



(A basin-wide research program co-sponsored by IOC-UNESCO, SCOR and IOGOOS)

To advance our understanding of interactions between geologic, oceanic and atmospheric processes that give rise to the complex physical dynamics of the Indian Ocean region, and to determine how those dynamics affect climate, extreme events, marine biogeochemical cycles, ecosystems and human populations.

EMC Experiment: Examining the Fate of the East Madagascar Current

The system of ocean currents that forms the global Meridional overturning circulation plays a central role in regulating Earth's climate. One of the least understood yet critical aspects of this system is the upper-layer circulation near the southern tip of Madagascar in the South Indian Ocean. The southward-flowing East Madagascar Current (EMC) -- a conduit for warm and fresh Indonesian Throughflow Water to the subtropical South Indian Ocean and beyond-- is in many ways a typical western boundary current, except that it 'runs out' of the boundary at relatively low latitude (25.5°S) (Figure-1). What happens when this vigorous current detaches from the southern tip of Madagascar is still a mystery, debated in the literature since the 1970s. Some argue that the EMC breaks up into mesoscale eddies which travel west and join the Agulhas Current, whose pinched-off rings and filaments drift into the Atlantic Ocean; others that the EMC retroflects eastward to the South Indian Countercurrent (SICC), which flows to Australia; while others contend that both pathways exist, but the retroflexion is restricted to the surface layer. It has also been hypothesized that a full or partial retroflexion of the EMC is a nutrient source to the yet unexplained Southeast Madagascar Bloom-- a global 'hotspot' for primary production in an otherwise oligotrophic subtropical region. There is a dearth of in situ observations in the detached EMC, and it is hard with satellite data alone to determine its pathways because the detached EMC is masked by ubiquitous mesoscale eddies. Now, we have a unique opportunity to observe the regional surface and subsurface pathways from a Lagrangian perspective.

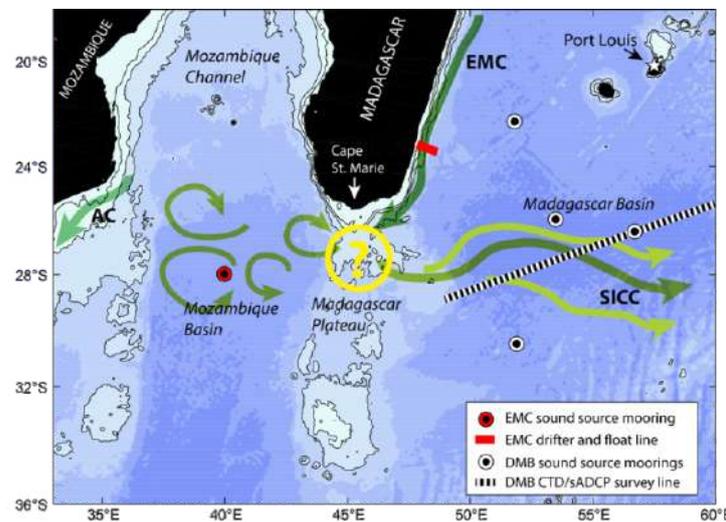


Figure-1: EMC experiment design. Red line shows the initially proposed Lagrangian instrument deployment (dependent on Madagascar EEZ access granting).

To observe the detached EMC pathways, we will simultaneously release surface drifters and subsurface RAFOS floats. The first release will occur during the R/V Revelle cruise (April 4 to May 15, 2023), with further releases later in the year.

This Lagrangian experiment, the first of its kind in this area, will be paired with particle tracking simulations. The knowledge obtained by such an experiment is crucial to understanding the Southeast Madagascar Bloom development. The proposed research is a US contribution to the Second International Indian Ocean Expedition [IIOE2-EP50].

[Report Courtesy: Viviane Menezes, Woods Hole Oceanographic Institution, United States; E-mail: vmenezes@whoi.edu]

Regional downscaling of dynamic sea level of the Indian Ocean based on CMIP6 models

Sea level change is one of the most influential and critical manifestations of global climate change. Rising mean sea level enhances the risks of flooding, coastal erosions, contamination of resources, loss of habitat and much more. The Indian Ocean, with a densely populated coastline, is prone to many such climate disasters. The design of policies to mitigate the effects of the rising sea level under the global warming scenario requires a deep understanding of the dynamics of the factors driving the sea-level change.

Phase six of the Coupled Model Intercomparison Project (CMIP6) provides a large ensemble of standardised model output covering the historical span of 1850-2014 and projected changes till 2100 under different emission scenarios. In this study, we analyse the dynamic sea level (DSL) and surface winds from 27 models and its future projections under mid (SSP2-4.5) and high (SSP5-8.5) emission future scenarios over the Indian Ocean. We look at the representation of simulated large-scale features, climate modes and remote influences through inter-basin transports by these models, document the common caveats and the inter-model spread in the ensemble across the different parts of the Indian Ocean basin. Most models reproduce the observed mean state of the dynamic sea level realistically; however, consistent positive bias is evident across the latitudinal range of the Indian Ocean (Figure 1). The equatorward shift of the southern hemisphere wind field results in the strongest sea level bias in the Antarctic Circumpolar Current fronts. Moreover, this equatorward bias of the trade winds causes anomalous equatorial easterlies resulting in sea level bias towards tropical Indian Ocean zonal mode.

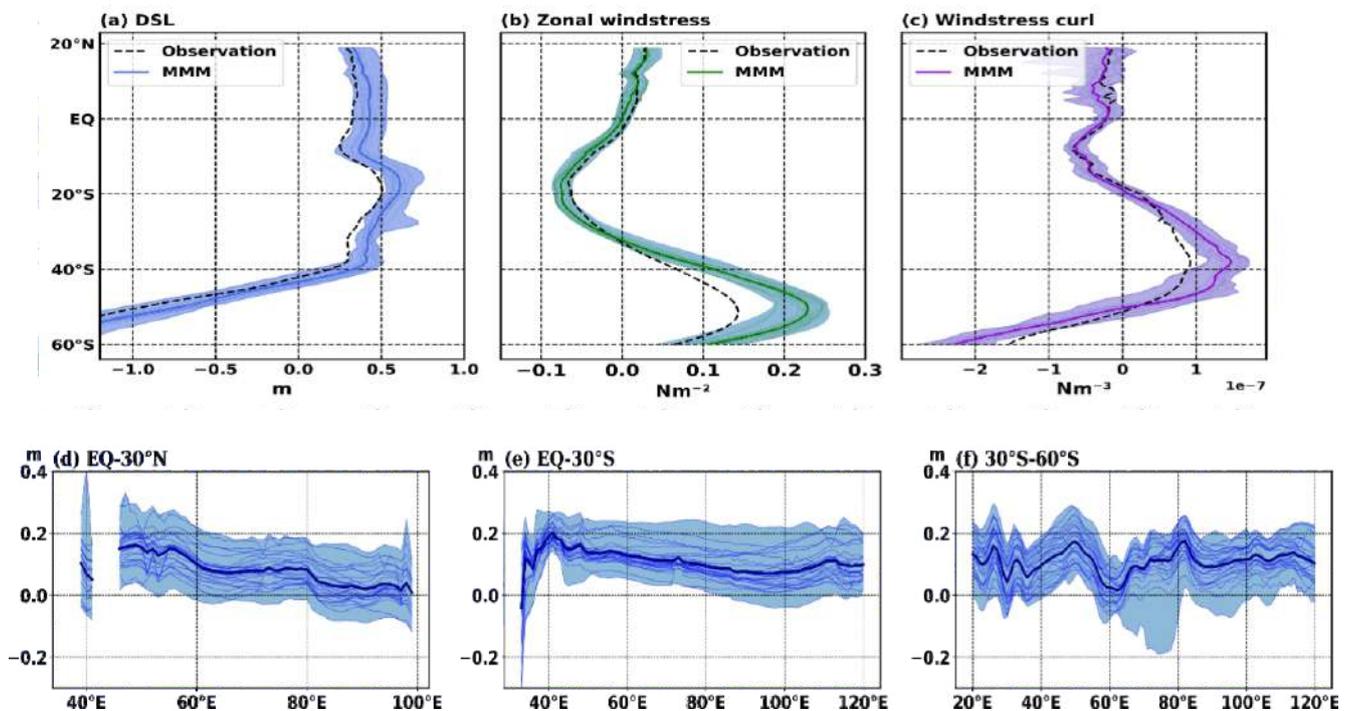


Figure-1: (Top): (a) Zonally averaged dynamic sealevel (DSL); (b) zonal windstress; and (c) windstress curl, from observations (dotted black) and MMM model (blue, green and purple solid lines respectively). (Bottom): (d) Spread of the model simulated sealevel bias for NIO (0°–30° N, 20°–120° E); (e), STIO (0°–30° S, 20°–120° E); and (f) SIO (30°–60° S, 20°–120° E). The thick blue line and thin blue lines indicate the MMM and individual models respectively in each panel. The shaded area represents model spread.

We employ a suite of objective and subjective selection rationale to create a subset of the best performing models based on their fidelity in historical simulation and assess the future projection over the Indian ocean. Interestingly, while high-resolution models compare better in simulating sea level variability, this improved simulated variability not necessarily translates into an improvement in simulation for the mean state. In fact, most of the high-resolution models show poor performance in simulating the mean state. Based on the skill score in simulating the mean state for the DSL and the Windstress curl and their RMSEs, the ten best-performing models are selected for assessing the best estimate of future projections of dynamic sea level.

Under both future scenarios, sea level change shows a similar projected pattern across the basin by the end of the century except that the rise in sea level is much stronger under the influence of high-emission scenarios (Figure 2). There is a west-to-east gradient in the northern Indian Ocean. Under the RCP8.5 scenario, sea level rise in the Arabian sea is expected to be much larger (~35 cm) compared to the Bay of Bengal (~28 cm) (Figure 2b). In the southern hemisphere, the Antarctic circumpolar current regime shows a significant possible increase in sea level of around ~35-40 cm. In contrast, the sub-tropical Indian Ocean shows a dip in the wind-driven sea level. Notably, 85% of the sea level change is due to the increase in global mean thermosteric sea level, and the weakening of the tropical winds drives the rest. Interestingly the best-performing subset shows a weaker sea level rise compared to the ensemble mean. In summary, this study reiterates the importance of reducing the spread of the projected sea level with a minimum risk of mal-adaptation for proper policymaking.

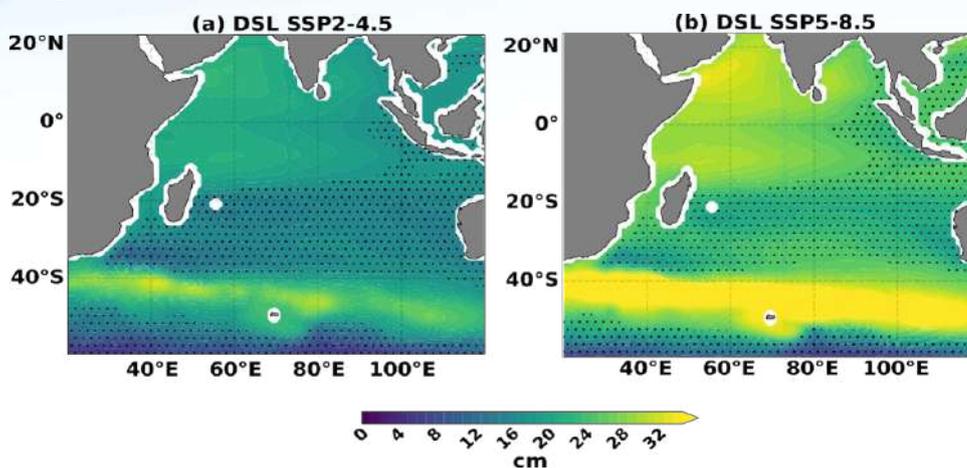


Figure-2: (a) Projected change in the multi model mean DSL for SSP2-4.5 scenario. (b) same as (a) but for SSP5-8.5 scenario. The stippling indicates the regions where the DSL (without the global thermosteric effect) is negative.

Citation: Sajidh, C.K. and Chatterjee, A. Indian Ocean dynamic sea level, its variability and projections in CMIP6 models. *Clim Dyn* (2023). <https://doi.org/10.1007/s00382-023-06676-z>

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SCOR Working Group 167, Reducing Uncertainty in Soluble aerosol Trace Element Deposition (RUSTED)

Quantifying the transfer of micronutrient trace elements and pollutants across the air-sea interface is a current research priority. The newly-established, SCOR WG 167 (RUSTED), bring together experts from the ocean biogeochemistry, atmospheric chemistry and modelling communities to focus on assuring the quality of trace element solubility data produced from aerosol leaching schemes and to provide advice on their use in Earth System models. This will help constrain how atmospheric deposition of soluble iron and other trace elements modulates marine biological activity and, ultimately, the oceanic sequestration of atmospheric CO₂. Key deliverables include: (1) Standard Operating Procedures for frequently used aerosol leaching schemes; (2) a comprehensive, open-access database of atmospheric trace element data, following FAIR (Findable, Accessible, Interoperable, and Reusable) data principles aimed to facilitate easier evaluation and calibration of global models than is currently possible; (3) a glossary of terms addressing terminology inconsistencies across communities. In addition, a workshop-seminar series will be held in India in 2025. Participation from the IIOE2 community is encouraged.

A call will be released shortly to invite researchers to contribute aerosol trace element data produced within the last few decades for inclusion in the database. Beyond its use in understanding the impacts of air-sea exchange, this dataset also has value for other fields including public health and climate sciences.

RUSTED addresses several of the UN Decade of Ocean Science for Sustainable Development Priority Challenges (<https://www.oceandecade.org/challenges/>) helping to align our goals towards the realization of a healthy future ocean. We look forward to working together as SCOR Working Group 167 to realise our common goals.

The Terms of Reference and list of members can be found at the below link:

<https://scor-int.org/group/reducing-uncertainty-in-soluble-aerosol-trace-element-deposition-rusted/>

For further information please contact Rachel Shelley (rachel.shelley@uea.ac.uk), Morgane Perron (morgane.perron@univ-brest.fr) or Douglas Hamilton (dshamil3@ncsu.edu).

12th International Conference and Workshop on Lobster and crabs 22-27 October 2023 in Fremantle, Western Australia



The Organising Committee of the 12th International Conference and Workshop on Lobster and crab is pleased to announce the go ahead of this workshop that was originally planned for October 2020, for **22-27 October 2023**. Please check the website (<https://icwl2023.com.au>) for updates on the conference. This will be updated over the next month with more details on the program. We will be accepting abstracts and registrations from the 24 January 2023. This workshop is being planned as a face-to-face meeting.

The overall theme for the 2023 workshop is '**Ecosystem-based fisheries management (EBFM)**' as this generally represents best practice for fisheries management and reflects that fisheries research and management focus is now broader than just sustainability. Therefore we hope to attract presentations that cover a wide array of subjects under the EBFM banner including biology, stock assessment, management, ecosystem effects of fishing such as interaction with whales, habitat, economics, social, governance and management compliance.

We will be holding a **2-day EBFM workshop** which will be sponsored by the OECD Co-operative Research Programme: Biological Resource Management for Sustainable Agricultural Systems. This will occur on the first two days of the 5-day conference.

While this conference comes back to Western Australia where the 1st International Lobster Workshop was held in 1978, we have adopted the approach of the 2nd lobster conference in St Andrews in 1985 where **crab presentations** were welcome. We look forward to their participation in this conference.

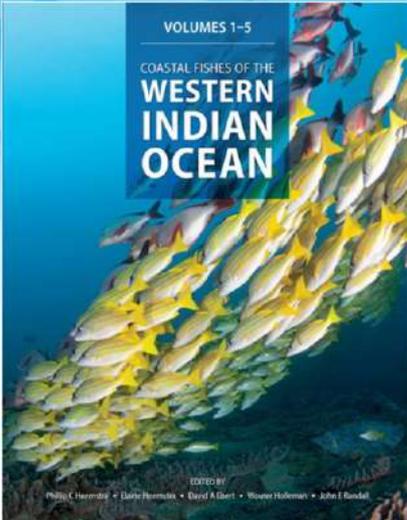
An **industry day** is also planned for Thursday 26 October and this is an important component of the program so we are looking forward to strong support from lobster and crab industry participants around the world. We are also keen to attract papers on **lobster and crab aquaculture** as this has been an important developing industry in Asia.

Students can apply for the **Paul Kanciruk Student award** for financial support to attend the conference.

The Department of Primary Industry and Regional Development (DPIRD) and the Western Rock Lobster (WRL) council are looking forward to hosting scientists, managers and industry participants in Western Australia in 2023. Don't hesitate to contact us or the conference organisers, Arinex, if you have any questions.

Co-hosts of the workshop Nick Caputi, DPIRD (nick.caputi@dpird.wa.gov.au) & Nic Sofoulis, WRL (sofs1@bigpond.com).

Coastal Fishes of the Western Indian Ocean



This remarkable 5-volume publication on the fishes of the Western Indian Ocean was launched at the annual Smith Memorial Lecture on 29 September 2022 in South Africa. **Coastal Fishes of the Western Indian Ocean** took 25 years to complete and involved almost 100 contributors from many parts of the world. It includes descriptions of 3500 species of fishes and has generated much interest in the diversity of coastal fishes in the Western Indian Ocean. It covers the region from Cape Point, South Africa to the Red Sea and east to Kanyakumari, India.

Searchable pdf versions of each volume have been created and for more information go to:

<https://www.saiab.ac.za/coastal-fishes-of-the-western-indian-ocean.htm>

[Report Courtesy: Lynnath Beckley, Environmental & Conservation Sciences Murdoch University, Western Australia; E-mail: L.Beckley@murdoch.edu.au]

DEEP-SEA RESEARCH PART II



THE SUBMISSION PORTAL FOR VOL. 6 OF THE DEEP-SEA RESEARCH II SPECIAL ISSUE SERIES ON THE IIOE-2 IS NOW OPEN

Submission of manuscripts that describe the results of studies related to the physical, chemical, biological, and/or ecological variability and dynamics of the Indian Ocean (including higher trophic levels) is encouraged.

Submission of manuscripts from students and early career scientists is also encouraged.

If you are interested in submitting a manuscript, please contact Raleigh Hood (rhoood@umces.edu).

Indo-Pacific Fish Conference and the Australian Society for Fish Biology 20-24 November 2023, Auckland, New Zealand

The Indo-Pacific Fish Conference will be held in Auckland, New Zealand from Nov 20-24 2023 in partnership with the Australian Society for Fish Biology. Submission of abstracts is open from 10 Feb - 11 June 2023. Registration opens 20 April 2023. Closing date for nominations for the associated IPFC Bleeker Awards in fish Systematics and Taxonomy is 30 April 2023.

Conference Manager:
Li Zhang
Event Services
The University of Auckland
Email:
li.zhang1@auckland.ac.nz

For more details visit Conference Website: <https://www.ipfc11-asfb.ac.nz/>

Endorse your projects in IIOE-2

Don't miss the opportunity to network, collaborate, flesh out your research project and participate in IIOE-2 cruises!!

The endorsement of your scientific proposal or a scientific activity focusing on the Indian Ocean region is a recognition of the proposal's or activity's alignment with the mission and objectives of IIOE-2, of its potential for contributing to an increased multi-disciplinary understanding of the dynamics of the Indian Ocean, and of its contribution to the achievement of societal objectives within the Indian Ocean region. Over 50 international, multi-disciplinary scientific projects have already been endorsed to date by the IIOE-2. Yours could be the next one!

Visit <https://iioe-2.incois.gov.in/IIOE-2/EndorsementForm.jsp> for further details and for projects already endorsed by IIOE-2 https://iioe-2.incois.gov.in/IIOE-2/Endorsed_Projects.jsp.

CLIVAR January 2023 Bulletin is available online



The International CLIVAR Project Office distributes a monthly bulletin with announcements, funding opportunities, meeting notifications relevant to the ocean/climate science community.

The latest CLIVAR Bulletin January, 2023 is available at:

<https://mailchi.mp/clivar.org/clivar-january-2023-bulletin>

Call for Contributions

Informal articles/short notes of general interest to the IIOE-2 community are invited for the next (February-end) issue of the IIOE-2 Newsletter. Contributions referring IIOE-2 endorsed projects, cruises, conferences, workshops, "plain language summary" of published papers focused on the Indian Ocean etc. are welcome. Articles may be up to 500 words in length (Word files) accompanied by suitable figures, photos.(separate.jpg files).

Deadline: **25 February, 2023**



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