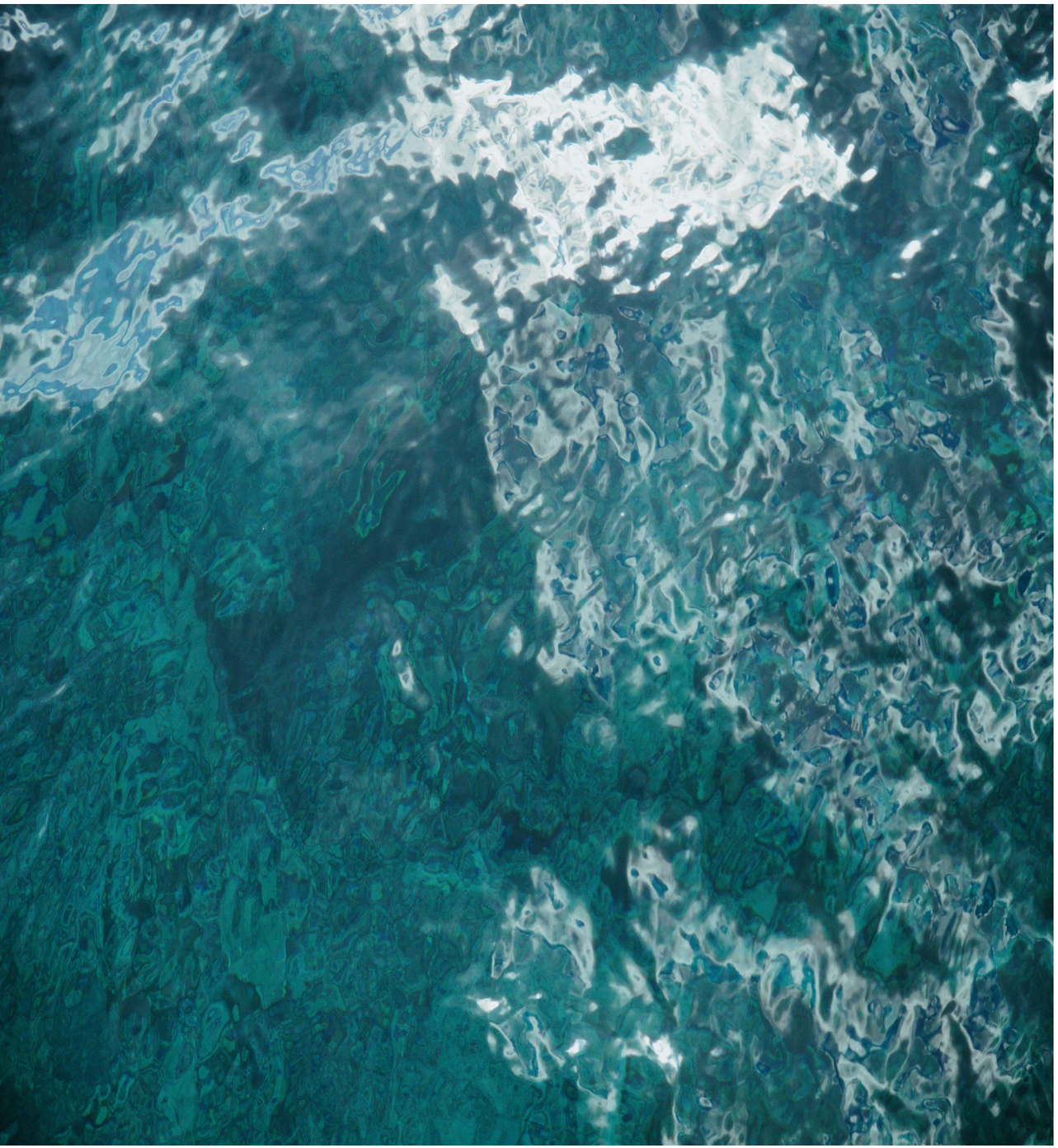
2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Initiative on Disaster Mitigation and Prevention in pan-Indian Ocean Region

Dr. Shizhu Wang | May 22th, UAE



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Ocean and Climate Challenges in the Indian Ocean Region

Global and Regional Efforts to Address These Challenges

What We Need for the Indian Ocean Region

Our Call for a Safe and Sustainable Indian Ocean

Climate Change Impacts on the Indian Ocean

- **Sea level rise:** The rates of sea-level rise in Indian Ocean subregions are **higher** than the global mean rate over 1993–2023 (3.43 ± 0.3 mm/year) and they continued to rise at a sustained rate.
- **Sea-surface temperature:** In the Indian Ocean, mean SST anomalies ranged between **0.5°C and 1°C** in 2024, being one of the most affected regions.
- **Marine heat wave:** Indian Ocean is warming rapidly and moving towards a state of near-permanent marine heat waves, with **220-250 days** of heat waves projected in a year until 2050.

Table 1. Rate of area-averaged sea-level change over the period from January 1993 to May 2023 according to satellite measurements. Subregions are defined in Figure 13.

Subregion number	*Area*	*Trend in rate of sea-level rise (in mm per year)*
1	North-west Indian Ocean	4.07 ± 0.12
2	North-east Indian Ocean	4.44 ± 0.15
3	South-east Indian Ocean	4.19 ± 0.10
	Global mean	3.40 ± 0.33

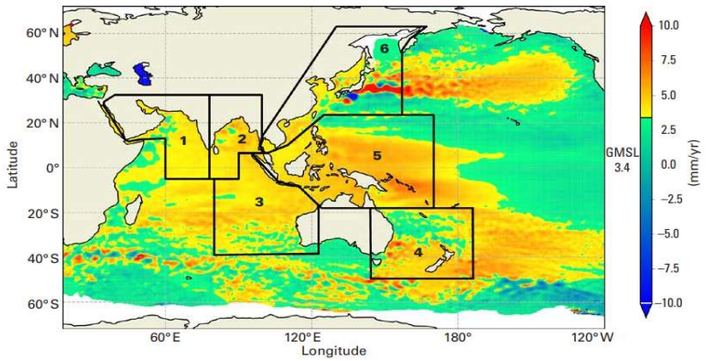


Figure 13. Spatial patterns in sea-level trends observed by altimeter satellites over the period from January 1993 to May 2023. The transition from green to yellow corresponds to the 3.4 mm/year global mean averaged trend. The numbered boxes represent subregions where the rates of area-averaged sea-level change are provided in Table 1.

Source: Copernicus Climate Change Service (C3S)

WMO, State of the Climate in Asia 2023

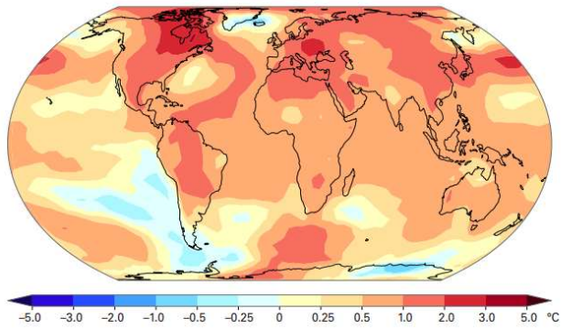
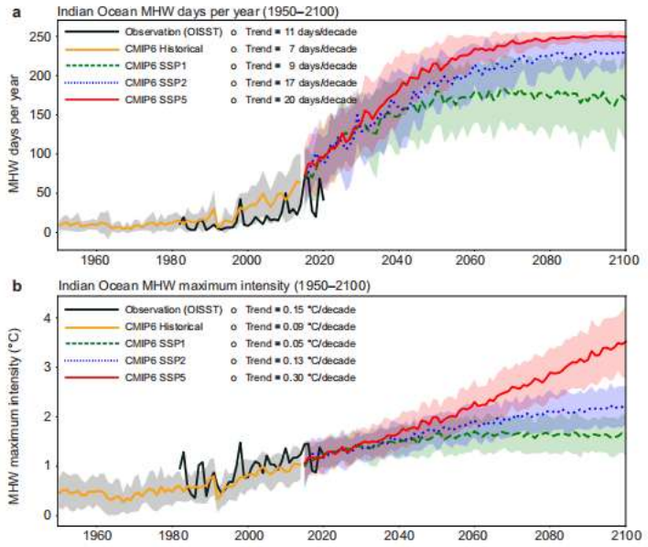


Figure 9. Annual average temperature anomalies relative to the 1991–2020 average. The values shown are the median of six global temperature datasets.

Source: Data from six global temperature datasets. For details see Datasets and methods.

Mercator Ocean International, Assessing the Ocean in 2024



M.K. Roxy et al. Future projections for the tropical Indian Ocean

High Vulnerability to Tropical Cyclones

Severe human casualties and economic losses caused by Mocha and Chido

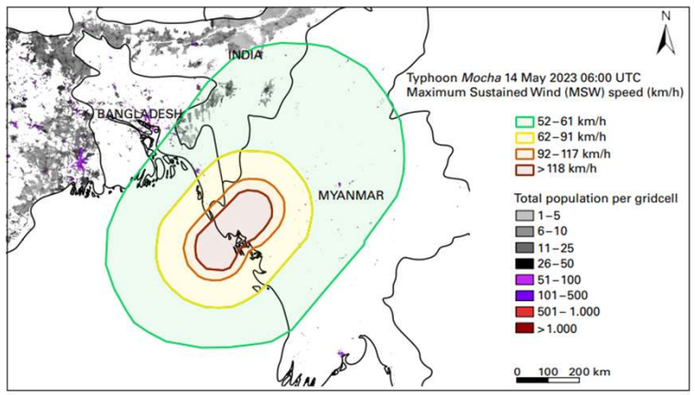


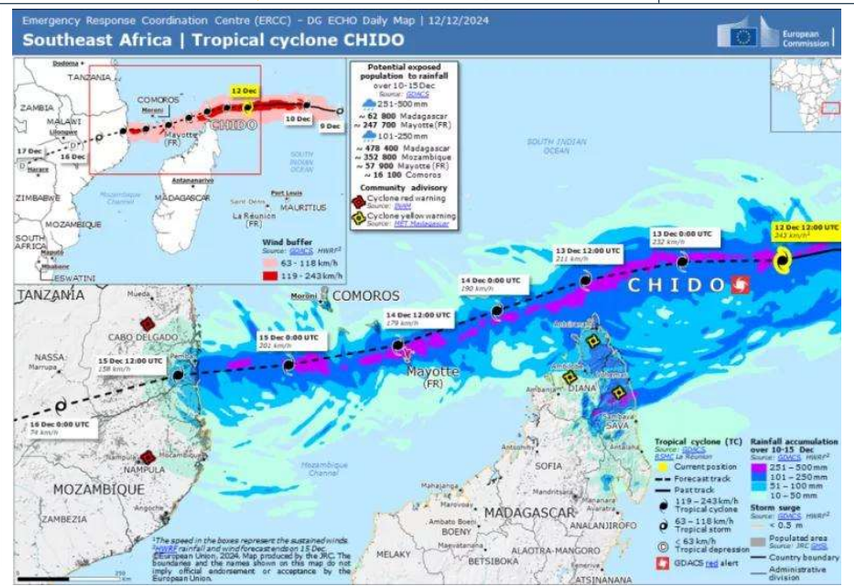
Figure 18. Impact-based forecasting of the population exposed to Typhoon *Mocha*. Maximum Sustained Wind speed of Typhoon *Mocha*, 14 May 2023 and Worldpop 2020 Population Estimates.
Source: UNESCAP and India Meteorological Department (IMD)

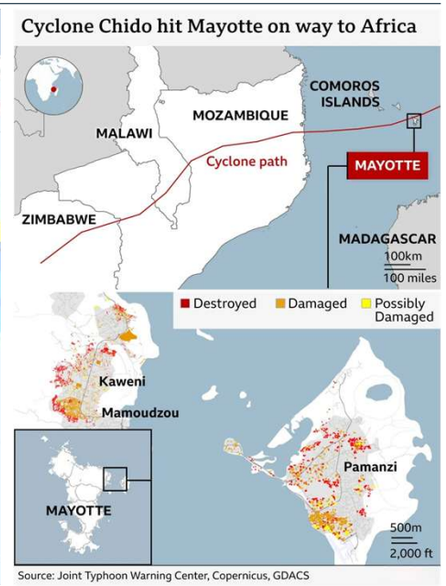
Extremely Severe Cyclonic Storm Mocha made landfall along the Rakhine Coast in Myanmar on 14 May, 2023, causing widespread destruction and a reported loss of **156** lives in the region. This was the strongest cyclone in the Bay of Bengal in the last 10 years and caused significant damage to people's homes, infrastructure, power and water services, affecting around **800,000** people.

The median estimate of total direct damage caused by Cyclone Mocha is **$2.24 billion,** equivalent to **3.4%** of Myanmar's GDP in 2021.

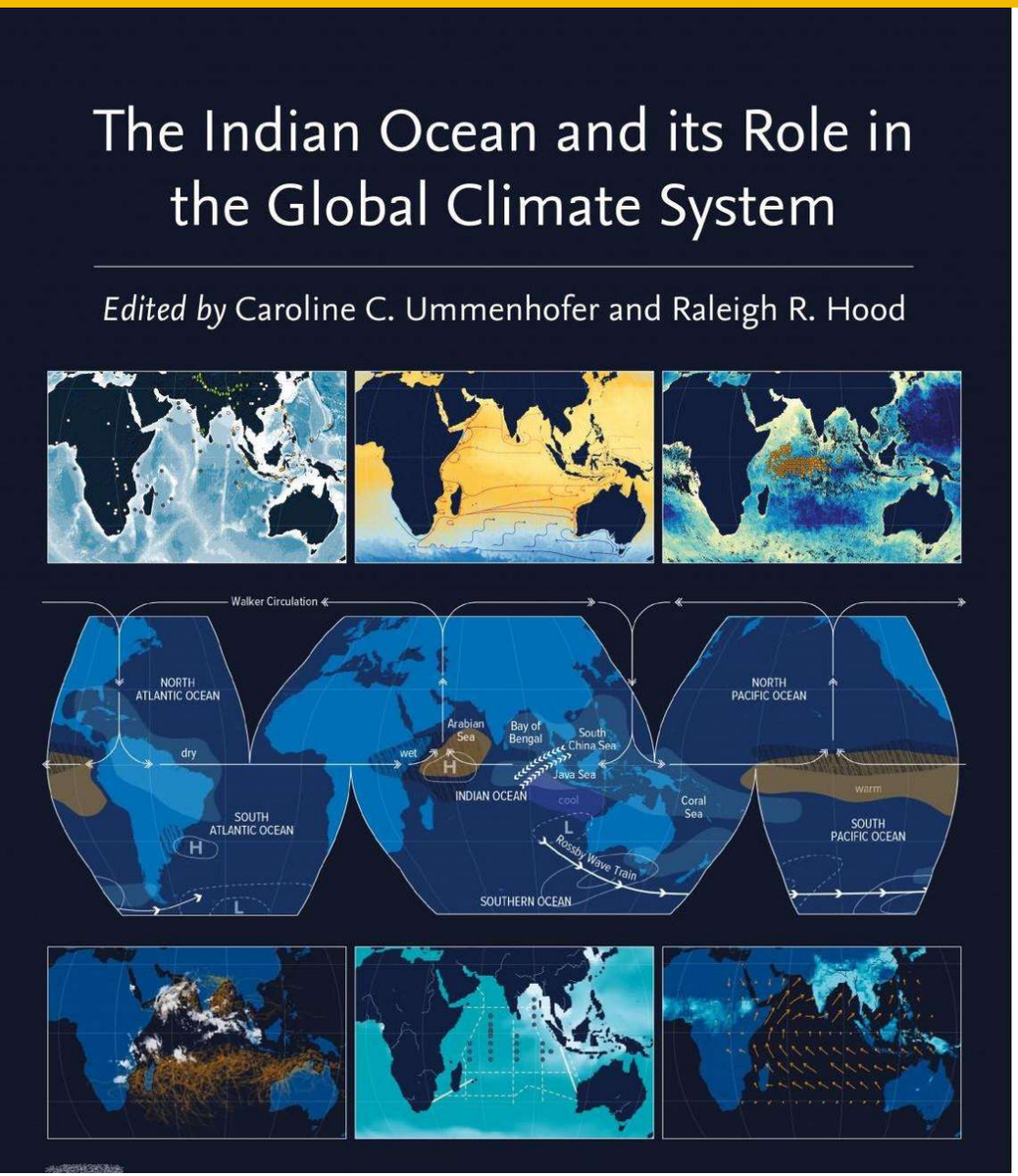
Tropical Cyclone Chido swept across Mayotte, Mozambique, and Malawi in December 2024, causing **$3.9 billion** in damages—the highest on record in the South-West Indian Ocean basin.

As the most powerful to strike Mayotte in 90 years, the storm claimed at least **172** lives and injured over **6,500** people across Mozambique, Mayotte, and Malawi.





India Ocean is Key to Understanding Global Climate Change



Historic Yangtze flooding of 2020 tied to extreme Indian Ocean conditions

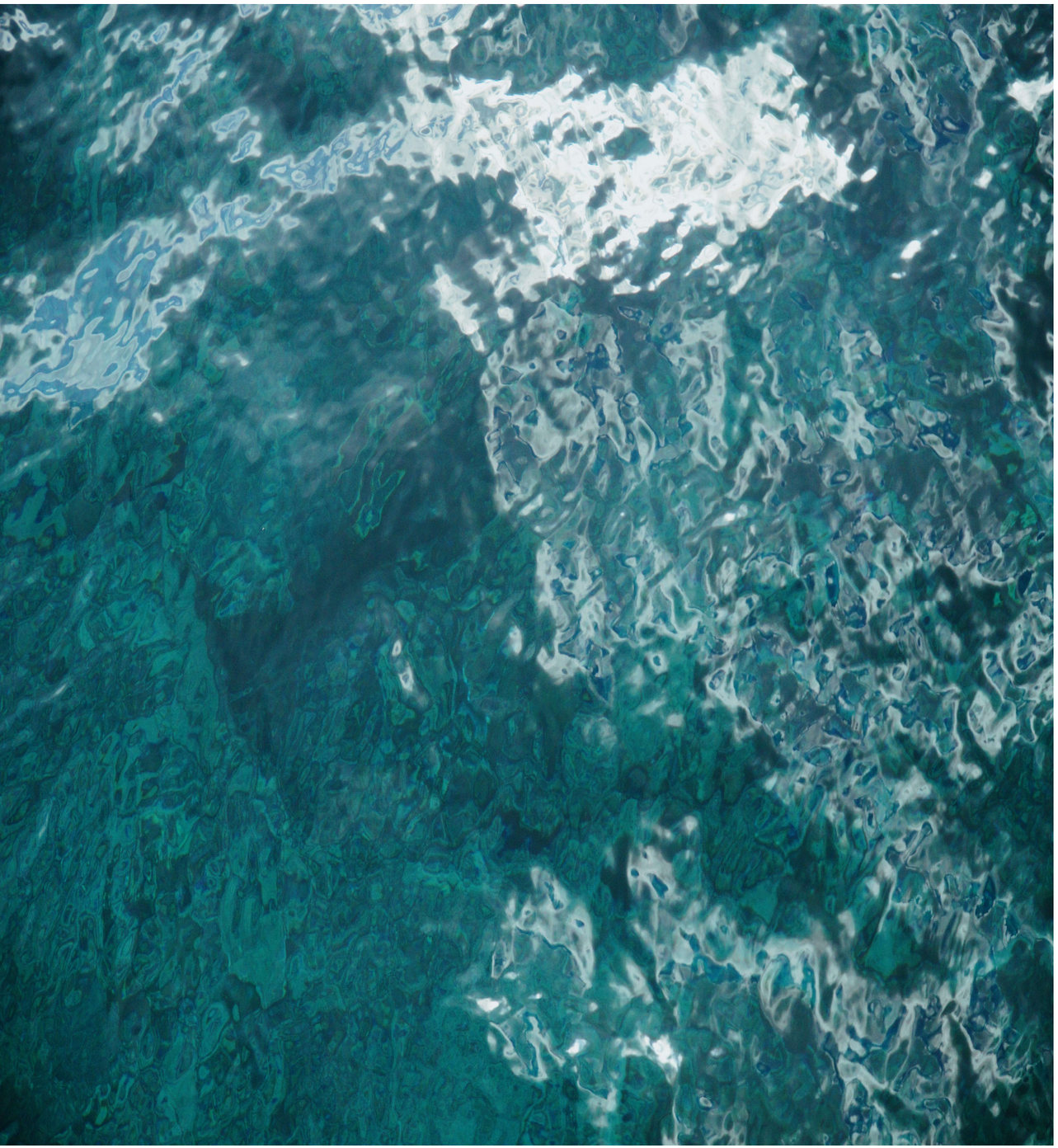
Heavy monsoon rainfall ravaged a large swath of East Asia in summer 2020. Severe flooding of the Yangtze River displaced millions of residents. Using observations and model experiments, researchers show that the record strong Indian Ocean Dipole event in 2019 is an important contributor to the extreme Yangtze flooding of 2020.

Z. Zhou, S. Xie, & R. Zhang, Historic Yangtze flooding of 2020 tied to extreme Indian Ocean conditions, The Proceedings of the National Academy of Sciences (PNAS), 2021.

Indian Ocean causes drought and heatwaves in South America

Atmospheric waves originating from convection over the Indian Ocean had a dramatic impact on climate conditions over South America and South Atlantic, leading to record-breaking South American drought of 2013/14 with its succession of heatwaves and long marine heatwave, revealing complex remote connections.

Regina R. Rodrigues, et al. Common cause for severe droughts in South America and marine heatwaves in the South Atlantic. Nature Geoscience, 2019



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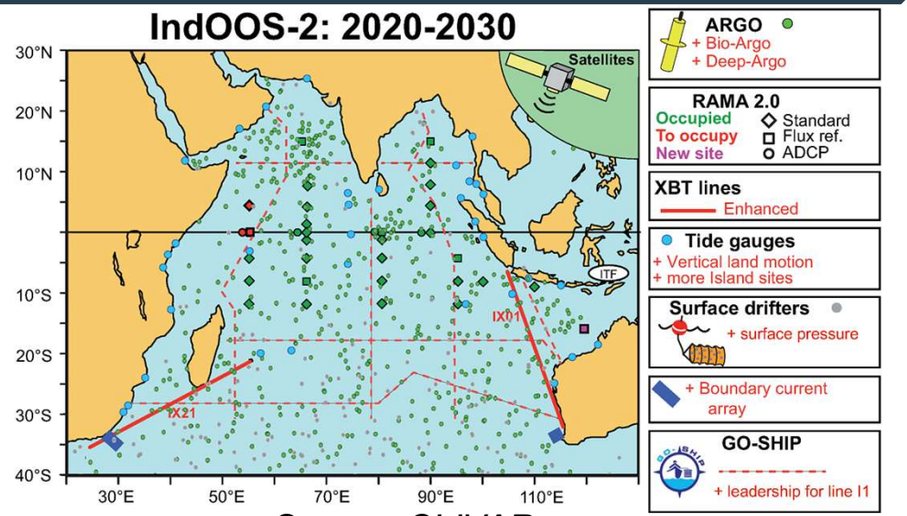
Global Efforts

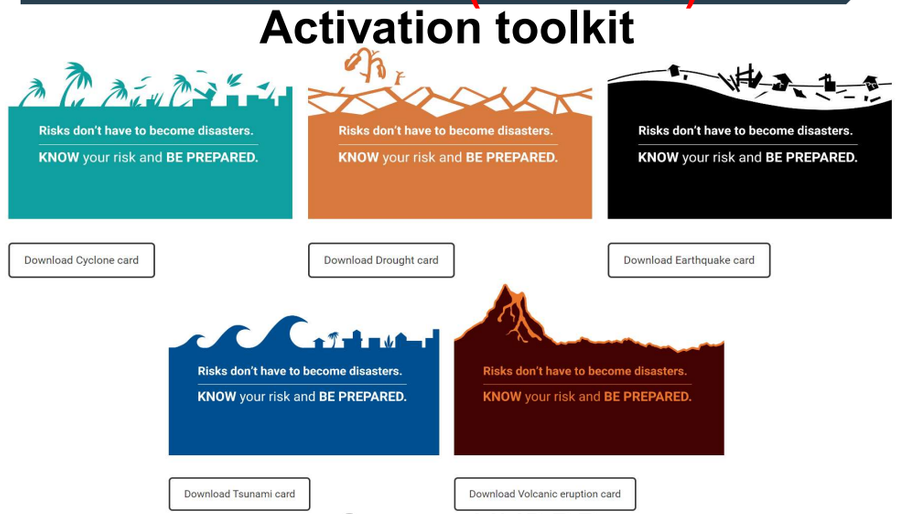
Indian Ocean Observing System (IndOOS)



Source: CLIVAR

- Sustained observing system for the Indian Ocean, a network operated and supported by various national agencies and coordinated internationally under the Global Ocean Observing System framework by the CLIVAR/IOC-GOOS Indian Ocean Region Panel
- Provide sustained high-quality oceanographic and marine meteorological measurements that can support knowledge-based decision-making and policy developmentthrough improved scientific understanding, and ultimately, improved regional weather, ocean and climate forecasts

Resilience building and disaster response management in the Indian Ocean (RDRM-IO)

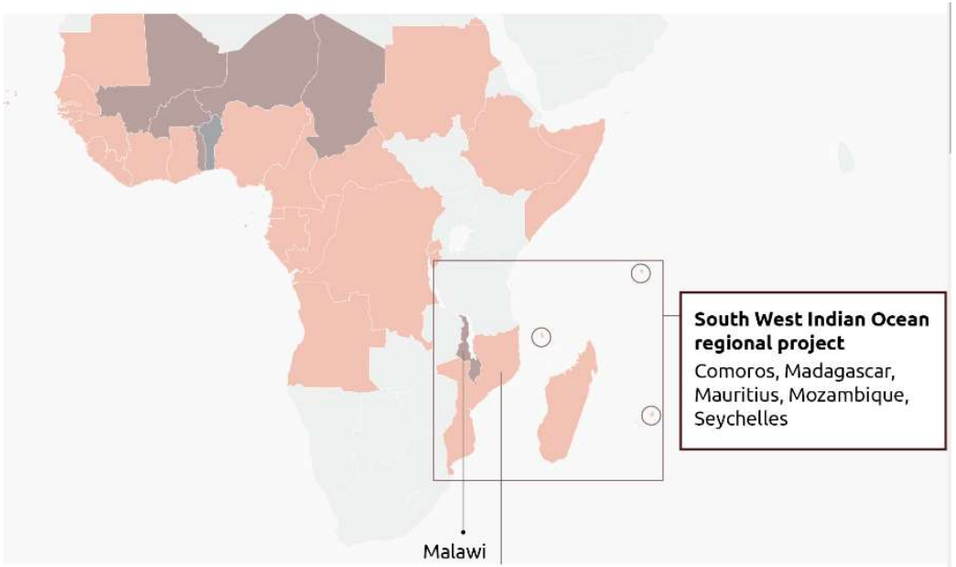


Source: UNDRR

- The overall objective of the RDRM-IO Programme is to reduce disaster and climate related losses in the human, economic, social, physical, and environmental assets of Indian Ocean Commission (IOC) member states.
- In the context of this programme, a UNDRR component was launched on 22 March 2022. The objective of this component is to improve Disaster Risk Reduction (DRR) understanding and governance capacities of the island states of Comoros, Madagascar, Mauritius, and Seychelles

Regional Efforts

➢ Climate Risk & Early Warning Systems (CREWS) Initiative Project: South-West Indian Ocean

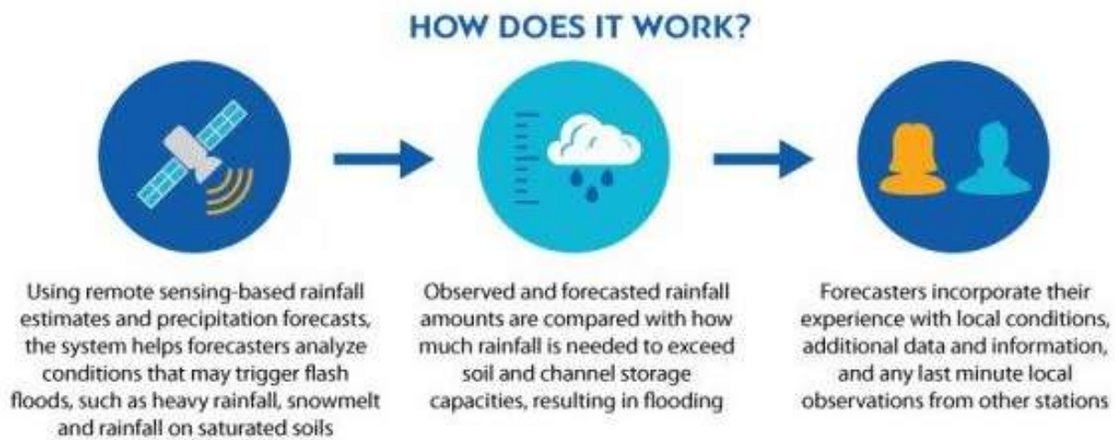


Source: WMO

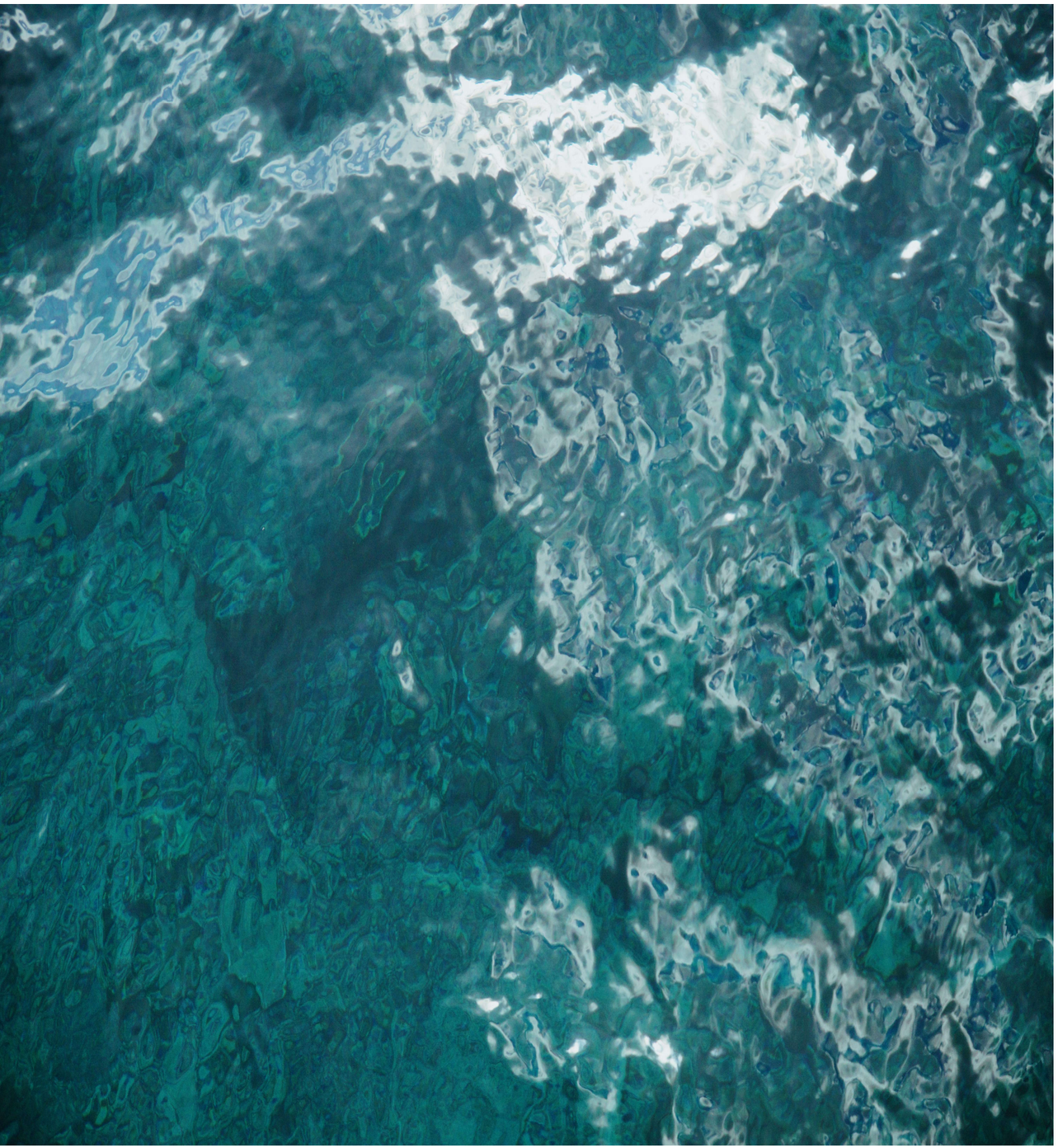
Key goals

- Stregthen multi-hazard and impact-based early warning systems.
- Improved regional cooperation frameworks for forecasting climate and weather.
- Dissemination, emergency planning, and response capacities developed in each of the beneficiary countries

➢ Flash Flood Guidance System with Global Coverage (FFGS): Southwest Indian Ocean Flood & Flash Flood Guidance System



Source: Flash Flood Guidance System



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Current gaps

- **Early Warning Systems (EWS) and Coverage:** Many countries in the Indian Ocean region still lack adequate multi-hazard early warning systems. Efforts are ongoing to close these gaps, particularly in SIDS and LDCs.
- **Integration of Multi-Hazard and Climate Change Frameworks:** Disaster risk reduction strategies frequently address hazards in isolation, neglecting the interconnected nature of risks. The increasing frequency and intensity of climate-related events, such as cyclones intensified by the warming Indian Ocean, are not consistently integrated into disaster planning.
- **Community Engagement and Education:** Risk communication strategies are not always tailored to local languages and cultural contexts, reducing their effectiveness. Strengthening infrastructure, enhancing technical capabilities, and improving communication channels are essential to ensure effective early warning dissemination and response.

What we have developed

Coastal city Ocean-bAsed Solution Toolkit for sustainable development (COAST)

Ocean & Climate Early wArNing Universal System	Maritime Navigation Safety	Coastal Ecosystem Health	Integrated Coastal Management	Blue Economy Development	Ocean Literacy and Capacity Building
Ocean Forecasting system	Maritime Silk Road forecasting	Coral reef bleaching monitoring and forecasting	ICM Code	Ocean renewable energy development	Ocean Literacy Alliance for Primary and Middle Schools
Typhoon forecasting system	Polar shipping risk assessment	Pollution tracing and trajectory prediction	MPA planning	Blue carbon storage estimation	Marine Museums Alliance
Climate prediction: SLR, climate heat wave and drought/flood	Optimal route planning	Marine aquaculture environment assessment	Estuarial pollution monitoring	Assessment on marine environment effects	Marine knowledge outreach
Marine search and rescue; oil spill tracking	Customized forecasting support	Marine endangered species protection	Island Management	Ocean tourism index	Best practice on human-ocean harmony

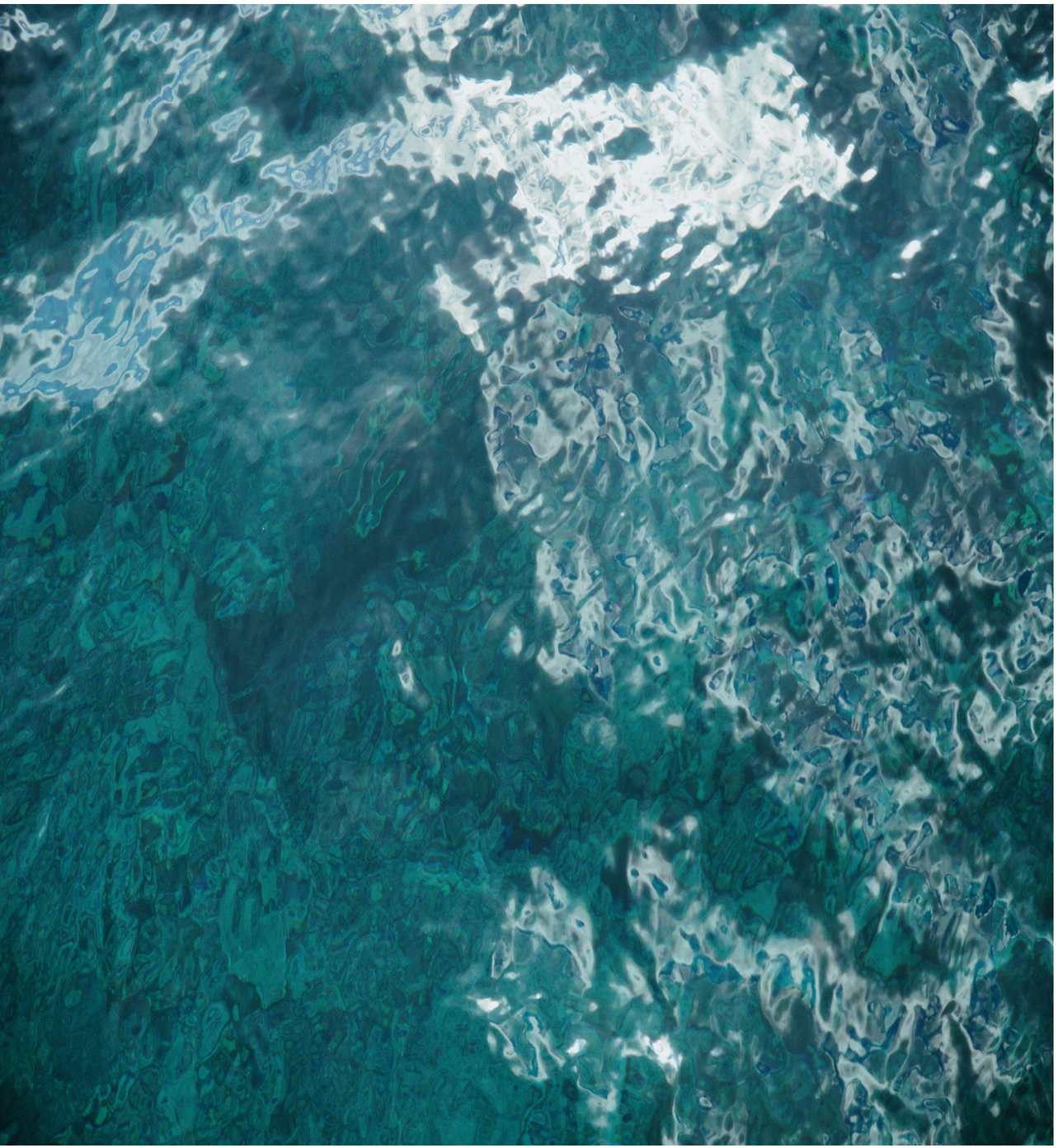
FUEL

DRIVER LICENSE

Data support

State-of-the-art model + AI

Capacity building



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Strengthen Multi-Hazard Early Warning Systems (MHEWS)

Expand and integrate region-wide early warning systems that are people-centered, inclusive, and accessible, especially in Small Island Developing States (SIDS) and Least Developed Countries (LDCs).

Invest in Resilient Infrastructure and Planning

Promote risk-informed urban planning and enforce resilient building codes in coastal zones to reduce vulnerability to sea-level rise, storm surges, and cyclones.

Integrate Climate and Disaster Risk Management

Embed climate change adaptation into disaster risk reduction frameworks to account for the intensifying impacts of warming seas, extreme heat, and rising sea levels.

Empower Communities through Education and Engagement

Support culturally tailored risk communication and community-led preparedness programs to strengthen local resilience and foster a safety culture.