Project ORFOIS Contract No. EVK2-CT-2001-00100
"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"

Minutes of the kickoff meeting held in Copenhagen at the Ministry of Justice, January 17-18 2002

Rapporteur: Christoph Heinze

Agenda:

Thursday, January 17, 2002:

13:00-13:30	greetings, adjustment of agenda
13:30-14:00	summary on the project goals, milestones, and deliverables (by the coordinator)
14:00-15:00	participants' views on where to start from practically, (participants 1-4, ca. 15 minutes each) participant 1 (leader of WPs 3, 4, 7, 10) participant 2 (leader of WPs 5, 6) participant 3 (leader of WPs 1, 9) participant 4 (leader of WP 2)
15:30-16:30	participants' views on where to start from practically (participants 5-8, ca. 15 minutes each) participant 5 (leader of WP 8) participant 6 participant 7 participant 8
16:30-17:30	consultants' advice on how to carry out work and to shape the deliverables, expectations ?
19:00	joint dinner (hosted by NERI)

Friday, January 18, 2002:

09:00-10:30	general discussion on procedure and material presented on the day before
11:00-12:00	focus on the first workpackages and related deliverables to be provided during the next months, summary
12:00-12:30	technical details to make project flow easy, wrapping up
13:00	end of meeting

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Summary:

The meeting was dedicated to initialise the concrete scientific work in ORFOIS. On the first day, the suggestions of the participants on where to start from were presented, difficulties were identified, and solutions were discussed. On the second day, action items were defined and guidelines for smooth project flow were given.

Project goals:

Main scientific objectives are to:

- **Goal 1.** Identify and quantify globally the mechanisms underlying the transformation of biogenic particles to dissolved substances within the ocean water column in order to predict correctly surface ocean carbon dioxide sources and sinks.
- **Goal 2.** Develop a refined particle flux model for operational use in ocean general circulation models which realistically describes particle dynamics in the water column, deposition of material to the sediment, and the interaction with the carbon dioxide partial pressure (pCO_2).
- **Goal 3.** Provide a global closed carbon and nutrient budget for modern (preindustrial) conditions including the water column sediment interaction.
- **Goal 4.** Estimate the changes in CO_2 sea surface source sink patterns and vertical redistributions of carbon as well as nutrients for future global change, climate change as well as carbon sequestration scenarios including the associated potential economic impacts.

Main technological objectives are to:

- Establish publically available community models for particle flux dynamics in the water column and early sediment diagenesis which are suited for use in general circulation ocean climate models.
- Establish data bases for marine carbon and nutrient cycling which will be easily publically available.

Deliverables in chronological sequence:

DL DELIVERABLE LIST, PART I (continued on next page)				
Deliver–able No.	Deliverable title	Deliverable date, month	Nature	Dissemination level
46	Workshop 1 (kick-off)	1	Re	RE
37	management report to the EC after 6 months	6	Re	PU
13	Preindustrial atmospheric forcing fields for BOGCM I and II	6	Da	PU
14	Atmospheric forcing fields for anthropogenic climate change scenarios (for BOGCM I and II)	6	Da	RE
43	scientific report to the EC after 12 months	12	Re	PU
38	management report to the EC after 12 months	12	Re	PU
47	Workshop 2 (implementation and optimisation)	12	Re	RE
4	Data extraction techniques	15	Me	PU
5	Parameterisation of particle flux dynamics (sinking velocity, coagulation, disaggregation)	15	Me	RE
6	Parameterisation of the dissolution rate of POC, $CaCO_3$, and biogenic silicate in the water column and in the sediment	15	Me	RE
7	Parameterisation of the conversion of biogenic silicate to other mineral phases in the sediments.	15	Me	RE
7a	Parameterisation of $CaCO_3$ dissolution.	15	Me	RE
8	1-D ecological/particle flux model	15	Me	RE
9	1-D sediment early diagenesis model	15	Me	RE
10	Coupled version of 1-D biogeochemical/particle flux and sediment model	15	Me	RE
11	particle flux dynamics module ready for coupling to BOGCM (community model)	15	Me	RE
12	sediment module ready for coupling to BOGCM (community model)	15	Me	RE
1	Storage of data sets in online data base	18	Da	CO
2	CD-ROM with copy of online data base (basic version)	18	Da	PU
3	Project home page with references to the data sets (basic version)	18	Da	PU
15	Basic BOGCM I version with community model components running for preindustrial conditions	18	Me	RE
16	Basic BOGCM II version with community model components running for preindustrial conditions	18	Me	RE
17	Basic shelf regime parameterisation (BOGCM I)	18	Me	RE
39	management report to the EC after 18 months	18	Re	PU
24	Distribution of surface ocean CO_2 sources and sinks and oceanic biomass for the preindustrial ocean	24	Si	PU
40	management report to the EC after 24 months	24	Re	PU
44	scientific report to the EC after 24 months	24	Re	PU
48	Workshop 3 (application)	24	Re	RE
36	Invitation to final project workshop	33	Re	PU
41	management report to the EC after 30 months	30	Re	PU
	(continued on next page)			

DL DELIVERABLE LIST, PART II (continuation from previous page)				
Deli-verable No.	Deliverable title	Deli-verable date, month	Nature	Diss-emina-tion level
18	Optimised data sets of observations including data coverage in key regions for BOGCM tuning, final CD-ROM with data bases	36	Da	PU
19	Optimised process parameterisations implemented within the community model components	36	Me	PU
20	Optimised community model source codes which can be coupled in a user friendly way to other models (1-D, 3-D)	36	Me	PU
21	Optimised preindustrial physical ocean forcing fields which are consistent with the ocean model physical fields	36	Da	PU
22	Comparison between BOGCM I, BOGCM II, and observations	36	Si	PU
23	List of publications on the prognostic system	36	Re	PU
25	Closed carbon and nutrient balance for the preindustrial ocean including marine sediments	36	Si	PU
26	Distribution of surface ocean CO_2 sources and sinks and oceanic biomass for greenhouse gas induced warming conditions	36	Si	PU
27	Distribution of surface ocean CO_2 sources and sinks and marine biomass under Fe-fertilisation of HNLC regions	36	Si	PU
28	Distribution of surface ocean CO_2 sources and sinks and sediment coverage under deep-ocean disposal of CO_2	36	Si	PU
28a	Distribution of surface ocean CO_2 sources and sinks and sediment coverage for a glacial ocean scenario	36	Si	PU
29	List of publications on application of the prognostic system	36	Re	PU
30	Estimates of economic impact of changes in sea surface CO_2 source/sink patterns and changes in marine biomass	36	Si	PU
31	List of publications on economic evaluation	36	Re	PU
32	Public data sets including user manual	36	Re	PU
33	Public model source codes and model data	36	Re	PU
34	Presentation of the main steps and results for non-specialists	36	Re	PU
35	Electronic (online) presentation of the main steps and results	36	Re	PU
42	management report to the EC after 36 months	36	Re	PU
45	scientific report to the EC after 36 months	36	Re	PU
49	Workshop 4 (finish, open to the public)	36	Re	PU

Participants' views on where to start from practically:

Christoph Heinze, NERI:

- WP 3 Community model development:
  - The ClearCase installation at MPI/HH is under way. The software allows systematic source code archiving of different model cycles. Model developers within ORFOIS will get a user account on a SUN workstation at MPI where ClearCase is available.
  - A common nomenclature for parameters (e.g., half saturation constants) and variables (e.g., phosphate concentration in the water column) has to be found.
  - Interfaces between the different models have to be created.
  - Details will be discussed on a separate modellers' workshop.
- WP 4 Compilation of model forcing fields:
  - The following variables are needed as physical input fields input for the Biogeochemical Ocean General Circulation Models (BOGCMs), namely the HOPE-C model (MPI HH/NERI) and the IPSL model (LSCE): 2m-T, 2m-dew point, precipitation, short wave radiation, windstress, wind velocity, topography, (landuse,) 3D grid configuration.
  - At present both models are forced from the ECMWF reanalyses (e.g.: Frank Röske, 2001, An atlas of surface fluxes based on the ECMWF Re-Analysis - a climatological data set to force global ocean general circulation models, Max-Planck-Institut für Meteorologie, Report No. 323).
  - For the future greenhouse gas scenarios appropriate reference runs as well as anthropogenic disturbance runs hace to be reloaded from the CERA data base at the Modelle&Daten-group at MPI HH. Anomalies have to computed to be added to the climatological forcing later on.
  - Glacial: Arne Winguth (Univ. of Wisconsin) has to be consulted for forcing field differences modern/glacial (especially for the fresh water forcing).
- WP5 BOGCM implementation:
  - As starting point, the basic BOGCM I run of HOPE-C in the global version of Stephanie Legutke (Modelle&Daten-group MPI HH) with equatorial refinement will be used (poles over Greenland and Antarctica, forcing from reanalyses, dynamcis can run off/online from biogeochemistry, phytoplankton, zooplankton, microbial loop, C, N, P, Si, O cycles, water column, bioturbated sediment - down to denitrification).
  - Test runs at NERI on Linux PCs + Portland FORTRAN and the 128 processor sun cluster at the Danish Technical University where carried out.
  - Graphicssoftware has to be modified (netCDF, NCAR).
  - Details will be discussed at a separate modellers' workshop.

Marion Gehlen, LSCE:

- WP 2 Process parameterisations:
  - New $CaCO_3$ dissolution laboratory experiments are under way.
  - It is important to capture realistic aggregates for the experiments.

  - Attention: A literature survey on POC remineralistion (dependency on oxygen concentration and other factors) has to be carried out within ORFOIS in order to fill the gap between explicit experimental work on $CaCO_3$ and opal.

- WP5 BOGCM implementation:

  - The IPSL model in the version as run by Olivier Aumont will be used, including the PISCES modul with 2 different phyto-/zooplankton size classes.
  - The coupling of the HOPE-C sediment model to the IPSL model will be carried out soon.

Nicolas Dittert and Olivier Ragueneau, IUM:

- WP 1 Data base compilation of observations:

  - The PANGAEA information system as run by the Alfred Wegener Institute, Bremerhaven, Germany, will be used as data base system; the World Data Center for Marine Environmental Sciences as run by the MARUM group, Bremen, Germany, will be used as the data distribution system.
  - A set of variables (with their common units) to be collected has to be defined jointly.
  - It is suggested to concentrate first on those variables that are essential for particle dynamics. Scope of variables might be extended during the project. Input must come from the entire ORFOIS group to this point.

- WP 2 Process parameterisations:

  - Samples must cover a representative spectrum of reactivities for opal dissolution laboratory experiments.
  - Those parameters must be identified and measured which serve a sa constraint for teh opal deposition flux strength to the sediment.

Iris Kriest, MPI HH:

- WP 2 Process parameterisations:

  - An introduction to the aggregation model was given (e.g. see also:
    Kriest, I., and G. T. Evans, 1999, Representing phytoplankton aggregates in biogeochemical models, *Deep-Sea Research*, Part I, 46(1), 1841-1859; and
    Kriest, I., and G. T. Evans, 2000, A vertically resolved model for phytoplankton aggregation, *Proc. Indian Acad. Sci. (Earth Planet. Sci.)*, 109, 453-469).
  - Besides sediment trap data also direct video camera recordings should be used for validation of particle sinking speeds.
  - Implementation into BOGCMs including different functional groups (such as POC, $CaCO_3$, and oal producers) and differential stickiness should be discussed in a separate modellers' workshop.

Richard Tol, Uni HH:

- WP 8 Economic evaluation:

  - The principal tasks were presented. Basic model approaches are available which can be modified for the problems to be tackled.

- Claus Brüning suggested to omit the biomass evaluation due to too large assumptions which would have to be made between phytoplankton and exploitable biomass. A decison about this will be made after a re-evaluation of the assumptions by the project members.
- The question of negotiable oceanic CO_2 sources and sinks within the Kyoto protocol fulfilment was presented. This could make ORFOIS a hot political topic.
- *After the meeting Richard asked about test fields for the econmic evaluation. We will try to provide them after the modellers' meeting.*

Karline Soetaert, NIOO:

- WP 2 Process parameterisation:
  - An overview on the early diagenesis model approach was given.
  - An economic spin up/sediment initialisation method was presented which will be valuable for the "slow" BOGCMs such as HOPE-C and IPSL-BOGCM.
  - Difficulties in correct simulation of the sedimentary P cycle were pointed out. Here, probably simplifying assumptions will have to be made. This will also be discussed in a separate modellers' meeting.
  - Concerning code homogenisation and coupling of different model parts: At the moment, the NIOO sediment model is written in FORTRAN95. It could probably without greater difficulty be re-transformed to FORTRAN90 if necessary. Mapping of variables as interfaces between different modules of the BOGCM/early diagensis model set up will be facilitated through use of the new FORTRAN versions.

Dorothee Bakker, UEA:

- WP 1 Data base compilation of observations:
  - A comprehensive data source survey for potential pCO_2 sea surface data sets was presented.
  - A decision has to be made, whether we will set up our own pCO_2 data base, or whether we will share a data base with other organisations. One option would be shared use of the CDIAC data base in Oak Ridge, TN. Legal issues such as property rights and US/EU cooperation would have to be clarified. This decision incolves also the question of data formatting, mutual benefits and a general data policy within the project.
    News: A mirror site of the CDIAC pCO_2 data archive will be established at the World Data Center for Marine Environmental Sciences as run by the MARUM group, Bremen. A consortium agreement on corresponding property rights will be signed by all participants.

Consultants' advice:

Axel Michaelowa, HWWA:

- The geographical coverage of the results should be lareg enough to tackle the political issues associated with the Kyoto protocol (near ocean states might bring in oceanic CO_2 sinks/sources into the fulfilment negotiations).
- Who competes on the field of biogeochemical modelling (Europe/US, Princeton University/GFDL) ?

- For economic and political conclusions data quality flags are important.
- Data exchange should be easy (property rights should be clarified).

Isabelle Dadou, LEGOS:

- The question on how to model PON was raised.
- How will the coupling be done between: particle reactivities, particle properties, and qualities ? Will an entire spectrum of particles and properties be considered ?
  Comment from Karline: 2 size classes and 2 reactivity classes might be sufficient at first (fast and slowly reacting particels).
  Comment from Iris: Discrete and aggregated particles have different properties (lab experiments !).
  Comment form Marion: Necessary literature review on POC reactivity was emphasised.

EC project officer's advice:

Claus Brüning, EC:

- Within the 6^{th} framwork, larger integrated projects will be favored. For the atmosphere, such an integrated project is under its way. For the ocean it is still diffuse. A joint meeting for all ocean carbon cycle project coordinators in Brussels is encouraged.
- An ORFOIS logo would be helpful, e.g., for dissemination.

Action items in order to start work on work packages:

- Modelling:
  A meeting of the modellers within ORFOIS will held as early as possible in order to coordinate details of the work. The meeting will tentatively be held in Yerseke, Netherlands during 21-22 March 2002. Details will be arranged through a separate invitation to the ORFOIS modellers:
  Christoph Heinze, Jørgen Bendtsen (NERI)
  Marion Gehlen, Laurent Bopp, Olivier Aumont, Christophe Rabouille (LSCE)
  Philippe Pondaven (IUEM)
  Iris Kriest, Ernst Maier-Reimer (MPI HH)
  Karline Soetert, Henrik Andersson (NIOO)
  Others are welcome, but: Please note, that this will be in large part a technical meeting on how to get things going not a general modelling symposium.
  On the agenda of that meeting will be:
  - Interface between the modules.
  - Reduced 3-D models as 1-D models.
  - The P cycle in the sediemnt (what is the most efficient simplification ?).
  - How to use ClearCase ?
  - Ernst's expertise on feasibility and other things.
  - Final choice of BOGCM resolution in space and time, appropriate choice of the NIOO sediment model configuration.

- Data base of observations:
  - A focus will be on multi tracer data sets at selected key regions. These key regions as ensemble should be representative for the global ocean.
    These data sets should be the basis for process parameterisations.
    Priorities should be given to those variables/parameters, which would verify the 3-D-particle-dynamics best, e.g.: particle fluxes (Antia, Lampitt, direct video observations), O_2-exchange between water column and sediment, synoptic data sets covering the water column and sediment simultaneously.
  - Suggestions for key variables and desired units are welcome from all participants.
  - Suggestions for sites are welcome from all participants.
  - CDIAC-data base use for pCO_2: Legal issues have to be clarified. (*Done meanwhile.*
- Experimental laboratory work:
  - It is essential to establish the different behavior in solubility, dissolution kinetics, and other properties for (a) aggergates as well as (b) "single particle species".
  - Literature review on POC reactivity.
  - Prioririty for parameters to be measured from lab experiments if possible:
    rate limiting factors
    stickiness
    specific surface area
    how are particles falling apart ? (specific change of surface)
    properties of aggregates
- General project work:
  - Legal project agreements will be set up (by the coordinator or a designated person) on:
    1. Data policy within the project.
    2. Contents of the project website.
  - Project website(s) will be established at http://www.pangaea.de/Projects/ORFOIS/
  - An ORFOIS "Intranet" or ftp server will be established (not accessible by the public) in order to:
    1. Exchange the status of the models and the data base.
    2. Exchange the status of the data collections by predefined retrieval tools.
    3. Information exchange (on such as key papers, which should be read by each participant, key information about the partners' work, tools etc.).
  - Website and ORFOIS "Intranet" could be upgraded for the publication of technical reports (part of dissemination) if agreeable for all.
  - General discussions are proposed to be done via mailing list. (The mailing list orfois@dkrz.de is still in use; new mailing lists are being established at NERI, more on that soon.)
  - An ORFOIS logo has to be found. Price: 1 bottle of Mumm extra dry.

Guidelines on easy project flow:

- Focus on deliverables gives space: early production of deliverables renders time for additional checks and extensions.

- Problems: keep in touch with each other and address coordinator so that we can find solution.
- Finances:
  - Deliver cost statements timely.
  - Buy durable equipment asap.
  - Discuss budget shifts with the coordinator. A solution can be found in most cases.
- Management reporting:
  - Personnel: send updates for the contact person, the person responsible, and all persons payed by project (start/end/position) to the coordinator.
  - For travel outside of the EU always ask for permission (through the coordinator, who will address the EC project officer).
  - Collect exact dates and data on talks, papers, publications, posters, workshop contributions, travels etc. associated with project and keep copies for documentation
  - Create a file on your computer to update your list of activities. This is time saving. For reporting you simply have to email this file to the coordinator.
  - **IMPORTANT: acknowledge in ALL publications, posters, and talks EC with contract no. !!!**
- Scientific reporting:
  - Create a file on your computer to update your list of activities.
  - Archive important results, plots etc. for later reporting.
  - Focus on publishable results.
- The coordinator is asked to present a first technological implementation plan (TIP) after 1 year.

Next workshop:

The next joint ORFOIS workshop will be held in about one year (January 2003), perhaps at UEA, Norwich ?

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