ICEMASA-2 SCIENCE PLAN FOR 2014-2018

RESEARCH PROGRAM

The research program is summarized in the following Science Plan comprising 3 main themes and 12 tasks.

Theme 1 - CLIMATE AND OCEAN

- 1.1 Large scale oceanic circulation and the Meridional Overturning Circulation
- 1.2 Climate change scenarios at a regional scale over Southern Africa
- 1.3 Southern Ocean: circulation and vertical mixing
- 1.4 Biogeochemistry of tracers in the Southern Ocean
- 1.5 Novel experiments at sub-mesoscale

Theme 2 - ENVIRONMENTAL IMPACTS ON ECOSYSTEMS

- 2.1 Benguela upwelling system and Agulhas Bank
- 2.2 Mesoscale processes in the Mozambique Channel
- 2.3 Mesoscale processes along the Mascarene ridge

Theme 3 - CLIMATE-ECOSYSTEM-FISHERIES INTERACTIONS

- 3.1 Global scale interactions
- 3.2 Fishing and climate effects on the pelagic and demersal fish communities off South Africa
- 3.3 High seas pelagic fisheries around South Africa

This science plan is the outcome of consultations held with the different partners and contributors to ICEMASA-2. They depict the main themes that need to be addressed to consolidate and further the ICEMASA-1 outcomes. Most of the tasks will be implemented from the beginning of ICEMASA-2, as activities are mostly underway. However, other tasks such as 1.5, part of 2.2, 2.3 and part of 3.3 rely on external funding sources to be accomplished, especially to fund data collection. Therefore, the date of implementation of these tasks/subtasks is still unknown.

It is noteworthy that more direct discussions will be undertaken at an open scientific workshop that ICEMASA-2 will organize in Cape Town, April 2014, with all partners identified in the science plan. Then, it will be possible to get into more details in terms of individual commitment, implementation (planning) and funding of tasks among partner teams. We hope that such a workshop will strengthen the bonds between people, at national and international level, and create some sort of “task forces”, preferably of multidisciplinary nature, in order to maximize chances of success in the submission of proposals to calls for projects.

For each tasks of the science plan, we present the specific objective and what has been learnt and delivered from ICEMASA-1 which will serve as foundations for ICEMASA-2. The deliverables expected at the end of ICEMASA-2 are also shown, as well as the list of contributors (playing at various degrees of engagement) from the various partner institutions.

Theme 1- CLIMATE AND OCEAN

This theme focuses on the physical and biogeochemical processes driving ocean dynamics and air-sea interactions, at regional and large scale. The first four tasks are a follow-up to ICEMASA-1, whereas task 1.5 is an innovative experiment combining observations and numerical approach, to characterize turbulence at sub-mesoscale.

Task 1.1 - Large scale oceanic circulation and the MOC

Specific objective	To determine the role of the Southern Ocean and the Agulhas leakage as regulators of the global climate
ICEMASA-1 deliverables	A network of in situ observations is developed, though international programmes (GOODHOPE, SAMOC) and contribution from ICEMASA Numerical experiments are implemented to improve the dynamical understanding in the Southern African region
ICEMASA-2 : Projected sub-tasks	Comparison between observation and high resolution ocean reanalyses (Drakkar and Mercator) Evaluation and inter-comparison of climate models to estimate the uncertainty in future climate predictions in relation with biases observed in the South Atlantic Proxies to quantify the leakage and time series at contemporary and geological timescales, including the development of data assimilation techniques in this regard, and defining indicators for eddy shedding in the retroflection region Refine the processes controlling the leakage at higher resolutions Influence of leakage on the MOC: how significant is its impact at a planetary scale ?
Personnel	Julie Deshayes (CNRS-IRD); Sabrina Speich (UBO); Pierrick Penven (IRD); C. Reason (UCT); Jennifer Veitch (UCT), Isabel Ansorge (UCT); Seb Swart (CSIR); Bjorn Backeberg (NTC/NERSC); Mathieu Rouault (NTC/NERSC); Juliet Hermes (SAEON); Mike Roberts (DEA); Gavin Louw (BCRE); Bradley Blows (BCRE); Ben Loveday (PhD UCT); Kyle Cooper (MSc UCT), Isabelle Giddy (MSc UCT); Karine Hutchinson (MSc UCT); 1 PhD (supervised by JD)

Task 1.2 - Climate change scenarios at a regional scale over Southern Africa

Specific objective	To improve climate change forecast capabilities by capturing interactions at regional scale
ICEMASA-1 deliverables	Regional air-sea coupled models are being developed to represent processes at local scales under large scale forcing
ICEMASA-2 : Projected sub-tasks	Regional aspects are still unrealistic and improvements are needed. Air sea coupling needs to be taken into account
Personnel	Sabrina Speich (UBO); Christophe Messager (CNRS); Serena Illig (IRD); Boris Dewitte (IRD); Chris Reason (UCT); Willem Landman (CSIR); Julie Rimaud (PhD UBO) + 3 postdocs

Task 1.3 - Southern Ocean: circulation and vertical mixing

Specific objectives	To understand how late and early seasonal sea-ice melting may lead to strong inter-annual variability in primary production To understand how topography may trigger vertical fluxes of biogeochemical tracers in the Southern Ocean
ICEMASA-1 deliverables	An idealized model of the Antarctic Circumpolar Current is produced
ICEMASA-2 : Projected sub-tasks	In the Weddell Sea, the release of fresh water during seasonal sea-ice melting stratifies a very thin surface layer. The presence of biogeochemical tracers in that layer triggers primary production if the process occurs during a time of maximal light exposure. Therefore, early and late sea-ice melting could lead to a much less important primary production because of light limitation. It is projected to model the complex interactions between sea-ice melting and ocean circulation, focusing on surface stratification and trapping of biogeochemical tracers. To study the influence of topography on the dynamics of the Antarctic Circumpolar Current, in particular how processes related to current-topography interactions can generate vertical fluxes of tracers. The ultimate goal is to understand the link between some regions of high primary production observed in the Southern Ocean and the presence of specific topographic features
Personnel	Steven Herbette (UBO); Pedro Monteiro (CSIR); C. Reason (UCT); Nomkwezane Kobo (PhD UCT); Francois Engelbrecht (CSIR); J. Collin (PhD UBO/UCT)

Task 1.4 - Biogeochemistry of tracers in the Southern Ocean

Specific objective	To understand the combined effect of iron and light on primary production and export in the Southern Ocean
ICEMASA-1 deliverables	The Flow Injection Analysis (FIA) to measure iron at subnanomolar concentrations has been set up in the new ultra clean laboratory built at Stellenbosch University Samples have been collected to measure iron concentrations on a transect from Cape Town to the Southern Ocean Onboard iron/light incubations have been carried out on the same transect
ICEMASA-2 : Projected sub-tasks	Sources of iron in the Southern Ocean and the inter-annual variability Effects of iron/light co-limitation in the Southern Ocean effects on Carbon export through the biological pump Iron/light co-limitation batch cultures experiments and impact on polysaccharides production
Personnel	Eva Bucciarelli (UBO); Géraldine Sarthou (CNRS); Frédéric Planchon (UBO); Howard Waldron (UCT); Alakendra Roychoudhury (Univ Stell); Thato Mtshali (CSIR);, Susanne Pfietz (Univ Stell); Alessandro Tagliabue (Univ Liverpool); Sandy Thomalla (CSIR); 1 PhD and 1MSc student

Task 1.5 - Novel experiments at sub-mesoscale

Specific objective	To understand how the dynamics at sub-mesoscale (1-10 km) affects the evolution of the biogeochemical system and the dominance of group species in the biological compartments
ICEMASA-1 deliverables	This is not an ICEMASA-1 deliverable per se. Two workshops have been organized with ACCESS in 2011 to progress on a research strategy. They highlighted the new vision that the motion at submesoscale (1-10 km) drives the upper ocean dynamics with implications for air-sea interactions, and that 50% of the vertical velocity (in the first 500 m) is within submesoscales outside the mesoscale eddies. Biological compartments, notably plankton, may also be affected at such spatial scales. This field of research is therefore recognized as a new frontier in the understanding of ocean and ecosystem processes
ICEMASA-2 : Projected sub-tasks	Waters around South Africa are excellent natural laboratories. ESA will launch Sentinel-1 (imaging SAR) in early 2014 and followed by Sentinel-3 (high resolution altimeter, IR radiometer and imaging spectrometer) in 2015. Validation campaigns are highly needed to compare observations with high resolution model simulations. Partner teams (especially from Norway, South Africa and France) will push to have such campaigns in South African waters. Extensive field experiment (combining satellite and in situ) to monitor sub-mesoscale structures resulting from interactions between mesoscale eddies Very high resolution CO_2 fluxes can be inferred from satellite atmospheric CO_2 and non-linear multiscale processing techniques applied to oceanic satellite signals (SST, ocean color,..)
Personnel	Sabrina Speich (UBO); Claude Roy (IRD); Steven Herbette (UBO); Rosemary Morrow (UPS); Joël Sudre (CNRS); Véronique Garçon (CNRS); Isabelle Dadou (UPS); Sérena Illig (IRD); Boris Dewitte (IRD); Howard Waldron (UCT); Pedro Monteiro (CSIR); Seb Swart (CSIR); M. Krug-Rouault (CSIR); Jenny Veitch (UCT); Mike Roberts (DEA); Johnny Johannessen (NERSC); Anne Lebourges-Dhaussy (IRD);

Theme 2 - ENVIRONMENTAL IMPACTS ON ECOSYSTEMS:

This theme focuses on bottom-up processes structuring marine ecosystems and driving their internal dynamics. The three tasks represent geographically distinct case studies of ecosystem multidisciplinary approaches (Benguela, Greater Agulhas/Mozambique Channel and Mascareigne basin/ridge). They address the same topic: high resolution modelling of mesoscale turbulence and their biological impacts; and make use of the same methods.

Task 2.1 - Benguela upwelling system and Agulhas Bank

Specific objectives	To understand the fine scale ocean dynamics (<10 km) in the Benguela Upwelling System and the Agulhas Bank To understand the connection between the equatorial Atlantic and the Benguela Upwelling System at various timescales To understand the role of air-sea-land coupling in the Benguela Upwelling System and the Agulhas Bank

	To improve knowledge on the different processes responsible for the low oxygen events To assess the effects of the physical and biogeochemical environment on fish recruitment To define climatic niches for fish populations and explore the spatial shift in a changing climate To assess bottom-up effects of climate change on the structure of marine foodwebs
ICEMASA-1 deliverables	Southern Benguela regional configuration at 1/12° Coupled end-to-end (E2E) modelling (ROMS+BioBus+Osmose), hindcast interannual simulations Climate niche statistical envelopes are produced for major target pelagic and demersal species
ICEMASA-2 : Projected sub-tasks	Implement a high-resolution (1/12°) biogeochemical coupled model (ROMS-BIOEBUS) extending to the equatorial Atlantic and simulating the OMZ dynamics to understand the influence of equatorial waves Implement a high-resolution (1/12°) ocean-atmosphere coupled model to study air-sea-land interaction Combined analysis of high resolution model simulations and field observations, in order to explain the processes controlling fish habitat and primary production Coupled end-to-end modelling (ROMS + PISCES+ APECOSM), hindcast inter-annual simulations Spatial and temporal zooplankton distribution using hydroacoustics The different research actions envisaged are meant to produce a synthetic and integrative understanding of the impacts of climate on fish dynamics through the following processes: fish recruitment, fish spatial distribution, trophic interactions
Personnel	Eric Machu (IRD); Stephane Pous (MNHN); O. Maury (IRD); P. Penven (IRD); Claude Roy (IRD); Véronique Garçon (CNRS) ; Isabelle Dadou (UPS); Sérena Illig (IRD); Aurélien Paulmier (IRD); Boris Dewitte (IRD); Steven Herbette (UBO); Ainhoa Lezama-Ochoa (IRD); Arnaud Bertrand (IRD); Frank Shillington (UCT; Jenny Veitch (UCT); Howard Waldron (UCT); Matthieu Rouault (NTC/NERSC); Carl van der Lingen, (DAFF); Janet Coetzee (DAFF); Dawit Yemane (DAFF); Yunne Shin (IRD); Stewart Bernard (CSIR); Christo Whittle (CSIR); Ffjon Atkins (PhD UCT); Mogoabo Roagasha (Master UCT + PhD 2015)

Task 2.2 - Mesoscale processes in the Mozambique Channel (MC)

Specific objectives	To improve current coupled simulations of the processes generating mesoscale eddies, their propagation in the MC and their variability To better depict the linkage and interactions between the coastal and offshore domains To further explore the effects of eddies on the biogeochemistry and ecosystem dynamics in the MC)
ICEMASA-1 deliverables	A very high resolution (1/15°) regional model (ROMS with AGRIF) representing the physics of the MC is fully operational A high resolution (1/6°) coupled model (ROMS-PISCES with AGRIF) representing the physics and biogeochemistry of the MC is fully

	operational Climatological runs are produced for both A high resolution (1/10°) regional data assimilative model (HYCOM with EnOI) representing the physics of the MC is in development *(in collaboration with NTC/NERSC)* A historical hind-cast simulation from 1980 – 2009 (without assimilation) is available. An assimilated simulation (assimilating satellite SLA) for 2008 and 2009 is available *(in collaboration with NTC/NERSC)*
ICEMASA-2 : Projected sub-tasks	Present models need to be improved to explain the inter-annual variability, include the effects of tides, improve the interactions between bottom water and sediments and the effect of runoffs, and to better understand the drivers of upwelling and the nutrient production (using a high resolution biogeochemical coupling) Response of ocean structure to extreme weather events (using ROMS) Study the influence of equatorial Rossby waves in the Indian ocean on the Mozambique Channel circulation (using intermediate complexity and full physics models) Interactions between seafloor topography and eddies (at-sea cruises and using the model structure developed in the Southern Ocean in project 1.3) Biological connectivity between Madagascar and South Africa induced by mesoscale turbulence (SUITCASE project cruise, and ROMS) Use of very high resolution satellite currents (obtained by assembling multiple parameters provided by different sensors - same technique as very high resolution CO2 flux data) - giving access to turbulent flow to improve the knowledge of the impact of sub-mesoscale features on ecosystem dynamics. Environmental influences on larval recruitment on the Sofala Bank (ICHTHYOP coupled to ROMS), with emphasis on shrimps Vertical and horizontal structuring of the pelagic ecosystem (using ROMS-PISCES-APECOSM) in an eddy-driven environment at 1/6° (climatological run) and 1/4° (inter-annual run) *These research activities will be operated in close liaison with UNDP - GEF SAPPHIRE project to access equipment and potential ship time*
Personnel	Pierrick Penven (IRD); Stephane Pous (MNHN); Olivier Maury (IRD); Chris Reason (UCT); Issufo Halo (NTC); Bjorn Backeberg (NTC/NERSC); Jean-François Ternon (IRD); Francis Marsac (IRD); Christophe Lett (IRD); Michel Potier (IRD); Joël Sudre (CNRS); Christophe Maes (IRD); Sérena Illig (IRD); Boris Dewitte (IRD); Steven Herbette (UBO); Delphine Thibault-Botha (Univ Aix-Marseille); Matthieu Le Corre (Univ Reunion); Sebastien Jaquemet (Univ Reunion);Frank Shillington (UCT); Mike Roberts (DEA); Jenny Huggett (DEA); Tarron Lamont (DEA); Ray Barlow (BCRE); Lisa Hancke (BCRE); Tammy Morris (BCRE);Bernardino Malauene (IIP); Alberto Mavume (UEM); Fialho Nehama (UEM); Yonss Jose (Post Doc UCT); François Counillon (NERSC); Johnny Johannessen (NERSC); Obadias Cossa (INAHINA, PhD UCT); Clousa Chevane (INAHINA, PhD UCT), Louis du Buisson (PhD UCT); Charine Collins (PhD UCT) + 1 postdoc

Task 2.3 - Mesoscale processes along the Mascarene ridge

Specific objectives	To describe and understand the physical processes leading to biological enrichment resulting from mesoscale turbulence created by the presence of the Mascarene ridge across the flow of the South Equatorial Current.
ICEMASA-1 deliverables	No such activity conducted in ICEMASA-1. However, the area has been sampled during one cruise organized in 2008 under the Agulhas Somali Currents Large Marine Ecosystems (ASCLME) from Mauritius to Seychelles The cruise described the environmental and biological conditions (pelagic and demersal) on the plateau and along the eastern and western slopes of the Mascarene ridge. Mesoscale eddies are particularly well-developed on the lee (west) of the ridge. Data have been pre-processed by the involved scientists (outside ICEMASA) and are available for further processing. Two regional model configurations of the South-West Indian Ocean encompass the Mascarene ridge and are available for further studies: a ROMS configuration at 1/5° resolution with climatological forcing and a NEMO configuration at 1/12° resolution with inter-annual forcing.
ICEMASA-2 : Projected sub-tasks	Take part to the regional initiative (Western Indian Ocean Sustainable Ecosystem Alliance) and the GEF-funded SAPPHIRE project in the preparation of a multidisciplinary research cruise along the Mascarene ridge Analyze the existing simulations of the 2 model configurations presently available Develop a dedicated higher resolution (1/4° and higher) regional ocean model (ROMS) configuration to analyse the physical processes leading to the formation of mesoscale eddies in the lee of the Mascarene ridge Study the biological response induced by the mesoscale eddies in the pelagic domain.
Personnel	Pierrick Penven (IRD); Jean-François Ternon (IRD); Stephane Pous (MNHN); Christophe Maes (IRD); Issufo Halo (NTC); Mike Roberts (DEA); Ray Barlow (BCRE); Tammy Morris (BCRE); Lisa Hanke (BCRE); Sebastien Jaquemet (Univ Reunion); Rezah Badal (MOI, Mauritius); Beenesh Motah (MOI); 1 PhD student; and resources obtained in close liaison with the UNDP GEF SAPPHIRE project working in this region.

Theme 3 - CLIMATE-ECOSYSTEM-FISHERIES INTERACTIONS

This theme addresses the question on how biodiversity patterns are affected by both climate and fishing forcing. Just like other themes, modelling is used to explore responses and direct observations, through fisheries (catch statistics and observer programmes) or tagging techniques, are used to complement and validate model simulations. The last task (3.4), exploration of scenarios of impacts of global change on marine biodiversity, is a contribution to a worldwide effort devoted to understand the rate and magnitude of change in marine ecosystems and inform fisheries managers and policy makers

Task 3.1 - Global scale interactions

Specific objectives	To model the effects of climate variability and change on marine biodiversity at global scale: • spatial dynamics of structured (functional groups, life-history traits) generic communities • spatial dynamics of physiologically detailed exploited species (tunas) • bio-economic climate change scenarios
ICEMASA-1 deliverables	Global climatological runs of APECOSM with 3 generic diversified communities at 1° resolution Global climate change (2000-2100) runs of APECOSM with 3 generic diversified communities at 1° resolution Global climate change (2000-2100) runs of APECOSM-E for skipjack tuna at 1° resolution
ICEMASA-2 : Projected sub-tasks	Climate impacts on the structure of oceanic biodiversity globally including functional groups (jellies, fish, squids, crustaceans) Climate change and tuna fisheries: APECOSM simulations including skipjack, yellowfin & bigeye tuna fully structured and coupled to generic communities
Personnel	Olivier Maury (IRD); Laurent Bopp (CNRS); Olivier Aumont (IRD); Christian Chaboud (IRD); Mathieu Lengaigne (IRD); Frédéric Ménard (IRD); Michel Potier (IRD); J. Field (UCT); Jérome Guiet (PhD, IRD; Louis du Buisson (PhD UCT); Coleen Moloney (UCT), MSc students

Task 3.2 - Fishing and climate effects on the pelagic and demersal fish communities off South Africa

Specific objectives	To study the synergistic/antagonistic interactions between climate and fishing impacts on the southern Benguela ecosystem To determine what factors drove the past dynamics of fish populations and communities To determine which ecological and environmental indicators better capture the changes in the southern Benguela ecosystem, and would be useful to evaluate the health of marine exploited ecosystems in support of ecosystem-based fisheries management To determine the trends in selected life history parameters of coastal fishes in relation with environmental changes To assess the impact of spatial management (MPAs) on demersal ecosystems To run management scenarios in an exploratory way
ICEMASA-1 deliverables	Selection of a set of relevant indicators in support of an EBFM. Simulation experiments (E2E models+climate niches) to disentangle fishing and climate impacts on the southern Benguela (on-going)
ICEMASA-2 : Projected sub-tasks	OSMOSE, EwE and stock assessment modeling need to be parameterized in a compatible way to allow inter-comparisons Testing of the performance (sensitivity and specificity to fishing in a changing environment, responsiveness) of ecological indicators using E2E models Proposition of reference points for ecosystem indicators, using E2E models (multi-model approach)

	Simulation experiments (using E2E models+climate niches) to disentangle fishing and climate impacts on the southern Benguela (continued) Sensitivity/uncertainty analyses of E2E models, validation against size distribution observations and empirical trophic level estimates (isotope studies conducted by C. van der Lingen) Assessment and design of MPAs as a way to mitigate bycatch on demersal communities APECOSM simulations & analysis (1/4° & 1/12°) for sardines and anchovies
Personnel	Yunne Shin (IRD); Lynne Shannon (UCT); Coleen Moloney (UCT); Astrid Jarre (UCT); J. Field (UCT); Dawit Yemane (DAFF); Carl van der Lingen (DAFF); Olivier Maury (IRD); David Kaplan (IRD); Philippe Cury (IRD); Warren Potts (RU); Warwick Sauer (RU); Nikki James (SAIAB); MSc students from RU.

Task 3.3 - High seas pelagic fisheries around South Africa

Specific objectives	To depict habitat utilization of large pelagic fish (LPF) and its impacts on high seas fisheries, using observations and models, to identify biodiversity patterns from prey consumed by top predators and to identify top predator assemblages from observer programs.
ICEMASA-1 deliverables	Swordfish tagged with popup satellite archival tags (PSAT) in the Mozambique Channel and South West Madagascar
ICEMASA-2 : Projected sub-tasks	Spatial dynamics of LPF (swordfish, tuna, sharks) : • Further tagging of swordfish, tuna and pelagic sharks with PSATs • Otolith microchemistry to describe environmental history of individual fish (a valid methodology in a contrasted oceanic environment such as the Agulhas/Benguela areas) • Preparation of a tagging programme for albacore tuna across the Indian and Atlantic oceans • Development of habitat based models to assess the relative abundance of targeted LPF • Impacts of eddy-seafloor topography interactions on the distribution of top predators (seabirds, fish) • Effects of inter-annual climate variability on tuna occurrence and yield in the pelagic longline fisheries around South Africa • Simulations on the poleward extension of pelagic fish communities Fish and shark bycatch in the South African EEZ: fishing practices to mitigate bycatch while optimizing catch of targeted species, using experimental instrumented longlines. Trophic and functional ecology : • Trophic pathways explained by stomach content analyses of large predatory fish, stable isotopes measurements and fatty acids across trophic levels. • Identification and classification of morphological and biological traits which contribute to create functional groups in the marine ecosystems, using observer data and routine sampling of large pelagic fish.

Personnel	Francis Marsac (IRD); Pascal Bach (IRD); Michel Potier (IRD); Frédéric Ménard (IRD); Olivier Maury (IRD); Jean-François Ternon; J. Field (UCT); Wendy West (DAFF); Charlene da Silva (DAFF); Sven Kerwath (DAFF); Christopher Wilke (DAFF); Colin Attwood (UCT); Mathieu Le Corre (Univ Reunion), Sebastien Jaquemet (Univ Reunion) Stewart Norman (PhD UCT); Coralie Picoche (Engineer IRD),

Task 3.4 – Exploring future trajectories of marine biodiversity and associated ecosystem services

Specific objective	To integrate the various ecosystem compartments, through coupled models from physical forcing to fisheries and associated management and socio-economic environment (E2E modelling) in order to assess and quantify the sensitivity of marine ecosystems to global change, and to determine possible trajectories of marine biodiversity status.
ICEMASA-1 deliverables	Simulations at local and global scale produced by OSMOSE and APECOSM models under isolated and combined climate, and fisheries management scenarios
ICEMASA-2 : Projected sub-tasks	To improve model resolution and realism, performing validation with observations wherever possible. To perform simulations using IPCC and governance scenarios To project habitat changes and potential shifts in the distribution range of marine species To estimate upper and lower thermal limits of larval, juvenile and adult coastal fishes and implications on their spatial distribution To include fleet dynamics and market structure at the global scale (tuna) To determine and project relevant fisheries management scenarios (in the Benguela ecosystem, the simulations will be conditioned by the production of realistic downscaled IPCC scenarios (§ 1.2))
Personnel	Yunne Shin (IRD); Lynne Shannon (UCT); Olivier Maury (IRD); Francis Marsac (IRD); Eric Machu (IRD); Stéphane Pous (MNHN); Isabelle Dadou (UPS), Véronique Garçon (CNRS);Louis du Buisson (PhD IRD/UCT); Jérôme Guiet (PhD IRD); Rachel Cooper (PhD UCT), Astrid Jarre (UCT), Coleen Moloney (UCT), Dawit Yemane (DAFF); Laurent Bopp (CNRS); Olivier Aumont (IRD); Warren Potts (RU); Nikki James (SAIAB); MSc students from RU.

OTHER ASPECTS ON STRENGTHENING AND EXPANDING CURRENT RESEARCH ACTIVITIES

The modelling approach remains a strong component in ICEMASA-2. However, biogeochemical modelling in the Benguela, Greater Agulhas and Southern Ocean remains under-represented. This is obviously a domain that will need additional resources during the 2nd phase as biogeochemical processes are essential to model the energy flow through the trophic pathways.

The ocean dynamics in the subtropics and temperate region are influenced by the equatorial ocean internal waves and circulation. For instance, the dynamics of the front located at the northern boundary of the Benguela system, and its biogeochemical properties (with an oxygen depleted layer), is closely related to the intraseasonal and interannual variability in the Gulf of Guinea. The EU-FP7 PREFACE project will address this issue, ICEMASA-2 could also participate should contributors from new partner teams (e.g. LEGOS) be identified.

The role of air-sea-land interactions is also a topic of interest for ICEMASA-2 because a better understanding of such processes may help improving model simulations along the western coast of Africa. Current coupled models exhibit SST bias which may be partly explained by interpolation issues in satellite data processing. This has in particular implications for regional climate change projections. ICEMASA-2 needs to foster studies on this line of investigation which benefits from on-going activities with the partners (e.g. LEGOS).

Similarly, in the Indian Ocean, the ENSO/dipole variability affects the intensity of the Indonesian throughflow and the South Equatorial current with consequences for the generation of mesoscale eddies in the Mozambique Channel, which ultimately, control the Natal pulses in the Agulhas current. Such remote forcing could be investigated through the contribution of partner teams (e.g. LEGOS and LOCEAN).

ICEMASA-2 will also promote the development of trophic ecology studies in the marine ecosystem around South Africa. This will be undertaken by using new analysis facilities, e.g. calorimetric bomb (depending on funding) to complement the existing facilities on stable isotopes at UCT.