

## **IIOE-2 NATIONAL COMMITTEE - FRANCE**

### **Summary report for 2018 and cruise plans 2019-2022**

The IIOE-2 French National Committee was established in May 2017. It is composed of 12 members from 8 different institutions representing the multi-disciplinary nature of the programme. The Committee which meets at least once a year, facilitates communication and between the teams involved.

The French activities in the IIOE-2 span the 6 science themes of the programme. We list here the ongoing projects under each theme.

#### **ST1 – Human benefits and impacts**

The NUNDERGROUNG project aims at quantifying the nutrient transfers (C, N, Si, P) through groundwater in India, in relation to soil fertilization which contaminates water resources. It is a 3-year project (2018-2021) funded by the Indo-French Centre for the Promotion of Advanced Research (CEFIPRA-IFCPAR). The participating teams are from LOCEAN and the Institute of Ecology and Environmental Sciences, both located at Sorbonne University (Paris), and Geosciences Toulouse, IRD, for the French component. India is participating through the National Institute of Oceanography-CSIR (NIO) in Visakhapatnam, and the Center of Earth Sciences, Indian Institute of Science, at Bengaluru.

#### **ST-2: Boundary current dynamics, upwelling variability and ecosystem impacts**

Two major outcomes must be noted for 2018:

- The uncovering of a new current in the Southwest of Madagascar. The Southwest Madagascar Coastal Current (SMACC) is a surface current flowing poleward, against the dominant wind, forced by a strong cyclonic wind stress curl. It is likely to affect local fisheries and larval transport.  
*Ramanantsoa, J. D., P. Penven, M. Krug, M. Rouault, J. Gula (2018). Uncovering a new current: the South-west Madagascar Coastal Current (SMACC), 2018, Geophys. Res. Lett., 45: 1930–1938*
- A new insight at the Southeast Madagascar bloom. There are several hypotheses to explain the maintenance of such phytoplankton oceanic feature. Analysing 11 blooms that occurred over 1998-2016, Dilmahamod et al found that the mature phase of La Niña and the South Madagascar upwelling explain fairly well the observed variability, with La Niña having a stronger effect than the coastal upwelling.  
*Dilmahamod, F., Penven, P., Aguiar Gonzalez, B., Reason, CJC., Hermes, J. (2019). A new definition of the South-East Madagascar Bloom and analysis of its variability. J. Geophys. Res, Oceans*

Both studies were produced by PhD students registered at the University of Cape Town and University of Brest, with support of the French-South African international laboratory ICEMASA, SAEON and CSIR.

#### **ST-3: Monsoon variability and ecosystem response**

The PHYSINDIEN project investigates the outflows of Persian Gulf and Red Sea waters into the Arabian Sea. Two cruises were undertaken in 2011 and 2012 during the spring inter-monsoon. Another cruise will take place in 2019, at the onset of the upwelling season (boreal

summer). This project is developed by the University of Bretagne Occidentale (Brest) and the SHOM ((Brest)

#### **ST-4: Circulation, climate variability and change**

This theme has been developed through a scientific collaboration started in 2003 between France (IRD and Sorbonne Université) and India (NIO) in the North Indian Ocean, with 3 major areas: the water cycle in the Bay of Bengal, biophysical coupling and climate variability and change. Education and training is also a key component of this collaboration, with 8 PhD students and over 60 research papers co-signed by Indian students and researchers.

Other French activities are being initiated in 2019 in two different areas:

- Monitoring of Antarctic glaciers in the climate change context, with the SEIS-ADELICE project. A coastal observatory will be deployed on the Astrolabe glacier (Base Dumont d'Urville, Terre Adelie, Antarctica) and a series of measurements will be made from Dec 2019 to Feb 2020. This project involves the IPGP (Paris) and the IPEV (Brest).
- Development of Ecosystem Report Cards under the framework of the Indian Ocean Tuna Commission, with AZRI (Spain) and IRD (France). This project is to better communicate ecosystem science and to link it with fisheries management (ecosystem approach to fisheries).

#### **ST-5: Extreme events and their impacts on ecosystems and human populations**

Three groups of activities are reported.

- The role of salinity in influencing Bay of Bengal cyclones: conducted by IRD (France) and NIO (India). The major outcome is that air-sea coupling alleviates the effect of large-scale background conditions by inhibiting pre-monsoon tropical cyclones. Since air-sea coupling clearly contributes to the Bay of Bengal cyclones intensity, in particular before the monsoon, it should be accounted for in operational forecasts.  
*Neetu, S., Lengaigne, M., Vialard, J. et al (2019). Pre/post monsoon Bay of Bengal tropical Cyclones intensity: role of air-sea coupling and large-scale background state. Geophys. Res. Lett.*
- Cyclonic hazard in the South West Indian Ocean. A European-funded project (Re-Nov-Risk-Cyclone) involving 4 institutions (Meteo-France, Université de La Réunion, MOI, Univ. d'Antananarivo) from 3 countries (France-Reunion, Mauritius, Madagascar), with the objective of setting up early warning systems for the protection of exposed local populations.
- Seismic hazard in the Comores archipelago. An atypical seismic activity has been observed in the vicinity of Mayotte since May 2018, which could foreshadow the formation of a submarine volcano. Instruments were deployed in February 2019 to monitor the seismic activity until September 2019 (when records will be analyzed).

#### **ST-6: Unique geological, physical, biogeochemical and ecological features of the IO**

In terms of geophysical research, further analyses are still being done with the RHUM-RUM project, on the structure and dynamics of the Reunion mantle plume in the Southwest Indian Ocean. There is also an initiative to develop a detailed atlas of the mid-ocean ridges, which would require bathymetric and magnetic profiles to be performed during IIOE-2 cruises. More information can be found with Jérôme Dymont, ST6 Chair.

In terms of ecosystem research:

- Analyses are underway after the shallow seamounts exploration carried out in 2016 and 2017 in the South West Indian Ocean, to investigate the physical processes and the ecological responses associated to seamounts. One important achievement in 2018 was the recovery (Oct 2018) of two moorings that were deployed in November 2016 on the slopes of an unnamed pinnacle located on the South Madagascan ridge. These 2-year records of temperature, salinity and current of the water column should reveal key information on the perturbations caused by seamounts on ocean circulation and water properties. French and South African teams (IRD, CNRS and Nelson Mandela University) have collaborated in these seamounts surveys, with the participation of Madagascan and Mauritian students.
- The results of the 2016-2017 seamounts surveys (a suite of 16-18 papers) will be published in 2020 in a Special Issue of Deep Sea Research II.
- Fascinating results on the rapidly changing polar oceans are being assembled through sensors deployed on deep diving seals between Kerguelen and the Antarctic ice pack. This research is undertaken by the CNRS (Chizé, France), IPEV and CNES, with financial support from private donors (Foundation Total and Fondation BNP Paribas).

**Research cruises planned for 2019-2022**

Marine geosciences and biogeochemistry

- CARLMAG, April 2019, using the French R/V Beautemps-Beaupré, to investigate the structure and dynamics of the Carlsberg Ridge, NW Indian Ocean.
- GEOTRACES SWINGS project, Southwest Indian Ocean, expected by 2019-2020 using the French R/V Marion-Dufresne
- FINEGLOB, a worldwide calibration study of the SWOT experiment. Here, there will be a focus on the South Madagascan area which is under a SWOT measurement corridor. At this stage, this is a pre-project, planned for 2022.

Ecosystem research

- CYCLOPS, a study of the Durban eddy dynamics in relation to the Natal Pulse in the Agulhas current. 18 days, Jun-Jul 2021, with the French R/V ANTEA
- MAPS, a study of the Mahe Plateau Ecosystem (Seychelles) from physics to fish, 65 days, Sept-Oct 2022, with R/V ANTEA
- REACTION, a study of the biological resources (plankton and mesopelagic fauna) and coastal vulnerability with impacts from the Mozambique Channel eddies and climate change. The study area will be the Sofala Bank, Mozambique. A microplastic study component will also be included in the project. 18 days, Nov-Dec 2021, R/V ANTEA
- BLOOM, a pre-project to investigate further the seasonal bloom Southeast of Madagascar, in order to test the latest hypotheses on the genesis and maintenance of this plankton feature.

All cruises relevant to ecosystem research will be developed under the umbrella of the IIOE-2/WIOURI

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