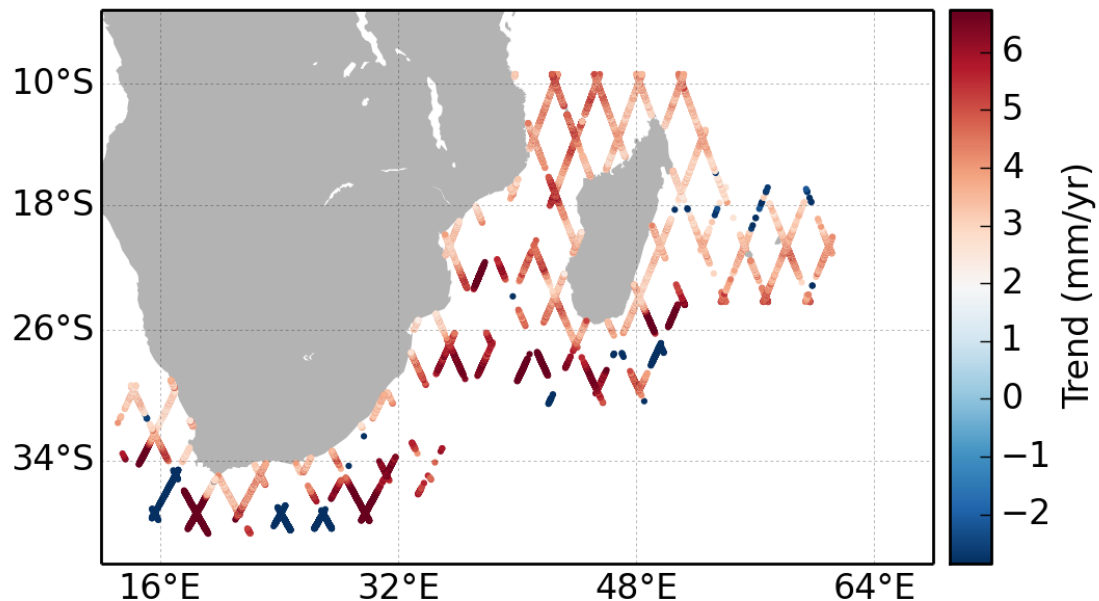
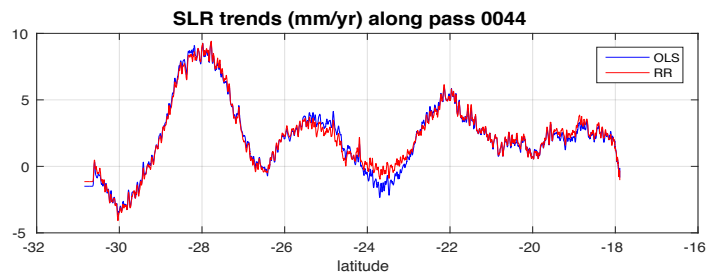
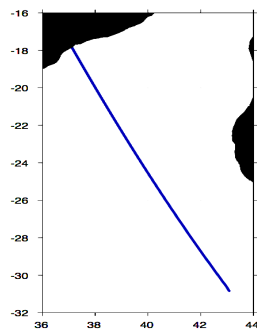


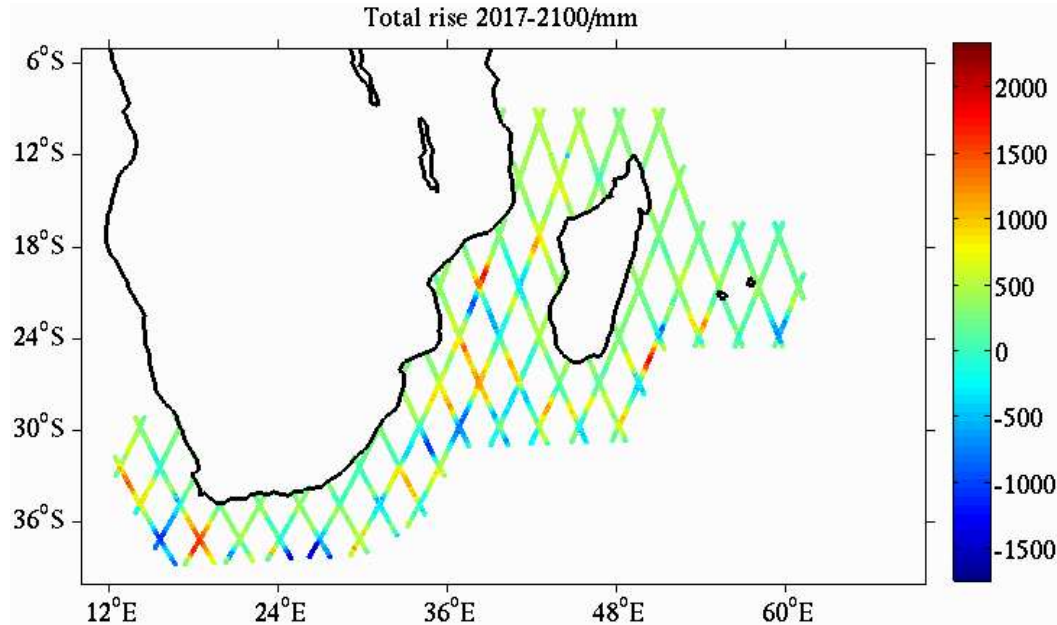
June mean wind
speed and direction

Surface Currents



Mean surface
current 01/10/16





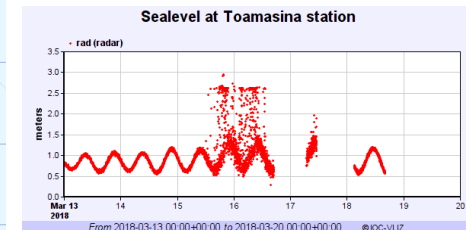
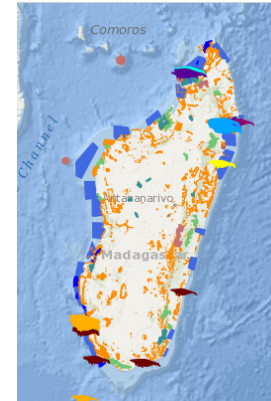
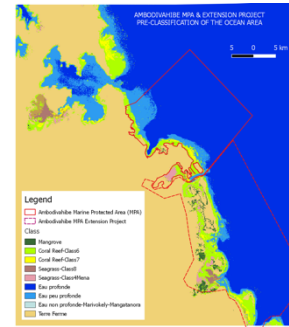
Work in progress to relate the total projected sea level rise by 2100, derived from C-RISe altimetry, to changes in MHW based upon Pickering et al. (2012)

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)?



- 27 Use Cases: Practical implementation in local applications to support Monitoring and Evaluation and assess usefulness and benefits.
 - Marine Protected Area Management - Information Services
 - 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
 - Wave and Wind (and current) climatologies
 - Operational planning
 - Coastal and Marine Atlas
 - Wind and wave energy resource
 - Climate change impact on marine ecosystems
 - Mangroves, coral reefs, shrimp fisheries,
 - Algal blooms, sea water quality, pollution, acidification
-
-



A key objective of C-RISe is Capacity Building, to ensure a sustained impact:

- Software for sea level validation/ analysis, wind/wave climatology statistical analyses
- Series of Workshops, to develop local capacity to access, analyse and apply oceanographic satellite data sets in applications to increase resilience to coastal hazards.
- 2 sets of workshops delivered in Mozambique and Madagascar, to 68 participants:
 - ***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."***



- 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 27 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

Any Questions?

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)