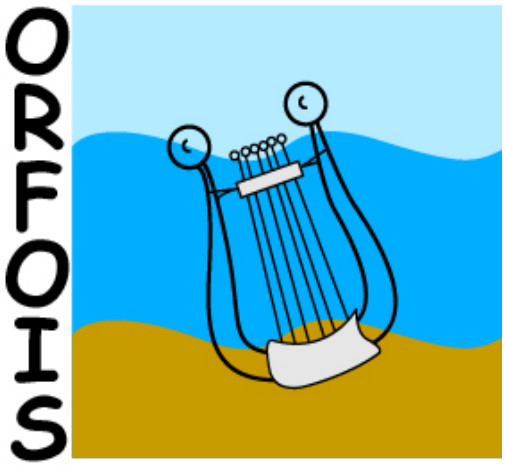
**RTD FP5 Project**

# "ORFOIS"

**"ORigin and Fate of biogenic particle fluxes in the Ocean and their Interactions with the atmospheric $CO_2$ concentration as well as the marine Sediment''**

## Contract No. EVK2−CT−2001−00100




## 1st Management Report for period: December 1, 2001 −May 31, 2002

**Sections included:**



## Co−ordinator: Christoph Heinze, NERI (DK)

## Project home page:
## http://www.pangaea.de/wdc−mare/Projects/ORFOIS/

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# 1. MANAGEMENT AND RESOURCE USEAGE SUMMARY, RELATED TO THE REPORTING PERIOD

## 1.1 Objectives of the reporting period

The first 6 months of ORFOIS were dedicated to efficiently start the project and to ensure that the tasks in WPs (WP = work package) No. 1−4, and 10 are tackled. In detail, the objectives of the workpackages within the reporting period were:

WP1. Data base compilation of observations:
To provide a synoptic multi tracer data base of existing observations (stocks and fluxes) in surface water, water column, sediment traps, sediments, early diagenesis, and sediment pore waters including level of data access, meta−documentation and referencing information (month 1−18).

WP2. Process parameterisations:
Development and calibration of 1−D biogeochemical model components of (1) a particle flux module which simulates particle interaction, modification and sinking speed (including a surface particle production formulation) and (2) an early diagenesis sediment model (including organic carbon chemistry). The model components simulate parts of the marine carbon, nitrogen and silicon cycles
(month 1−15).

WP3. Community model development:
To provide source codes for the model components on particle flux dynamics and early diagenesis which can easily be coupled to various existing 1−D models as well as 3−D Biogeochemical Ocean Circulation Models (BOGCMs) (month 1−15).

WP4. Compilation of model forcing fields:
To provide climatological ocean forcing fields for the two BOGCMs in order to prepare the preindustrial model run. Compilation of time dependent forcing fields of climate change scenarios (with and without sulfate aerosol effect) for the climate change BOGCM runs (month 1−6).

WP10. Coordination:
To ensure timely submission of deliverables, coordinate the project flow, compile the management and scientific reports for the EC, enhance communication between partners, organise work shops, keep in touch with the consultants, promote dissemination of results (month 1−36).

# 1.2 Scientific/Technical progress made in different work packages according to the planned time schedule

**Table: Diagram showing the carried out (O) and planned (X) activities.**

| *WP no.* | *Workpackage name* | *Year 1* | *Year 2* | *Year 3* |
|---|---|---|---|---|
| 1 | Data base compilation of observations | **O O X X** | **X X** | |
| 2 | Process parameterisations | **O O X X** | **X** | |
| 3 | Community model development | **O O X X** | **X** | |
| 4 | Compilation of model forcing fields | **O O** | | |
| 5 | BOGCM implementation | **X X** | **X X** | |
| 6 | Optimisation of the prognostic system | | **X X X X** | **X X X X** |
| 7 | Model application and demonstration | | **X X** | **X X X X** |
| 8 | Economic evaluation | | **X X** | **X X X X** |
| 9 | Dissemination | | | **X X X** |
| 10 | Coordination | **O O X X** | **X X X X** | **X X X X** |

**Table: Workpackage list.** (In the description of work, an error in table WPL for WP 8 must be corrected to be compatible with table WPM, which is correct: person months 9 instead of 8, start month 19 instead of 29. See below under 1.4.)

| *WP no.* | *Workpackage name* | *Lead participant* | *Person months, total as planned* | *Person months used up to now* | *Duration, month from/til* |
|---|---|---|---|---|---|
| 1 | Data base compilation of observations | 3 | 63 | 20 | 1−−18 |
| 2 | Process parameterisations | 4 | 73 | 28 | 1−−15 |
| 3 | Community model development | 1 | 17 | 6 | 1−−15 |
| 4 | Compilation of model forcing fields | 1 | 4 | 3 | 1−−6 |
| 5 | BOGCM implementation | 2 | 19 | 0 | 7−−18 |
| 6 | Optimisation of the prognostic system | 2 | 158 | 0 | 13−−36 |
| 7 | Model application and demonstration | 1 | 21 | 0 | 19−−36 |
| 8 | Economic evaluation | 5 | 9 | 0 | 19−−36 |
| 9 | Dissemination | 3 | 38 | 1 | 28−−36 |
| 10 | Coordination | 1 | 3 | 0.7 | 1−−36 |

**WP1. Data base compilation of observations:**

WP 1 shall provide a synoptic multi tracer data base of existing observations (stocks and fluxes) in surface water, water column, sediment traps, sediments, early diagenesis, and sediment pore waters including level of data access, meta−documentation, and referencing information. In order to archive the huge data collections that will become deliverables 1−4 and 18, the most powerful and leading edge instrument was chosen, namely the World Data Center for Marine Environmental Sciences (WDC−MARE) at the Institute for Marine environmental Sciences (MARUM), Bremen, Germany. WDC−MARE uses PANGAEA (Network for Geological and Environmental Data) as its Relational Data Base Management System, located at the Foundation Alfred Wegener Institute for Polar and Marine Research (AWI), Bremerhaven, Germany. The work on the data collections was taken up immediately on December 1, 2001, by N. Dittert, L. Corrin (both UBO) and D. Bakker (UEA).

By now the data base management part improved as follows: The first scientific groups providing data were contacted. A comprehensive list of variables was elaborated at the modellers' workshop on March 21−21, 2002, at NIOO, Yerseke, The Netherlands. An agreement was reached for collaboration between ORFOIS scientists (D. Bakker − UEA; N. Dittert − UBO, A. Dickson −Scripps Institute of Oceanography) and the World Data Centres for Marine Environmental Sciences (WDC−MARE, Bremen, Germany) and for Atmospheric Trace Gases at the Carbon Dioxide Information Analysis Centre (CDIAC, Oak Ridge, U.S.A.). The EU has agreed to the collaboration. ORFOIS scientists will work with A. Dickson on defining a uniform data format, as well as collect surface water $CO_2$ data from principal investigators and scattered data archives. The acquired $CO_2$ data will be contributed to the World Data Centre system. Physically, data shall be archived at WDC for Atmospheric Trace Gases and mirrored at the WDC−MARE. The international WDC system defends a consistent data policy that promotes data exchange among its data centres. The data managers of WDC for Atmospheric Trace Gases, A. Kozyr, and WDC−MARE, M. Diepenbroek, welcome this collaboration with ORFOIS. This approach will reinforce and concentrate ongoing efforts for an accessible global $p_{CO2}$ data inventory, which will benefit ORFOIS participants and the global $CO_2$ community.

NIOO sent an extensive dataset consisting of sediment−water oxygen consumption rates (SCOC) to N. Dittert. These data have been incorporated in the ORFOIS database.

The first data collections are archived and will be put online at URL http://www.wdc−mare.org once they are cross−checked by their Principal Investigators.

Work Package 1 strongly depends on the co−operation between Partner 3 and MARUM which is subcontractor of Partner 4, MPG−IMET. MARUM is responsible for the maintenance of WDC−MARE and a trouble−free (technical) interaction between PANGAEA, WDC−MARE, Partner 3, and the scientific community.

**WP2. Process parameterisations:**

The work in this task was started on 1−D modelling, 3−D modelling, experimental work and literature surveys. For the process parametersiations the role of partners was discussed and clarified in a modellers' meeting in Yerseke and subsequent smaller meeting (see also paragraph 1.4 below). A literature survey with respect to model implementation of disaggregation, aggregate composition (Si, $CaCO_3$) and decomposition has been carried out (MPG.IMET), and is still underway. Empirical

investigations suggest that decomposition of organic matter does not depend on size for the smaller aggregates in the size range 2−30 $mm^3$ (Ploug and Grossart, 2000; Ploug et al., 1999), but that it decreases with size for large, abyssal aggregates (Smith et al., 1998). Possible processes for aggregate
disruption/disaggregation are zooplankton feeding and movements (Dilling and Alldredge, 2000) and turbulent shear (Ruiz and Izquierdo, 1997). The available parameterisations are currently investigated for their feasibility for model implementation. Another focus is currently on the parameterisation of marine snow and its scaling properties and stickiness. A further literature review of available bibliography regarding biogeochemical processes involved in nutrient cycling in the oceanic coastal zones and continental shelves was carried out by NCMR. The incorporation of the nutrient biogeochemical processes at the land−ocean boundary in OGCM's requires an extensive survey of available qualitative and quantitative information such as the geographical distribution of these processes depending on climatic and oceanographic parameters. To this end, the efforts of NCMR are directed toward compiling the available information and deducing "source" and "sink" general values for nutrients at the land−ocean boundary. This information is will be used by NERI to develop a BOGCM parametersiation for the land−open ocean coupling.

NCMR has started their study on *reverse weathering* reactions and their connection to the oceanic cycling of $CO_2$. *Reverse weathering* is a general term that describes the formation of cation−rich minerals in oceanic sediments. These reactions involve uptake of major cations from seawater and an accompanying release of $CO_2$. The uptake of cations from seawater into newly formed minerals (in particular aluminosilicate minerals) and the resulting electrochemical imbalance is the key process that drives the release of $CO_2$ which maintains the alkalinity balance in seawater. The continental shelves and especially areas which receive massive amounts of clastic material from rivers have been identified as important sites of newly formed aluminosilicate minerals. On many occasions, in clastic depositional environments in the ocean margins there is a close relationship between the formation of biogenic silica in the water column and the delivery of biogenic silica to the ocean floor with the formation of new cation−rich aluminosilicate minerals through the transformation/reconstitution reactions of biogenic silica to cation−rich aluminosilicates during early diagenesis. The scientists of NCMR have initiated a study of ocean−margin depositional environments as sites of formation of *reverse weathering* products. The ultimate goal of this study is to derive estimates of the amounts (sinks) of major−cations and biogenic Si incorporated into *reverse weathering* products in these areas and consequently make an estimate of the magnitude of $CO_2$ released ($CO_2$ source) during reverse weathering reactions. To this end, mass balance calculation based on existing data sets from the literature as well as laboratory experiments are employed.

Laboratory experiments on the degradation of biogenic opal ($BSiO_2$) were carried out by UBO that suggest that $BSiO_2$ comprises distinct phases with discrete solubility and dissolution properties. The prevailing phase and the degree of coupling between surface waters and the sediment describe the $BSiO_2$ preservation in the sediment. Experiments will be repeated with refined resolution and different species to find proper parameterisations for the non−steady state model of $BSiO_2$ early diagenesis. A chemical engineer was hired by CEA−DSM who is in charge of the experimental work on calcium carbonate dissolution (CEA−DSM). A quality assessment of the analytical procedures is being completed by now.

CEA−DSM was up to now not able to attract a suitable candidate for this part of the 1−D modelling. A promising candidate from abroad would be available, and he will potentially be hired if no member state candidates can be found. The 1−D modelling efforts were coordinated between CEA−DSM and NIOO. The CEA−DSM contribution will be an improved parameterisation of early

diagenesis of biogenic opal and organic carbon within the modelling framework as provided by NIOO.
NIOO has investigated the relationship between water depth and several measures of benthic activity, including SCOC (see above under WP1). This will serve to constrain the particle flux dynamics. A paper is in preparation (Andersson et al., in prep.). NIOO has further started the work on an integrated 1−D modelling tool and to implement the 1−D model for particle dynamics as made available by MPG.IMET.

A 1−D FORTRAN source code of the phytoplankton aggregation model in the framework of a simple NPZD biogeochemical model has been prepared by MPG.IMET and handed to other partners. This is the starting point for implementing particle dynamics into the 1−D integrated model compiled by NIOO.

**WP3. Community model development:**

Next to the 1−D phytoplankton aggregation model mentioned in the above paragraph, experiments with an extended version of the aggregation model (Kriest, submitted) were realised. This model had shown a strong influence of the formation of detritus aggregates on subsurface nutrient distribution. A 1−D version of this model as FORTRAN code is in preparation. The Hamburg BOGCM has been prepared for implementation of aggregation subroutine. Implementation of basic version of aggregation subroutine, with respect to vectorisation, time step and model physics is underway. Parallel to implementation of model code, detailed model documentation (for later submission with community model) is written.

The HAMOCC/HOPE−C 3−D biogeochemical model was installed next to MPG.IMET also at NERI.
Implementation of the model was successful after a series of technical problems concerning the cooling of the LINUX workstation purchased. A plotting routine for the irregular grid of the model was started based on NCAR−Graphics and is available for maps by now (NERI).

**WP4. Compilation of model forcing fields:**

The monthly mean global IPSL forcing data set for the preindustrial climate (IPSL−CCM2 AOGCM run LF7) and an IPSL global warming scenario (run LF8, $CO_2$ greenhouse gas forcing only, IPCC SRES98 A2 scenario, 1860−2100, monthly means) were provided for use in the IPLS/ORCA and HOPE−C/HAMOCC models. For the HOPE−C/HAMOCC model climatological forcing data based on the ECMWF reanalysis with short−term variability accounting after Röske (2001) are available. The downloading of a full ocean model forcing data set of global warming scenario from the CERA data base (located at MPG.IMET) covering the period 1860−2049 (including sulfur aerosol and ozone forcing, scenario GSDIO of Roeckner et al., 1999) for the BOGCMs has been finished (NERI). Further, as an alternative, the download of second global warming scenario (without aerosol forcing, scenario GHG of Roeckner et al., 1999, following the IS92a IPCC scenario, 1860−2090) has been started. GSDIO and GHG data are available at 12 hour increments. The entire data set is of several tens of Gigabyte length. A universal FORTRAN algorithm for interpolation of arbitrarily distributed atmospheric forcing fields to arbitrary distributed ocean model grids was written (diffusion of "over ocean grid points" into "over land area" of the atmospheric model, subsequent interpolation using nearest n−neighbors method; the weighting metric − e.g., exponential with distance − can be specified individually if desired)

(NERI) in order to enable crosswise testing and use of the forcing fields for the BOGCMs during the model implementation phase.

**WP9. Dissemination.**

Though this WP formally starts in month 28 some very important work on it has been done already. A preliminary project related web page was established by UBO (N. Dittert). It will be updated at irregular time intervals and is available (at URL http://www.pangaea.de/wdc−mare/Projects/ORFOIS ). A project label was created (N. Dittert, UBO; D. Bakker, UEA). It is integral part of the web page and is available at URL http://www.pangaea.de/wdc−mare/Projects/ORFOIS/logo.jpg .

**WP10. Coordination:**

The project was initialised through a kickoff meeting organised by the coordinator. Consortium agreements on (1) the $CO_2$ data policy, (2) data policy within WDC−MARE (PANGAEA data base) (others than $pCO_2$ data) and (3) on ORFOIS material presented on the internet/world wide web were formulated. Minutes of the kickoff meeting and the model workshop in Yerseke were perpared and forwarded to the European Commission. This report was prepared.

**References:**

Andersson et al., in prep. Depth attenuation of organic matter mineralization in the global ocean).

L. Dilling and A.L. Alldredge, 2000. Fragmentation of marine snow by swimming macrozooplankton: A new process impacting carbon cycling in the sea. *Deep−Sea Res.* I, 47, 1227−1245

Kriest, I., submitted. Different parameterizations of marine snow in a 1D−model and their influence on representation of marine snow, nitrogen budget and sedimentation, submitted to *Deep−Sea Res. I.*

H. Ploug and H.−P. Grossart and F. Azam and B.B. Jørgensen, 1999, Photosynthesis, respiration, and carbon turnover in sinking marine snow from surface waters of Southern California Bight: implications for the carbon cycle in the ocean. *Mar. Ecol. Progr. Ser.* 179, 1−11.

H. Ploug and H.−P. Grossart, 2000. Bacterial growth and grazing in diatom aggregates: Respiratory carbon turnover as a function of aggregate size and sinking velocity. *Limnol. Oceanogr.*, 45 (7), 1467−1475.

Roeckner, E., L. Bengtsson, J. Feichter, J. Lelieveld, and H. Rodhe, 1999. Transient climate change simulations with a coupled atmosphere−ocean GCM including the troposheric sulphur cycle, *J. Clim.*, 12, 3004−3032.

Röske, F., 2001, An atlas of surface fluxes based on the ECMWF Re−Analysis− a climatological dataset to force global ocean general circulation models. MPI Report Ser. 323, MPI of Meteorology, Hamburg.

J. Ruiz and A. Izquierdo, 1997. A simple model for the break−up of marine aggregates by turbulent shear. *Oceanogr. Acta*, 20(4), 597−−605

K.L. Smith Jr.and R.J. Baldwin and R.C. Glatts and R.S. Kaufmann and E.C. Fisher, 1998. Detrital aggregates on the sea floor: Chemical composition and aerobic decomposition rates at a time−series station in the abyssal NE Pacific. Deep−Sea Res. II, 45, 843−−880.

## 1.3 Milestones and deliverables obtained

The sets of forcing fields for the unperturbed climate for the model spin−up and for global warming scenarios are available (deliverables 13 and 14). BOGCM implementation can start.

A project website is available (at URL http://www.pangaea.de/wdc−mare/Projects/ORFOIS ) which is part of deliverable 35.

This report (deliverable 37) is finished.

## 1.4 Deviations from the work plan or/and time schedule and their impact to the project

General remark: The project could be started successfully and the tasks/deliverables are under way as planned. A slight general delay of the project of about one month was caused by the extremely short notice concerning the start of the project. The coordinator of the project was informed on Friday, November 30, 2001, that the project would start on Saturday, December 1, 2001. Due to all the legal issues involved such as periods of notice associated with the hiring of personnel, the actual scientific work of the project started on January 1, 2002 (see letter on commencement of work from C. Heinze from December 14, 2001).

Change in responsibility for 1−D modelling tasks:
As clarified in our letter from May 2, 2002, the following internal redistribution of the responsibilities due to scientific reasons within ORFOIS were made. This redistribution is the result of a discussion between the participants within a modelling workshop held at NIOO, Yerseke, 21−22 March 2002,
and were clarified with Claus Brüning on a meeting in Amsterdam, April 17, 2002). The deliverables of the project will not be touched through this readjustment. The text of the DOW (p. 34) concerning Partner 7 (NIOO): ‘‘*NIOO's primary role is the development of the early diagenetic sedimentary model (WP 2) and its conversion into a community model (WP 3) under assistence of NERI and LSCE.*
*During the optimisation (WP 6), NIOO will revise and retune the 1−D version of the diagentic module with the data as collated by UBO and NCMR in WP 1.For the sedimentary process parameterisations NIOO will jointly work with all other participants, in particular, however, with NERI, LSCE, UBO, and NCMR.*’’ is converted to: ‘‘*NIOO's primary role is the development of the coupled 1−D model (WP 2) and its conversion into a community model (WP 3) under assistence of NERI and LSCE. During the optimisation (WP 6), NIOO will revise and retune the 1−D model module with the data as collated by UBO and NCMR in WP 1.*
*For the process parameterisations NIOO will jointly work with all other participants, in particular, however, with NERI, LSCE, UBO, and NCMR.*’’
The responsibilities for the development of the community sediment model will be taken over by participants 1 (NERI), 2 (LSCE), and 4 (MPI−MET). All ORFOIS participants were be informed about this change through email.

An obvious error in table WPL of the description of work was removed for compatibility with table WPM, which is correct: person months 9 instead of 8, start month 19 instead of 29. The coordinator informed partner 5 about this, agreement was achieved. (The correction does neither affect the program flow nor the deliverables.)

# 1.5 Co−ordination of the information between partners and communication activities (such as organised meetings, conference attendance, co−operation with other projects/networks)

**ORFOIS workshops_meetings:**

A **project kick−off meeting** was held in Copenhagen, Denmark, January 17−18, 2002, were scientific and organisational initial tasks were discussed. The meeting was organised and hosted by NERI. Participants: Christoph Heinze, Marion Gehlen, Iris Kriest, Axel Michaelowa, Jørgen Bendtsen, Karline Soetaert, Claus Brüning, Richard Tol, Aude Leynaert, Nicolas Dittert, Olivier Ragueneau, Henrik Andersson, Dorothee Bakker, Isabelle Dadou.
Minutes are available on the ORFOIS website.

A **workshop on modelling** within ORFOIS was carried out at NIOO, Yerseke, Netherlands, March 21−22, 2002, in order to coordinate the different modelling aspects and to clarify details of the procedure. The meeting was perfectly organised and hosted by Karline Soetaert and Jack Middelburg.
Participants: Karline Soetaert, Jack Middelburg, Henrik Andersson, Christoph Heinze, Jørgen Bendtsen, Marion Gehlen, Laurent Bopp, Olivier Aumont, Philippe Pondaven, Iris Kriest, Ernst Maier−Reimer, Isabelle Dadou.
Minutes are available on the ORFOIS website.

**Further project related meetings:**

Meeting in order to discuss the forthcoming non−steady−sate model of BSiO2 early diagenesis, Gif−sur−Yvette, France, May 15, 2002. Participants: O. Ragueneau (UBO), Christophe Rabouille (CEA−DSM), and M. Gehlen (CEA−DSM).

Meeting on coordination of research on pelagic dissolution of marine carbonate, Brussels, Belgium, April 18, 2002. Participants: M. Gehlen (CEA−DSM), Lei Cou (Univ. Lib. Bruxelles).

International $_{CO2}$ panel meeting, Honolulu (HW, USA), February 10, 2002. ORFOIS attendants: D. Bakker, A. Watson, N. Dittert.

**Conference attendance, presentations (posters/talks):**

Talks:

Bakker, D.C.E., A plea for international collaboration towards an uniform surface water $pCO_2$ inventory. ORFOIS kick off meeting. Copenhagen, Denmark. 17−18/01/2002.
Bakker, D.C.E. Meetings with international colleagues at Oceanology International. London, U.K., 06/03/2002.
Bakker, D.C.E. Planning meeting for a proposal on a Centre for Observation of Air−Sea Interactions and Fluxes (CASIX). London, U.K., 19/04/2002.
Gallinari, M, Ragueneau, O. G., DeMaster, D. J., and H. E. Hartnett, Bentho−pelagic coupling and biogenic silica early diagenesis: two case studies in the abyssal Northeast Atlantic and in an

Antarctic Continental Shelf, AGU Ocean Sciences Meeting, Honolulu, HW, USA, February 2002.

Ragueneau, O. G., N. Dittert, C. Heinze, and L. Corrin, Improving biogenic silica as a paleoproductivity proxy: A global study of Si and C decoupling in the World Ocean, AGU Ocean Sciences Meeting, Honolulu, HW, USA, February 2002.

Watson, A.J., Piecing surface water $p_{CO2}$ data together. Presentation of the collaboration between ORFOIS, Dr. Andrew Dickson WDC−MARE and CDIAC. SCOR−IOC $CO_2$ panel. Hawaii, U.S.A., 09/02/2002.

Watson, A.J. and D.C.E. Bakker. Initiative for an Integrated Project on the Marine Carbon Cycle (EU FP6). Amsterdam, The Netherlands, 17/04/2002.

Posters:

Dittert, N., M. Diepenbroek, and H. Grobe, Archiving, publishing and distributing of data sets from global change rrch using a scientific information system (PANGAEA) and a data center (WDC−MARE) that both are available online, AGU Ocean Sciences Meeting, Honolulu, HW, USA, February 2002.

Heinze, C., M. Gehlen, O. Ragueneau, E. Maier−Reimer, R. S. J. Tol, P. Michalopoulos, K. Soetaert, and D. Bakker, ORFOIS − how does the fate of biogenic particles influence the surface ocean $pCO_2$ ? Dansk Havforskermøde (Danish Ocean Researchers' Meeting, Aarhus, Denmark, January 2002.

**Visiting scientist:**

Dr. Ludger Mintrop (Institut für Ostseeforschung, Warnemünde, Germany), database manager of the CARINA project (Carbon Dioxide in the Atlantic Ocean) visited UEA on 8 March 2002 (see also http://www.ifm.uni−kiel.de/fb/fb2/ch/research/carina/data_inventory.htm ). Dr. Mintrop, Dr. Bakker, Dr. Nathalie Lefèvre (UEA, EU CAVASSOO project) and Prof. Watson discussed possibilities for collaboration between ORFOIS and CARINA, as well as a wide range of issues related to data management and data policy.

**Cooperation with other projects/networks:**

Several ORFOIS participants are also engaged in the EU FP5 RTN Si−WEBS (coordinated by O. Ragueneau, UBO), which will probably start in autumn 2002. Linkages with ORFOIS (e.g., the coastal sea − open ocean transition) were discussed during an Si−WEBS planning meeting, March 19, 2002, Paris. ORFOIS attendants: O. Ragueneau (UBO), A. Leynaert (UBO), P. Micholopoulos (NCMR), C. Heinze (NERI).
ORFOIS members are taking part in an expression of interest for a European Network on Excellence ECCO (Ecosystems, biogeochemical Cycles, and global Change in the anthropocene Ocean) and attended the planning meeting, April 10, 2002, Southampton, UK, to ensure a linkage of ORFOIS results to this network. ORFOIS attendants: M. Gehlen (CEA−DSM), C. Heinze (NERI), N. Dittert (UBO).

The lead of an expression of interest for an Integrated Project on the Marine Carbon Cycle is being taken by C. Heinze (project MARCASSA: Marine carbon sources and sinks assessment). ORFOIS members and consultants have attended the planning meeting in Amsterdam, Netherlands, April 17,

2002 (M. Gehlen, CEA−DSM, C. Heinze, NERI, E. Maier−Reimer, MPG.IMET, O. Aumont, LODYC). ORFOIS results will be merged with this project, if it will be funded. MARCASSA is directly linked through the terrestrial/atmospheric IP cluster CARBOEUROPE through an expression of interest for a European Network of Excellence in Global Aspects of the Carbon Cycle (ENEGACC) where ORFOIS is represented through NERI (C. Heinze) as participant.

NERI (C. Heinze, Trine Christiansen) participates in an application for a Nordic Centre of Excellence under the Pilote Programme (organised by Academy of Finland) "Nordic Centre for Pelagic Climate Coupling" (coordinated by Th. Kjørboe, Danish Institute for Fisheries Research, Charlottenlund, DK) where project results will be evaluated and used in a more biological context. This opens a door to disseminate and exploit research being carried out in ORFOIS.

NERI (Jørgen Bendtsen, in cooperation with H. Drange, Nansen Center, Bergen, Norway) has submitted a proposal on Modeling $CO_2$ sequestration in the deep ocean (proposal for Nordic Energy Research 2003−2006) building on ORFOIS tools and deliverables.

## 1.6 Difficulties encountered at management and co−ordination level and proposed/applied solutions

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*Roskilde, May 30, 2002*

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*(Christoph Heinze)*

## Appendix A:

## Updated version of "Participants Information" − Table:

| *No.* | *Institution* | *Address* | *PI name* | *Phone/fax* | *email* |
|---|---|---|---|---|---|
| 1 | National Environmental Research Institute **NERI** | Frederiksborgvej 399, P.O.Box 358, DK−4000 Roskilde, DENMARK | Dr. Christoph Heinze | P +45 46301862 F +45 4630 1114 | che@dmu.dk |
| 2 | Laboratoire des Sciences du Climat et de l'Environnement, CEA DSM **CEA−DSM** | C.E.N. Saclay − Orme des Merisiers Bât. 709, F− 91191 Gif−sur−Yvette CEDEX, FRANCE | Dr. Marion Gehlen | P +33 1 69088672 F +33 1 69087716 | gehlen@ lsce.saclay.cea.fr |
| 3 | Laboratoire des Sciences de l'Environnement Marin (LEMAR), UMR CNRS 6539 **UBO** | Institut Universitaire Européen de la Mer (IUEM), Place Nicolas Copernic, Technopôle Brest−Iroise, F−29280 Plouzané, FRANCE | Dr. Nicolas Dittert | P +33 298 498673 F +33 298 498645 | nicolas.dittert @univ−brest.fr |
| 4 | Max Planck Institute of Meteorology **MPIG.IMET** | Bundesstrasse 55, D−20146 Hamburg, GERMANY | Dr. Ernst Maier−Reimer | P +49 40 41173233 F +49 40 41173298 | maier−reimer@ dkrz.de |
| 5 | Hamburg University, Research Unit Sustainability and Global Change, Centre for Marine and Climate Research **Uni−HH** | Troplowitzstrasse 7, D−22529 Hamburg, GERMANY | Dr. Richard S.J. Tol Michael Otto Professor of Sustainability and Global Change | P +49 40 428387007 P +49 40 428387008 F +49 40 428387009 | tol@dkrz.de |
| 6 | National Center for Marine Research Institute of Oceanography **NCMR** | 14 Flemming St., GR−16672 Vari, GREECE | Dr. Panagiotis Michalopoulos | P +30 10 9656046 F +30 10 9653522 | pmichalo@ fl.ncmr.gr |
| 7 | Netherlands Institute of Ecology, Centre for Estuarine and Marine Ecology **NIOO** | Korringaweg 7, P.O. Box 140, NL− 4400 AC Yerseke, NETHERLANDS | Dr. Karline Soetaert | P +31 113 577300 F +31 113 573616 | soetaert@ cemo.nioo.knaw.nl |
| 8 | University of East Anglia, School of Environmental Sciences **UEA** | University Plain, NR4 7TJ Norwich, UNITED KINGDOM | Dr. Dorothee Bakker | P +44 1603 592648 F +44 1603 507719 | D.Bakker@ uea.ac.uk |
| | *Subcontractor to participant 4:* Centre for Marine Environmental Sciences (**MARUM**) , University of Bremen | Postfach 330440, D−28359 Bremen, GERMANY | Dr. Michael Diepenbroek | P +49 421 218 7765 | mdiepenbroek @pangaea.de |

## Appendix B: Personnel

**Table: Personnel working in ORFOIS.**

| *Par−tici−pant No.* | *Name* | *position* | *% of full time employ−ment paid by project* | *Begin of employment* | *End of employment* |
|---|---|---|---|---|---|
| 1 | Christoph Heinze | Senior scientist | 41.6 | Dec 1, 2001 | − |
| 1 | Jørgen Bendtsen | Researcher | 100 | Feb 1, 2002 | − |
| 2 | Marion Gehlen | Senior scientist | 20 | Dec 1, 2001 | − |
| 2 | Christophe Rabouille | Senior scientist | 17 | Dec 1, 2001 | − |
| 2 | Benoit Thiebault | Chem. engineer | 100 | Apr 1, 2002 | − |
| 3 | Lydie Corinne | Engineer | 50 | Mar 1, 2002 | − |
| 3 | Nicolas Dittert | Researcher | 100 | Dec 1, 2001 | − |
| 3 | Morgane Gallinari | Post doc | 100 | Dec 1, 2001 | May 31, 2002 |
| 3 | Aude Leynaert | Senior scientist | − | − | − |
| 3 | Philippe Pondaven | Senior scientist | − | − | − |
| 3 | Olivier Ragueneau | Senior Scientist | − | − | − |
| 4 | Iris Kriest | Researcher | 100 | Feb 1, 2002 | − |
| 4 | Ernst Maier−Reimer | Senior scientist | − | − | − |
| 5 | Richard S. J. Tol | Professor | − | − | − |
| 6 | Panagiotis Michalopoulos | Scientist | 85 | Mar 3, 2002 | − |
| 6 | Christos Anagnostu | Senior scientist | 15 | Jan 1, 2002 | − |
| 6 | Aristomenis Karageorgis | Scientist | 15 | Jan 1, 2002 | − |
| 6 | Maria Taxiarxi | Technician | 20 | Jan 1, 2002 | − |
| 6 | Panagiotis Traxalakis | Technician | 20 | Jan 1, 2002 | − |
| 7 | Henrik Andersson | PhD student | 100 | Feb 1, 2002 | Apr 1, 2002 |
| 7 | Jasper van Delft | Comput. Progr. | 100 | Jan 1, 2002 | May 1, 2002 |
| 7 | Jim Greenwood | Post doc | 100 | May 1, 2002 | − |
| 7 | Karline Soetaert | Senior Scientist | − | − | − |
| 8 | Dorothee Bakker | Sen. Res. Assoc. | 100 | Jan 1, 2002 | − |
| 8 | Andy Watson | Professor | − | − | − |

## Appendix C: Summary of the amounts transferred to the contractors by the co−ordinator

**Table: Advance amounts of EU funding transferred by the co−ordinator NERI to the single participants.**

| *Part.−No.* | *Receiving institution* | *Amount transferred by NERI [EUR]* |
|---|---|---|
| 1 | NERI | 129709 |
| 2 | CEA−DSM | 128526 |
| 3 | UBO | 153040 |
| 4 | MPG.IMET | 132048 |
| 5 | Uni−HH | 27464 |
| 6 | NCMR | 75100 |
| 7 | NIOO | 94080 |
| 8 | UEA | 108891 |