



ANNEX 2 – National IMBER Reports (as collected in June 2013)

Argentina

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South Atlantic Climate Change

Aim: The ongoing component of SACC is entitled *Export of shelf waters along the Subtropical Shelf Front: A one-way ticket?* Our goal is to determine the mechanisms responsible for the export of shelf waters to the deep ocean and its biological and biogeochemical implications. Specifically we will:

1. Determine whether the STSF is a preferential site for shelf/deep ocean exchanges.
2. Determine the changes of the physical, biological and biogeochemical characteristics of shelf waters along the STSF and their short-term variability.

Start date: October 2011

End date: October 2014

Website: <http://sacc.coas.oregonstate.edu/~sacc/index.php>

Major funding sources: Inter-American Institute for Global Change Research and Ministerio de Ciencia y Tecnología, Argentina

Major achievements: Two oceanographic cruises were carried out, in July and December 2012 (see Fig. 1).

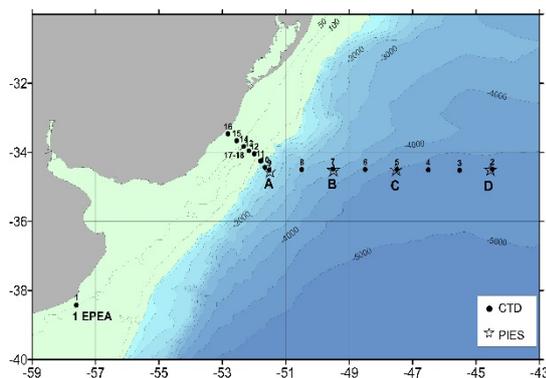


Figure 1. Hydrographic stations occupied during the Brazil Current SAMOC-7 and STSF cruise carried out on R/V *Puerto Deseado* in July 2012. Also shown is the location of the EPEA station (see following project).

The first available estimates of the transport variability of the South Atlantic deep western boundary current, based on direct observations (Meinen et al., 2012) were produced. Using analysis of *in-situ* and satellite derived velocity data, it was shown that the Malvinas Current is formed from a number of distinct jets (Piola et al., *J. Geophys. Res.*, in press). These fronts may have significant biological and geological implications (Preu et al., *Deep-Sea Res.*, 2013; Voigt et al., submitted to *Mar. Geology*). Analysis of underway current measurements collected during the Plata Summer cruise in February 2004, revealed previously undocumented counter currents along the upper slope near 38°S. To the north of the STSF, and south of Cape Santa Marta, high-frequency variability is induced by the passage of atmospheric fronts. Periods dominated by strong northeasterly winds lead to coastal upwelling events that can trigger significant near-coastal blooms (Campos et al., *J. Geophys. Res.*, 2013).

List of peer-reviewed publications:

Campos, P., O.O. Möller, A.R. Piola and E.D. Palma, Seasonal variability and western boundary upwelling: Cape Santa Marta (Brazil), *Journal of Geophysical Research*, **118**, 1–14, doi:10.1002/jgrc.20131.

Meinen, C.S., A.R. Piola, R.C. Perez, and S.L. Garzoli, 2012, Deep Western Boundary Current transport variability in the South Atlantic: Preliminary results from a pilot array at 34.5°S. *Ocean Science*, **8**, 1041–1054.

Mianzan, H.; Purcell, J. and J. Frost, 2012. Preface: Jellyfish blooms: interactions with humans and fisheries. *Hydrobiologia*: 10.1007/s10750-012-1050-z, published online 15 March 2012.

- Padovani, L.N., M.D. Viñas, F. Sánchez & H.W. Mianzan, 2012, Amphipod-supported food web: *Themisto gaudichaudii*, a key food resource for fishes in the southern Patagonian Shelf, *Journal of Sea Research*, **67**, 85-90.
- Palma, E. D., and R. P. Matano, 2012, A numerical study of the Magellan plume. *Journal of Geophysical Research*, **117**, C05041, doi:10.1029/2011JC007750.
- Piola, A.R., B.C. Franco, E.D. Palma and M. Saraceno, Multiple jets in the Malvinas Current, *Journal of Geophysical Research*, in press.
- Preu, B., F. J. Hernández-Molina, R. Violante, A.R. Piola, C.M. Paterlini, T. Schwenk, I. Voigt, S. Krastel and V. Speiss, 2012, Morphosedimentary and hydrographic features of the northern Argentine margin: the interplay between erosive, depositional and gravitational processes and its conceptual implications, *Deep-Sea Res. I*, **75**, 157–174, doi: 10.1016/j.dsr.2012.12.013.
- Rodrigues, R.R., R.J. Haarsma, E.J.D. Campos, & T. Ambrizzi, 2011, The impacts of inter-El Niño variability on the Tropical Atlantic and Northeast Brazil climate. *Journal of Climate*, **24**, 3402–3422. doi: 10.1175/2011JCLI3983.1

Estación Permanente de Estudios Ambientales (EPEA)

Aim: The EPEA station is a time-series site study of the project ‘Dynamics of Marine Plankton and Climate Change’ from the Argentine Institute of Fisheries Research (INIDEP). EPEA is also part of the Latin-American network Antares. The station is situated at 38° 28’S – 57° 41’W, close to the 50 m isobath. The project focuses on the study of long term variability in environmental and plankton composition (from bacterio to ichthyoplankton).

Start date: February 2000

End date: 2015

Website: www.antares.ws

Major funding sources: Instituto Nacional de Investigación y Desarrollo Pesquero, Argentina and Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina.

Major achievements: Only two samplings were possible during 2012. Three species of *Oithona* (*O. similis*, *O. atlantica* and *O. nana*) occurring in the Argentine sector of the South Atlantic Ocean, were examined based on DNA sequence variation of a 575 base-pair region of 28S rDNA, with comparative analysis of these species from other North and South Atlantic regions. DNA sequence variation clearly resolved and discriminated the species, and revealed low levels of intraspecific variation among North and South Atlantic populations of each species. During the study of picophytoplankton sequences, using eukaryotic universal primers, archaeal rDNA sequences from surface samples from EPEA were retrieved. Two DNA fragments of about 1,700 and 1,450 bp were visualized after electrophoresis in agarose gels. BLAST analysis showed that sequences of the highest size corresponded to eukaryotic organisms and, unexpectedly, those of about 1,460 bp corresponded to archaeal organisms. Phylogenetic analysis showed that archaeal sequences belong to Euryarchaeota of the Marine Group II, which is characterized as a methanogenic lineage. This is the first report on the presence of Euryarchaeota-Group II sequences in environmental water samples of the Argentine Sea. The fact that Archaea sequences were amplified with primers non specific for this group may suggest an unexpected abundance of these organisms in the early spring in the Argentine Sea.

List of peer-reviewed publications:

- Cepeda, G. D., Blanco-Bercial, L., Bucklin A., Berón, C. M. And Viñas, M. D. 2012. Molecular Systematic of Three Species of *Oithona* (Copepoda, Cyclopoida) from the Atlantic Ocean: Comparative Analysis Using 28S rDNA. *PLoS ONE* 7(4): e35861. doi:10.1371/journal.pone.0035861.
- Covacevich, F. R I Silva, A C Cumino, G Caló, R M Negri, G L Salerno. 2012. First archaeal rDNA sequences from Argentine coastal waters: Unexpected PCR characterization using eukaryotic primers. *Ciencias Marinas* 38(2): 427–439.
- Diaz, M.V. 2012. Condición nutricional de las larvas de anchoíta. Relación con las características ambientales del área de crianza. 368 pp. *Editorial Académica Española* ISBN 978-3-8484-7090-7
- Diaz, M.V.; Saia, J.; Soroet, S.; Pájaro, M.; Negri, R. Comparación estacional de la condición nutricional de larvas de anchoíta en la Estación Permanente de Estudios ambientales (EPEA). Periodo 2008-2010. *Revista de Investigación y Desarrollo Pesquero* (in press).

Viñas, M.; Negri, R.; Cepeda, G.; Hernández, D.; Silva, R.; Daponte, C., Capitanio, F. 2013. Seasonal succession of zooplankton in coastal waters of the Argentine Sea (Southwest Atlantic Ocean): prevalence of classical or microbial food webs. *Marine Biology Research* 9 – 4: 371-382.

IMBER-relevant activities or events:

- VIII Jornadas Nacionales de Ciencias del Mar, Comodoro Rivadavia, Argentina, Chubut. 3 - 7 December 2012.
- OCEATLAN Workshop, Buenos Aires, Argentina, 20-22 March 2013.
- SACC Fieldwork planning Workshop, Montevideo, Uruguay, 16-18 April 2013.
- 2013 AGU Meeting of the Americas, Cancun, Mexico 14-17 May 2013.

Upcoming activities relevant to IMBER:

- Interdisciplinary STSF cruise, September 2013.
- Hydrography and telemetry SAMOC cruise November 2013.

Belgium

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BioGeochemical cycles in the SOUTHERN Ocean: role within the Earth system (BIGSOUTH)

Aim: BIGSOUTH focuses on the following key questions:

- (1) What is the significance of the physical and biogeochemical processes of sea-ice on atmosphere - ocean fluxes of climate gases (CO₂, DMS, CH₄, N₂O) and fluxes of matter (carbon, macro- and micro-nutrients) to the water column?
- (2) Can we reconstruct paleo-sea ice extension based on sedimentary records and sound knowledge of sea-ice biological and physico-chemical processes?
- (3) How are formation rate, composition, lability and sinking speed of marine biogenic particles related to planktonic community structure and trophic interactions and how do margin systems, open ocean and sea-ice covered systems, which differ in Fe availability, compare?
- (4) What are the physical and ecosystem conditions and pathways that lead either to shallow remineralisation or to deep export of organic matter produced in sea-ice and surface waters?
- (5) What is the impact of these processes on water column nutrient ratios and nutrient distribution in the Global Ocean?

BIGSOUTH participants focused, in particular, on the significance of:

1. ammonium vs nitrate uptake under conditions of nitrate repleteness (NO₃ mostly > 20 μM) and the impact of Fe on this process,
2. euphotic layer nitrification and its impact on new production and export, and the possible role of Fe, and
3. the export flux of particles and carbon, and the remineralization of exported matter in the subsurface mesopelagic waters. C, N uptake processes and nitrification were studied via isotope enrichment experiments. Carbon export from the upper mixed layer (biopump) was assessed via the ²³⁴Th-deficit method while remineralisation of sinking material in the subsurface, mesopelagic waters was estimated from ²³⁴Th excess and the mesopelagic build-up of the biogenic particulate Ba stock. In order to evaluate short term and integrated effects of nitrate uptake, remineralisation, nitrification and spatial variability, possibly induced by varying availability of Fe in the region, on nitrate distribution, its natural N, O isotopic composition was analysed.

Broad deliverables of BIGSOUTH will be:

1. An assessment of the physical and biogeochemical processes in sea-ice and their impact on the exchange of climate gases, between the ocean and atmosphere and, on fluxes and isotopic signatures of matter exchanged with the water column and the sediment.
2. A comparative assessment of the functioning of the biological carbon pump for different oceanic functional entities (sea-ice zones, open-ocean zones, margin areas)
3. An integrated assessment of the magnitude and efficiency of deep ocean carbon sequestration (relative to primary production).
4. An assessment of the impact of biopump processes on nutrient distribution and ratios in deep ocean waters, which affect future production once upwelled at the surface.
5. A robust, up to date, sea-ice biogeochemical model for integration in widely used ocean biogeochemistry general circulation models (OPA-LIM-PISCES).
6. In order to assess fluxes of carbon and nutrients (N, Si), which are essential components of the biopump, the team has developed a unique integrated approach based on key stable isotopes and proxy techniques, as well as modelling. This toolbox will be applied in contrasting but representative functional entities of the Southern Ocean: the Fe-deficient high nutrient-low chlorophyll open circumpolar ocean; the Fe-replete areas in the vicinity of margins and plateaus (KEOPS 2 expedition) and the sea-ice zone (ISPOL2; YROSI/AE; SIPEX2 expeditions).

To achieve these goals and challenges, the expertise of a triumvirate of modellers, biogeochemists and glaciologists will be used for further interpretation of existing data gathered during previous projects and expeditions and also, importantly, for additional, focused field studies.

Start date: Jan 2011 **End date:** Dec 2014

Website: www.co2.ulg.ac.be/bigsouth/

Major funding source: Belgian Federal Science Policy Office

Major achievements: Several field surveys have been carried out since the start of the project. The KEOPS 2 expedition (Kerguelen Ocean and Plateau compared Study) took place from 6 October to 30 November 2012, on board R/V Marion Dufresne, to understand the impact of natural iron fertilization from plateau sediments on the efficacy of the biological pump in the vicinity of Kerguelen Island (Indian sector of the Southern Ocean).

List of peer-reviewed publications:

- Bowie A.R., F. B. Griffiths, F. Dehairs and T.W. Trull, 2011. Oceanography of the subantarctic and polar frontal zones south of Australia during summer: setting for the SAZ-Sense study, *Deep-Sea Research II*, 58, 2059-2070.
- Bowie A.R., T.W. Trull and F. Dehairs, 2011. Estimating the sensitivity of the subantarctic zone to environmental change: the SAZ-Sense project, *Deep-Sea Research II*, 58, 2051-2058.
- Brabant, F., S. El Amri and J.-L.Tison, 2011. A robust approach for the determination of dimethylsulfoxide in sea ice. *Limnology and Oceanography, Methods*, 9, 261-274.
- Cavagna A.-J., F. Dehairs, V. Woule-Ebongué, S. Bouillon, F. Planchon, B. Delille and I. Bouloubassi, 2012. Whole water column distribution and carbon isotopic composition of POC-bulk, cholesterol and brassicasterol from the Cape Basin to the northern Weddell Gyre, *Biogeosciences Discussion*, 9, 1667-1709 (accepted with minor revision for *Biogeosciences*).
- Cavagna A.-J., M. Elskens, F.B. Griffiths, F. Fripiat, S.H.M. Jacquet, K.J. Westwood and F. Dehairs, 2011. Contrasting regimes of production and potential for carbon export in the SAZ and PFZ south of Tasmania, *Deep-Sea Research II*, 58, 2235-2247.
- Cavagna A.-J., F. Fripiat, F. Dehairs, D. Wolf-Gladrow, B. Cisewski, N. Savoye, L. André, and D. Cardinal (2011). Silicon uptake and supply during a Southern Ocean iron fertilization experiment (EIFEX) tracked by Si-isotopes, *Limnology & Oceanography*, 56(1), 147-160.
- de Brauwere A., F. Fripiat, D. Cardinal, A.-J. Cavagna, L. André and M. Elskens, 2012. Isotopic model of oceanic silicon cycling: the Kerguelen Plateau case study, *Deep-Sea Research I*, 70, 42-59.
- De Jong, J., V. Schoemann, D. Lannuzel, H. de Baar and J.-L. Tison, 2012. Natural iron fertilization of the Atlantic Southern Ocean by continental shelf sources of the Antarctic Peninsula. *Journal of Geophysical Research*, 117, G01029, doi:10.1029/2011JG001679.
- Dumont, I., V. Schoemann, F. Masson, S.H.M. Jacquet and S. Becquevort, 2011. Bacterial remineralization in epipelagic and mesopelagic waters in Sub-Antarctic and Polar frontal zones south of Tasmania. *Deep-Sea Research II*, 58, 2212-2221.
- Fripiat F., A.-J. Cavagna, F. Dehairs, A. de Brauwere, L. André and D. Cardinal, 2012. Processes controlling Si-isotopic composition in the Southern Ocean for an application in paleoceanography, *Biogeosciences*, 9, 2443-2457.
- Fripiat F., A.-J. Cavagna, F. Dehairs, S. Speich, L. André and D. Cardinal, 2011. Silicic acid pools dynamics in the Antarctic Circumpolar Current inferred from Si-isotopes, *Ocean Sciences*, 8, 533-547.
- Fripiat F., K. Leblanc, A.-J. Cavagna, M. Elskens, L. Armand, L. André, F. Dehairs and D. Cardinal (2011). Summer efficient silicon loop despite contrasted diatom Si-affinity across the Polar Front and SubAntarctic Zone, *Marine Ecology Progress Series*, 435, 47-61.
- Fripiat, F., A.J. Cavagna, N. Savoye, F. Dehairs, L. André, and D. Cardinal, 2011. Isotopic constraints on the Si-biogeochemical cycle of the Antarctic Zone. *Marine Chemistry* 123: 11-22.
- Fripiat F., D.M. Sigman and J.-L.Tison (in prep.). Nitrogen isotope dynamic in Antarctic sea ice, *Limnology and Oceanography*.
- Geilfus, N. X., G. Carnat, G.S. Dieckmann, H. Eicken, N. Halden, G. Nehrke, T. Papakyriakou, J.-L. Tison and B. Delille, 2013. First estimates of the contribution of CaCO₃ precipitation to the release of CO₂ to the atmosphere during young sea ice growth, *Journal of Geophysical Research*, 118, 1-12.
- Geilfus, N. X., G. Carnat, T. Papakyriakou, J.-L.Tison, B. Else, H. Thomas, E.H. Shadwick and B. Delille, 2012. Dynamics of pCO₂ and related air-ice CO₂ fluxes in the Arctic coastal zone (Amundsen Gulf, Beaufort Sea), *Journal of Geophysical Research*, 117, C00G10.

- Geilfus, N. X., B. Delille, V. Verbeke and J.-L. Tison, 2012. Instruments and methods towards a method for high vertical resolution measurements of the partial pressure of CO₂ within bulk sea ice, *Journal of Glaciology*, 58(208), 287.
- Gonzalez-Davila M., J.M. Santana-Casiano, R.A. Fine, J. Happell, B. Delille and S. Speich, 2011. Carbonate system in the water masses of the Southeast Atlantic sector of the Southern Ocean during February and March 2008, *Biogeosciences*, 8, 1401-1413, doi:10.5194/bg-8-1401-2011.
- Hassler, C.S., V. Schoemann, C.A.M. Nichols, E.C.V. Butler and P.W. Boyd, 2011. Saccharides enhance iron bioavailability to Southern Ocean phytoplankton. *Proceedings of the National Academy of Sciences*, 108(3), 1076-1081, 10.1073/pnas.1010963108.
- Hassler, C.S., V. Schoemann, M. Boyé, A. Tagliabue, M. Rozmarynowycz and R.M.L. McKay, 2012. Iron availability in the Southern Ocean. *Oceanography and Marine Biology: An Annual Review*, 50, 1-64.
- Hoppema M., F. Dehairs, J. Navez, C. Monnin, C. Jeandel, E. Fahrbach, H.J.W. de Baar, 2010. Dissolved barium distributions in the Weddell Gyre: Impact of circulation and biogeochemical processes, *Marine Chemistry*, 122, 118-129.
- Jacquet S.H.M., F. Dehairs, I. Dumont, S. Becquevort, A.-J. Cavagna and D. Cardinal, 2011. Twilight zone organic carbon remineralization in the Polar Front Zone and Subantarctic Zone south of Tasmania, *Deep-Sea Research II*, 58, 2222-2234.
- Jacquet S.H.M., P.J. Lam, T.W. Trull and F. Dehairs, 2011. Carbon export production in the Polar Front Zone and Subantarctic Zone south of Tasmania, *Deep-Sea Research II*, 58, 2277-2292.
- Lannuzel, D., A. Bowie, T. Remenyi, P. Lam, A. Townsend, E. Ibsanmi, E. Butler, T. Wagener and V. Schoemann, 2011. Distributions of dissolved and particulate iron in the sub-Antarctic and Polar Frontal Southern Ocean (Australian sector), *Deep-Sea Research II*, 58, 2094-2112.
- Lannuzel, D., A.R. Bowie, P.C. van der Merwe, A.T. Townsend and V. Schoemann, 2011. Distribution of dissolved and particulate metals in Antarctic sea ice, *Marine Chemistry*, 124, 134-146.
- Lewis, M.-J., J.-L. Tison, B. Weissling, B. Delille, S.F. Ackley, F. Brabant and H. Xie, 2011. Sea ice and snow cover characteristics during the winter-spring transition in the Bellingshausen Sea: an overview of SIMBA 2007, *Deep-Sea Research II*, 58, 1019-1038, doi:10.1016/j.dsr2.2010.10.027.
- Loose, B., P. Schlosser, D. Ringelberg, D.T. Ho, T. Takahashi, J. Richter-Menge, C.M. Reynolds, W. McGillis and J.-L. Tison, 2011. Gas diffusion through columnar laboratory sea ice: implications for mixed-layer ventilation of CO₂ in the seasonal ice zone, *Tellus - Series B - Chemical and Physical Meteorology*, 63(1), 23-39.
- Petrou, K., M.A. Doblin, P.J. Ralph, C.S. Hassler, K. Shelly, V. Schoemann, S. Wright and R. van den Enden, 2011. Iron-limitation and high light on phytoplankton populations from the Australian Sub-Antarctic zone (SAZ), *Deep-Sea Research II*, 58, 2200-2211.
- Planchon F., A.-J. Cavagna, D. Cardinal, L. André and F. Dehairs, 2013. Late summer particulate organic carbon export from mixed layer to mesopelagic twilight zone in Atlantic sector of Southern Ocean, *Biogeosciences*, 10, 803-820.
- Quéguiner, B., K. Leblanc, V. Cornet-Barthaux, L. Armand, F. Fripiat, and D. Cardinal, 2011. Using a new fluorescent probe of silicification to measure species-specific activities of diatoms under varying environmental conditions. *Global Change: Mankind-Marine Environment Interactions*, *Proceedings of the 13th French-Japanese Oceanography Symposium* (Ceccaldi H.-J., Dekeyser I., Girault M., and Stora G., Eds.), Springer Dordrecht, Heidelberg, London, New York, pp. 283-287.
- Rysgaard, S., J. Bendtsen, B. Delille, G.S. Dieckmann, R.N. Glud, H. Kennedy, J. Mortensen, S. Papadimitriou, D.L. Thomas and J.-L. Tison, 2011. Sea ice contribution to the air-sea CO₂ exchange in the Arctic and Southern Oceans. *Tellus - Series B - Chemical and Physical Meteorology*, 63(5), 823-830.
- Stefels, J., G. Carnat, J.W. Dacey, T. Goossens, J.T.M. Elzenga and J.-L. Tison, 2012. The analysis of dimethylsulfide and dimethylsulphoniopropionate in sea ice: dry-crushing and melting using stable isotope additions. *Marine Chemistry*, 128-129, 34-43, doi: 10.1016/j.marchem.2011.09.007.
- Thomas H., E. Shadwick, F. Dehairs, B. Lansard, A. Mucci, J. Navez, Y. Gratton, F. Prowe, M. Chierici, A. Fransson, T. Papakyriakou, E. Sternberg, L. Miller, C. Monnin, 2011. Barium and Carbon fluxes in the Canadian Arctic Archipelago, *Journal of Geophysical Research-Oceans*, 116, C00G08, doi:10.1029/2011JC007120.

Vancoppenolle, M., R. Timmerman, S.F. Ackley, T. Fichefet, H. Goosse, P. Heil, J. Lieser, K.C. Leonard, M. Nicolaus, T. Papakyriakou and J.-L. Tison, 2011. Assessment of model forcing data sets for large-scale sea ice models in the Southern Ocean. *Deep-Sea Research II*, 58, 1237-1249, doi:10.1016/j.dsr2.2010.10.039.

Vogt, M., C., O'Brien, J. Peloquin, V. Schoemann, E. Breton, M. Estrada, J. Gibson, D. Karentz, M.A. Van Leeuwe, J. Stefels, C. Widdicombe, L. Peperzak, 2012. *Earth System Science Data* 4 (1), 107-120

YROSIAE survey

Aim: This survey was carried out in the frame of Bigsouth project. The aim was a year-round survey of landfast sea-ice focusing on the study of sea-ice physics and biogeochemistry in order to:

- a) better understand and budget exchanges of energy and matter across the ocean-sea and ice-atmosphere interfaces during sea-ice growth and decay,
- b) quantify their potential impact on fluxes of climate gases (CO₂, DMS, CH₄, N₂O) to the atmosphere and on carbon and macro- nutrients and micro-nutrients export to the ocean.

Start date: Nov 2011 **End date:** Dec 2012

Website: <https://fr-fr.facebook.com/Yrosiae>

Major funding sources: BELSPO, Belgian National Science Foundation (FRS-FNRS), Antarctica New Zealand

Major achievements: During YROSIAE leg 1 (October 10 to December 24, 2011), a one-year survey of air-sea and ice-ocean fluxes of carbon, nutrients, trace metal and climate gases together with sea ice biogeochemistry in McMurdo Sound in collaboration with Tim Haskell and Antarctica New Zealand was initiated. The YROSIAE study lasted until the end of 2012.

This study involved the set-up of a meteorological observation tower and energy supply devices on Cape Evans shore. The tower was equipped for measurement of air-ice CO₂ fluxes by eddy-correlation and DMS fluxes using the gradient flux method. Two dust collecting towers were also set up to provide a temporal record of a full suite of trace metal and dust measurements at different levels above the ground. Three main labs (cold lab, wet lab and trace metal lab) were set up in dedicated containers at Scott Base. We also carried out a survey of three process stations with the combined objectives of testing the various physical and biogeochemical protocols and providing a reference spring-summer sequence of data acquisition that will be compared to next year's measurements (inter-annual variability). The structure of first-year landfast sea ice at Cape Evans was characterized by typical "calm thermodynamic conditions" controlled by columnar ice down to 85 cm, with a very limited surface frazil layer. Although located in a bay partly protecting the sites from super cooled water inputs originating from the McMurdo Ice Shelf, the ice cover showed a transition to platelet ice, below 85 cm and down to the bottom. Salinities between 4 and 7 were typical of first year sea ice in the Antarctic, but showed a peculiar "break" at about 80 cm, suggesting that there might have been a change in seawater source in the middle of the winter. This hiatus actually corresponded to an accumulation of platelet ice in the ice cover. Besides the expected maximum of DMSP at the bottom of the sea ice layer, where the algal community was clearly visible, another internal maximum was visible between 80 and 100 cm, i.e. at the transition to platelet ice. This usually corresponds to the month of July when light input is quite limited, raising the question of the origin of this internal peak. We also observed that DMSP is not negligible in early winter, and actually increases steadily in the top 60 cm. Finally, the DMSP maximum at 80 cm appears to increase steadily over time suggesting active production. DMS shows a flat profile in the top 50 cm (as expected from the permeability conditions) and increases in the lower half of the ice cover, somewhat mimicking the variability of the DMSP profiles. We observed a general DMS loss at the third station, both at the ice water interface and internally. This internal loss of DMS corresponds to an increase in the concentration of DMS in the atmosphere suggesting that the ice actively releases DMS to the atmosphere during warming. Eddy correlation measurements of CO₂ fluxes reveal a transition of summer air-ice CO₂ fluxes from a source to a sink for atmospheric CO₂.

List of peer-reviewed publications: On-going project

Sea Ice Physics and Ecosystem eXperiment (SIPEX-2) survey

Aim: Participation to this survey was carried out in the frame of Bigsouth project. More than 50 scientists from eight countries will conduct the Sea Ice Physics and Ecosystem eXperiment 2012 (SIPEX-2). The 2012

voyage will build on information and observations collected in 2007, by re-visiting the study area at about 100-120° East. This is the culmination of years of preparation for the Australian Antarctic Division and, more specifically, the ACE CRC sea-ice group who will lead this international, multi-disciplinary, sea ice voyage to East Antarctica.

Work will begin at the sea-ice edge and the aim will be to penetrate the pack ice towards the coastal land-fast ice. The purpose of SIPEX-2 is to investigate relationships between the physical sea-ice environment, marine biogeochemistry and the structure of Southern Ocean ecosystems. While the scientists and crew will not set foot on Antarctic terra firma, about 10 multi-day research stations will be set up on suitable sea ice floes, and a range of novel and state-of-the-art instruments will be used. These include:

- A Remotely Operated Vehicle (ROV) to observe and film (with an on-board video camera) krill, and to quantify the distribution and amount of sea ice algae associated with ice floes.
- An Autonomous Underwater Vehicle (AUV) to study the three-dimensional under-ice topography of ice floes.
- Helicopter-borne instruments to measure snow and ice thickness, floe size and sea ice type. Instruments include a scanning laser altimeter, infrared radiometer, microwave radiometer, camera and GPS.
- Sea ice accelerometer buoys to measure sea ice wave interaction and its effect on floe-size distribution.
- Customized pumping systems and light-traps to catch krill from below the ice and on the sea floor.

An autonomous underwater vehicle (AUV) is a robot that travels underwater without requiring input from an operator. AUVs constitute part of a larger group of undersea systems known as unmanned underwater vehicles, a classification that includes non-autonomous remotely operated underwater vehicles (ROVs) – controlled and powered from the surface by an operator/pilot via an umbilical or using remote control.

ACE CRC/AAD sea-ice ecologist Dr Klaus Meiners is the chief scientist of the project. “We aim to achieve from this voyage an expansion of the multi-disciplinary observational record of East Antarctic sea ice characteristics and processes, and an assessment of impacts of climate change on the physical and biological elements of the Antarctic sea ice zone,” he said. “We will measure a large number of environmental and ecological parameters across different sea ice regimes to understand the physical processes and their impact on the ecosystem of the Southern Ocean. Data collected during the voyage will be used to improve satellite estimates of sea-ice thickness, provide input to sea-ice physical and ecosystem models and will help to detect climate change impacts in the Southern Ocean.”

Start date: Sep 2012 **End date:** Nov 2012

Website: <http://seaice.acecrc.org.au/sipex2012/>

Major funding sources: Australian Antarctic Division, AceCRC, Belgian Science policy

Major achievements: During SIPEX 2 (Sea Ice Physics and Ecosystem eXperiment; Oct.-Nov. 2012; Australian sector; RV Aurora Australis) the focus was on within sea ice biogeochemical processes in an early season situation. We performed within sea ice isotope enrichment experiments to assess primary production, ammonium, nitrate uptake. Sample for analysis of nitrate isotopic composition within sea ice has been also taken. Analysis of these samples will be carried out in 2013.

Coral reef ecology in acidified mesocosm

Aim: The project aims to study changes induced on the balance between bioaccretion by hermatypic corals and bioerosion/grazing by sea urchins using a long-term (36 months) experiment in artificial mesocosms where pCO₂ of 800 µatm (acidified ocean condition) is compared with current conditions around 400 µatm CO₂.

Start date: 1/1/2012 **End date:** 31/12/2014

Major funding sources: National Fund for Scientific Research (Belgium)

Major achievements: Ongoing-project

List of peer-reviewed publications: On-going project

Métabolisme, calcification et résistance à l'acidification des océans chez les échinodermes

Aim: The goal is to test the hypothesis linking the resistance towards ocean acidification and temperature increase in metazoa either to metabolism or to adaptation/acclimation to stress.

Start date: 1/1/2007 **End date:** 30/9/2017

Major funding sources: Fundação para a Ciência e la Tecnologia (Portugal) National Fund for Scientific Research (Belgium), Université Libre de Bruxelles

List of peer-reviewed publications:

- Moulin L., Catarino A. I., Claessens T and Dubois P. 2011. Effects of seawater acidification on early development of the intertidal sea urchin *Paracentrotus lividus*. *Mar. Pollut. Bull.* 62: 48-54.
- Catarino AI, De Ridder C, Gonzalez M, Gallardo P, Dubois P. 2012. Sea urchin *Arbacia dufresnei* (Blainville 1825) larvae response to ocean acidification. *Polar Biology* 35: 455-461.
- Ingels J, Vanreusel A, Brandt A, Catarino AI, David B, De Ridder Ch, Dubois P., Gooday AJ, Martin P, Pasotti F and Robert H. 2012. Possible effects of global environmental changes on Antarctic benthos: a synthesis across five major taxa. *Ecology Evolution* 2: 453-485.
- Catarino AI, Bauwens M, Dubois P. 2012. Acid-base balance and metabolic response of the sea urchin *Paracentrotus lividus* to different seawater pH and temperatures, *Environmental Science and Pollution Research* 19: 2344-2353.
- Kaiser S, Simone N. Brandão, Saskia Brix, David K.A. Barnes, David A. Bowden, Nils Brenke, Jeroen Ingels, Florian Leese, Stefano Schiaparelli, Claudia P. Arango, Renuka Badhe, Narissa Bax, Magdalena Blazewicz-Paszkowycz, Angelika Brandt, Ana I. Catarino, Bruno David, Chantal De Ridder, Philippe Dubois, Kari E. Ellingsen, Adrian G. Glover, Huw J. Griffiths, Julian Gutt, Kenneth M. Halanych, Charlotte Havermans, Christoph Held, Dorte Janussen, Anne-Nina Lörz, David A. Pearce, Benjamin Pierrat, Torben Riehl, Armin Rose, Chester J. Sands, Anna Soler-Membrives, Myriam Schüller, Jan M. Strugnell, Ann Vanreusel, Gritta Veit-Köhler, Nerida G. Wilson and Moriaki Yasuhara (2013). Pattern, process and vulnerability of Antarctic and Southern Ocean benthos - a decadal leap in knowledge and understanding. *Mar. Biol.* (in press)

IMBER-relevant activities or events:

- 44th International Liège Colloquium on Ocean Dynamics, Remote sensing of colour, temperature and salinity – new challenges and opportunities, 7-11 May 2012 (<http://modb.oce.ulg.ac.be/colloquium/?page=colloquium&year=2012>)
- 14th International Echinoderm Conference, August 20-24th, 2012; Brussels (www.14iec.be)

Upcoming activities relevant to IMBER:

- 45th International Liège Colloquium On Ocean Dynamics, Primary production in the ocean: from the synoptic to the global scale, May 13-17 2013 (<http://modb.oce.ulg.ac.be/colloquium/>)
- Participation in the ISPOL 2 cruise organized by the Alfred Wegner Institute on the *RV Polarstern* in the Weddell sea from June 2013 to August 2013.

China-Taiwan

National contact: **Kon-Ke Liu**, kkliu@ncu.edu.tw

Effects of Global Change on Ocean Biogeochemistry and Ecosystems in the Seas surrounding Taiwan in the Northwest Pacific (ECOBEST)

Aim: To determine how external forcings (such as dust deposition, river discharges, monsoons and typhoons) and physical processes (such as boundary currents, tides and internal waves) control the biogeochemistry and marine ecosystem of the western North Pacific Ocean near Taiwan

Start date: 1 August 2011 **End date:** 31 July 2014

Major funding source: National Science Council

Major achievements: Capture of typhoon induced phytoplankton bloom in the Kuroshio upwelling dome northeast of Taiwan after Typhoon Morakot (Hung et al., 2012).

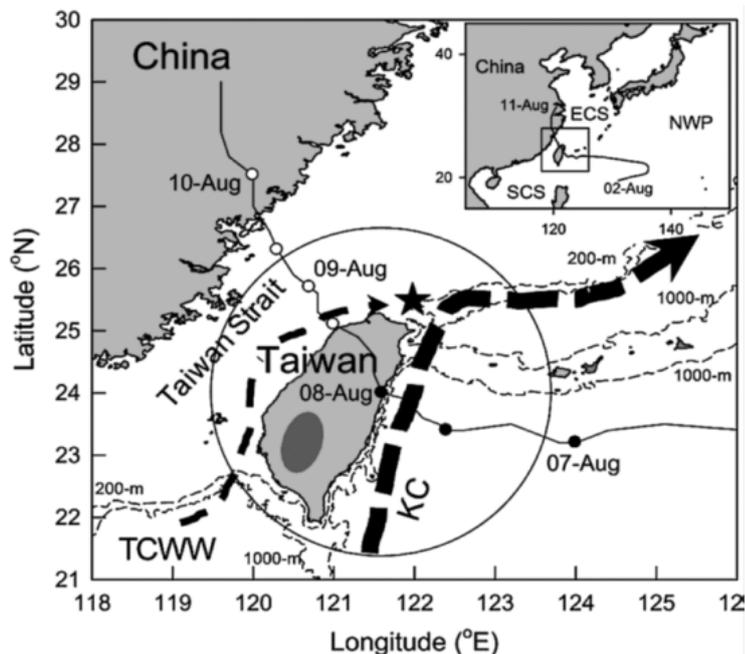


Figure 1: Map showing the path of Typhoon Morakot in August 2009. Also shown are the flow paths of the Kuroshio Current (KC) and the Taiwan Current Warm Water (TCWW).

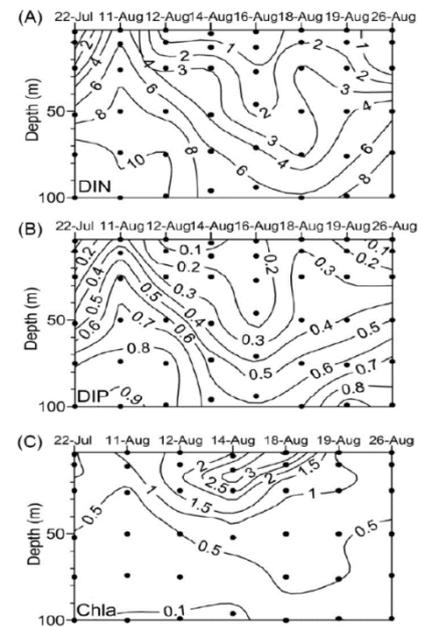


Figure 2: Time-series observations of nutrients and Chl-a at the station indicated by ★ in Figure 1.

Typhoon Morakot hit Taiwan on 8 August 2009 causing severe damage. The strong wind enhanced upwelling in the cold dome region off northeastern Taiwan (★ in Fig. 1), where the Kuroshio subsurface water upwells permanently due to the topographic effect. Repeated surveys of the cold dome region from 22 April to 26 August, showed outcropping of subsurface water with elevated nutrients (dissolved inorganic nitrogen and phosphorus) shortly after the typhoon passed ((A) and (B) in the right panel of Fig. 2). A phytoplankton bloom occurred starting on 13 August, five days after the typhoon passed across Taiwan. The surveys also demonstrated that the phytoplankton bloom was mainly attributed to diatom growth induced by the typhoon. Secondary production was also significantly enhanced, as revealed by the abrupt increase in copepod abundance, which resulted in enhanced export production shown by the number of faecal pellets collected in floating traps 50 m below the surface.

Publications:

Chang, C.Y., Ho, P.C., Sastri, A.R., Lee, Y.C., Gong, G.C. and Hsieh, C.H. 2012a. Methods of training set construction: Towards improving performance for automated mesozooplankton image classification systems. *Continental Shelf Research*, 36: 19-28 10.1016/j.csr.2012.01.005.

- Chang, F.H., Marquis, E.C., Chang, C.W., Gong, G.C. and Hsieh, C.H. 2012b. Scaling of growth rate and mortality with size and its consequence on size spectra of natural microphytoplankton assemblages in the East China Sea. *Biogeosciences Discuss*, 9: 16589-16623.
- Chang, N.N., Shiao, J.C. and Gong, G.C. 2012c. Diversity of demersal fish in the East China Sea: Implication of eutrophication and fishery. *Continental Shelf Research*, 47: 42-54 10.1016/j.csr.2012.06.011.
- Chang, N.N., Shiao, J.C., Gong, G.C., Kao, S.J. and Hsieh, C.H. 2013. Contributions of riverborne inorganic and organic matters to the benthic food web in the East China Sea as inferred from stable isotope ratios. *Biogeosciences Discuss.*, 10: 1051-1081.
- Chen, C.-C., Gong, G.-C., Shiah, F.-K., Chou, W.-C. and Hung, C.-C. 2013a. The large variation in organic carbon consumption in spring in the East China Sea. *Biogeosciences*, 10: 2931-2943 10.5194/bg-10-2931-2013.
- Chen, W.Y., Wang, Y.C. and Lee, M.A. 2012. Early-summer ichthyoplankton biodiversity associated with oceanic factors on the continental shelf of the southern East China Sea. *Journal of Marine Science and Technology-Taiwan*, 20(6): 698-706 10.6119/jmst-012-0727-1.
- Chen, W.Y., Lee, M.A., Lan, K.W. and Gong, G.C. 2013b. Distributions and assemblages of larval fish in the East China Sea in the northeasterly and southwesterly monsoon seasons 2008. *Biogeosciences Discuss.*, 10: 7075-7102.
- Chiang, K.-P., Tsai, A.-Y., Tsai, P.-J., Gong, G.-C. and Tsai, S.-F. 2013. Coupling of the spatial dynamic of picoplankton and nanoflagellate grazing pressure and carbon flow of the microbial food web in the subtropical pelagic continental shelf ecosystem. *Biogeosciences Discuss.*, 10: 233-263.
- Chou, W.-C., Gong, G.-C. and Cai, W.-J., 2012. Seasonality of CO₂ in coastal oceans altered by increasing anthropogenic nutrient delivery from large rivers: evidence from the Changjiang-East China Sea system. *Biogeosciences Discuss.*, 9: 18993-19017.
- Chou, W.-C., Gong, G.-C., Hung, C.-C. and Wu, Y.-H. 2013. Carbonate mineral saturation states in the East China Sea: present conditions and future scenario. *Biogeosciences Discuss.*, 10: 5555-5590.
- Chung, C.C., Gong, G.C. and Hung, C.C. 2012. Effect of Typhoon Morakot on microphytoplankton population dynamics in the subtropical Northwest Pacific. *Marine Ecology Progress Series*, 448: 39-49 10.3354/meps09490.
- Hsieh, W.C., Chen, C.C., Shiah, F.K., Hung, J.J., Chiang, K.P., Meng, P.J. and Fan, K.S. 2012. Community Metabolism in a Tropical Lagoon: Carbon Cycling and Autotrophic Ecosystem Induced by a Natural Nutrient Pulse. *Environmental Engineering Science*, 29(8): 776-782 10.1089/ees.2011.0252.
- Hung, C.-C., Tseng, C.-W., Gong, G.-C., Chen, K.-S., Chen, M.-H. and Hsu, S.-C. 2013a. Behavior and fluxes of particulate organic carbon in the East China Sea. *Biogeosciences Discuss.*, 10: 4271-4302.
- Hung, C.C., Gong, G.C. and Santschi, P.H. 2012. Th-234 in different size classes of sediment trap collected particles from the Northwestern Pacific Ocean. *Geochimica Et Cosmochimica Acta*, 91: 60-74 10.1016/j.gca.2012.05.017.
- Hung, S.H., Chung, C.C., Liao, C.W., Gong, G.C. and Chang, J. 2013b. Sequence diversity and expression levels of *Synechococcus* phosphate transporter gene in the East China Sea. *Journal of Experimental Marine Biology and Ecology*, 440: 90-99 10.1016/j.jembe.2012.11.018.
- Kang, L.K., Tsui, F.H. and Chang, J. 2012. Quantification of diatom gene expression in the sea by selecting uniformly transcribed mRNA as the basis for normalization. *Applied and Environmental Microbiology*, 78(17): 6051-6058 10.1128/aem.00935-12.
- Lin, K.Y., Sastri, A.R., Gong, G.C. and Hsieh, C.H. 2013. Copepod community growth rates in relation to body size, temperature, and food availability in the East China Sea: a test of metabolic theory of ecology. *Biogeosciences*, 10: 1877-1892 10.5194/bg-10-1877-2013.
- Liu, K.-K., Wang, L.-W., Dai, M., Tseng, C.-M., Yang, Y., Sui, C.-H., Oey, L.Y., Tseng, K.-Y. and Huang, S.-M. 2013. Inter-annual variation of chlorophyll in the northern South China Sea observed at the SEATS Station and its asymmetric responses to climate oscillation. *Biogeosciences Discuss.*, 10: 6899-6938.
- Tsai, A.-Y., Gong, G.-C. and Hung, J. 2012a. Seasonal variations of viral- and nanoflagellate-mediated mortality of heterotrophic bacteria in the coastal ecosystem of subtropical Western Pacific. *Biogeosciences Discuss.*, 9: 17235-17261.

Tsai, A.Y., Gong, G.C., Sanders, R.W., Chiang, K.P. and Chao, C.F. 2012b. Heterotrophic bacterial and *Synechococcus* spp. Growth and mortality along the inshore-offshore in the East China Sea in summer. *Journal of Oceanography*, 68(1): 151-162 10.1007/s10872-011-0076-6.

Upcoming activities relevant to IMBER:

The on-going ECOBEST project consists of 20 sub-projects with topics ranging from ocean circulation in the western North Pacific Ocean to biogeochemistry of Aeolian fluxes of iron, from primary production to microbial food loop and coral reef ecology. Special emphases are given to effects of acidification on coral reefs and impacts of human-induced environmental change (such as hypoxia) on fisheries resources. The major approach still employs traditional shipboard observations, but research methodology also covers remote sensing, atmospheric modeling of Aeolian transport and ocean modeling of currents, nutrient transport and lower trophic levels of marine ecosystems.

Any suggestions of new potential collaboration for IMBER:

Inter-comparison of marine biogeochemistry and ecosystems in large marginal seas around the world, such as the East China Sea, South China Sea, Japan/East Sea, Andaman Sea, the Caribbean Sea, Gulf of Mexico, etc.

Greece

National contacts: **Alexandra Gogou**, agogou@hcmr.gr and **Constantin Frangoulis**, cfrangoulis@hcmr.gr

Regional Drivers of Ecosystem Change and its Influence on Deep-Sea Populations in the Mediterranean (ReDEco)

Aim: To understand effects of climate change on deep-sea ecosystems in relation to climate-driven regional key factors and events including the impact of large-scale episodic events, dense shelf water cascading (DSWC) and also anthropogenic impacts

Start date: 01/05/2009 **End date:** 30/04/2013

Website: www.seas-era.eu/np4/186.html

Major funding sources: MarinERA (EU-RTD, FP6 ERA-NET) and the Greek General Secretary of Research and Technology (GSRT)

Major achievements: ReDEco, a consortium of six partners from four European countries was funded under the EU FP6 ERA-NET Scheme to study the effects of ecosystem change on deep-sea populations in the Mediterranean and ran successfully for a period of 4 years (2009 – 2013). It was able to provide over 100 days of shiptime, produced, so far, over 10 peer-reviewed papers (already published or under review) and supported more than 20 PhD and MSc students either through a direct grant or through other means of support such as providing access to shiptime, lab facilities and equipment, as well as, samples.

The main results so far indicate that deviations of the main water characteristics (e.g. salinity, temperature, etc.) in the eastern Mediterranean strongly depend on the meteorological conditions that prevailed during the winter/spring period. Also, Dense Shelf Water Cascading (DSWC) and open sea convection seem to be the main processes driving particulate fluxes. Since the Mediterranean is a strongly food-limited ecosystem, such events result almost certainly in an increased arrival of organic matter to the sea floor. Indeed, a time series analysis of sediment characteristics and benthic communities indicate that during periods of such episodic events, both the sediment geochemistry and benthic communities are significantly altered.

List of peer-reviewed publications:

- Gambi C., Lampadariou N., Danovaro R. (2010) Latitudinal, longitudinal and bathymetric patterns of abundance, biomass of metazoan meiofauna: importance of the rare taxa and anomalies in the deep Mediterranean Sea. *Advances in Oceanography and Limnology* 1:167-197
- Lopez-Fernandez P., Bianchelli S., Pusceddu A., Sanchez-Vidal A., Danovaro R., Calafat A.M., Canals M. (2013) Biochemical composition of sinking organic particles in the Blanes canyon (NW Mediterranean Sea): effect of biological processes vs. episodic events. *Progress in Oceanography* (accepted)
- Lopez-Fernandez P., Calafat A.M., Sanchez-Vidal A., Cateura J., Company J.B., Flexas M.M., Canals, M. (2013) Particle fluxes in the bathyal zone of the North Catalan margin: Blanes submarine canyon and adjacent slope. *Progress in Oceanography* (accepted)
- Pasqual C., Goñi M., Tesi T., Sanchez-Vidal A., Calafat A.M., Canals M. (2013) Composition and provenance of terrigenous organic matter transported along submarine canyons in the Gulf of Lion (NW Mediterranean). *Progress in Oceanography* (accepted)
- Pedrosa-Pàmies R., Sanchez-Vidal A., Calafat A.M., Canals M., Duran R. (2013) Organic matter and mineral interactions in sediments of the Catalan margin: the influence of extreme events. *Progress in Oceanography* (accepted)
- Puig P., Canals M., Martín J., Amblas D., Lastras G., Palanques A., Calafat A.M. (2012) Ploughing the deep sea floor. *Nature* 489:286-289
- Sanchez-Vidal A., Canals M., Calafat A.M., Lastras G., Pedrosa-Pàmies R., Menendez M., Medina R., Company J.B., Hereu B., Romero J., Alcoverro T. (2012) Impacts on the Deep-Sea Ecosystem by a Severe Coastal Storm. *PLoS ONE* 7:e30395 doi:10.1371/journal.pone.0030395
- Tecchio S., Ramírez-Llodra E., Sardà F., Company J.B., Palomera I., Mechó A., Pedrosa-Pàmies R., Sanchez-Vidal A. (2011) Drivers of deep Mediterranean megabenthos communities along longitudinal and bathymetric gradients. *Marine Ecology Progress Series* 439:181-192

Decadal scale Variability of the Mediterranean Ecosystem (MedEcos)

Aim: The MedEcos project aims to improve our understanding and predictive capacity of the evolution of the Mediterranean Marine Ecosystem at decadal time scales by:

- hindcasting conditions at the vicinity of connecting Straits and
- developing worst-case scenarios.

To this end, the approach of MedEcos encompasses:

- collecting available information on remote and local forcing
- filling-in existing oceanographic and biogeochemical information and assessing variability
- concentrating on natural Holocene climate shifts using multi-technique proxy records
- analyzing decadal variability
- developing site-specific circulation and ecosystem models.

Start date: 01/05/2009 **End date:** 30/04/2013

Website: www.marinera-medecos.eu

Major funding sources: MarinERA (EU-RTD, FP6 ERA-NET) and the Greek General Secretary of Research and Technology (GSRT)

List of peer-reviewed publications:

Theocharis, A., G. Krokos, D. Velaoras and G. Korres, 2013. An internal mechanism driving the alternation of the Eastern Mediterranean dense/deep water sources. Accepted in: *The Mediterranean Sea: Temporal Variability and Spatial Patterns*, edited by G. L. E. Borzelli, M. Gačić and P. Malanotte-Rizzoli. *AGU Book Series* (accepted)

Gogou A., A. Sanchez-Vidal, X. Durrieu de Madron, S. Stavrakakis, A.M. Calafat, M. Stabholz, S. Psarra, M. Canals, S. Heussner, I. Stavrakaki, V. Papathanassiou, 2013. Carbon Flux to the Deep in three open sites of the Southern European Seas (SES). *Journal of Marine Systems*, accepted.

Incarbona, A., P. Ziveri, E. Di Stefano, F. Lirer, P.G. Mortyn, B. Patti, N. Pelosi, M. Sprovieri, G. Tranchida, M. Vallefuoco, S. Albertazzi, L.G. Bellucci, A. Bonanno, S. Bonomo, P. Censi, L. Ferraro, S. Giuliani, S. Mazzola, and R. Sprovieri, The impact of the Little Ice Age on coccolithophores in the central Mediterranean Sea, *Climate of the Past*, 6, 795-805, doi:10.5194/cp-6-795-2010, 2010.

Policy-oriented marine Environmental Research in the Southern European Seas (PERSEUS)

Aim: The overall scientific objectives of PERSEUS are to identify the interacting patterns of natural and human-derived pressures on the Mediterranean and Black Seas, assess their impact on marine ecosystems and, using the objectives and principles of the Marine Strategy Framework Directive as a vehicle, design an effective and innovative research governance framework based on sound scientific knowledge.

Well-coordinated scientific research and socio-economic analysis will be applied on a wide-ranging scale, from basin to coastal. The new knowledge will advance our understanding of the selection and application of the appropriate descriptors and indicators of the MSFD. New tools will be developed in order to evaluate the current environmental status, by way of combining monitoring and modelling capabilities and existing observational systems will be upgraded and extended. Moreover, PERSEUS will develop a concept of an innovative, small research vessel, aiming to serve as a scientific survey tool, in very shallow areas, where the currently available research vessels are inadequate. In view of reaching Good Environmental Status (GES), a scenario-based framework of adaptive policies and management schemes will be developed. Scenarios of a suitable time frame and spatial scope will be used to explore interactions between projected anthropogenic and natural pressures. A feasible and realistic adaptation policy framework will be defined and ranked in relation to vulnerable marine sectors/groups/regions in order to design management schemes for marine governance. Finally, the project will promote the principles and objectives outlined in the MSFD across the SES. Leading research Institutes and SMEs from EU Member States, Associated States, Associated Candidate countries, non-EU Mediterranean and Black Sea countries, will join forces in a coordinated manner, in order to address common environmental pressures, and ultimately, take action in the challenge of achieving GES.

Start date: 01/01/2012 **End date:** 31/12/2015

Website: www.perseus-net.eu

Major funding sources: EU under FP7 Theme "Oceans of Tomorrow" OCEAN.2011-3

List of peer-reviewed publications:

- Astorga, D., Ruiz, J., Prieto, L., 2012. Ecological aspects of early life stages of *Cotylorhiza tuberculata* (Scyphozoa: Rhizostomae) affecting its pelagic population success. *Hydrobiologia* (2012) 690:141–155.
- Durrieu de Madron, X., Houpert, L., Puig, P., Sanchez-Vidal, A., et al., 2013. Interaction of dense shelf water cascading and open-sea convection in the northwestern Mediterranean during winter 2012. *Geophysical Research Letters*, Vol. 40, 1379–1385, doi:10.1002/grl.50331
- Felline, S., Caricato, R., Cutignano, A., Gorbi, S., Lionetto, MG., et al., 2012. Subtle Effects of Biological Invasions: Cellular and Physiological Responses of Fish Eating the Exotic Pest *Caulerpa racemosa*. *PLoS ONE* 7(6): e38763. doi:10.1371/journal.pone.0038763.
- Huertas, I. E., et al., 2012. Atlantic forcing of the Mediterranean oligotrophy. *Global Biogeochemical Cycles*, Vol; 26, GB2022, doi:10.1029/2011GB004167.
- Katsanevakis et al., 2013. ELNAIS meets EASIN: distribution of marine alien species in Greece using EASIN mapping services and ELNAIS spatial data. *Medit. Mar. Sci.*, 14/1, 2013, 95-98.
- Ruiz, J., Macias, D., Rincon, M.M., Pascual, A., Catalan, I.A., et al., 2013. Recruiting at the Edge: Kinetic Energy Inhibits Anchovy Populations in the Western Mediterranean. *PLoS ONE* 8(2): e55523. doi:10.1371/journal.pone.0055523.
- Ruiz, J., Prieto, L., Astorga, D., 2012. A model for temperature control of jellyfish (*Cotylorhiza tuberculata*) outbreaks: A causal analysis in a Mediterranean coastal lagoon. *Ecological Modelling* 233 (2012) 59– 69.
- Simboura et al., 2012. Indicators for the Sea-floor Integrity of the Hellenic Seas under the European Marine Strategy Framework Directive: Establishing the thresholds and standards for Good Environmental Status. *Medit. Mar. Sci.*, 13/1, 2012, 140-152.

Mediterranean Sea in a Changing Climate (MedSea)

Aim: MedSea assesses uncertainties, risks and thresholds related to Mediterranean acidification at organismal, ecosystem and economical scales. It also emphasizes conveying the acquired scientific knowledge to a wider audience of reference users, while suggesting policy measures for adaptation and mitigation that will vary from one region to another. In particular MedSea aims to:

- identify where the impacts of acidification on Mediterranean waters will be more significant, taking into account the sequence of causes and effects, from ocean chemistry through marine biology to socio- economic costs.
- generate new observational and experimental data on Mediterranean organism and ecosystem responses to acidification and fed into existing fine-scale models of the Mediterranean Sea that are modified to better represent key processes, and then used to project future changes. The MedSea focuses on a selected set of key ecosystem and socio-economic variables that are likely to be affected by both acidification and warming, studying the combination of both effects through ship-based observations, laboratory and mesocosm experiments, physical-biogeochemical-ecosystem modeling, and economical analyses.
- provide best estimates and related uncertainties of future changes in Mediterranean Sea pH, CaCO₃ saturation states, and other biogeochemical-ecosystem variables, assessing the changes in habitat suitability of relevant ecological and economically-important species.

Start date: 01/02/2011 **End date:** 31/01/2014

Website: medsea-project.eu

Major funding sources: EU under FP7

List of peer-reviewed publications:

- Asnaghi V, Chiantore M, Mangialojo L, Gazeau F, Francour P, Alliouane S, Gattuso J-P, 2013, Cascading effects of ocean acidification in a rocky subtidal community, *PLoS ONE* 8, 4, doi: 10.1371/journal.pone.0061978
- Arnold T, Mealey C, Leahey H, Miller AW, Hall-Spencer JM, Milazzo M, Maers K, 2012 Ocean Acidification and the Loss of Phenolic Substances in Marine Plants, *PLoS ONE* 7, 4, 140–141, doi:10.1371/journal.pone.0035107
- Azzurro E, Milazzo M, Maynou F, 2012, First confirmed record of the Lessepsian migrant *Pteragogus pelycus* Randall, 1981 (Teleostei: Labridae) for the North African coasts, *BioInvasions Records*, 27, 3, 45-48 doi:10.3391/bir.2012.1.1.10

- Barry J P, Widdicombe S., & Hall-Spencer J., 2011, Effects of ocean acidification on marine biodiversity and ecosystem function, Gattuso J.-P. & Hansson L. (Eds.), 344, 5, 192-209 Chapter in book "Ocean acidification"
- Basso D, 2012, Carbonate production by calcareous red algae and global change, *Geodiversitas*, vol 2, issue 286, 12420, 13 – 33, doi:10.5252/g2012n1a2
- Bayden D. Russell, Sean D. Connell, Sven Uthicke, Nancy Muehllehner, Katharina E. Fabricius, Jason M. Hall-Spencer, 2013, in press. Future seagrass beds: Can increased productivity lead to increased carbon storage? *Marine Pollution Bulletin*, doi:10.1016/j.marpolbul.2013.01.031
- Beare D, McQuatters-Gollop A, van der Hammen T, Machiels M, Teoh SJ, et al., 2013, Long-Term Trends in Calcifying Plankton and pH in the North Sea. *PLoS ONE* 8, 5, e61175. doi:10.1371/journal.pone.0061175
- Boatta F, D'Alessandro W, Gagliano A L, Liotta M, Milazzo M, Rodolfo-Metalpa R, Hall-Spencer J M, Parello F, 2013, in press. Geochemical survey of Levante Bay, Vulcano Island (Italy), a natural laboratory for the study of ocean acidification, *Marine Pollution Bulletin*, doi:10.1016/j.marpolbul.2013.01.029
- Boussetta S, Kallel N, Bassinot F, Labeyrie L, Duplessy JC, Caillon N, Dewilde F, Rebaubier H, 2011, Mg/Ca-paleothermometry in the western Mediterranean Sea on planktonic foraminifer species *Globigerina bulloides*, *Comptes Rendus, Geoscience*, 18, 9, 344, 5, 267–276, doi:10.1016/j.crte.2012.02.001
- Bramanti L, Movilla J, Guron M, Calvo E, Gori A, Dominguez-Carrió C, Grinyó J, Lopez-Sanz A, Martinez-Quintana A, Pelejero C, Ziveri P and Rossi S, 2013, Detrimental effects of ocean acidification on the economically important Mediterranean red coral (*Corallium rubrum*), *Global Change Biology*, in Press. doi:10.1111/gcb.12171.
- Brown A, 2012, Flourishing seaweed, *Nature Climate Change*, in Press, vol 2, issue 286, doi:10.1038/nclimate1618
- Calosi P, Rastrick S P S, Graziano M, Thomas S C, Baggini C, Carter H A, Hall-Spencer J M, Milazzo M, Spicer J I, 2013, in press. Distribution of sea urchins living near shallow water CO₂ vents is dependent upon species acid–base and ion-regulatory abilities, *Marine Pollution Bulletin*, doi:10.1016/j.marpolbul.2012.11.040
- Comeau S, Gattuso J-P, Jeffree R, Gazeau F, 2012, Effect of carbonate chemistry manipulations on calcification, respiration, and excretion of a Mediterranean pteropod., *Biogeosciences Discussions*, 115, 9, 2012, 6169–6189, doi:10.5194/bgd-9-6169-2012
- Duarte CM, Hendriks IE, Moore TS, Olsen YS, Steckbauer A, Ramajo L, Carstensen J, Trotter JA and McCulloch M, 2013, Is Ocean Acidification an Open-Ocean Syndrome? Understanding Anthropogenic Impacts on Seawater pH, *Estuaries and Coasts*, 36(2), 221-236. doi:10.1007/s12237-013-9594-3
- Gattuso J-P, Mach KJ and Morgan G (2013), Ocean acidification and its impacts: an expert survey, *Climatic Change*, 117, 725-738. doi:10.1007/s10584-012-0591-5
- Gazeau F, Parker LM, Comeau S, Gattuso J-P, O'Connor WA, Martin S, Pörtner H-O and Ross PM (2013), Impacts of ocean acidification on marine shelled molluscs, *Marine Biology*, 1-39. doi:10.1007/s00227-013-2219-3
- Giani M, Djakovac T, Degobbi D, Cozzi S, Solidoro C, Umani S F, 2012, Recent changes in the marine ecosystems of the northern Adriatic Sea, *Estuarine Coastal And Shelf Science*, 115, doi:10.1016/j.ecss.2012.08.023
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Inter-basin exchange in the changing Mediterranean Sea: Impact on the ecosystems in the vicinity of the Straits connecting the Mediterranean Sea with the adjacent Basins (MedeX)

Aim: The Greek national component of the MedeX program aims to study the changing inter-basin exchange processes between the Black Sea and the Mediterranean Sea (due to climate change) and their impact on the planktonic ecosystem of the Northeast Aegean Sea (area of the Black Sea waters inflow). Existing and new observations in the latter area as well as modelling are the tools used a) to estimate the main trends in the inter-basin exchange and their influence on the structure and functioning of the planktonic ecosystem and b) to predict future ones.

Start date: 01/05/2009 **End date:** 30/04/2013

Website: www.marinera-medex.eu

Major funding sources: MarinERA (EU-RTD, FP6 ERA-NET) and the Greek General Secretary of Research and Technology (GSRT)

List of peer-reviewed publications:

Prieto L., G. Navarro, S. Rodríguez-Gálvez, I.E. Huertas, J. M. Naranjo & J. Ruiz, 2009. Meteorological and oceanographic forcing on the pelagic ecosystem of the Gulf of Cadiz shelf (SW Iberian Peninsula). *Continental Shelf Research*, 29, 2122-2137, doi: 10.1016/j.csr.2009.08.007

Macías D., I.A. Catalán, J. Solé, B. Morales-Nin, J. Ruiz, 2011. Atmospheric-induced variability of hydrological and biogeochemical signatures in the NW Alboran Sea. Consequences for the spawning and nursery habitats of European anchovy. *Deep-Sea Research I*, 58, 1175-1188, doi:10.1016/j.dsr.2011.08.013

Navarro G., A. Vázquez, D. Macías, M. Bruno, J. Ruiz, 2011. Understanding the patterns of biological response to physical forcing in the Alborán Sea (western Mediterranean). *Geophysical Research Letters*, VOL. 38, L23606, doi:10.1029/2011GL049708

Delgado J., J. García Lafuente, E. Bruque-Rozas, C. Naranjo, 2011. Short period sea level oscillations at Strait of Gibraltar: Observations versus model results. *Estuarine, Coastal and Shelf Science*, Volume 95, Issues 2-3, 10 December 2011, Pages 307-313, doi: 10.1016/j.ecss.2011.09.014.

Navarro G., I.E. Huertas, E. Costas, S. Flecha, M. Díez-Minguito, I. Caballero, V. López-Rodas, L. Prieto & J. Ruiz, 2012. Use of a real-time remote monitoring network (RTRM) to characterize the Guadalquivir estuary ecosystem. *Sensors*, 12, 1398-1421, doi: 10.3390/s120201398

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Catalán I.A., D. Macías, J. Solé, A. Ospina-Álvarez, J. Ruiz, 2013. Stay off the motorway: resolving the pre-recruitment life history dynamics of the European anchovy in the SW Mediterranean through a spatially-explicit individual-based model (SEIBM). *Progress in Oceanography*, doi: 10.1016/j.pocean.2013.02.001

Technological and oceanographic cooperation Network for the Study of mechanisms fertilizing the North-East Aegean Sea (AegeanMarTech)

Aim: The subject of the proposed research is the development of sustainable long-term collaboration between academic and research groups involved in marine research, through the common development and combined use of new tools and methodologies acting as “power multipliers” for the study of the major fertilization mechanisms of the Aegean Sea marine ecosystem. The project investigates the two major physical mechanisms of fertilization of the Aegean Sea, i.e. the inflow of mesotrophic waters from the Black Sea in the North Aegean, and the wind-generated coastal upwelling taking part in the Eastern Aegean every summer and their consequent effect on the carbon uptake by the ocean.

Start date: 01/05/2012 **End date:** 30/09/2015

Major funding sources: co-financed by the European Union (European Social Fund – ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: THALES. Investing in knowledge society through the European Social Fund.

Atmospheric deposition and Mediterranean sea water productivity – (ADAMANT)

Aim: The Mediterranean Sea (MS), especially the eastern basin, is one of the most oligotrophic seas. The N/P ratio is unusually high with a west (22:1) to east (28:1) increasing gradient.

Atmospheric deposition was recently suggested as the main external mechanism supplying nutrients to the marine environment. The proposed project aims at quantifying the role of atmospheric deposition of nutrients as a driver for the seawater productivity changes in the MS through modelling and experimental work. This will be achieved by coupling atmospheric and seawater observations and elaborating them by a marine biogeochemical / ecosystem model that will be forced by an atmospheric chemistry / transport / deposition model. The project will quantify the atmospheric deposition of nutrients, their anthropogenic component and their long-term variability (hindcast and forecast simulations). It will then evaluate the response of the oceanic biogeochemistry to these forcings. It is the first time that such a strong coupling between atmospheric scientists and oceanographers is realized in the Mediterranean. The project aspires to highlight the biogeochemical functioning of the MS and how this is influenced by anthropogenic activity and future climatic changes. In this perspective, the proposed work is structured in four WP which cover: atmospheric and marine observations and targeted experiments (both atmospheric and oceanic) aimed at determining the drivers of the marine ecosystem changes and parameterizing their impact (WP1); modelling of the atmosphere (WP2) and of the marine ecosystem in the East and the West Mediterranean (WP3). Present day evaluations of impacts will be complemented by hind cast and forecast simulations to evaluate the evolution of these impacts since 1900 and until 2100 (WP2 & WP3). Maximum profit of the project resources and best dissemination of the results is assured by WP4 that focuses on the management and the dissemination of the project results to the scientific community, the general public and policy makers.

Start date: 01/03/2012 **End date:** 30/09/2015

Website: www.thales-adamant.hcmr.gr

Major funding sources: co-finance by the European Union (European Social Fund – ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: THALES. Investing in knowledge society through the European Social Fund.

Towards COast to Coast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential (COCONET)

Aim: The project will have two main themes:

- identify prospective networks of existing or potential MPAs in the Mediterranean and the Black Seas, shifting from a local perspective (centred on single MPAs) to the regional level (network of MPAs) and finally the basin scale (network of networks). The identification of the physical and biological connections among MPAs will elucidate the patterns and processes of biodiversity distribution. Measures to improve protection schemes will be suggested, based on maintaining

effective exchanges (biological and hydrological) between protected areas. The national coastal focus of existing MPAs will be widened to both off shore and deep sea habitats, incorporating them into the networks through examination of current legislation, to find legal solutions to set up transboundary MPAs.

- explore where Offshore Wind Farms (OWF) might be established, producing an enriched wind atlas both for the Mediterranean and the Black Seas. OWF locations will avoid very sensitive habitats but the possibility for them to act as stepping-stones through MPAs, without interfering much with human activities, will be evaluated. Socioeconomic studies employing ecosystem services valuation methods to develop sustainable approaches for both MPA and OWF development will also be carried out, to complement the ecological and technological parts of the project, so as to provide guidelines to design, manage and monitor networks of MPAs and OWF.

Start date: 1/2/2012 **End date:** 31/1/2016

Website: www.coconet-fp7.eu

Major funding sources: EU

IMBER-relevant activities or events :

- Faro, 11–14 September 2012: ReDEco progress meeting held in parallel with the HERMIONE project final meeting
- Heraklion, 6-8 February 2013: ReDEco final meeting and data integration and analysis workshop
- Heraklion, 5-6 March 2013: 2nd MedSea Annual Meeting. Mediterranean Sea in a Changing Climate. MedseA is an IMBER-endorsed project. Local organiser C. Frangoulis (IMBER Greek national contact).
- Barcelona, 22-23 January 2013: PERSEUS Umbrella Workshop.
- Athens, 18 February 2013: AegeanMarTech kick-off meeting
- Athens, 19-20 February 2013: Medex final meeting

Upcoming activities relevant to IMBER:

Meeting in Athens on 13-14 June 2013, organised by HCMR (V. Papathanasiou, PERSEUS coordinator) gathering coordinators of FP7 ongoing projects in the Mediterranean and Black Sea (COCONET, ODEMM, MEDINA, PEGASO, MEDSEA, ULIXES, MARILISCO, VECTORS, MISIS, MERMAID, STAGES, MYOCEAN2, JELLYRISK, CLEANSEA, UNDP-Black Sea, PERSEUS, Kill*Spill, CREAM). It will be suggested to the participants to make a short description of their project for the IMBER newsletter.

India

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The national SIBER (Sustained Indian Ocean Biogeochemical and Ecological Research) programme supported by the Ministry of Earth Sciences (MoES), Government of India, continues to be implemented at the participating institutions. Internationally SIBER is jointly sponsored by IMBER and IOGOOS (Indian Ocean Global Ocean Observing System). The SIBER International Project Office is hosted by the Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, an institution belonging to the MoES. SIBER-India consists of 14 projects clustered under two groups – the Open-Ocean cluster (6 projects) and the Estuaries & Coasts cluster (8 projects). A few highlights of the work carried out are as follows:

- Time series sampling at two stations in the Arabian Sea (AS) and Bay of Bengal (BoB) reveal higher phytoplankton standing stock but lower microbial population (total bacterial and heterotrophic nanoflagellate (HNF) counts) in the AS compared to the BoB. This is attributed to grazing pressure exerted by bacterivorous nanoflagellates in the AS. The highest bacterial counts were recorded at 75 m in the AS and at 2000 m in the BoB.
- Time series sediment trap data show high particle flux during the south west monsoon (SWM) (August-September) in the BoB with fluxes in the middle and deep traps being higher than in the shallow trap. Surprisingly, low flux was recorded in the AS traps during the SWM, the reason for which is being investigated.
- Continued observations over the western Indian shelf reveal large inter-annual variability in seasonal (SWM) anoxia with an indication of southward expansion of the sulphidic zone. High concentrations of dimethyl sulphide were recorded in anoxic waters. Extremely high rates of denitrification (several micromoles per litre per day) were measured in anoxic waters. A coupling between nitrogen and sulphur cycles may account for the huge N₂O accumulation in the region. Rates of both anammox (anaerobic ammonia oxidation) and DNRA (dissimilatory nitrate reduction to ammonium) were much lower/negligible.
- Seasonal anoxia alters the food-web structure and system productivity. Pico- and nano-autotrophs dominate phytoplankton community apart from few diatoms (*Thalassionema Pseudonitzschia*, *Thalassiothrix*, *Asterionella*, *Rhizosolenia*). Occurrence of blooms of *Trichodesmium* and subsequent increase in bacterial and HNF suggests a close coupling between these two microbial components together with the dominance of carnivorous copepods, indicating the operation of multi-step microbial food web.
- Observations in the Mandovi-Zuari estuarine system (Goa) show high N₂O concentrations at the river mouths during SWM due to the input from the coastally-upwelled low oxygen waters. But high concentrations were also observed in the mid-estuarine region during the pre-monsoon season, indicating the existence of a local (nitrification) source. High CH₄ concentrations were measured towards the freshwater end the SWM and post-SWM in both estuaries. Both the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ of the suspended particulate organic matter (SPOM) showed distinct marine signatures at the estuarine mouths ($\sim -21\text{‰}$ and $\sim 5.7\text{‰}$), but in the upstream region the SPOM is largely of terrestrial origin ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ being around -29‰ and $\sim 1\text{‰}$, respectively). Mean C:N ratio (6.64 ± 0.9) indicates largely planktonic source of organic matter.
- Phytoplankton growth rates in the estuaries varied seasonally ($0.69 - 1.43 \text{ d}^{-1}$) with a large fraction (44-80%) of the autotrophic crop being mobilized through microzooplankton grazing. Salinity was found to control the composition of mesozooplankton with herbivorous copepods dominating in low salinity waters and the carnivorous copepods being more abundant in the high salinity regime. Distribution of TBC and HNF indicates that HNF are major bacterivores in the tropical estuarine system.
- Observations of macro- and meio-benthic diversity off Goa coast with special emphasis on OMZ has led to identification of three species of crabs, eight species of molluscs, and six species of polychaetes; 41 species of Nematodes belonging to 25 genera, 25 families, and three orders; and nine species of Copepods belonging to eight genera, five families and one order.

- Time series measurements have been initiated in coastal waters off Cochin along the SW coast of India. The results reveal major changes brought about by the SW monsoon circulation. The oxygen concentrations seem to have declined in near-bottom waters as compared to the time series data collected at the same site in the 1950s.
- Heterotrophic bacteria and cyanobacteria involved with the nitrogen cycle are being investigated in the Cochin estuary and coastal waters. Symbiotic association of *Richelia* with *Rhizosolenia* has been recorded for the first time in the south-eastern Arabian Sea.
- Along the east coast of India regular measurements are being made in the Vellar – Coleroon estuarine system and Parangipettai coastal waters (Tamil Nadu) and in the Hooghly–Matla estuarine system (West Bengal). Both regions are strongly affected by the monsoonal cycle. The Vellar-Coleroon estuarine system appears to serve as a strong source of nutrients to coastal waters. Data from the Hooghly–Matla estuary revealed strong net heterotrophy with the P/R ratio of 0.27.

Japan

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1. Research Cruise

A research cruise on R/V Hakuho-maru (KH-12-3, P.I. Dr. H. Ogawa) was conducted from 6 July 2012 – 14 August 2012 in the western North Pacific. This cruise was titled “Integrated Marine Biogeochemistry and Ecosystem Research for creating a new ocean paradigm”, and 31 scientists related to IMBER projects participated. In Leg. 1 (6-26 July 26), a full-depth transect survey along the meridian of 160°E between 47°N and 5°N, and observations were conducted at 11 stations. It covered several geographical domains of the western North Pacific with different biogeochemical and ecological properties, including tropical upwelling system, oligotrophic subtropical gyre, Kuroshio Extension and subarctic gyre. In Leg. 2 (29 July to 14 August), a full-depth survey from the subtropical gyre off Kuroshio to the cross section of Kuroshio 29 with seven observation stations was also conducted. It is expected that the detailed distributions and fluxes of a variety of chemical and biological parameters along the north-south transect in the western North Pacific would be obtained. Another research cruise related to IMBER-Japan will be conducted. The cruise will be on R/V Hakuho-maru (KH-13-7, P.I. Dr. K. Furuya) during December 11, 2013 – February 12, 2014 in the central South Pacific

2. Symposium

Recent findings and future challenges of IMBER-Japan activities

Date: June 5-6, 2012 in Tokyo (conveners: H. Ogawa and H. Saito)

This symposium was organized mainly by the IMBER-Japan community. Speakers from various disciplines including physics, chemistry, and biology presented the latest knowledge of biogeochemical cycles and plankton ecosystems in Pacific Ocean.

3. Funding

An IMBER-related group in Japan, including both natural and social scientists (chief scientist: Dr. K. Furuya) submitted a proposal to a large-scale research fund, “Scientific Research on Innovative Area” sponsored by Ministry of Education, Culture, Sports, Science and Technology-Japan. The New Ocean Paradigm on Its Biogeochemistry, Ecosystem and Sustainable Use: NEOPS project is planned for five years (2012-2016) with total expenses of approximately 800,000,000 yen (= ca. \$ 8,000,000). The proposal was successfully accepted on 28 June 2012 and the research project has just started.

Korea

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IMBER-relevant activities or events:

International Workshop titled 'Marginal seas in change: the East Sea and the Mediterranean Case', 6-8 November 2012

Venue: Seoul National University, Korea

Conveners: Kyung-Il Chang (SNU), Tongsup Lee (PNU), Laurent Coppola (CNRS-UPMC)

Aim: to provide an open forum for scientists studying these two seas, to increase understanding of their oceanography and gain insight into ways of tackling their individual problems.

East Asian Seas Time Series Project – stage I (EAST-1)

Aim: The East/Japan Sea may serve as a miniature 'test ocean' for global change in the future, as it has many oceanic features, including its own conveyor belt system. In this regard, PICES approved a CREAMS/PICES program, named EAST (East Asian Sea Time series)-I, to promote international cooperation in the East/Japan Sea, especially between Japan, Korea and Russia. The long-term goal of the Korea EAST-I project is to identify, quantify and model the dynamic processes governing climate variability and their linkage to changes in the marine ecosystem.

Start date: June 2011 **End date:** May 2016

Website: east-1.snu.ac.kr

Major funding sources: Ministry of Oceans and Fisheries of Korea

Major achievements: Through the Korea EAST-I project, integrated time-series monitoring (e.g. E-RAP: Fig. 1, UBIM) was successfully carried out on various spatiotemporal scales of the East/Japan Sea. Furthermore, Korea EAST-I project has successfully promoted international cooperation through joint cruises and international workshops. As part of the EAST-I, data were collected on the Russia *R/V Akademik Oparin* from 13–29 October 2012 (Fig. 2). A team of 31 scientists from six institutes (POI, SNU, POSTECH, PNU, CNU) participated in this cruise. At 43 hydrographic stations, salinity, temperature, oxygen and nutrient concentrations were measured, and concentrations of total dissolved inorganic carbon and total alkalinity were determined at 25 of these stations.

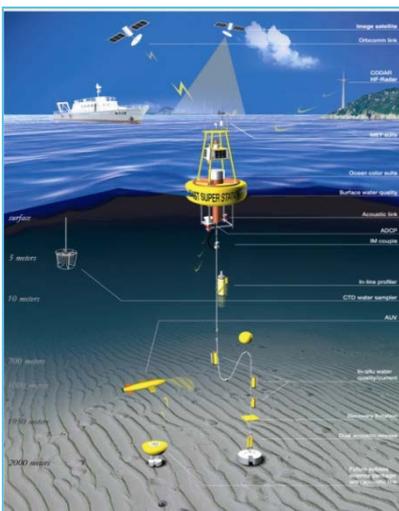


Figure 1: Cartoon of the time-series monitoring various spatiotemporal scales of the East/Japan Sea

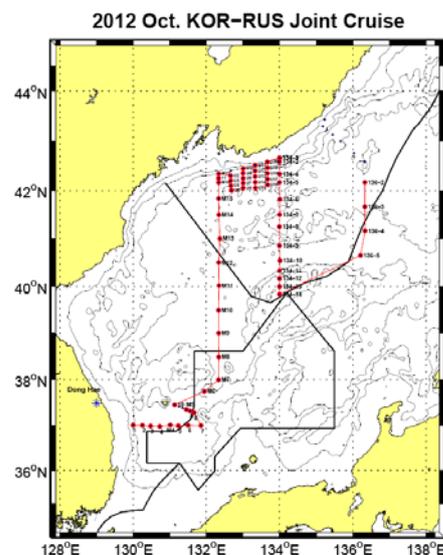


Figure 2: Map showing the track of the *R/V Akademik Oparin* and hydrographic stations where samples were taken

List of peer-reviewed publications:

Jeon, J.-M. *et al.* (2012) Two type I crustacean hyperglycemic hormone (CHH) genes in Morotoge shrimp (*Pandalopsis japonica*): cloning and expression of eyestalk and pericardial organ isoforms produced by

- alternative splicing and a novel CHH with predicted structure shared with type II CHH peptides. *Comparative Biochemistry and Physiology Part b* 162(4): 88-99
- Kim, M.S. *et al.* (2012) Molecular characterization of three crustin genes in the Morotoge shrimp, *Pandalopsis japonica*. *Comparative Biochemistry and Physiology Part b* 162(4): 161-171
- Lee, S.-R. *et al.* (2012) Metagenomic Examination of diversity within eukaryotic plankton from the Ulleung Basin in the East Sea of Korea. *Journal of Plant Biology* 55(4): 310-315
- Kim, T.-H. *et al.* (2012) Important role of colloids in the cycling of ^{210}Po and ^{210}Pb in the ocean: Results from the East/Japan Sea. *Geochimica et Cosmochimica Acta* 95: 134–142
- Kim, Y.-B. *et al.* (2013) Variability of the Dokdo Abyssal Current observed in the Ulleung Interplain Gap of the East/Japan Sea. *Acta Oceanologica Sinica* 32(1): 12-23
- Park, K.-A. *et al.* (2013) Characteristics of satellite chlorophyll-*a* concentration speckles and a removal method in composite process in the East/Japan Sea. *International Journal of Remote Sensing* 34(13): 4610-4635
- Kim, T.-H. *et al.* (2013) Factors controlling the C:N:P stoichiometry of dissolved organic matter (DOM) in the N-limited, cyanobacteria-dominated East/Japan Sea. *Journal of Marine Systems* 115-116: 1-9

Northwestern Pacific Ocean Study on Environment and Interactions between Deep Ocean and marginal seas (POSEIDON)

Aim: To examine and predict the influence of oceanic variability in the northwestern Pacific Ocean on the marginal seas around Korea in association with future climate change, and also to prepare an appropriate scenario in the near future (2030)

Start date: Jan 2012 **End date:** Dec 2015

Major funding sources: Korea Institute of Ocean Science & Technology

Major achievements:

- Three subsurface buoy systems and five pressure-inverted echo sounders (PIES) were deployed for monitoring long-term ocean currents and internal waves along 135°E in the subtropical-tropical Pacific.
- Total mass flux = $9.72\text{mg m}^{-2}\text{day}^{-1}$ ($0.01 \sim 28.3\text{mg m}^{-2}\text{day}^{-1}$) at subtropical stations,
- Organic carbon flux 0.23 to $2.24\text{mg m}^{-2}\text{day}^{-1}$
- CaCO_3 flux $3.67 \sim 23.1\text{mg m}^{-2}\text{day}^{-1}$.
- During the 2008-2012 surveys in the Warm Pool region, primary production in the warmer (colder) surface waters showed lower (higher) rates. The 0.5~1.0, 1.0~2.0, and 2.0~5.0mm size groups of meso-zooplankton in the East China Sea were similarly important with the composition of 24 to 27%. The biomass was dominated by 2.0~5.0mm meso-zooplankton in Philippine Sea, with 33~44% composition, and 1.0~2.0mm of meso-zooplankton in the warm pool with 25~41% composition.
- Bi-weekly/monthly water samples have been collected for sampling phytoplankton, micro- and meso-zooplankton in the western channel of the Korea Strait since March 2006.
- Coupled physico-biogeochemical modeling has been carried out for the pilot study of interannual variation in the past 10 years, from 1992 to 2001.
- 2012 Cruise (June 4 ~ June 23, 2012) from Jangmok to Chuuk, Micronesia
- 2013 Cruise (May 14 ~ June 1, 2013) from Jangmok to Guam

List of peer-reviewed publications:

- Kang, H.G. *et al.* (2012) Effects of suspended sediments on reproductive responses of *Paracalanus* sp. (Copepoda: Calanoida) in the laboratory. *Journal of Plankton Research* 34(7): 626-635
- Park, J.H., *et al.* (2012) Comparisons of sea surface height variability observed by pressure-recording inverted echo sounders and satellite altimetry in the Kuroshio Extension. *Journal of Oceanography* 68(3): 401-416
- Choi, S.H. *et al.* (2012) Seasonal variations of surface fCO_2 and sea-air CO_2 fluxes in the Ulleung Basin of the East/Japan Sea. *Terrestrial Atmospheric and Oceanic Sciences* 23(3): 343-353
- Lee, C.L. *et al.* (2012) Biomass and trophic structure of the plankton community in subtropical and temperate waters of the northwestern Pacific Ocean. *Journal of Oceanography* 68: 473-482
- Yang, E.J. *et al.* (2012) Mesoscale distribution of protozooplankton communities and their herbivory in the western Scotia Sea of the Southern Ocean during the astral spring. *Journal of Experimental Marine Biology and Ecology* 428(6): 5-15

- Kim, Y.O. *et al.* (2012) Tintinnid species as biological indicators for monitoring intrusion of the warm oceanic waters into Korean coastal waters. *Ocean Science Journal* 47(3): 161-172
- Kwon, M.H. *et al.* (2012) Changes in the linear relationship of ENSO-PDO under the global warming. *International Journal of Climatology* 1(1): 1-10
- Moon, J.U. *et al.* (2012) Initial Validation of GOCI Water Products against in situ Data Collected around Korean Peninsula for 2010-2011. *Ocean Science Journal* 47(3): 261-277
- Son, H. Y. *et al.* (2012) Nonlinear impact of the Arctic Oscillation on extratropical surface air temperature. *Journal of Geophysical Research* 117(D19102): 1-13

Assessment of the impact of climate change on marine ecosystem in the South Sea of Korea

Aim: Understanding and predicting the effects of climate/marine environment changes (warming, acidification) on the structure and function of marine ecosystem in the South Sea of Korea

Start date: October 2008 **End date:** July 2013

Website: None

Major funding sources: Ministry of Oceans and Fisheries of Korea

Major achievements:

- Retrospective analysis of long-term variation of SST and chlorophyll using historic data
- Evaluating the biological and ecological responses on ocean warming and acidification
- Building an observation infrastructure to monitor the regional/coastal marine environment/ecosystem changes

List of peer-reviewed publications:

- Shin, H.H. *et al.* (2012) Dinoflagellate cyst production and flux in Gamak Bay, Korea: A sediment trap study. *Marine Micropaleontology* 94-95: 72-79.
- Son, Y.B. *et al.* (2012) Detecting massive green algae (*Ulva prolifera*) blooms in the Yellow Sea and East China Sea using Geostationary Ocean Color Imager (GOCI) data. *Ocean Science Journal* 47(3): 359-375
- Choi, K.-H. *et al.* (2012) The influence of coastal waters on distributions of heterotrophic protists in the northern East China Sea, and the impact of protist grazing on phytoplankton. *Journal of Plankton Research* 34(10): 886-904
- Jung, J.-H. *et al.* (2012) Development of Single-Nucleotide polymorphism-Based Phylum-Specific PCR Amplification Technique: Application to the Community Analysis Using Ciliates as a Reference Organism. *Molecules and Cells* 34(4): 383-391
- Wi, J. H. *et al.* (2013) Two *Farranula* (Copepoda: Cyclopoida: Corycaeidae) species from Korean waters. *Journal of Natural History* 47(5-12): 289-312
- Kim, S. *et al.* (2012) The complete mitochondrial genome of the Japanese ghost shrimp *Nihonotrypaea japonica* (Crustacea, Decapoda, Axiidea). Mitochondrial DNA
- Jang, P.-G. *et al.* (2013) Nutrient distribution and effects on phytoplankton assemblages in the western Korea/Tsushima Strait. *New Zealand Journal of Marine and Freshwater Research* 47(1): 21-37
- Kim, D. *et al.* (2013) Biologically Mediated Seasonality of Aragonite Saturation States in Jinhae Bay, Korea. *Journal of Coastal Research* (in press)
- Hwang, S.-W. *et al.* (2013) Collapse of the crustacean mesozooplankton in the Northern East China Sea: Effects of the Three Gorges Dam? *Journal of Coastal Research* (in press)

Long-term change of structure and function in marine ecosystems of Korea

Aim: 1) To understand the sensitivity and response of marine ecosystems to global climate change, on time scales ranging from year to decades, 2) To predict the future direction of marine ecosystems of Korea and thereby provide information to develop policy for conservation and sustainable use of marine ecosystems

Start date: June 2011 **End date:** February 2021

Website: None

Major funding sources: Ministry of Oceans and Fisheries of Korea

Major achievements: Climate change and global warming issues are the centre of scientific attention today. This raised the question - How does environmental change affect structural and functional biodiversity? - which this project aims to address.

Physical forcing can affect the availability of primary food sources, which constitute the trophic base of food webs. Then, changes in physical and nutritional conditions can directly affect physiological processes, which control the allocation of food energy to biological activities, such as feeding, metabolism, growth and reproduction etc. In line with subsequent change in community structure, this will affect trophic interactions and finally food web structure. So, our project has been focused on a series of interesting processes to understand the effects of environmental change on the marine ecosystem of Korea. **Major achievements** are as follows:

- 1) Longitudinal variation of community and food web structures along a salinity gradient in the estuarine and coastal ecosystem (Gwangyang Bay)
- 2) Developing a coupled model of food web structure and biogeochemical model to assess ecosystem functioning (Hupo Bank)
- 3) Population dynamics of native and invasive species

List of peer-reviewed publications:

- Jeong, S.J. *et al.* (2012) Trophic diversity in amphipods within a temperate eelgrass ecosystem as determined by gut contents and C and N isotope analysis. *Marine Biology* 159: 1943-1954
- Wondol, M.R. *et al.* (2012) Early growth and reproduction of hatchery-produced Pacific oyster *Crassostrea gigas* in Gamakman Bay off the southern coast of Korea. *Fisheries Science* 78(6): 1285-1292
- Shaha, D.C. *et al.* (2012) Effects of River Discharge and Tide Driven Sea Level Variation on Saltwater Intrusion in Sumjin River Estuary: An Application of Finite-Volume Coastal Ocean Model. *Journal of Coastal Research* 29: 460-470
- Sun, Y.J. *et al.* (2012) Simulation of brine discharge near sea farms in the Korea Strait. *Desalination and Water Treatment* 43: 201-211
- Jeong, H.J. *et al.* (2012) Heterotrophic feeding as a newly identified survival strategy of the dinoflagellate *Symbiodinium*. *Proceedings of the National Academy of Sciences of the United States of America* (PNAS) 109: 12604-12609
- Jeong, H.J. *et al.* (2012) First report of the epiphytic dinoflagellate *Gambierdiscus caribaeus* in the temperate waters off Jeju Island, Korea: morphology and molecular characterization. *Journal of Eukaryotic Microbiology* 59: 637-650
- Yoon, E.Y. *et al.* (2012) *Gyrodinium moestrupii* n. sp., a new planktonic heterotrophic dinoflagellate from the coastal waters of western Korea: morphology and ribosomal DNA gene sequence. *Journal of Eukaryotic Microbiology* 59: 571-586
- Nam, S.W. *et al.* (2012) Ultrastructure of oral apparatus of *Mesodinium rubrum* from Korea. *Journal of Eukaryotic Microbiology* 59: 625-636
- Han, J.W. *et al.* (2012) Accumulation of galloyl derivatives in a freshwater green alga, *Spirogyra varians*, in response to cold stress. *Journal of Applied Phycology* 24: 1279-1286
- Yu, S.C. *et al.* (2012) Modeling of high-resolution 3D sonar for image recognition. *International Journal of Offshore and Polar Engineering* 22: 1-7
- Kim, M.S. *et al.* (2012) Molecular characterization of three crustin genes in the Morotoge shrimp, *Pandalopsis japonica*. *Comparative Biochemistry and Physiology Part B* 163: 161-171
- Jeon, J.M. *et al.* (2012) Two type I crustacean hyperglycemic hormone (CHH) genes in Morotoge shrimp (*Pandalopsis japonica*): cloning and expression of eyestalk and pericardial organ isoforms produced by alternative splicing and a novel type I CHH with predicted structure shared with type II CHH peptides. *Comparative Biochemistry and Physiology Part B* 162: 88-99
- Vandieken, V. *et al.* (2012) Three manganese oxide-rich marine sediments harbor similar communities of acetate-oxidizing manganese-reducing bacteria. *International Society for Microbial Ecology* 6: 2078-2090
- Li, W.T. *et al.* (2013) An examination of photoacclimatory responses of *Zostera marina* transplants along a depth gradient for transplant-site selection in a disturbed estuary. *Estuarine Coastal and Shelf Science* 118: 72-79

The impact of the Yellow Sea Bottom Cold Water Mass on the ecosystem

Aim: The project was designed to suggest marine food web trophic continuum from which induced by quantification of end-to-end foodweb structure, distributional characteristics and interactions of key/target species, and energy flow between trophic components in the Yellow Sea bottom cold waters.

Start date: January 2012 **End date:** December 2014

Website: No

Major funding sources: Korea Institute of Ocean Science and Technology

Major achievements: The project examined the spatial and inter-annual distribution of cold waters, correlations between cold waters and marine climatic index, and factors affecting the physicochemical properties of cold waters.

Studies of the organization of the microbial loop and classical food structures correspond to the perspective of the planktonic ecosystem in cold waters. This year, essential studies include investigating the basic structure of trophic components and understanding how they are affected by the environmental characteristics of cold waters. Major research items are the spatial and inter-annual distribution of physicochemical factors (nutrients) and planktonic components (three size groups: phytoplankton, ciliates, and mesozooplankton), distribution and biomarker analysis of krill, and clarification of the ecosystem characteristics of cold waters (using stable isotopes) associated with cold waters.

Based on a retrospective analysis using reference and recent field data, the dynamics of high temperature and saline water were analyzed in comparison with climate change, and the variability in the distribution of cold waters investigated. In 2012, the microbial structure (bacteria-phytoplankton-ciliates) was first investigated in cold waters. Stable carbon and nitrogen isotope ratios were used to clarify the food web characteristics before and after the formation of cold waters. In addition, the ratio was suggested as a new method for assessing the variability in ecosystem food web characteristics and krill prey items. Studies of the relationship between suspended solids and the scattering layer of planktonic components will help in understanding the distribution pattern of significant prey organisms as fishery resources in the Yellow Sea.

List of peer-reviewed publications: On-going project

IMBER-relevant activities or events (conferences):

The 4th Korea-China Joint Workshop on Yellow Sea Cold Water Mass

Venue: Busan, Korea (6-9 December 2012)

Upcoming activities relevant to IMBER:

The 5th China-Korea Joint Workshop on Yellow Sea Cold Water Mass will be held in China in 2013.

Long- and mid-term changes in the lower trophic level ecosystem of the East Sea

Aim: To identify and understand the mechanisms of long-term ecosystem changes that occurred in past decades in the East Sea.

Start date: Jan 2011 **End date:** Dec 2013

Website: None

Major funding sources: Korea Institute of Ocean Science and Technology (KIOST)

Major achievements:

- Bi-monthly chlorophyll-a time series from 1970-2005 were reconstructed for the Ulleung Basin in the East Sea. A regime shift was identified around 1988-1989 that divided this timeframe into two distinctive sub-periods. The shift coincided with changes in other ecosystem variables, such as zooplankton biomass, squid and pollack catch, as well as oceanographic variables. The shift occurred mostly from April to August, and mostly in coastal areas. Several hypotheses are currently being considered, including coastal upwelling to explain the shift.
- A ROMS model coupled with NPZD components has been set up and we are experimenting with some hypotheses regarding the variability in the southern part of the East Sea. These include variability related to coastal upwelling, volume transport through the Korea Strait, and North Korean Cold Current.

List of peer-reviewed publications:

Lim, S.H. et al. (2012) Climatology of the mixed layer depth in the East/Japan Sea. *Journal of Marine Systems* 96–97: 1-14

Yoon, J.-E. et al. (2012) Comparison of primary productivity algorithms for Korean waters. *Ocean Science Journal* 47(4): 473-487

Upcoming activities relevant to IMBER:

We will report the findings from this study at IMBER OSC.

Ocean Climate Change: Analyses, Projections, and Adaptation

Aim: Dynamic downscaling of regional climate change in the northwestern marginal seas

Start date: July 2009 **End date:** Feb 2014

Website: None

Major funding sources: Ministry of Ocean

Major achievements:

- Analyses of ocean climate changes and variability in the northwestern Pacific and marginal seas from the IPCC AR4 results and long-term data. These include changes in El Nino, PDO, and Asian monsoon patterns, changes in SST and mixed layer depth, long-term variability of heat contents in the East/Japan Sea and northwestern Pacific.
- Simulating changes in SST and surface currents in the Yellow, East China, and East/Japan Seas in 2050 and 2100 by performing regional downscalings based on three IPCC AR4 (A1B scenario) and two AR5 (RCP 4.5 scenario) climate models. Evaluation of present state simulation results.
- Assessment of global reanalysis products (air-sea heat fluxes) in the marginal seas inputting to regional climate models by comparing them with fluxes estimated using ocean buoy data.

List of peer-reviewed publications:

Lim, S.H. *et al.* (2012) Climatology of the mixed layer depth in the East/Japan Sea. *Journal of Marine Systems* 96–97: 1-14

Kim, J.-S. *et al.* (2012) Statistical Evidence for the Natural Variation of the Central Pacific El Nino. *Journal of Geophysical Research* 117(C6); DOI: 10.1029/2012JC008003

Yeo, S.-R. *et al.* (2012) Decadal changes in the relationship between the tropical Pacific and the North Pacific. *Journal of Geophysical Research* 117(D15-16); DOI: 10.1029/2012JD017775

Kim, Y. *et al.* (2012) Seasonal Evolution mechanism of the East Asian Winter Monsoon and its Interannual Variability. *Climate Dynamics* DOI10.1007/s00382-012-1491-0

Hamlington, B.D. *et al.* (2012) Improving sea level reconstructions using non-sea level measurements. *Journal of Geophysical Research* 117: C10025

Hamlington, B.D. *et al.* (2012) Regional Sea Level Reconstruction in the Pacific Ocean. *Marine Geodesy* 35(S1): 98-117

Kim, Y. *et al.* (2013) Physical mechanisms of European winter snow cover variability and its relationship to the NAO. *Climate Dynamics* 40(7-8): 1657-1669

Kim, S.-K. *et al.* (2013) Contribution of ocean current to the increase in N abundance in the Northwestern Pacific marginal seas. *Geophysical Research Letters* 40(1): 143-148

Kim, Y.-B. *et al.* (2013) Variability of the Dokdo Abyssal Current observed in the Ulleung Interplain Gap of the East/Japan Sea. *Acta Oceanologica Sinica* 32(1): 12-23

Any suggestions of new potential collaboration for IMBER:

We plan to develop regional coupled physics-ecosystem models to evaluate changes in marine ecosystem due to climate change in the northwestern Pacific marginal seas. We'd like to collaborate with related IMBER project components and scientists involved in IMBER and interested in our activities.

New Zealand

National contacts: **Julie Hall**, julie.hall@niwa.co.nz and **Matt Pinkerton**, m.pinkerton@niwa.co.nz

Offshore New Zealand: Analysis of data from the New Zealand Fisheries Oceanography II voyage (November 2012) has continued, with a focus on quantifying the abundance, distribution and trophic connections of key middle-trophic level taxa in the Chatham Rise region of New Zealand. Key middle-trophic level taxa studied included meso- and macrozooplankton, mesopelagic fish (especially myctophids), squid, larval and juvenile fish, and hyperbenthic invertebrates (especially shrimps and prawns). Scientists from NIWA and the University of British Columbia, Canada (Associate Professor Evgeny Pakhomov and Dr Brian Hunt) visited New Zealand to carry out stomach contents analysis of myctophids, and to analyse size-fractionated MOCNESS zooplankton samples. The **Fisheries Oceanography III voyage** is scheduled for austral spring 2015 (November 2015/January 2016) and expressions of interest for international participation are welcomed (to m.pinkerton@niwa.co.nz).

Other work in New Zealand over the last year includes research on the effects of ocean acidification on plankton in New Zealand waters, including research on coccolithophore blooms led by Dr Cliff Law.

Ross Sea: Foodweb modelling of the Ross Sea region has continued, with a focus on characterising the key trophic pathways through the system. Research presented to CCAMLR and submitted to journals suggest priorities to detect and monitor the effects of climate change and fishing on the Ross Sea ecosystem. The Continuous Plankton Recorder has been used for five years on transects between New Zealand and the Ross Sea, courtesy of the longline fishing vessel *San Aotea II*. Spatial analysis of the Ross Sea CPR dataset, in conjunction with the Southern Ocean CPR survey, is planned for September 2013.

Spain

National contact: **X. Antón A. Salgado**, xsalgado@iim.csic.es

Shelf-Ocean Exchange in the Canaries-Iberian Large Marine Ecosystem (CAIBEX)

Aim: Multidisciplinary observation and modelling programme of the eastern boundary upwelling system of Iberia–NW Africa (10°–44°N) focused on the open ocean subduction forced by the sinking of Mediterranean outflow water in the bay of Cadiz and the role of upwelling filaments in the seasonal upwelling off Cape Silleiro (42°N) and the permanent upwelling of Cape Ghir (Morocco) with special reference to its effect on the recruitment of common octopus paralarvae and the biogeochemical transformations experienced by the material produced in the coastal zone.

Start date: 01/11/2007 **End date:** 31/10/2010

Website: www.iim.csic.es/~barton/caibex

Major funding sources:

List of peer-reviewed publications in 2012:

- Gregori M., F.J. Aznar, E. Abollo Á. Roura, Á.F.G. González, S. Pascual (2012) *Nyctiphanes couchii* as intermediate host for the acanthocephalan *Bolbosoma balaenae* in temperate waters of the NE Atlantic. *Diseases of Aquatic Organisms* 99, 37–47.
- Lønborg, C., X.A. Álvarez–Salgado (2012) Recycling versus export of bioavailable dissolved organic matter in the coastal ocean and efficiency of the continental shelf pump. *Global Biogeochemical Cycles* 26, GB3018, doi: 10.1029/2012GB004353
- Roura, A., A.F.G. Gonzalez, A. Guerra, K. Redd (2012) Molecular prey identification in wild *Octopus vulgaris* paralarvae. *Marine Biology* 159, 1335–1345.

Circumnavigation Expedition Malaspina 2010: Global Change and Biodiversity Exploration of the Global Ocean (MALASPINA 2010)

Aim: Circumnavigation expedition on board the Spanish research vessels Hespérides and Sarmiento de Gamboa to produce a high resolution coherent inventory of the impact of global change on the world ocean and to explore its biodiversity, particularly in the dark ocean.

Start date: 15/12/2008 **End date:** 14/12/2014

Website: www.expedicionmalaspina.es

List of peer-reviewed publications in 2012:

- Aparicio-González A., C.M. Duarte, A. Tovar-Sánchez (2012) Trace metals in deep ocean waters: A review. *Journal of Marine Systems*, 100–101, 26–33.
- Bueno J., A. López-Urrutia (2012) The offspring-development-time/offspring-number trade-off. *The American Naturalist*, 179(6), E196-E203.
- Chust G., X. Irigoien, J. Chave, R.P. Harris (2012) Latitudinal phytoplankton distribution and the neutral theory of biodiversity. *Global Ecology and Biogeography* DOI: 10.1111/geb.12016.
- Condon R.H., W.M., Graham, C.M. Duarte, K.A. Pitt, C.H. Lucas, S.H.D. Haddock, K.R. Sutherland, K.L. Robinson, M.N. Dawson, M.B. Decker, C.E. Mills, J.E. Purcell, A. Malej, H. Mianzan, S.-i. Uye, S. Gelcich (2012) Questioning the Rise of Gelatinous Zooplankton in the World's Oceans. *Biogeoscience*, 62, 160–169.
- Díez-Vives C., J.M. Gasol, S.G. Acinas (2012) Evaluation of marine Bacteroidetes-specific primers for microbial diversity and dynamics studies. *Microb. Ecol.*, 64, 1047–1055.
- Lana A., R. Simó, S.M. Vallina, J. Dachs (2012) Re-examination of global emerging patterns of ocean DMS concentration. *Biogeochemistry*, 110, 173–182.
- Lana A., R. Simó, S.M. Vallina, J. Dachs (2012) Potential for a biogenic influence on cloud microphysics over the ocean: a correlation study with satellite-derived data. *Atmos. Chem. Phys.*, 12, 7977–7993.
- Regaudie-de-Gioux A., C.M. Duarte. Temperature dependence of planktonic metabolism in the ocean. *Global Biogeochemical Cycles* 26, GB1015, doi: 10.1029/2010GB003907.

Sebastian M., V. Pitta, J.M. González, T.F. Thingstad, J.M. Gasol (2012) Bacterioplankton groups involved in the uptake of phosphate and dissolved organic phosphorus in a mesocosm experiment with P-starved Mediterranean waters. *Environ. Microbiol.*, 14, 2334–2347.

Vázquez-Domínguez E., D. Vaqué, J.M. Gasol (2012) Temperature effects on the heterotrophic bacteria, heterotrophic nanoflagellates, and microbial top predators of NW Mediterranean. *Aquat. Microb. Ecol.*, 67, 107–121.

Lunar Cycles and Iron Fertilization (LUCIFER)

Aim: The objectives of LUCIFER are the biogeochemical consequences of (1) the vertical mixing and the consequent planktonic bloom in the oceanic subtropical waters around the Canary Islands, (2) the influence of the lunar cycle observed in zooplankton in the transport of organic carbon towards the mesopelagic zone, and (3) the process of natural fertilization with iron promoted by the deposition of Saharan dust which is produced in several events during winter around the Canary Islands.

Start date: 01/01/2009 **End date:** 31/12/2011

Website: <http://proyectolucifer.blogspot.com.es>

List of peer-reviewed publications in 2012:

Herrera I., L. Yebra and S. Hernández-León (2012) Effect of temperature and food concentration on *Paracartia grani* nauplii growth and protein synthesis rates. *Journal of Experimental Marine Biology and Ecology* 416-417, 101–109.

Landeira, J.M., F. Lozano-Soldevilla and S. Hernández-León (2012) Temporal and alongshore distribution of decapod larvae in the oceanic island of Gran Canaria (NW Africa). *Journal of Plankton Research* 35, 309–322.

Schmoker C., J. Arístegui and S. Hernández-León (2012). Planktonic biomass variability during a late winter bloom in the subtropical waters off the Canary Islands. *Journal of Marine Science* 95, 24-31.

Coastal Ocean Microbial Plankton and Temperature (COMITE)

Aim: The project addresses the effects of future warming on the ecology and biogeochemical role of temperate coastal microbial assemblages through three different approaches: (i) a retrospective analysis of the linkages between temperature and bacterial community structure and size-abundance relationships in the Xixón coastal oceanographic time-series; (ii) monthly experiments assessing the response of physiological and phylogenetic groups of heterotrophic bacterioplankton to temperature, ambient plus -3 and +3°C; and (iii) comprehensive evaluations of the temperature-dependence of the flow of organic matter through microbial plankton in the Southern Bay of Biscay continental shelf. The final goal is to build a predictive, testable model of the effects of realistic temperature rises on the biogeochemical role of coastal ocean bacteria.

Start date: 01/01/11 **End date:** 31/12/2013

List of peer-reviewed publications in 2012:

Huete-Stauffer T.M., X.A.G. Morán (2012) Dynamics of heterotrophic bacteria in temperate coastal waters: similar net growth but different controls in low and high nucleic acid cells. *Aquatic Microbial Ecology* 67, 211-223.

Mediterranean sea acidification in a changing climate (MedSeA)

Aim: MedSeA is a project funded by the European Commission under Framework Program 7 that involves 22 institutions from 12 countries to assess uncertainties, risks and thresholds related to Mediterranean acidification at organism, ecosystem and economical scales. It also emphasizes conveying the acquired scientific knowledge to a wider audience of reference users, while suggesting policy measures for adaptation and mitigation that will vary from one region to another.

Start date: 2011 **End date:** 2014

Website: <http://medsea-project.eu>

List of peer-reviewed publications in 2012:

Azzurro E., M. Milazzo, F. Maynou (2012) First confirmed record of the Lessepsian migrant *Pteragogus pelycus* Randall, 1981 (Teleostei: Labridae) for the North African coasts. *BioInvasions Records*, 27, 3, 45–48.

- Hönisch, B., A. Ridgwell, D.N. Schmidt, E. Thomas, S.J. Gibbs, S.J. Sluijs, R. Zeebe, R. Lee Kump, R. C. Martindale, S.E. Greene, W. Kiessling, J. Ries, J.C. Zachos, D.L. Royer, S. Barker, T.M. Marchitto Jr., R. Moyer, C. Pelejero, P. Ziveri, G. L. Foster, B. Williams (2012) The geological record of ocean acidification, *Science*, 335, 1058–1063.
- Grelaud M., G. Marino, P. Ziveri, E.J. Rohling (2012) Abrupt shoaling of the nutricline in response to massive freshwater flooding at the onset of the last interglacial sapropel event. *Paleoceanography*, 27, 3, doi: 10.1029/2012PA002288
- Incarbona A, P. Ziveri, N. Sabadino, D. Salvagio Mantec, M. Sproveri (2012) Conflicting coccolithophore and geochemical evidence for productivity levels in the Eastern Mediterranean sapropel S1, *Marine Micropaleontology*, 9, 131–143.
- Teleki K., A. Abdulla, P. Ziveri, C. Turley (2012) Tipping the balance: CO₂ and the Mediterranean Sea. Mediterranean Sea Acidification in a Changing Climate Project, 6 pp.
- Ziveri P., S. Thomas, I. Probert, M. Geisen, G. Langer (2012) A universal carbonate ion effect on stable oxygen isotope ratios in unicellular planktonic calcifying organisms. *Biogeosciences*, 41524, 9, doi: 10.5194/bg-9-1025-2012.

Deep-water submarine canyons and slopes in the Mediterranean and Cantabrian seas: from synchrony of external forcings to living resources (DOS MARES)

Aim: The general objective of DOS MARES is twofold. First, to understand the effects of atmospheric teleconnections between the Cantabrian and the NW Mediterranean seas, and their impacts on the deep ecosystem, both pelagic and benthic. Second, to know in which way the transfer of the signal from the external forcings towards the deep ecosystem controls community structure and population dynamics, thus affecting the most valuable living resources. The study will concentrate on the submarine canyons of Aviles and Blanes, in the Cantabrian Sea and the Mediterranean Sea, respectively, and the adjacent continental slopes.

Start date: 01/01/2011 **End date:** 31/12/2013

List of peer-reviewed publications in 2012:

- Aguzzi, J., J.B. Company, C. Costa, M. Matabos, E. Azzurro, A. Manuel, P. Menesatti, F. Sardà, M. Canals, E. Delory, D. Cline, P. Favali, S.K. Juniper, Y. Furushima, Y. Fujiwara, J.J. Chiesa, L. Marotta, N. Bahamon, I.G. Priede (2012) Behavioural rhythms challenges to assessments of benthic populations and biodiversity: cabled observatory video solutions. *Oceanography and Marine Biology, an Annual Review*, 50, 235–286.
- Amblas, D., T.P. Gerber, B. De Mol, R. Urgeles, D. Garcia-Castellanos, M. Canals, L.F. Pratson, N. Robb, J. Canning (2012) Survival of a submarine canyon during long-term outbuilding of a continental margin. *Geology*, 40, 543–546.
- Company, J.B., E. Ramirez-Llodra, F. Sardà, J. Aguzzi, P. Puig, M. Canals, A.M. Calafat, A. Palanques, M. Solé, A. Sanchez-Vidal, J. Martín, G. Lastras, S. Tecchio, S. Koenig, U. Fernandez-Arcaya, A. Mechó, P. Fernández (2012) Submarine canyons in the Catalan Sea (NW Mediterranean): megafaunal biodiversity patterns and anthropogenic threats. In *Mediterranean Submarine Canyons, Ecology and Governance* (M. Würtz, ed.), International Union for Conservation of Nature and Natural Resources (IUCN), Gland / Málaga (Suiza / España), ISBN: 978-2-8317-1469-1, p. 133–144.
- González-Taboada, F. and Anadón, R. (2012) Patterns of change in sea surface temperature in the North Atlantic during the last three decades: beyond mean trends. *Climatic Change*, 115, 419–431
- Palanques, A., P. Puig, X. Durrieu de Madron, A. Sanchez-Vidal, C. Pasqual, J. Martín, A. Calafat, S. Heussner, M. Canals (2012) Sediment transport to the deep canyons and open-slope of the western Gulf of Lions during the 2006 intense cascading and open-sea convection period. *Progress in Oceanography*, 106, 1–15.
- Puig, P., M. Canals, J.B. Company, J. Martín, D. Amblas, G. Lastras, A. Palanques, A.M. Calafat (2012) The ploughing of the deep seafloor. *Nature*, 489, 286–290.
- Sanchez-Vidal, A., M. Canals, A.M. Calafat, G. Lastras, R. Pedrosa-Pàmies, M. Menéndez, R. Medina, J.B. Companys, B. Hereu, J. Romero, T. Alcoverro (2012) Impacts on the Deep-sea Ecosystem by a Severe Coastal Storm. *PLoS ONE*, 7 (1), e30395.
- Zeppilli, D., M. Canals, R. Danovaro (2012) Pockmarks enhance deep-sea benthic biodiversity: a case study in the western Mediterranean Sea. *Diversity and Distributions*, 2011, 1–15.

Atmospheric deposition and ocean plankton dynamics (ADEPT)

Aim: ADEPT will study the effect of atmospheric aerosol deposition on the dynamics of the Mediterranean. At the basin scale, ADEPT will relate satellite chlorophyll data with modelled Saharan dust deposition. At the coastal scale, deposition will be directly measured at six locations across the NW Mediterranean. Laboratory experiments with aerosol amendments to seawater will be conducted to test plankton stimulation dynamics, utilization of organic matter by bacteria, and changes in bacterial composition and diversity.

Start date: 01/01/2012 **End date:** 31/12/2014

Website: www.icm.csic.es/bio/adept

List of peer-reviewed publications in 2012:

Romero E, F. Peters, C. Marrasé (2012) Dynamic forcing of coastal plankton with nutrient imbalances and turbulent match-mismatch. *Marine Ecology Progress Series* 464, 69-87.

Carbon Transport and Acidification Rates in the North Atlantic (CATARINA)

Aim: The objectives of CATARINA are (i) to quantify the meridional overturning circulation and water mass ventilation changes and their effects on the uptake and capacity to storage anthropogenic carbon of the North Atlantic; and (ii) to evaluate the effect of present CO₂ emissions and past atmospheric CO₂ concentrations in the production and preservation of CaCO₃ in the North Atlantic as well as the potential impact of future ocean acidification in benthic foraminifera by means of culture experiments. CATARINA is part of a decadal experiment that repeated WOCE line A25, from Greenland to Portugal, every second year since 2002.

Start date: 01/01/2011 **End date:** 31/12/2013

Website: <http://catarina.iim.csic.es>

List of peer-reviewed publications in 2012:

Maze, G., H. Mercier, V. Thierry, L. Memery, P. Morin, F.F. Pérez (2013) Observed acidification trends in North Atlantic water masses. *Biogeosciences*, 9, 4099–4113.

Vázquez-Rodríguez, M., F.F. Perez, A. Velo, A.F. Ríos, H. Mercier (2012) Observed acidification trends in North Atlantic water masses. *Biogeosciences*, 9, 1–14.

IMBER related projects launched in 2012

Although Spain does not have a proper IMBER program, several projects funded through the 2012 call of the National Subprogram of Marine Science and Technology are closely related to IMBER. We have selected six projects from this call that deal with IMBER's scientific goals. They received about 33% of the 4.84 M€ distributed by the subprogram in 2012 (ship time not included) and additional funds for training three PhD students was also provided.

Marine acidification: new insights from manipulative experiments on selected species and paleoceanographic reconstructions over key periods of time (MANIFEST), led by Carles Pelejero (CSIC, Barcelona).

The project delves into the study of ocean acidification effects. Some of the planned experiments have a tight connection with paleoceanography, having a focus on promising species as sources of paleoceanographic information. In addition, MANIFEST aims to provide new evidence on the linkage between the Southern Ocean and the tropical Pacific Ocean over glacial to interglacial times and its role in regulating atmospheric CO₂ concentration, from the comparison of deep-sea sediment core paleoreconstructions in the Eastern Equatorial Pacific and in the New Zealand Sector of the Southern Ocean. On shorter time-scales, MANIFEST will test corals as paleoenvironmental archives. Cutting-edge analytical techniques will be used during this project, including innovative applications of Laser Ablation Inductively-Coupled-Plasma mass spectrometry (LAICPMS) for high resolution depth-profiling analyses of single foraminifera and corals.

Synergy and antagonism among multiple stressors on marine Mediterranean ecosystems (EstresX), led by Susna Agustí (CSIC, Illes Balears).

The project aims to assess the vulnerability of coastal ecosystems of the Mediterranean Sea to the accumulation of stresses associated with global change, and to examine the synergistic and antagonistic responses of multiple stresses impacting on them. A series of laboratory and mesocosm experiments, to analyze the responses of benthic and planktonic communities and organisms to different environmental stress factors (radiation, UVB, warming, acidification, pollution) including biological stresses (predation, invasive species, habitat loss), are planned, at different levels of stress complexity. There are also plans to monitor coastal changes in the Balearic Sea, this being the most important tool to detect changes in Mediterranean coastal ecosystems and to analyze their relationship with global change.

Study of the vertical oceanic pump in mesoscale eddies (PUMP), led by Pablo Sangrà (University of Las Palmas de Gran Canaria).

This project will study the dynamics/kinematics of the ageostrophic secondary circulation (ASC) and mixing in surface mesoscale anticyclonic eddies and how they modulate plankton activity, plankton community structure, and accumulation and downward transport of organic matter (the Vertical Oceanic Pump, VOP). Particular attention will be paid to the control of the ASC by eddy/wind interaction, by mixing, and by current/wind interaction and frontogenesis/frontolysis at its periphery. Mixing regime, dynamic stability and vertical diffusion of tracers will be observed and derived from direct measurement of mixing/turbulence. Near-inertial wave trapping and its role in driving shear mixing will be studied from drifter trajectories and vertical variability of the horizontal velocity field. Processes-oriented models will be developed and implemented in regional physical and physical-biogeochemical models for the Canary Region. Advantage will be taken of the exceptional source of tracers provided by the El Hierro Island submarine volcanic eruption for the study of eddies. Finally, the physical and biogeochemical observations and processes will be combined and correlated to derive a conceptual model of the dynamics of the marine system linked to the VOP in mesoscale eddies.

Dissolved organic matter remineralization in the ocean: microbial and biogeochemical constraints (DO-RE-MI), led by Cèlia Marrasé (CSIC, Barcelona).

DO-RE-MI will examine the biological and biogeochemical mechanisms that hinder total DOC remineralisation in marine systems applying a multidisciplinary approach to the design of experiments, the field program and the analysis of the results. DO-RE-MI will work to achieve the following objectives: 1) to quantify DOM remineralization in contrasting marine systems; 2) to test the effects of nutrient availability, and microbial community structure and its metabolic capability on the efficiency of DOM degradation; 3) to experimentally test whether DOC concentration and DOM chemical diversity can explain the limits of DOM degradation in the deep ocean; and 4) to evaluate the role of different bacterial community structures in the degradation processes.

Particulate dust deposition: characterization and effect on the active carbon transport in the Alboran Sea, led by Jesús Mercado (IEO, Malaga) and Esperanza Liger (University of Malaga).

The current project will (1) determine the direct impact of the atmospheric particulate matter inputs on the surface nutrients concentration in the Alboran Sea, and (2) assess the role of the atmospheric nutrient inputs on the structure and functioning of the planktonic communities in low productive areas of Alboran. To fulfil objective (1) the composition of the particulate organic matter (nutrients, trace elements and radionuclides) deposited in a coastal fixed station during an annual cycle will be analysed. Furthermore, the relationship between origin, quantity and composition of the atmospheric deposit and meteorological variables will be studied. Objective (2) will be tackled by means of an oceanographic cruise to determine the contribution on diel migrant zooplankton to the carbon export flux in and out of the anticyclonic gyre, that is, under different trophic and hydrologic conditions. The effect of nutrient enrichment due to dust inputs on the composition, abundance and metabolic rates (primary production and respiration) of the microplankton communities within the area dominated by the anticyclonic gyre will also be studied.

Migrants and active flux In the Atlantic Ocean (MAFIA), led by Santiago Hernández-León (University of Las Palmas de Gran Canaria), Juan Ignacio González Gordillo (University of Cádiz), Pilar Olivar (CSIC, Barcelona), and M^{re} Luz Fernández Puelles (IEO, Illes Balears).

This project will examine the total active flux in different areas of the Atlantic Ocean, and the effect of increased productivity in the upper layers of the ocean on the increase of backscatter in the bathypelagic zone of the equatorial area. It is hypothesized that the increase in productivity due to upwelling near the equator unveils the development of the so-called Ladder of Migration in the ocean. The migrant community descending from the shallower and more productive layers serves as food for the populations of the depths. Species feeding on migratory forms can descend to even greater depths and serve as food for animals living at even greater depths. In this way, organic matter from surface layers is actively transferred downward, increasing the efficiency of the biological pump. Thus, the objectives of the project include (1) assessment of active flux due to zooplankton and micronekton, and identification of the main species responsible, (2) assessment of the effect of upper ocean productivity on zooplankton and micronekton active fluxes, (3) assessment of the importance of neustonic assemblage on the feeding by meso- and bathypelagic organisms, and (4) quantification of the metabolic end products of these fauna and the enhancement of dissolved organic carbon and bacterial activity at depth. In order to achieve these objectives, the project also seeks to innovate sampling at the meso- and bathypelagic depths by improving acoustics, image processing and net sampling.

IMBER-relevant activities or events:

Special IMBER session on 'Primary production variability and coastal-offshore export in upwelling regions', convened by J. Arístegui at the 45th International Liège Colloquium on Ocean Dynamics – The variability of primary production in the ocean: from the synoptic to the global scale (13-17 May 2013, Liège, Belgium)

United Kingdom

National contacts: **Eugene Murphy**, eimu@bas.ac.uk and **Carol Robinson**, carol.robinson@uea.ac.uk

1. The Atlantic Meridional Transect programme

The Atlantic Meridional Transect – AMT (www.pml.ac.uk/amt) is a multidisciplinary programme which undertakes biological, chemical and physical oceanographic research during an annual voyage between the UK and destinations in the South Atlantic - previously the Falkland/Malvinas Islands and South Africa, and this year, Punta Arenas, Chile. This transect crosses a range of ecosystems from sub-polar to tropical and from euphotic shelf seas and upwelling systems to oligotrophic mid-ocean gyres.

The programme was established in 1995 and this was the 22nd in the series of research cruises that have involved over 220 scientists from 18 countries. AMT has proved to be a long-term multidisciplinary ocean observation programme, which is a platform for national and international scientific collaboration, a training arena for the next generation of oceanographers and an ideal facility for validation of novel technology. AMT continues to contribute to science and policy development, including the social and economic understanding of the marine environment and services it delivers.

The main deliverable of AMT is an unique time series (1995-2012) of spatially extensive and internally consistent observations on the structure and biogeochemical properties of planktonic ecosystems in the Atlantic Ocean that are required to validate models addressing questions related to the global carbon cycle. Data sets include:

- Vertical CTD profiles and continuous underway data
- Optical characteristics of the water column
- Biogeochemical measurements on water samples including nutrients, pigments, dissolved gases
- Particulate carbon and nitrogen
- Primary, new production and respiration measurements

The 22nd cruise was undertaken in Oct/Nov 2012 between the UK and the Falkland Islands and to Punta Arenas. RRS James Cook JCO79 (10 October – 24 November 2012)

The cruise report for AMT22 is available from www.amt-uk.org.

2. Integrating Climate and Ecosystem Dynamics in the Southern Ocean (ICED)

The international report of ICED activities is provided as a separate report. Within ICED the UK has developed a series of papers aimed at developing analyses and modelling of Southern Ocean food webs (www.iced.ac.uk)

BAS has also started an international project funded by NERC UK: Coordinating International Research on Southern Ocean Ecosystems: Implementation of the ICED Programme

The grant is aimed at developing further scientific coordination within ICED and projections of change in Southern Ocean ecosystems. As part of this project BAS scientists are developing ecological, physical and chemical change scenarios that will be reviewed in an international workshop in November 2013. The aim is to agree on a suite of scenarios that will then be used in developing ecological projections and available to the whole community. BAS work is particularly examining the impacts of change (in sea ice and temperature) on krill and food webs in Southern Ocean ecosystems.

3. NERC shelf seas biogeochemistry programme

The Shelf Sea Biogeochemistry research programme (www.nerc.ac.uk/research/programmes/shelfsea) directly relates to the delivery of the NERC Earth system science theme and aims to provide evidence that supports a number of marine policy areas and statutory requirements, such as the Marine Strategy Framework Directive and Marine and Climate Acts.

The Shelf Sea Biogeochemistry research programme aims to take a holistic approach to the cycling of nutrients and carbon and the controls on primary and secondary production in UK and European shelf seas, to increase understanding of these processes and their role in wider biogeochemical cycles. It will thereby significantly improve predictive marine biogeochemical and ecosystem models over a range of scales.

The scope of the programme includes exchanges with the open ocean (transport on and off the shelf to a depth of around 500m), together with cycling, storage and release processes on the shelf slope, and air-sea exchange of greenhouse gases (CO₂ and N₂O).

Funded projects are underway and details are given at www.nerc.ac.uk/research/programmes/shelfsea.

4. NERC Greenhouse gas emissions and feedbacks programme

NERC continues to develop its programme on Greenhouse gas emissions and feedbacks (www.nerc.ac.uk/research/programmes/greenhouse). It aims to quantify the influence of man-made greenhouse gases (GHGs) on recent and future climate, it is essential to quantify their sources and sinks, including both anthropogenic emissions and the response of natural sources and sinks to changing environmental conditions. NERC is investing £8.1m into a five-year Greenhouse Gas Emissions & Feedbacks research programme. The overarching aim of the programme is: "*To develop the capability to measure and predict sources and sinks of the major anthropogenic greenhouse gases.*"

This includes a major marine project entitled:

RAGNARoCC: Radiatively active gases from the North Atlantic Region and Climate Change involving UEA, NOC, PML, Univ. Newcastle and Univ. Southampton scientists (http://gotw.nerc.ac.uk/list_full.asp?pcode=NE%2FK002473%2F1).

5. NERC Ocean Acidification Programme

The NERC Ocean Acidification Research Programme directly relates to delivery of the NERC strategy (in particular the Earth system science and biodiversity science themes) and the UK government's strategic objectives with respect to the adaptation to, and mitigation of, climate change and ensuring a healthy, resilient, productive and diverse natural environment.

The Ocean Acidification Research Programme is a 5-year collaborative programme with a budget of £12m funded by NERC, the Department for Environment, Food & Rural Affairs (Defra) and the Department of Energy & Climate Change (DECC). The activities are focused on the North-East Atlantic (including European shelf and slope), Antarctic and Arctic Oceans, and include the effects of acidification on biochemistry and biodiversity, past responses to acidification, ecosystem structure and function, habitats and species, and socio-economic implications. www.nerc.ac.uk/research/programmes/oceanacidification

Major successful cruises in the Arctic and Antarctic have been undertaken in the last 12 months. See also www.oceanacidification.org.uk for full UK activities relating to ocean acidification.

Uruguay

National contact: **Omar Defeo**, odefeo@dinara.gub.uy

Bringing management and conservation in Latin American artisanal shellfisheries: the impact of climate, fisheries and governance and potential actions for adaptive and mitigation strategies.

Aim: Assess the impact of climate, fisheries and governance on Latin American artisanal shellfisheries

Start date: 2010 **End date:** 2014

Website: www.pewenvironment.org/research-programs/marine-fellow/id/8589941401

Major funding sources: The Pew Charitable Trusts

Major achievements: Evaluation of co-management as an institutional arrangement for managing fisheries, identification of the relative impact of fishing and climate in shellfisheries

List of peer-reviewed publications:

McLACHLAN A, DEFEO O, JARAMILLO E, SHORT A (2013) Sandy beach conservation and recreation: guidelines for optimising management strategies for multi-purpose use. *Ocean and Coastal Management* 71: 256-268.

ORTEGA L, CELENTANO E, FINKL C, DEFEO O (2013) Effects of climate variability on the morphodynamics of Uruguayan sandy beaches. *Journal of Coastal Research*: DOI: 10.2112/JCOASTRES-D-13-00003.1.

DEFEO O, CASTILLA JC (2012) Governance and governability of coastal shellfisheries in Latin America and the Caribbean: multi-scale emerging models and effects of globalization and climate change. *Current Opinion in Environmental Sustainability* 4: 344-350.

ORTEGA L, CASTILLA JC, ESPINO M, YAMASHIRO C, DEFEO O (2012) Large-scale and long-term effects of fishing, market price and climate on two South American sandy beach clam species. *Marine Ecology Progress Series* 469: 71-85.

GUTIÉRREZ NL, HILBORN R, DEFEO O (2011) Leadership, social capital and incentives promote successful fisheries. *Nature* 470: 386-389.

BECK MW, BRUMBAUGH RD, AIROLDI L, CARRANZA A, COEN LD, CRAWFORD C, DEFEO O, EDGAR GJ, HANCOCK B, KAY MC, LENIHAN HS, LUCKENBACH MW, TOROPOVA CL, ZHANG G, GUO X (2011) Oyster reefs at risk and recommendations for conservation, restoration and management. *Bioscience* 61: 107-116.

GELCICH S, HUGHES T, OLSSON P, FOLKE C, DEFEO O, FERNÁNDEZ M, FOALE S, GUNDERSON L, RODRIGUEZ-SICKERT C, SCHEFFER M, STENECK R, CASTILLA JC (2010) Navigating transformations in governance of Chilean marine coastal resources. *Proceedings of the National Academy of Sciences USA* 107: 16794–16799.

Piloting of an Ecosystem-based Approach to Living Aquatic Resources Management

Aim: To transform the utilization of Uruguay's fisheries resources into sustainable production systems through the integration of ecosystem-related principles and concepts into national legal and planning frameworks that, in turn, would contribute to a reduction in the loss of biodiversity and an increase in social well-being.

Start date: 2009 **End date:** 2013

Website: www.dinara.gub.uy (specific web page under construction)

Major funding sources: Global Environmental Facility (GEF)

1. **Major achievements:** Development and implementation of community-based Ecosystem Approach to Fisheries (EAF) plans
2. Implementation of co-management and creation of fishing protected areas
3. incorporation of EAF principles into the national policy framework
4. integration of inter-alia climate risks and climate proofing measures in a pilot site planning process to identify and promote adaptation measures among vulnerable fisher communities
5. strengthening institutional capacity in the National Institute of Fisheries and other project institutional stakeholders, to better understand and promote the EAF principles as well as to facilitate the implementation of supporting policies and regulations.

List of peer-reviewed publications:

- GUTIERREZ NL, DEFEO O (2013) Evaluación de Recursos Pesqueros de Uruguay Mediante Modelos Dinámicos. MGAP-DINARA – FAO, 2013. 78 pp. ISBN: 978-9974-563-74-2.
- DEFEO O, CASTILLA JC (2012) Governance and governability of coastal shellfisheries in Latin America and the Caribbean: multi-scale emerging models and effects of globalization and climate change. *Current Opinion in Environmental Sustainability* 4: 344-350.
- ORTEGA L, CASTILLA JC, ESPINO M, YAMASHIRO C, DEFEO O (2012) Large-scale and long-term effects of fishing, market price and climate on two South American sandy beach clam species. *Marine Ecology Progress Series* 469: 71-85.
- HORTA S, DEFEO O (2012) The spatial dynamics of the whitemouth croaker artisanal fishery in Uruguay and interdependencies with the industrial fleet. *Fisheries Research* 125-126: 121-128.
- BARBOZA R, GÓMEZ J, LERCARI D, DEFEO O (2012) Disentangling diversity patterns in sandy beaches along environmental gradients. *PLoS ONE* 7(7): e40468.
- LERCARI D, BERGAMINO L, DEFEO O (2010) Trophic models in sandy beaches with contrasting morphodynamics: comparing ecosystem structure and biomass flow. *Ecological Modelling* 221: 2751-2759.
- CELENTANO E, GUTIÉRREZ N, DEFEO O (2010) Effects of morphodynamic and estuarine gradients on a sandy beach mole crab demography and distribution: implications for source - sink habitat dynamics. *Marine Ecology Progress Series* 398: 193-205.
- SAUCO S, EGUREN G, HEINZEN H, DEFEO O (2010) Effects of herbicides and freshwater discharge on water chemistry, toxicity and benthos in a Uruguayan sandy beach. *Marine Environmental Research* 70: 300-307.
- DEFEO O, HORTA S, CARRANZA A, LERCARI D, de ÁLAVA A, GÓMEZ J, MARTÍNEZ G, LOZOYA JP, CELENTANO E (2009) Hacia un manejo ecosistémico de pesquerías: Áreas Marinas Protegidas en Uruguay. FACULTAD DE CIENCIAS-DINARA, Montevideo: 122 pp.

Variability of Ocean Ecosystems around South-America (VOCES)

Aim: To assess the impact of climate variability—both natural and anthropogenic—on the Humboldt, Patagonia, and South Brazil Large Marine Ecosystems.

Start date: 2013 **End date:** 2015

Website: N/A

Major funding sources: Inter-American Institute for Global Change Research

Major achievements: This project is in the beginning phase. This is a multinational project where Argentina, Brazil, Uruguay, Peru, Chile and other countries will participate. The project is led by Alberto Piola (Argentina)

Upcoming activities relevant to IMBER:

XV Latin American Congress of Marine Sciences. Conrad Hotel, Punta del Este, Uruguay, October 27-31, 2013. www.colacmar2013.com

United States of America

National contact: **Heather Benway**, hbenway@whoi.edu

Joint U.S. CLIVAR/OCB Working Group *Oceanic carbon uptake in the CMIP5 models*

Aim: This joint working group's primary objective is to analyze CMIP-5 (Coupled Model Inter-comparison Project phase 5) simulations to better characterize physical and biogeochemical processes controlling ocean carbon uptake in the North Atlantic, tropical Pacific, and Southern Ocean.

The working group fosters and promotes collaboration between members of the U.S. CLIVAR (physical circulation, climate dynamics) and OCB (biogeochemical cycling, marine ecosystems) communities and between modelers and theoreticians within each community.

Start/end dates: 2012-2014

Website: www.usclivar.org/working-groups/ocu

Major funding sources: U.S. CLIVAR (NSF, NOAA, NASA, DOE), OCB (NSF, NASA)

Major achievements:

- December 2012 meeting (San Francisco, CA) - Discussion of key physical processes controlling ocean carbon uptake; identified potential biases in historical data sets and metrics for testing model biases in ocean C uptake
- Currently reviewing IPCC-WGI AR5 to assess current status of CMIP-5 models, specifically physical (ocean and atmosphere) processes that are poorly represented.

Peer-reviewed publications: None so far

Joint U.S. CLIVAR/OCB Working Group *Heat and carbon uptake by the Southern Ocean*

Aim: To combine data and models (and develop data/model metrics) to explore Southern Ocean response to climate change, with an emphasis on examining the importance of mesoscale eddies in heat and carbon uptake

Start/end dates: 2012-2014

Website: www.usclivar.org/working-groups/southern-ocean

Major funding sources: U.S. CLIVAR (NSF, NOAA, NASA, DOE), OCB (NSF, NASA)

Major achievements: December 2012 meeting (San Francisco, CA) – Included presentations on modeling and observational studies on physical and biogeochemical processes in the Southern Ocean and in-depth discussions (break-out groups) on (i) observational metrics needed for alignment of model-derived and observational evidence; (ii) model biases and ways for their reduction; (iii) strategies on planning an observational campaign for detecting and understanding SO changes; (iv) most critical observations and detection of “tipping points”.

Peer-reviewed publications: Members are working on a paper focused on the most important metrics for: (i) model inter-comparison and validation; (ii) field campaigns, including analysis of how these quantities are simulated in CMIP-5 models, and how well they are known from observational datasets

Joint OCB/NACP Coastal Carbon Synthesis

Aim: The objective of this activity is to synthesize individual, small-scale observational and modeling studies from different regions of the North American continental margin across broader spatial and temporal scales to improve quantitative assessments of the North American coastal carbon budget.

Building on recommendations put forward during the 2005 North American Continental Margins (NACM) Synthesis and Planning Workshop (Hales et al., 2008) and progress made since then, OCB has been collaborating with the NACP on coastal synthesis activities to gather existing observational and modeling resources on coastal carbon fluxes along the North American continental margins. This activity has been divided geographically into five regions: East Coast, West Coast, Gulf of Mexico, Arctic and Great Lakes.

Start/end dates: 2008-present (ongoing)

Website: <http://coastalcarbon.pbworks.com/w/page/15143273/FrontPage>

Major funding sources: NASA, NSF

Major achievements:

- [Kickoff workshop](#) (Dec. 2010) to stimulate community interest (see [report](#))
- East coast carbon cycle synthesis workshop (Jan. 2012) – revised east coast carbon budget (see [report](#))
- [Gulf of Mexico carbon cycle synthesis workshop](#) (March 2013) – revised carbon budget and report in preparation
- [West coast carbon cycle synthesis work](#) (ongoing)
- [Arctic](#) – publications (see below)

Publications: NOTE – most of these are not peer-reviewed

- Alin, S., S. Siedlecki, B. Hales, J. Mathis, W. Evans, M. Stukel, G. Gaxiola-Castro, J. Martin Hernandez-Ayon, L. Juranek, M. Goñi, G. Turi, J. Needoba, E. Mayorga, Z. Lachkar, N. Gruber, J. Hartmann, N. Moosdorf, R. Feely, F. Chavez (2012). Coastal Carbon Synthesis for the Continental Shelf of the North American Pacific Coast (NAPC): Preliminary Results. Winter 2012 issue of the OCB Newsletter.
- Benway, H. M., (2011). Quantifying the coastal contribution to the North American carbon budget: A Coastal Interim Synthesis Workshop, San Francisco, California, 11-12 December 2010. *Eos* 92 (23).
- Coble, P. G., L. L. Robbins, K. L. Daly, W.J. Cai, K. Fennel, S. E. Lohrenz (2010). A Preliminary Carbon Budget for the Gulf of Mexico. Fall 2010 issue of the OCB newsletter.
- Evans, W., J.T. Mathis, P. Winsor, H. Statscewich, and T.E. Whitledge (2013): A regression modeling approach for studying carbonate system variability in the northern Gulf of Alaska. *J. Geophys. Res.*, 118(1), doi: 10.1029/2012JC008246, 476–489.
- Mathis, J. T., N. R. Bates (2010). The Marine Carbon Cycle of the Arctic Ocean: Some Thoughts About The Controls on Air-Sea CO₂ Exchanges and Responses to Ocean Acidification. Article in Spring/Summer 2010 Issue of the OCB Newsletter.
- Mathis, J.T., Evans, W., Sabine, C.L., Juranek, L.W., Stockwell, D.A., Shake, K. L., Wiengartner, T.J., Feely, R.L., The Physical and Biological Controls on CO₂ Fluxes and Carbonate Mineral Saturation States in the Northern Gulf of Alaska (Continental Shelf Research – submitted).
- McKinley, G., N. Urban, V. Bennington, D. Pilcher, and C. McDonald (2011). Preliminary Carbon Budgets for the Laurentian Great Lakes. Spring/Summer 2011 Issue of the OCB Newsletter.
- Najjar, R.G., Friedrichs, M.A.M., Cai, W.-J. (Editors) (2012) Report of The U.S. East Coast Carbon Cycle Synthesis Workshop, January 19-20, 2012, Ocean Carbon and Biogeochemistry Program and North American Carbon Program, 34 pp.
- Najjar, R., D. E. Butman, W.-J. Cai, M. A. M. Friedrichs, K. D. Kroeger, A. Mannino, P. A., Raymond, J. Salisbury, JD. C. Vandemark, P. Vlahos, P. (2010). Carbon Budget for the Continental Shelf of the Eastern United States: A Preliminary Synthesis. Winter 2010 Issue of the OCB Newsletter.
- Osburn, C. L., T. S. Bianchi, R. F. Chen, P. G. Coble, E. J. D'Sa, C. Chandler (2011). Building a CDOM Database for a Coastal Carbon Synthesis Project. Winter 2011 Issue of the OCB Newsletter.

IMBER-relevant activities or events:

*OCB activity or partner activity **OCB co-sponsorship/travel support

- **June 26-28, 2012:** Global Ocean Acidification Monitoring Network workshop (Seattle, WA)
- **July 16-19*:** [OCB Summer Workshop](#) (Woods Hole, MA) ([workshop report](#))
- **September 10-13:** [2012 LTER All Scientists Meeting](#) (Estes Park, CO)
- **September 24-27:** [Third Symposium on the Ocean in a High-CO₂ World](#) (Monterey, CA) (release of [updated ocean acidification FAQs](#))
- **November 28-30*:** [International Biogeochemical Time-Series Methods Workshop](#) (St. Georges, Bermuda) (partner activity with IOCCP)
- **December 5*:** [U.S. CLIVAR/OCB Ocean Carbon Uptake Working Group](#) meeting (San Francisco, CA) (partner activity with U.S. CLIVAR)
- **December 7-8*:** [U.S. CLIVAR/OCB Southern Ocean Working Group meeting](#) (San Francisco, CA) (partner activity with U.S. CLIVAR)
- **February 4-7, 2013:** [4th North American Carbon Program All-Investigators Meeting](#) (Albuquerque, NM)
- **February 11-13*:** GEOMICS (Genome-Enabled Ocean Microbiology Integrated with Chemical Surveys) Workshop (Friday Harbor Laboratory, WA)
- **February 17-22:** [ASLO 2013 Aquatic Sciences Meeting](#) (New Orleans, LA)

- **March 10-15:** [Gordon Research Conference \(GRC\) on Polar Marine Science](#) (Ventura, CA)
- **March 27-28*:** [Gulf of Mexico Coastal Synthesis Workshop](#) (St. Petersburg, FL) (partner activity with North American Carbon Program)
- **May 6-8**:** [First International Ocean Colour Science meeting](#) (Darmstadt, Germany)
- **May 13-17**:** [45th International Liege Colloquium on Ocean Dynamics](#) (Liege, Belgium)

Relevant publications and resources:

Church, M. J., M. W. Lomas, F. Muller-Karger (2013). [Sea Change: Charting the course for biogeochemical ocean time-series research in a new millennium](#). *Deep-Sea Research Part II: Topical Studies in Oceanography* (in press).

[Science for an ocean nation: Update of the ocean research priorities plan](#) Subcommittee on Ocean Science and Technology, National Science and Technology Council (February 2013)

[U.S. National Climate Assessment Report](#) (2013)

Benway, H. M., M. Telszewski, and L. Lorenzoni (2013), [Improving Intercomparability of Marine Biogeochemical Time Series](#), *Eos Trans. AGU* 94(17), 160.

OCB, in partnership with [IOCCP](#) and [IOC-UNESCO](#), has launched a new [time-series network website](#) and [email list](#) to improve coordination and communication among shipboard biogeochemical time-series

Lorenzoni, L., Benway, H. (2013). Global inter-comparability in a changing ocean: An international time-series methods workshop. Workshop report (In review)

Benway, H. M., Doney, S. C. (2013). Addressing biogeochemical knowledge gaps. *International Innovations* (In press).

[National Research Council Review of the Federal Ocean Acidification Research and Monitoring Plan](#) Special theme section in *Marine Ecology Progress Series* [Biological responses in an anthropogenically modified ocean](#)

Le Quéré, C. et al.: [The global carbon budget 1959–2011](#), *Earth Syst. Sci. Data Discuss.*, 5, 1107-1157, doi:10.5194/essdd-5-1107-2012, 2012.

OCB releases a statement on recent iron dumping off west coast of Canada (November 2012):

www.whoi.edu/files/server.do?id=136984&pt=10&p=39295

[Legacy of in situ Iron Enrichment Experiments: Creation of a Relational, Open-Access Database](#) (SCOR Working Group 131)

JGR-Oceans [Special Section on the Southern Ocean Gas Exchange Experiment \(SO GasEx\)](#)

Updated Ocean Acidification FAQs (September 2012), www.whoi.edu/OCB-OA/FAQs

Najjar, R.G., Friedrichs, M.A.M., Cai, W.-J. (Editors) (2012) [Report of The U.S. East Coast Carbon Cycle Synthesis Workshop](#), January 19-20, 2012, Ocean Carbon and Biogeochemistry Program and North American Carbon Program, 34 pp.

Smith B, Baron N, English C, Galindo H, Goldman E, et al. (2013) COMPASS: [Navigating the Rules of Scientific Engagement](#). *PLoS Biol* 11(4): e1001552. doi:10.1371/journal.pbio.1001552.

Doney, S.C, and H. Ducklow, 2013: Rapid climate change along the West Antarctic Peninsula: impacts from sea-ice to penguins, [Flotsam & Jetsam, Massachusetts Marine Educators](#), (Winter 2013), 42(3), Pages 1 & 15-18.

Upcoming U.S. activities relevant to IMBER:

*OCB activity or partner activity **OCB co-sponsorship/travel support

- **May 28-June 29, 2013:** [C-MORE 2013 Summer Course on Microbial Oceanography](#) (Honolulu, HI)
- **May 31-June 14**:** [Summer Satellite Remote Sensing Training Course](#) (Ithaca, NY)
- **June 3-7**:** [9th International Carbon Dioxide Conference \(ICDC9\)](#) (Beijing, China)
- **June 16-July 6:** [BIOS Summer Course - Microbial Oceanography: The Biogeochemistry, Ecology and Genomics of Oceanic Microbial Ecosystems](#) (BIOS, Bermuda)
- **July 7-August 2**:** [Ocean Optics Summer Class: Calibration and validation of ocean color remote sensing](#) (Darling Marine Center, Walpole, ME)
- **July 9-11:** [U.S. CLIVAR Summit](#) (Annapolis, MD)

- **July 16-19:** [2013 International Atlantic Meridional Overturning Circulation \(AMOC\) Science Meeting](#) (Baltimore, MD)
- **July 22-25*:** [Ocean Carbon & Biogeochemistry \(OCB\) Summer Workshop](#) (Woods Hole, MA)
- **July 22-August 23:** [Summer Course on Ocean Acidification Methodologies](#) (Friday Harbor Laboratories, WA)
- **July 29-August 16:** [NCAR Advanced Studies Program \(ASP\) Student Colloquium *Carbon-climate connections in the Earth System*](#) (Boulder, CO)
- **August 6-10**:** Researcher workshop [Key Uncertainties in the Global Carbon-Cycle: Perspectives across terrestrial and ocean ecosystems](#) (curricular component of [NCAR Advanced Studies Program \(ASP\) Student Colloquium *Carbon-climate connections in the Earth System*](#)) (Boulder, CO)
- **August 12-16:** [2013 Community Earth System Modeling Tutorial](#) (Boulder, CO)
- **August 19-23:** [PICES Summer School *Ocean observing systems and ecosystem monitoring*](#) (Newport, OR)
- **September 18-20*:** [U.S. Ocean Acidification PI Meeting](#) (Washington, DC)
- **October 12-19:** [DISCCRS VIII Interdisciplinary Climate Change Research Symposium](#) (La Foret Conference and Retreat Center, CO)
- **December 9-13:** [Fall American Geophysical Union \(AGU\) Meeting](#) (San Francisco, CA)
- **February 23-28, 2014:** [2014 Ocean Sciences Meeting](#) (Honolulu, HI)
- **April 15-18:** [North Pacific Marine Science Organization \(PICES\) Open Science Meeting *Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems \(FUTURE\)*](#) (Kohala coast, Big Island, HI)
- **July 6-11:** [Gordon Research Conference *Ocean Global Change Biology*](#) (Waterville Valley, NH)

Any suggestions of new potential collaboration for IMBER:

- Short course on working with large hydrographic data sets (Summer 2015? U.S. venue TBD)
- Global network of shipboard biogeochemical time-series