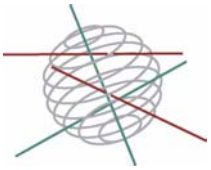
PLAN D'APPUI SCIENTIFIQUE A UNE POLITIQUE DE DEVELOPPEMENT DURABLE
(PADD II)



Partie 3:
Actions de support

RAPPORT FINAL

Solas.be

OA/25

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SOLAS.be

Gather and promote Surface Ocean - Lower Atmosphere related Belgian efforts

http://www.co2.ulg.ac.be/solas/

A cluster supported by

POLITIQUE SCIENTIFIQUE FEDERALE

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CONTEXT

In the context of Sustainable Development, the most challenging issue addressed to the scientific community involved in climate, oceanographic and atmospheric research is to understand and quantify the role that ocean-atmosphere interactions play in the regulation of climate and global change. This issue is specifically addressed by the international research initiative SOLAS (Surface Ocean Lower Atmosphere Study; http:// www.solas-int.org) sponsored by the International Geosphere-Biosphere Programme (IGPB), the commission of Atmospheric Chemistry and Global Pollution (CACGP) and the World Climate Research Programme (WCRP). SOLAS implementation is based on national and trans-national research programmes and currently has activity in 25 countries around the world. The activities of SOLAS are run by a Scientific Steering Committee chaired up to end-2007 by Prof. P. Liss with Belgium represented by Prof C. Lancelot. The new chair is Prof D. Wallace.

The Federal Science Policy Office has been concerned for a long time with climate change issues throughout the funding of several projects which address the questions raised by the SOLAS Science Plan (www.solas-int.org). The aim of the Solas.be cluster was to group the present mosaic of individual research projects under the flag of SOLAS BELGIUM and organize the research activities with respect to the international SOLAS Science Plan and Implementation Strategy. Altogether this networking activity aimed to reinforce the international visibility of the Belgian expertise in global change and foster collaboration among national research projects and networks.

OBJECTIVES

Objectives were dictated by the Science Plan of international SOLAS and focused on actions needed in the Belgian scientific community to address challenges defined by SOLAS and communicate research achievements at the international level. Basically this required not only the stimulation of an interdisciplinary approach (involving biogeochemistry, physics, mathematical modeling etc…) but also integrated studies requiring marine and atmospheric experts working together. All the necessary expertise existed separately among the Belgian scientific community but needed to be coordinated to specifically address the 3 issues or Foci of the International SOLAS Science Plan.

Therefore the main objective of the cluster SOLAS.be was to promote Belgian achievements and organize the ongoing research activities supported by the Federal Science Policy Office and the French Community in accordance with the SOLAS international Science Plan and Implementation Strategy that deals with the 3 following foci:

- Focus 1 : Biogeochemical Interactions and Feedbacks Between Ocean and Atmosphere
- Focus 2 : Exchange Processes at the Air-Sea Interface and the Role of Transport and Transformation in the Atmospheric and Oceanic Boundary Layers
- Focus 3: Air-Sea Flux of CO_2 and Other Long-Lived Radiatively-Active Gases

Specifically, the mission of the cluster SOLAS.be was to provide to Belgian scientists a platform for:

- Sharing data and model results and expertise, within the cluster but also within the international SOLAS community;
- Stimulating and editing synthesis reports and publications to be submitted to international SOLAS.
- Sharing ideas and concepts for new research initiatives and their implementation.
- Creating a dialogue between the SOLAS scientific community and decision and policy makers, the media and the general public in particular with respect to global change and sustainable development issues.

IMPLEMENTATION

In addition to the research mission of the cluster, SOLAS.be built new instruments to promote the visibility of Belgian activities linked to international SOLAS issues towards the international scientific community and the various stake holders (public authorities, industry, the media, non-governmental organizations and the general public).

Five activities or Tasks were therefore carried out to achieve the SOLAS.be objectives

- Task 1: Setting up of a Communication Office for coordinating Belgian activities
- Task 2: Setting up of an online link with International SOLAS, including the edition of annual reports posted on the SOLAS.be web site and their transfer to the International SOLAS web site
- Task 3: Organization of the data-base Management
- Task 4 : Coordination of the Belgian modeling effort
- Task 5 : Setting up and maintenance of the SOLAS.be Web Site for informing the scientific community, policy makers, the media and the general public

EXPECTED RESULTS AND PRODUCTS

The expected results and products of SOLAS.be were:

- A SOLAS.be web site;
- A Communication Office ;
- The participation of Belgian scientists in SOLAS annual meetings and activities *via* a competitive distribution of travel grants;
- The publication of joint scientific peer-reviewed manuscripts involving Belgian scientists as well as scientists from international SOLAS.
- The participation in general public and student events (Printemps des Sciences, Pole position competetion …)
- Increased awareness by policy makers, media and general public of SOLAS challenging issues related to global change

INVOLVED PARTNERS

- Université Libre de Bruxelles

  Christiane Lancelot (Coordinator)

  Sylvie Becquevort
  Lei Chou
  Nathalie Gypens
  Jean-Louis Tison
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  Guy Munhoven

- Vrij Universiteit Brussel

  Willy Baeyens
  Natacha Brion
  Frank Dehairs

- Musée Royal d'Afrique Centrale – Koninklijk Museum voor Midden Afrika

  Luc André
  Damien Cardinal

- Université Catholique de Louvain

  Hugues Goosse

- Universiteit Antwerpen

  René Van Grieken
  Magda Claeys

- Universiteit Gent

  Willy Maenhaut

RESULTS

Task 1: Communication Office

The Communication Office of SOLAS.be was run by ULB-ESA who had also in charge the scientific secretariat of Focus 1 of International SOLAS over 2005 and 2006. Over the contract period ULB-ESA was the contact point for the SOLAS Belgian scientific community and other groups both scientific and beyond (public authorities, industry, the media, non-governmental organisations, young students, the general public).

At the beginning of the contract, the communication office organized a SOLAS.be general meeting attended by 25 participants. The objective was to provide an overview of the Belgian efforts related to SOLAS and discuss about their possible synergy. A large part of the meeting was therefore devoted to discussions between participants, especially between modeling approaches which cover different scale (from local to regional to global) and different trophic resolutions (from simple biogeochemistry to complex biology). Another important debate was the establishment of links with the Eutrophication cluster COMETS. This was achieved throughout the writing of the chapter *Carbon dynamics in the eutrophied Belgian Coastal Zone* in the “in press” COMETS book dedicated to the eutrophication status of the Belgian coastal zone. This chapter discusses how increased or reversed eutrophication can affect the capability of the Belgian coastal zone in absorbing atmospheric CO_2.

The office reported annually to international SOLAS on the advancement of activities and initiatives of the SOLAS.be cluster (contribution from all partners). These annual reports were posted on the web site of international SOLAS.

Along the cluster duration, most communications were made by email and important information was uploaded on the website.

Task 2: Link with International SOLAS

The SOLAS.be office was well established in International SOLAS, with Pr C. Lancelot being a member of the Steering Committee. Dr V. Schoemann from ULB-ESA was the Officer in charge of the implementation Group 1 of SOLAS-International (Biogeochemical Interactions and Feedbacks Between Ocean and Atmosphere). The SOLAS.be office reported the Belgian activities to SOLAS international office and is available on the SOLAS international website. A page of the SOLAS International website is dedicated to SOLAS.be and present the Belgian project and initiatives related to SOLAS (http://www.solas-int.org/ - > national report -> Belgium)..

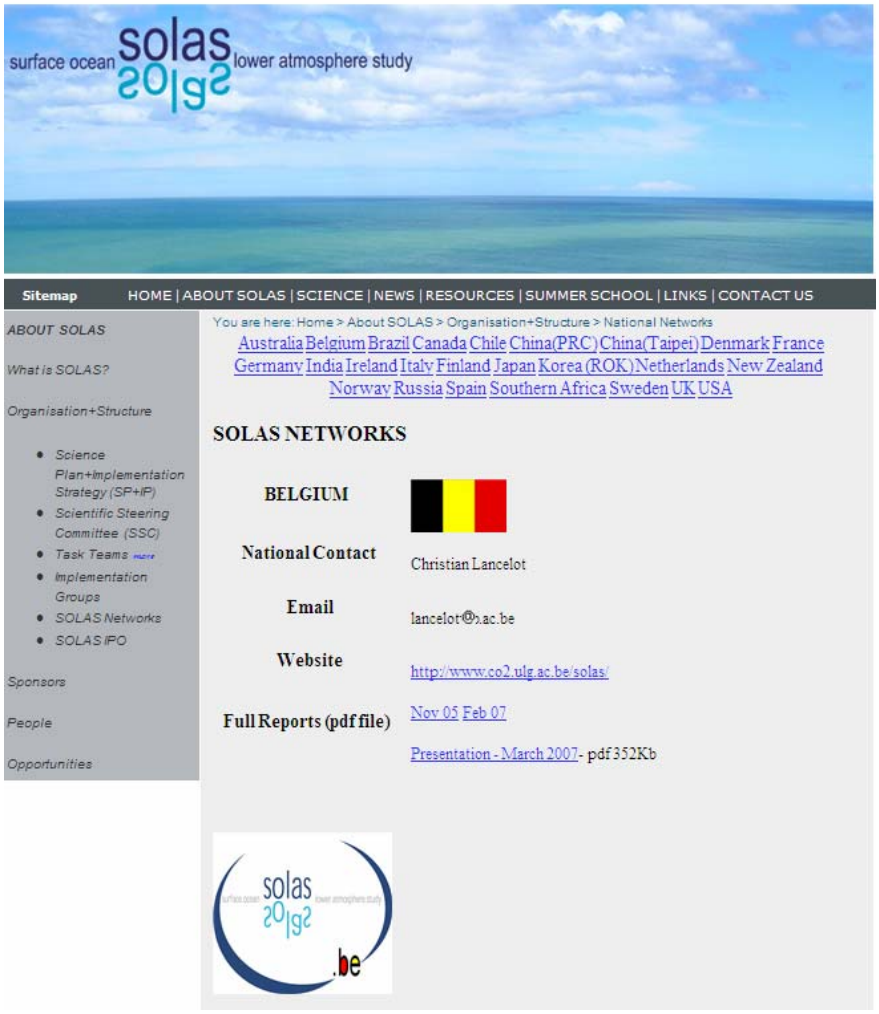

Figure 1: SOLAS.be on the SOLAS international website

Over the contract period the SOLAS.be office organized the **C**omparison of **O**ceanic **Di**methylsulfide **M**odels (CODIM - http://www.quebec-ocean.ulaval.ca/CODiM/) workshop at the Université Libre de Bruxelles (December 4-8, 2006). The CODIM group is a SOLAS initiative aiming to reduce uncertainties in ocean DMS modelling. This workshop was dedicated to the comparative synthesis and the interpretation of different DMS models simulations performed before. Four Belgian scientists were invited to attend the workshop. Achievements were presented at the 2007 SOLAS Open Science meeting in China and the joint publication “*A first appraisal of ocean DMS models and prospects for their use in climate models*” was submitted to Geophysical Research letter by Vézina A., Levasseur M., le Clainche Y., Gunson, J. Vallina S., Vogt M., Lancelot C., Allen I., Archer S., Bopp L. Cropp R., Deal C., Elliot S., Jin M., Malin G., Schoemann V., Simo R., Six, K and Stefels J.

The communication office fostered and supported participation of Belgian young researchers to all activities of international SOLAS such as annual open science meetings, joint field studies and modelling activities, mobility and exchange of scientists, summer schools. A loop sum was reserved to sustain scientific activities related to SOLAS and to strengthen the link with SOLAS-International through competitive travel grants. A special attention was paid to the young Belgian researchers. Call for application to travel fees was launched in the SOLAS.be community and a committee selected 8 applications as follows.

Young researcher	Stat.	Affiliation	Conference	Title (**p**oster/**o**ral)
Caroline DE BODT	PhD	ULB, Océanographie Chimique et Géochimie des Eaux	SOLAS Open Science Conf. 6-9 March 2007, Xiamen, China	Calcification and transparent exopolymer particles (TEP) production in batch cultures of Emiliania huxleyi exposed to different pCO2 (**p**)
Bruno DELILLE	Post-D	ULg, Unité d'Océanographie Chimique	SOLAS Open Science Conf. 6-9 March 2007, Xiamen, China	CO2 dynamics and related air-ice-sea gas transfer in spring pack and land fast sea ice (**p**)
Jérôme HARLAY	PhD	ULB, Océanographie Chimique et Géochimie des Eaux	SOLAS Open Science Conference. 6-9 March 2007, Xiamen, China	Coccolithophorid calcium carbonate dissolution in surface waters (**p**)
Fréderic BRABANT	PhD	ULB Glaciologie	GRC- Gordon Research Conference (Polar Marine Science)	Control processes of total gas content and gas composition (O_2, N_2) within spring and summer first-year pack ice (Antarctica) (**p**)
Isabelle DUMONT	PhD	ULB Ecologie des Systèmes aquatiques	GRC- Gordon Research Conference (Polar Marine Science)	Distribution and characterization of dissolved and particulate organic matter in Antarctic sea ice
Véronique SCHOEMANN	Senior Scientist	ULB Ecologie des Systèmes aquatiques	GRC- Gordon Research Conference (Polar Marine Science)	Discussion leader
Nathalie GYPENS	Post-D	ULB Ecologie des Systèmes aquatiques	EGU European Geophysical Union General Assembly Vienna, 15 – 20 April 2007	Response of the Belgian coastal zone (Southern North Sea) to increased CO2 and nutrient loads: from pristine to 2015 (**o**)
Mahdia BELOUNIS	PhD	ULG Laboratoire de Physique Atmosphérique et Planétaire	SOLAS summer school 2007	Poster on PhD: Effect of climate change on water mass circulation and biogeochemical cycles in the Mediterranean Sea (**p**)

A poster summarizing SOLAS.be activities was prepared for presentation at international conferences.

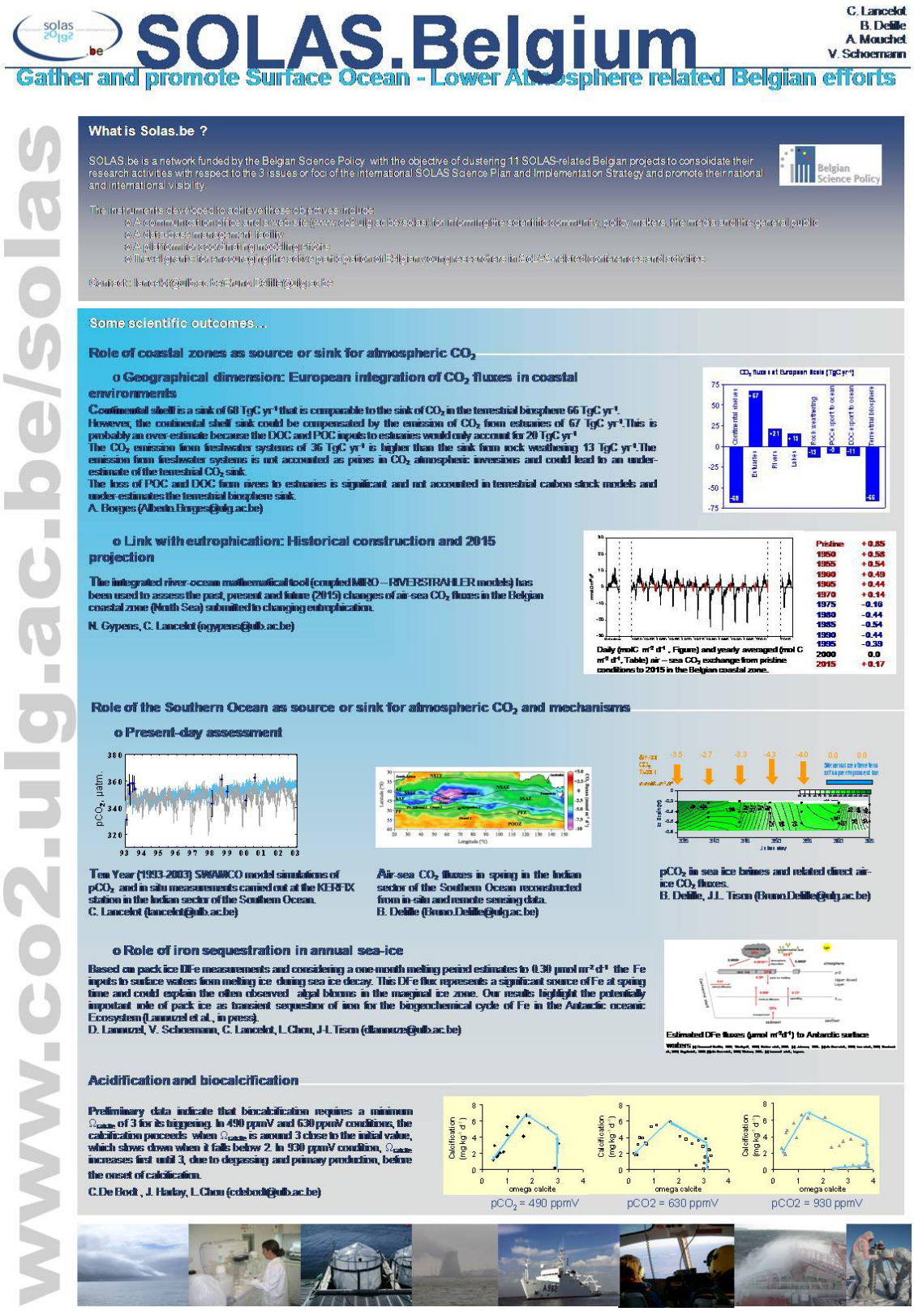

Figure 2: Poster describing the activities of SOLAS.be presented at several international scientific meetings (SOLAS open science, GRC, SOLAS summer school)

The SOLAS.be communication office also fostered participation of young researchers in international field activities. Dr Delphine Lannuzel from the Université Libre de Bruxelles received a grant for a post-doctoral stay of several weeks at the University of Tasmania (Australia). She was invited to present some major achievements of the Belgian French community ARC SIBLCIM project and was invited to take part in the Australian SAZ-SENSE cruise in the Southern Ocean in January and February 2007. This work complemented the studies carried out by scientists of the Belcanto III consortium who were also invited to participate to this cruise.

Task 3: Data-base Management

The aim of Task 3 was to support data sharing by providing facilities to participant for posting their data on existing data-base.

At the time of the report issue, international SOLAS supports the integration of collected data in the scope of SOLAS projects. The COST (European Cooperation in the field of Scientific and Technical Research) Action 735 launched in June 2006 provides the operational basis for SOLAS data integration. The main objective of this action is to develop tools for assessing global air-sea fluxes of climate and air pollution relevant gases. This action aims to facilitate knowledge sharing of the independent research projects around Europe and work towards common goals as a collective. Drs Alberto Borges and Christiane Lancelot are representing SOLAS.be in the COST Action 735 consortium.

Data transfer was performed on a voluntary basis to other data-bases chosen in accordance with the type of data to be banked. It is difficult to measure the impact of such data transfer on open access data base; the integration of these data by other scientist in large-scale budget or models can take several years and is difficult to track. Nevertheless one of the main achievements of Task 3 was the transfer of thousands measurements of surface partial pressure of CO_2 (pCO_2) to the Carbon Dioxide Information Analysis Center. These data were integrated to the pCO_2 climatology compiled by Pr Taro Takahashi and published in June 2008 as :

Takahashi T., C.S. Sutherland, R. Wanninkhof, C. Sweeney, R.A. Feely, D.W. Chipman, B. Hales, G. Friederich, F. Chavez, A. Watson, D.C.E. Bakker, U. Schuster, N. Metzl, H. Yoshikawa-Inoue, M. Ishii, T. Midorikawa, C. Sabine, M. Hoppema, J. Olafsson, T. Arnarson, B. Tilbrook B., T. Johannessen, A. Olsen, R. Bellerby, H. J. W. de Baar, Y. Nojiri, C.S. Wong, B. Delille, N. R. Bates & H.J.W. de Baar, *Climatological Mean and Decadal Change in Surface Ocean pCO_2, and Net Sea-air CO_2 Flux over the Global Oceans*, *Deep-Sea Research II in press*

It is worth to note that this is a crucial publication for CO_2 budgets and global change related studies. This climatology is the most reliable source to constrain CO_2 fluxes between the atmosphere and the oceans, and how the oceans buffer the increase of CO_2 concentration in the atmosphere. Last pCO_2 climatology ranks among the 100 most cited publication in geosciences (in cites.com). This new, climatology is much more accurate and reliable (gathering 3 millions data) and provides some clues about how this fluxes evolved over the three last decades.

Task 4 : Coordination of modelling efforts

An online survey of modeling capabilities available in Belgium has been designed and posted on the SOLAS.be website. Belgian modelers involved in SOLAS-related problematic are invited to fill it.

The aim of this survey is to identify possible synergies in the field of environmental modeling among the Belgian community. We believe the results of such a survey would promote cooperation and knowledge sharing, by bringing attention of the whole community, the experience and skills developed by different groups as well as the existence of specific tools and their availability. In addition, it will provide a clear overview of modeling capabilities available in Belgium to the SOLAS community and the Federal Science Policy.

While our survey focuses on processes that affect the interaction between the ocean and the atmosphere, it leaves room for research domains indirectly related to that topic. Despite this enlarged focus, the survey is restricted to the modeling activities. We felt that enlarging it too much, would not allow to get a clear overview of how possible collaborations could emerge from the available potential.

The content of the survey was developed on the basis of the SOLAS science plan. A special emphasis is brought on processes which control or significantly influence the air-sea exchange of gases at different timescales.

The final content of the form (

Figure 3 and

Figure 4) was adopted after submitting intermediate versions to several scientists belonging or not to the modeling community.

The survey was transformed into an HTML form with javascript functions in order to facilitate the post processing. It is publicly available at http://www.co2.ulg.ac.be/solas/survey.

Model name (acronym) _____
Internet Site _____
Contact people (Name, institution, email) _____
Bibliographic references (max 3) _____

Realm

- Atmospheric ☐
- Oceanic ☐
- Geologic ☐
- Coupled ☐
- Dynamic ☐
- Chemical ☐
- Biological ☐
- Biogeochemical ☐
- Climatic ☐
- Carbon cycle ☐
- Perturbation ☐
- Other _____

Type

- Inverse ☐
- Empirical ☐
- Mechanistic ☐
- Predictive/Prognostic ☐
- Stochastic ☐
- Diagnostic ☐
- Other _____

Dimension

- 0D ☐
- 1D ☐
- 2D ☐
- 2,5 D ☐
- 3 D ☐
- Box ☐

Time scale

- Day ☐
- Season ☐
- Year ☐
- Decade ☐
- Century ☐
- Geological ☐
- Other _____

Era

- Past ☐
- Present ☐
- Future ☐

Domain

- High atmosphere ☐
- Low atmosphere ☐
- Open ocean ☐
- Coastal seas ☐
- Pelagic ☐
- Benthic ☐
- Cryosphere ☐
- Sediment ☐
- Other _____

Spatial scale

- Global ☐
- Regional ☐
- Local ☐

Geographical location

Please precise: _____

Application

- Long term climate change ☐
- Atmospheric greenhouse gas ☐
- Air-sea exchange ☐
- Interannual Oscillation ☐
- Ecosystem functionning ☐
- Iron ☐
- Ocean acidification ☐
- Ocean ventilation ☐
- Ocean circulation ☐
- Deep-sea export ☐
- Deep-sea burial ☐
- other: _____

Total number of state variables

Please precise: _____

Gas considered

Climatologically active

- CO2 ☐
- CH4 ☐
- N2O ☐
- CF6 ☐
- DMS ☐
- VOC (please precise) ☐
- Other _____

Non-climatologically active

- O2 ☐
- He ☐
- Ar ☐
- SF6 ☐
- Others _____

Physical Variables

- Temperature ☐
- Salinity ☐
- Velocity ☐
- Heat fluxes ☐
- Pressure ☐
- Insolation ☐
- Wind ☐
- Others _____

Ecological variables

- Macronutrients ☐
- Micronutrients ☐
- Please precise micronutrient: _____
- Bacteria ☐
- Algae ☐
  - How many classes ? _____
- Zooplankton ☐
  - Micro ☐
  - Copepods ☐
  - Krill ☐
- Top predators ☐
- DOM ☐
- POM ☐
- DOC ☐
- POM ☐
- DON ☐
- PON ☐
- DOP ☐
- POP ☐
- Other _____

GeoChemical variables

- DIC ☐
- Alk ☐
- pH ☐
- PIC ☐
- Others _____

Isotopes and proxies

- 3H ☐
- 13C ☐
- 14C ☐
- 15N ☐
- 234Th ☐
- Ba ☐
- He ☐
- Other _____

Figure 3 Overview of the survey of modeling activities (model type, parameters)

Validation		**Parametrisation**		**Availability of code**	
Data base	☐	Laboratory experiments	☐	Public	☐
Remote sensing	☐	Literature	☐	Upon request	☐
Dedicated fieldwork/survey	☐	Adjustment	☐	No	☐
Other	☐	Other	☐		

Solas Focus		**Activity**	
Focus 1: Biogeochemical interactions and feedbacks between Ocean and Atmosphere	☐	Activity 1.1: Sea-salt particle formation and transformations	☐
		Activity 1.2: Trace gas emissions and photochemical feedbacks	☐
		Activity 1.3: Dimethylsulphide and Climate	☐
		Activity 1.4: Iron and marine productivity	☐
Focus 2: Exchange processes at the air-sea interface and the role of transport and transformation in the atmospheric and oceanic boundary layers	☐	Activity 1.5: Ocean-atmosphere cycling of nitrogen	☐
		Activity 2.1: Exchange Across the Air-sea interface	☐
		Activity 2.2: Processes in the Oceanic Boundary Layer	☐
		Activity 2.3:Processes in the Atmospheric Boundary Layer	☐
Focus 3: Air-Sea Flux of CO2 and other Long-Lived Radiatively-Active Gases	☐	Activity 3.1:Geographic and Sub-Decadal variability of Air-sea CO2 fluxes	☐
		Activity 3.2: Surface Layer Carbon Transformations in the Oceans: Sensitivity to Global Change	☐
		Activity 3.3: Air-Sea Flux of N2O and CH4	☐

NOTES

Here are some explanations for the different items. If you feel something important is missing please let us know (A.Mouchet@ulg.ac.be or B.Delille@ulg.ac.be). If you are not sure of the appropriate answer to a question, we would appreciate that you contact us.

Realm	Please specify here the sphere of activity, the domain of the model
Type	Choose the property(ies) which does correspond best to the model. If in doubt give details in the "Other" box
Time scale	What timescale is your model primarily designed for?
Domain	Which domain of the Earth system does your model address?
Spatial scale	Global: ocean basin or province, atmosphere... Regional: continents, seas… Local: bay, forest, estuary...
Geographical location	Give the geographical namewhere your model is mainly used (e.g. Southern Bay of the North Sea…)
Application	Under this topic we mean the fundamental motivation for your modelling work
Solas Focus	Which SOLAS focus does correspond best to your model application and characteristics?
Activity	Which SOLAS activity (described on page 9 of Solas science plan) does correspond best to your model application and characteristics?
Gas considered	Please make a distinction between climatologically active gases and other gases.
Parametrisation	Are the model parameters derived from literature, from dedicated experiments or tuned so as to adjust the model results to data?

Figure 4: Overview of the survey of modeling activities (validation, availability and links to SOLAS)

Task 5 : SOLAS.be website

The design of the SOLAS.be (www.co2.ulg.ac.be/solas) website was the first activity achieved as the instrument was used by participants as the main communication mean. SOLAS.be is online since the 12th March 2006.

The different sections of the SOLAS.be website describe :

- The structure of the SOLAS Belgium cluster and contact points
- SOLAS Belgium activities.
- Upcoming meetings and other events relevant to SOLAS belgium
- Scientific Belgian achievements related to SOLAS
- Survey of Belgian modelling initiatives related to SOLAS
- A restricted area to promote exchange between SOLAS.be members.

Fig.5 shows, as an example the home page of the SOLAS.be web site

Figure 5: Homepage of the SOLAS.be website

A link to the SOLAS.be website appears on the SOLAS international website in the National network section.

A search with the main search engine (google, yahoo,…) with the "Solas Belgium" keywords return the SOLAS.be website as first hit. Mean frequentation of the site is 30 hits per month (see Table 1).

Summary (Solas)	6th June 2008 18:17:23

This stat is based on all traffic recorded to date.

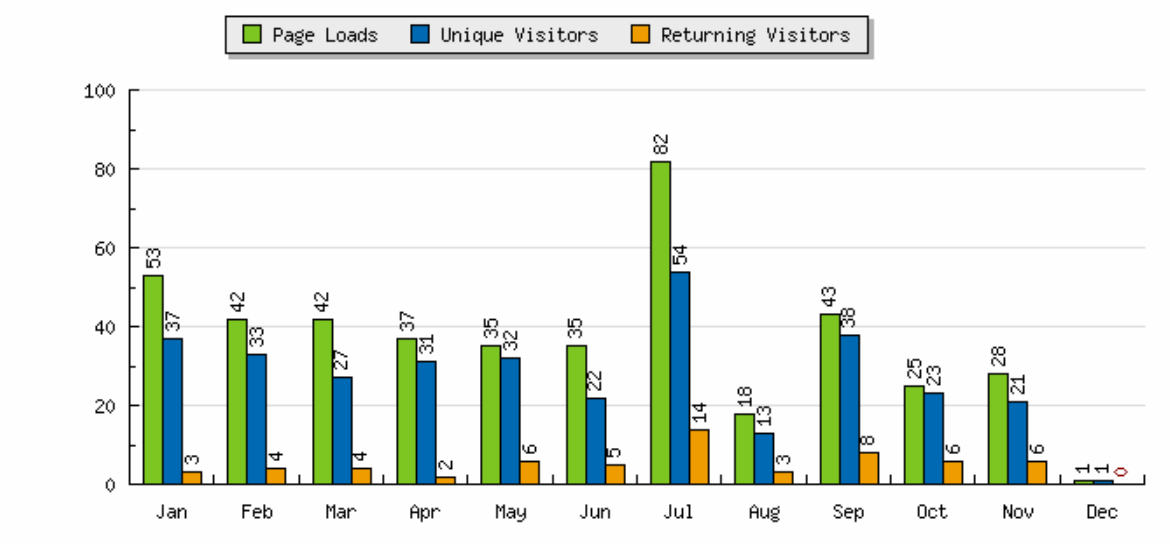

Figure 6: Website statistics in 2007 produced by Statcounter

	Page Loads	Unique Visitors	First Time Visitors	Returning Visitors
Total	**441**	**332**	**271**	**61**
Average	37	28	23	5

Month	Page Loads	Unique Visitors	First Time Visitors	Returning Visitors
Dec 2007	1	1	1	0
Nov 2007	28	21	15	6
Oct 2007	25	23	17	6
Sep 2007	43	38	30	8
Aug 2007	18	13	10	3
Jul 2007	82	54	40	14
Jun 2007	35	22	17	5
May 2007	35	32	26	6
Apr 2007	37	31	29	2
Mar 2007	42	27	23	4
Feb 2007	42	33	29	4
Jan 2007	53	37	34	3

Table 1: Details of website statistic produced by Statcounter

CONCLUSIONS

The funding by the Federal Science Policy Office of the SOLAS.be cluster as well as the Focus 1 secretary office of international SOLAS has greatly promoted the international visibility of SOLAS-related Belgian activities. Belgian research is now recognized by the SOLAS international community and several scientists are currently invited to international conferences and to join international research activities. The cluster provided also an opportunity for young researchers to insert their research at an international level.

Regretfully however the funding of both the cluster and the secretariat were limited to a two-year period which corresponds to the launch and implementation of joint activities without giving opportunities for their maintenance on the long term.