

Compte rendu de l'action "SOLAS France" financé en 2007 par le programme LEFE.

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L'action SOLAS France a connu deux moments forts en 2007. Le premier a été la participation française nombreuse à la conférence de Xiamen, du 6 au 9 mars, et le deuxième la réunion SOLAS-France à Paris les 11 et 12 septembre. Ces deux manifestations ont donné lieu à deux publications dans la "SOLAS Newsletter", respectivement issues 5 et 6 (Annexe 3), l'exposition d'un Poster à Xiamen (Annexe 2) et l'édition d'un abstract (Annexe 1), la création de pages web publiés sur internet pour le meeting en France:

<http://www.lisa.univ-paris12.fr/SOLAS/2007/>

et enfin la création d'un répertoire de stockage de la majorité des posters présentés à Xiamen:

<http://www.lisa.univ-paris12.fr/SOLAS/Xiamen2007>

L'organisation de la réunion à Paris, a coûté un peu plus de 3k€, essentiellement en remboursement des frais de déplacement pour 11 personnes. L'université Paris7 Denis Diderot a prêté un amphithéâtre de cours pour cette occasion. L'assistance a toujours oscillé entre 40 et 50 personnes pendant les 4 demi-journées du colloque, soit un peu plus dans son maximum que les inscrits régulièrement enregistrés (45 personnes).

Bilan-Conclusion: Grâce au soutien actif de LEFE, nous avons pu motiver de nombreuses personnes dans leur participation à l'action internationale SOLAS, et ainsi montrer l'excellence de la recherche française à l'interface Océan-Atmosphère.

ANNEXE 1: Abstract proposé à l'Open Science Conference de Xiamen

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), MDES (Universities) CNRS, ANR, IFREMER, IPEV, CEA, IRD and EU-FP6.

Two major cruises were carried out in 2004-2005.

BIOCOPE (**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 ("**B**io*g*éochimie du fer à l'interface **O**céan-**A**tmosphère. 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 **DU**st experiment in a low **Nutrient**, low chlorophyll **Ecosystem**) 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.

ANNEXE 4: Résumé de la demande à LEFE 2007.

Résumé du projet, résultats attendus, calendrier :

(2 pages maximum)

L'action thématique SOLAS (<http://www.uea.ac.uk/env/solas/>) se développe au niveau international avec une forte composante motrice au niveau des pays participants.

L'organisation de cette action se fait par l'intermédiaire d'un conseil scientifique qui fixe les priorités, les besoins et labellise les projets qui lui sont soumis. Des projets LEFE sont parfaitement inclus dans la thématique SOLAS qui concerne l'océan superficiel et la basse atmosphère.

L'organisation de réunions de travail régulières est indispensable à l'animation au niveau national, sans qu'il soit nécessaire d'adopter un rythme annuel. La dernière réunion a été organisée en septembre 2005 à Paris grâce aux soutiens conjoints de PROOF et du PNCA. Elle a permis une bonne communication entre les équipes plutôt orientées sur la partie atmosphérique et celles, plus nombreuses, s'occupant de l'Océan. La réunion de ces deux communautés a encouragé les synergies qui s'est traduite par des réalisations communes (BIOSOPE, KEOPS, KEPHREN, BOA, BIRD).

En plus de la présentation internationale des actions SOLAS, un site français en langue française (<http://www.lisa.univ-paris12.fr/SOLAS>) a été récemment créé pour regrouper les actions nationales, donner une meilleure lisibilité à la communauté francophone. On peut y lire une description des projets plus détaillée que sur le site international et la mise à jour y est beaucoup plus rapide et souple.

La communauté internationale SOLAS organise un meeting en mars 2007, la réunion prévue en France permettra de dresser un bilan et une prospective du positionnement de la communauté française.

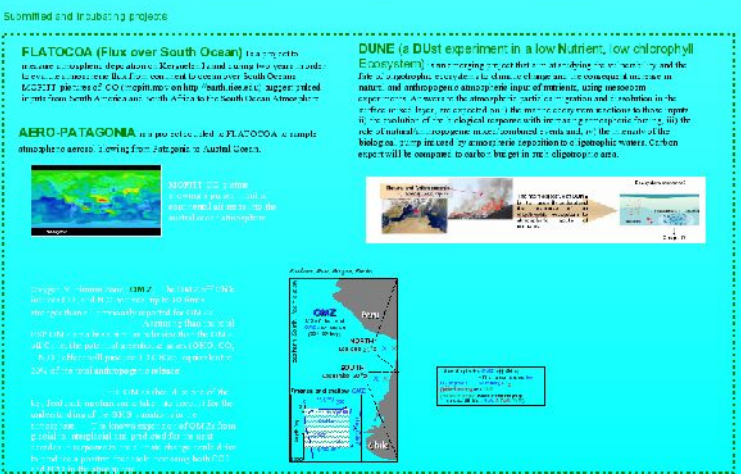
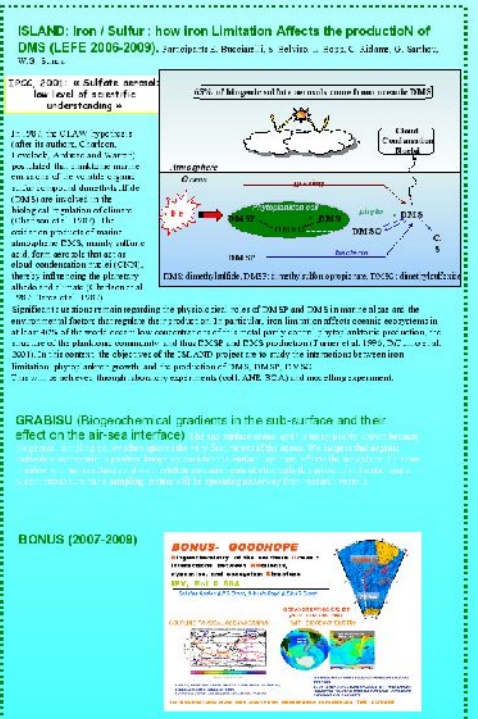
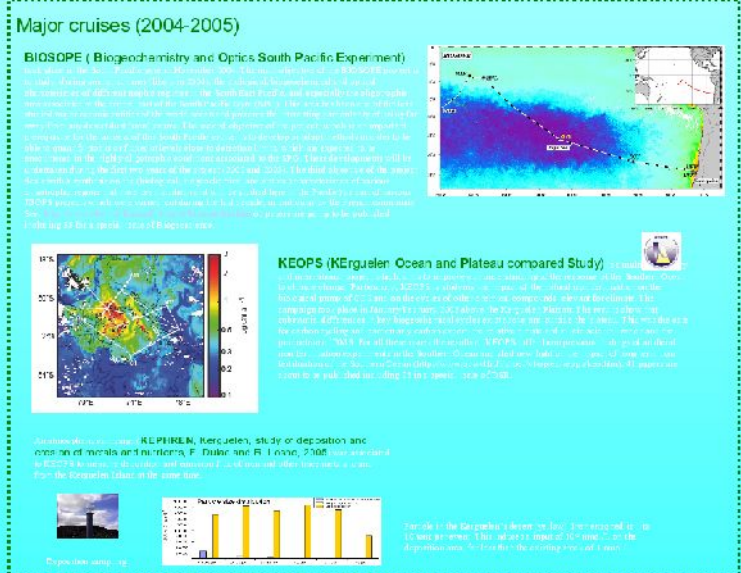
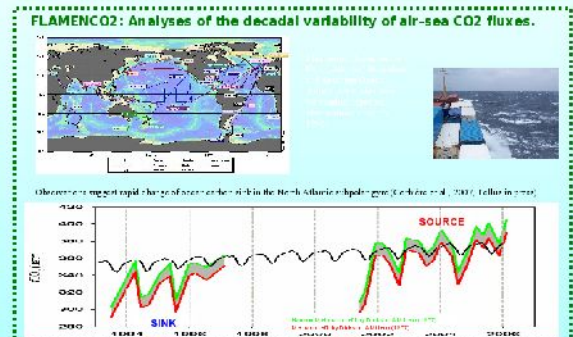
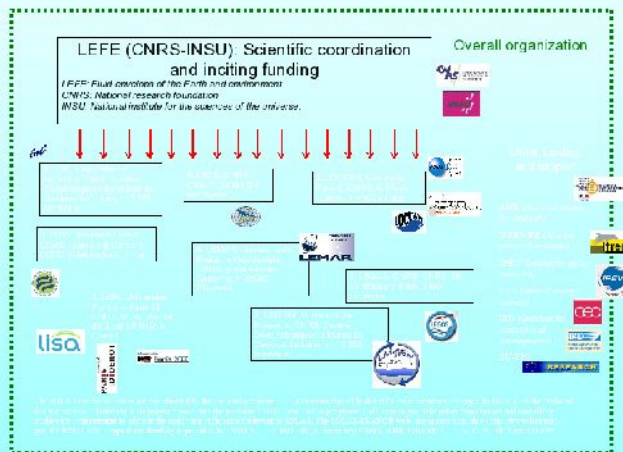
Il avait été attribué au total 5 kE (4 kE demandé, augmenté de 1 kE pour faire face à l'affluence du meeting de septembre).

ANNEXE 2: Copie du Poster présenté à Xiamen pour SOLAS-France

SOLAS France: an overview of today's research work, Xiamen 4-7 march 2007



<http://solas.fr/fr/annex2/>



ANNEXE 3: Contribution aux Newsletter SOLAS

<http://www.uea.ac.uk/env/solas/news/newsletter/newsletter.html>

Submission to SOLAS Newsletter, 20/04/2007, issue 5 (summer), R. Losno, V. Garçon.



The French SOLAS community has presented 13 contributions at the Xiamen Open Science Meeting, including 2 invited talks. The efforts are focussed on biogeochemistry and CO₂. For this first item, we have seen posters on field measurements: "Role of dissolved organic nitrogen in the North Atlantic Ocean", "Dust size measurement over Austral

Ocean" and a description on a proposal for a mesocosm enrichment experiment with Saharan dust in Mediterranean water (DUNE). Laboratory work is also done on dust dissolution kinetic processes, including dissolution study on pure phases and dissolution of natural aerosol and photochemically activated dust. Finally an evidence of bacteria effect in "interactions between dust inputs and marine bacteria" was shown.

The second item is documented by the way of the interpretation of field experiment results. One point is exchange coefficients and flux variability: "Air-Sea CO₂ exchanges coefficients deduced from satellite QSCAT wind speeds from 1999 to 2006", "CO₂ and associated parameters variability in the Southern Atlantic Ocean: CARIOCA and ARGO drifters", and "Air sea CO₂ fluxes in the Southern Ocean: different methods, converging results?". The second point is on the measured fluxes themselves: "A seasonal carbon budget for a naturally iron fertilized bloom (Kerguelen)" and "A rapid decrease of the carbon sink in the North Atlantic sub polar gyre: results from the SURATLANT program".

All this work was done in the SOLAS focus thanks to the scientific, financial and administrative pulse given by all the national research organisms. The national program LEFE (Les enveloppes Fluides et l'Environnement) managed by INSU (Institut National des sciences de L'Univers) is today the major coordinating structure for SOLAS France.

Submission to SOLAS Newsletter, issue 6 (winter), R. Losno, V. Garçon; SOLAS-France, 11-12 September 2007 in the new buildings of University Paris7 – Denis Diderot.

The French SOLAS community has met together in Paris to discuss the ongoing and upcoming projects related to sea, air and air-sea interface. About 50 people were registered and attending the 2 days meeting, 28 talks of 20 min were given. From the last French SOLAS meeting in 2005, we noticed a large increase of the attendance and a true renewal of the discussed topics, projects and results.

Eight talks were devoted to SOLAS Focus 3, Air-sea flux of CO₂, mainly focussed on the Southern Hemisphere. Two talk topics were on the effect of nutrients on the biological carbon pump in the Weddell Sea and above the Kerguelen Plateau (KEOPS program). Three talks were dealing with the spatial and temporal variability of CO₂ flux, two with the CO₂ flux data provided by the

CARIOCA buoy system, and one on the benefits of boron isotope measurements in corals to retrieve past pH variations.

Focus 1, Biogeochemical Interactions and feedbacks between Ocean and Atmosphere, generated the largest number of talks (12), but mainly on macro- and micro-nutrients and their possible impact on the carbon cycle. The fate, behaviour and effect of dissolved organic matter was pointed out. The solubility of iron was the most popular approached topic, with 6 talks on both laboratory and field experiments. Two new projects were presented, one already funded to operate dust fertilization in mesocosms (DUNE), and one still in a proposal stage to investigate the coccolithophoridae blooms in the Patagonian Shelf and the related atmospheric input of Patagonian dust (PATAGONIA). Finally, one talk interested us on the Oxygen Minimum Zones in the South East Pacific, one on the biological fixation of N_2 and one on the influence of UV solar radiations on the dissolved organic material chemistry.

Focus 2, Air-Sea Exchange Processes and transport in the atmospheric and oceanic boundary layers, tackled mainly physical questions: breaking waves model, atmospheric turbulent fluxes, and the use of gliders in the North-West Mediterranean Sea. Chemistry issues were also addressed with a presentation on sea water concentration measurements of Volatile Organic Carbon and CO in the Southern Ocean, and finally with spectroscopic measurements of reactive molecules in the marine atmosphere.

One talk was devoted to present the International SOLAS organization and the SOLAS Summer School programs, another one to present the European COST 735 Action entitled "Tools for assessing global air-sea fluxes of climate and air pollution relevant gases".

This meeting was successful in all aspects. It allowed presentations in the native author's language of excellent science and subsequent rich and open discussions. Some PhD students delivered here their first talk out of their laboratory, which is a good training for future international conferences. Web pages are now published where all details of the topics raised here are developed (see <http://www.lisa.univ-paris12.fr/SOLAS/2007/>).



Figure 1: Location of the refurbished 20th century industrial building where University Paris7 – Denis Diderot is newly installed and where meeting took place.

(la photo n'a pas été publiée).