

SOLAS FRANCE, February 2007.

The SOLAS France activities are coordinated by the national program LEFE (Les enveloppes Fluides et l'Environnement) managed by INSU (Institut National des sciences de L'Univers). This program continues the previous PROOF and PNCA programs. Field campaigns, laboratory experiments and modelling studies are implemented to address the major scientific issues relevant to SOLAS. The SOLAS-FRANCE web site is now available (<http://www.lisa.univ-paris12.fr/SOLAS>). Support and funding is provided by INSU (LEFE), MDESR (Universities) CNRS, ANR, IFREMER, IPEV, CEA, IRD and EU-FP6.

Two major cruises were carried out in 2004-2005.

BIOSOPE (**B**iogeochemistry and **O**ptics **S**outh **P**acific **E**xperiment) took place in the South Pacific gyre in November 2004 and has 3 large scopes:

1. Characterize optical and bio-optical water properties to validate SeaWiFS detection for low chlorophyll area and to measure the deepest UV penetration.
2. Evaluate the biogeochemistry of the surface waters in ultra low iron and nitrate concentrations.
3. To assess the resulting biodiversity in this extreme system.

See: <http://www.obs-vlfr.fr/proof/vt/op/ec/biosope/bio.htm>

KEOPS (**K**erguelen **O**cean and **P**lateau compared **S**tudy) is a multidisciplinary and international project which, aims to improve our understanding of the response of the Southern Ocean to climate change. Particularly, KEOPS is studying the impact of the natural iron fertilisation on the biological pump of CO₂ and on the cycles of other chemical compounds relevant for climate. The campaign took place in January/February 2005 above the Kerguelen Plateau. The results show that substantial differences in key biogeochemical cycles exist above and outside the plateau. This was the case for carbon cycling and particularly carbon export, the relative nitrate and silicic acid utilization and the production of DMS. For all these issues the results of KEOPS differ from previous findings of artificial iron fertilization experiments in the Southern Ocean and shed new light on the impact of long term iron fertilisation of the Southern Ocean (<http://www.obs-vlfr.fr/proof/vt/op/ec/keops/keo.htm>).

An atmospheric campaign (**KEPHREN**, Kerguelen, study of deposition and erosion of metals and nutrients) was associated to KEOPS to measure deposition and emission flux of iron and other trace metals to and from the Kerguelen Island at the same time.

The **FLAMENCO2** project is focused on the variability of CO₂ air/sea flux at decadal scale deduced from measurements, atmospheric inversions and oceanic models. Particular effort is conducted to improve air-sea CO₂ fluxes estimates in the Atlantic and Southern Oceans, with a special attention to the dynamical, thermodynamical and biological processes controlling this flux. This project has a strong modelling component but it also includes repeated sections of in situ observations in the Southern Ocean. Shorter term variability (diurnal to seasonal) is addressed in the EU-FP6 **CarboOcean** project (<http://www.carboocean.org/>), including use of CARIOCA buoy systems and satellite data processing to determine air/sea exchange coefficients.

Research including laboratory experiments is done with UVECO and BOA. The **UVECO** project (<http://www.com.univ-mrs.fr/LMGEM/uveco/Uvecoanglais/index.htm>) evaluates the effect of UVR on bacterial and phytoplanktonic communities and on photochemical transformations of dissolved organic matter with a special emphasis on the Mediterranean Sea. Experimental work has been undertaken after coastal seawater collection in the Banyuls/mer Institute and at the Center of Oceanology of Marseille France. In these two institutes, atmospheric UV-R are now continuously monitored whereas UV-R penetration in the coastal Sea are regularly measured and freely available. This research also help for a better understanding of the impact of UV light in marine biogeochemical cycles, such as for example, the acclimation of phycobilisomes of *cynaobacterium Synechococcus* to high light (Six et al., *Journal of Bacteriology*, **187**, 1685-1694, 2005), or the capability of heterotrophic bacteria to degrade dissolved organic compounds. Furthermore, UVECO allowed to identify new dissolved organic compounds i.e. dicarboxylic acids which are abundantly produced by UV effects on fatty acids (Tedetti et al., *Analytical Chemistry*, **78**, 6012-6018, 2006).

BOA ("Biogéochimie du fer à l'interface Océan-Atmosphère. Interactions between atmospheric input of iron and sea water biology") involves both laboratory experiments and modelization on the iron chemistry at the ocean/atmosphere interface, with a special emphasis on the bioavailability of this metal. It includes a complete characterization of this element in the atmospheric phase and impact studies on the carbon cycle through biological activity (http://www.univ-brest.fr/IUEM/UMR6539/prog_scientif/boa/boa.htm).

Ongoing and future projects are:

ISLAND (Iron / Sulphur : how iron **L**imitation **A**ffects the production **N** of **D**MS) on the influence of iron in the DMS-DMSP production, The main question involved are:

1. How iron limitation does affect DMSP, DMS and DMSO relative production?
2. How does it affect DMS emission?
3. What should be the global oceanic response to an iron fertilization?

The work will be achieved using laboratory experiments and a biogeochemical predictive model (PISCES).

GRABISU (Biogeochemical gradients in the sub-surface and their effect on the air-sea interface). The sub-surface ocean layer is today poorly known because the general sampling policy often ignores the very first meters of the ocean. We suspect that organic particulate matter with a positive buoyancy enriches the surface layer and affects the sea colour. This can interfere with air-sea fluxes and with satellite measurements of chlorophyll, especially in frontal zones. A continuous automatic sampling system will be operating underway from research vessels.

DUNE (a **D**Ust experiment in a low **N**utrient, low chlorophyll **E**cosystem) is an emerging project that aim at studying the vulnerability and the fate of oligotrophic ecosystems to climatic change and the consequent increase in natural and anthropogenic atmospheric input of nutrients, using mesocosm experiments. Answers to the atmospheric particles migration and dissolution in

the surface mixed layer, are expected on i) the marine ecosystem reactions to those inputs, ii) the evolution of the biological response with increasing atmospheric forcing, iii) the role of natural/anthropogenic mixed/combined events and, iv) the intensity of the biological pump induced by atmospheric deposition to oligotrophic waters. Carbon export will be compared to carbon budget in such oligotrophic area.