NEMO Consortium Agreement

BETWEEN:

The **CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE**, a scientific and technological public establishment, having its registered office at 3, rue Michel-Ange 75794 PARIS Cedex 16, France, N° SIREN 180089013, APE CODE 731Z, represented by its General Manager, Mr Arnold MIGUS, who has delegated for the present agreement Mrs Liliane FLABBEE, Regional Delegate for Paris B delegation, 16 rue Pierre et Marie Curie, 75005 Paris,

Hereinafter referred to as "CNRS",

AND

The **GIP MERCATOR OCEAN**, Groupement d'Intérêt Public, SIRET n°130 002 231 00012, having its registered office at Parc Technologique du Canal, 8/10 rue Hermès – 31520 Ramonville St-Agne, represented by its General Manager, Mr Pierre BAHUREL,

Hereinafter referred to as "MERCATOR OCEAN"

AND

The **MET OFFICE** for and on behalf of the Secretary of State for the Defence of the United Kingdom and Northern Ireland at FitzRoy Road, Exeter, EX1 3PB, United Kingdom.

Hereinafter referred to as "MET OFFICE"

AND

The Natural Environment Research Council, Polaris House, North Star Avenue, Swindon, SN2 1EU, UK ("the Council") incorporated by Royal Charter in 1965 as represented by its component body the National Oceanography Centre, Southampton

Hereinafter referred to as "NERC NOCS".

PREAMBLE:

CNRS is the owner of an ocean modelling Software system called OPA and has recently developed a new version of it called NEMO (Nucleus for European Modelling of the Ocean).

MET OFFICE MERCATOR OCEAN and NERC NOCS having long-term projects using NEMO and its coming developments want to get more closely involved in the decision making process and development priorities of the NEMO System.

Purpose of the Consortium

The purpose of this Agreement is to set up appropriate arrangements for the successful and sustainable development of the NEMO System as a well-organised, state-of-the-art ocean model code system suitable for both research and operational work.

In order to achieve this goal the Consortium Members have agreed in this Agreement on:

i) the resources they will commit each year to the NEMO System Team which will maintain the code;
ii) the arrangements for managing and coordinating the work of this NEMO System Team and for setting its priorities;
iii) the arrangements for the Intellectual Property rights over the Software to make the code freely available under an appropriate version of the CeCILL Free Software Licence with the aim of attracting a critical mass of scientists to use the Software and contribute developments to be incorporated into it.

Article 1 defines the expressions in the Agreement whose words begin with capital letters.
Article 2 and Schedule 1 describe the Work-Plan for the NEMO System Team which is to be updated on an annual basis.
Article 3 defines the financial commitments of the Consortium Members.
Article 4 describes the organisational structure which will be used to manage and coordinate the work of the NEMO System Team.
Articles 5-8 present agreements on Intellectual Property rights and licensing, liabilities within the Consortium and confidentiality.
Articles 9-11 describe the procedures for making changes to the Consortium Members and this Agreement and its term of duration.
Schedules 1-4 are integral to the Agreement but are intended to be updated on an annual basis.

The Consortium Members expect to obtain real mutual benefits from collaboration including: common decision making on priorities, strategic and technical choices; sharing of work on technical model support enabling a greater proportion of ocean modellers' time to focus on research issues; making the latest developments readily available to research and operational oceanography groups; and improving the

collaboration within Europe on ocean modelling research, ocean forecasting in deep and shallow water and coupled climate modelling.

Collaboration Principles of the Consortium

For the purpose of enabling the Consortium Members to work together, it is agreed that each of the Consortium Members

i) will devote sufficient resources and expertise to enable the work outlined in Article 2 below to proceed in a competent and timely manner in line with recognised best practices for such work;
ii) ensure that the relationship and all dealing between the Consortium Members are undertaken, promptly, openly and transparently and that disputes and differences are identified and resolved as soon as reasonably practicable;
iii) recognise and understand each other's objectives, needs, capabilities responsibilities and constraints, regarding the activities outlined in Article 2 and other related activities;

Article 1. Definitions

For the purpose of this Agreement, when the following expressions commence with a capital letter they shall have the following meaning:

Access Rights means licences and user rights to Background IPR or Foreground IPR.

Agreement means this consortium agreement and its schedules, and any subsequent versions of it.

Background Intellectual Property means the Intellectual Property excluding Foreground Intellectual Property owned by any of the Consortium Members, and which is necessary for the purpose of the work to be undertaken under this Agreement.

Background IPR means the Intellectual Property rights to Background Intellectual Property as defined by this Agreement.

CECILL means the CECILL licence agreement. The relevant version of the licence is defined in schedule 3.

Configuration means a file defining the grid locations and bathymetry to be used for an integration of the NEMO ocean model.

Consortium Member means one of the institutions that have signed the Agreement. (the Consortium Members means **all** the signatories).

Consortium means all the Consortium Members.

Contribution means any or all modifications, corrections, translations, adaptations and/or new functions integrated into the Software by any or all contributors.

Developers Committee means the committee described in article 4.4 whose current members are identified in schedule 2.

External Module means any or all Modules, not derived from the Software, so that this Module and the Software run in separate address spaces, with one calling the other when they are run.

Foreground Intellectual Property means all and any Intellectual Property created as a direct result from work undertaken by one or several Consortium Members in the development of the Software under this Agreement,

Foreground IPR means the Intellectual Property rights to the Foreground Intellectual Property as defined in this Agreement.

Full Configuration means a set of files which when used with the NEMO System completely defines the scientific options and parameter choices as well as the grid locations and bathymetry used in an ocean model integration.

Intellectual Property means any and all trade marks, designs, UK or foreign patents, copyright (including copyright in software), confidential information, trade or business names, database rights, know how, technology and other intellectual property rights (and any applications for the foregoing) whether registerable or not in any country.

Man-Year means the equivalent of a full year of staff time (as defined by the rules used by the Consortium Member concerned).

Module means a set of sources files including their documentation that enables supplementary functions or services in addition to those offered by the Software.

NEMO Project Manager means the post described in article 4.3 occupied at present by the person identified in schedule 2.

NEMO Scientific Leader means the post described in article 4.3 and occupied at present by the person identified in schedule 2.

NEMO System means the NEMO 2.3 System and subsequent releases. The components included in the current system are described in schedule 3.

NEMO System Team means the team described in article 4.2 (whose current members are identified in schedule 2.)

NEMO System Team Co-ordinator means the post described in article 4.2 and 4.3 and occupied at present by the person identified in schedule 2.

Ocean Model System means the Software for an ocean model, and its associated models (such as sea-ice or biogeochemistry models and the ocean model's tangent and adjoint), together with built-in interfaces to external libraries (such as OASIS and IO libraries), the script systems used for configuration control and to create and run executables, specific pre-processing tools (such as those to build Configurations) and post-processing tools to analyse model outputs, a package of standard configurations and installation tests.

OPA System means the OPA 8.2 Ocean Model System and all previous versions of the OPA Ocean Model System. The components included in this system are described in schedule 3.

Party means any Party (it is not restricted to Consortium Members).

Project means the work to be carried out by the NEMO System Team defined in Schedule 1.

Reference code means the NEMO System source code, scripts and documentation maintained updated and distributed by the NEMO System Team through the NEMO server and web pages (http://www.locean-ipsl.upmc.fr/NEMO). This reference code is the core and main product of the Project. It includes all revisions of the NEMO System, i.e. the previous versions and all the shared developments identified by revision number.

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Software means the Source Code and its Object Code together with any additional documentation.

Source Code means the set of instructions, in the form people usually read, intended to be executed (often after compilation into its object code form) by a computer to achieve a stated purpose, together with its "in-line" documentation (i.e. its "comments").

Steering Committee means the committee described in article 4.1

Work-Plan means the annual plan of work for the NEMO System Team describing the contributions to be made by staff from each of the Consortium Members. The current plan is attached as schedule 1.

These expressions may be used in both singular and plural form.

Article 2. Work-Plan

The Work-Plan describing the work which each of the Consortium Members will contribute to the NEMO System Team is attached in Schedule 1. This Work-Plan will be updated annually according to the following schedule:

31 March: Report of work by NEMO System Team delivered by NEMO Project Manager to Steering Committee;
Not later than one month before the Steering Committee: draft of Work-Plan for following year prepared by NEMO Project Manager and approved by NEMO Scientific Leader, following consultation of Developers Committee and discussion with all Consortium Members;
Not later than the 30th of November: Work-Plan for following year agreed by Steering Committee;
Before the end of the year: All schedules to Agreement updated for following year.

Article 3. Financial arrangements

3.1 Each Consortium Member shall contribute at least 1 full Man-Year of effort each year to the Work-plan of the NEMO System Team and pay their travel/subsistence expenses for meetings.

3.2 Each Consortium Member shall bear its own costs relating to the tasks which it agrees to undertake in the Work-Plan of the NEMO System Team.

3.3 The weight given to the priorities of each Consortium Member in making decisions on the priorities for the NEMO System Team will be commensurate with their (financial and intellectual) contribution to the NEMO System Team.

Article 4. Organisational structure

4.1 Steering Committee

4.1.1 Role

The Steering Committee is the consortium's decision-making and arbitration body. It must decide and agree on:

i) the strategic direction of the Project;
ii) the NEMO Project Manager, the NEMO Scientific Leader and NEMO System Team Coordinator;
iii) the Work-Plan for following year;
iv) the contributions of each Consortium Member to the Work-Plan;
v) the financial commitment of each Consortium Member for the next financial year;
vi) the principles of distribution of non national funding supporting the NEMO System Team;
vii) approval on an annual basis of the members of Developers Committee as proposed by the NEMO Project Manager and NEMO Scientific Leader;
viii) any modifications needed to this Agreement;
ix) approval on an annual basis of the list of personnel assigned to the NEMO System Team.
x) whether to include any new Consortium Members;
xi) whether to expel any Consortium Member;
xii) the settlement of disputes;

4.1.2 Composition

The Steering Committee is composed of one representative from each Consortium Member. These representatives are identified in schedule 2. The NEMO Scientific Leader and the NEMO Project Manager shall also attend the meetings. The director of LOCEAN is a permanent invitee.

4.1.3 Chairperson of the Steering Committee

The chairperson of the Steering Committee is the representative of CNRS/INSU for the term of this Agreement. Each time this Agreement is renewed the chair will rotate to another Consortium Member for the term of the Agreement.

The chairperson sets the agenda for the meetings of the Steering Committee, chairs meetings of the Steering Committee and makes sure that the decisions taken by the Steering Committee have been implemented.

4.1.4 Meetings

The Steering Committee normally meets once a year. Extraordinary meetings may be requested by any Consortium Member or by the NEMO Project Manager.

The chairperson shall give each of the Consortium Members at least thirty (30) calendar days written advance notice of such meetings or fifteen (15) calendar days notice in case of extraordinary meetings.

Should a Consortium Member suggest adding a discussion point/resolution to the proposed agenda, it shall give written notice thereof to all other Consortium Members at least seven (7) calendar days prior to the meeting date.

The chairperson shall draft the minutes of each meeting to formalise in writing all decisions taken and shall dispatch them to all Consortium Members within fifteen (15) calendar days of the concerned meeting.

The minutes shall be considered as accepted by the Consortium Members if, within fifteen (15) calendar days from receipt thereof, no Consortium Member present or represented at the said meeting has objected in writing to the chairperson.

4.1.5 Voting rules

Each Consortium Member representative on the Steering Committee will be eligible to vote on matters concerning the Consortium. This person may not be the NEMO Scientific Leader or the NEMO Project Manager.

All decisions will be taken by unanimous vote. The voting rules will be re-considered before the Consortium expands to five (5) Consortium Members.

4.2 The NEMO System Team

4.2.1 Role

The NEMO System Team is in charge of the Reference code of NEMO System and its distribution through the NEMO System web server located at www.locean-ipsl.upmc.fr/NEMO. The NEMO System Team shall carry out the Work Plan proposed by the Developers Committee and approved by the Steering Committee. This Work Plan may include;

i) incorporation into NEMO System of new developments (scientific or technical);
ii) re-organisation of code to improve its readability, orthogonality or structure;
iii) optimisation of NEMO System on the computers available in the Consortium;
iv) maintenance of the paper and on-line documentation;
v) configuration control of the available versions of NEMO System;
vi) testing and release of new versions (typically once or twice a year);
vii) making NEMO System readily available to the scientific community and Consortium Members;
viii) providing assistance to new users;
ix) practical support for user meetings (held typically once a year);
x) assistance in scientific development in an area of high priority.

The NEMO System Team will NOT be responsible for support in the following areas:

i) any scientific investigations;
ii) tuning of the parameters of model configurations;
iii) emergency responses following operational failures (for example in the Mercator or FOAM systems).

4.2.2 Composition

The list of personnel assigned to the Project by each Consortium Member and the time spent by each of them on the Project will be agreed on an annual basis and specified in schedule 2.

4.2.3 Co-ordination

The NEMO System Team will be co-ordinated by the NEMO System Team Co-ordinator. The NEMO System Team Co-ordinator is identified in Schedule 2.

4.3 NEMO Project Manager, Scientific Leader, and System Team Co-ordinator roles

4.3.1 NEMO Project Manager

The NEMO Project Manager will be responsible for:

i) Co-ordinating inputs to and agreement of the annual Work Plan for NEMO System Team;
ii) Writing a co-ordinated summary of the work on NEMO System planned by other Consortium Members;
iii) Maintaining regular contact between NEMO System Team members and encouraging constructive team working;
iv) Monitoring progress against plans and reporting exceptions to the Work Plan to the chairperson of the Steering Committee;

v) Presenting report on progress in the previous year and the Work Plan for next year to the Steering Committee;
vi) Organising the users' meeting.
vii) Proposing on an annual basis to the Steering Committee the members of the Developers Committee

4.3.2 NEMO Scientific Leader and System Team Co-ordinator

The NEMO Scientific Leader and the NEMO System Team Co-ordinator will jointly:

i) Develop scientific and technical knowledge within the NEMO System Team;
ii) Clarify scientific and technical priorities for development of the NEMO System code;
iii) Ensure timely and appropriate reviews of proposed contributions to the NEMO System code;
iv) Publicise the Consortium and seek opportunities for funding.

The NEMO Scientific Leader and the NEMO Project Manager are identified in schedule 2.

4.4 Developers Committee

4.4.1 Role:

The Developers Committee is responsible for ensuring that the most useful developments in the research and operational community are integrated into NEMO System. Its roles are:

i) to give advice on research developments plan;
ii) to co-ordinate developments planned by scientists outside the NEMO System Team, and in particular to coordinate them with the Work-Plan for the NEMO System Team;
iii) to set up working groups, to appoint their leaders and to validate the report drafted by the working group;
iv) to propose opportunities for funding to the Steering Committee.

4.4.2 Composition

The Developers Committee is composed of leading ocean modelling scientists, having complementary and necessary expertise for the development of NEMO.

The list of members shall be approved on an annual basis by the Steering Committee and will be attached in Schedule 2.

According to the agenda, any expert may be invited to attend meetings of the Developers Committee. The invitees will be suggested by the NEMO System Team.

4.4.3 Chairpersons of the Developers Committee

The Developers Committee will be chaired by the NEMO Scientific Leader and the NEMO Project Manager.

4.4.4 Meetings

The chairpersons set the agenda for the meetings of the Developers Committee and chair meetings of the Developers Committee.

The chairpersons shall give each of the member of the Developers Committee at least thirty (30) calendar days written advance notice of such meetings or fifteen (15) calendar days notice in case of extraordinary meetings.

Should a member of the Developers Committee suggest adding a discussion point/resolution to the proposed agenda, it shall give written notice thereof to all others members at least seven (7) calendar days prior to the meeting date.

The chairpersons shall draft the minutes of each meeting and shall dispatch them to all members within fifteen (15) calendar days of the concerned meeting.

The minutes shall be considered as accepted by the members if, within fifteen (15) calendar days from receipt thereof, no member present or represented at the said meeting has objected in writing to the chairpersons.

The Developers Committee meets at least once a year. The NEMO System Team shall attend the meeting. Extraordinary meetings may be requested by the two chairpersons.

The final session of the meeting will involve only the members of the Developers Committee and will be devoted to examination of the Work-Plan for the coming year.

4.4.5 Working groups

The Developers Committee will set up each year working groups as needed to further explore particular strategies and/or technical choices. These groups will be coordinated by a leader, will work on specific questions for a limited duration, and will report at the latest at the next Developers Committee meeting.

4.5 Users' meeting

These meetings will be held annually. They are intended to provide a relaxed, informal, forum for presentation of recent progress, discussion of problems and constructive feedback from users, and facilitate the development of collaborations between groups.

Article 5. Intellectual Property Rights and Licences

5.1 Background Intellectual Property

5.1.1 Each Consortium Member shall take appropriate measures to ensure that it can grant Access Rights and fulfil its obligations under this Agreement notwithstanding any rights of its staff, agents or subcontractors.

5.1.2 The Background Intellectual Property of each Consortium Member belongs to that Consortium Member and this Agreement does not transfer in any way to another Consortium Member any Intellectual Property nor confer any rights in it. No Consortium Member has any right under this Agreement to use any other Consortium Member's brand names or logos.

5.1.3 The Consortium Members have identified and listed in schedule 4 the Background IPR they hold, which is relevant to this Agreement. In particular CNRS is the sole owner of the IPR for the OPA System and the initial version of the NEMO System.

5.1.4 The Consortium Members shall grant to each other a world-wide, royalty free licence, free of charge, to install, use, further develop and copy the Background Intellectual Property for the purpose of the execution of the Project.

5.2 Foreground Intellectual Property

5.2.1 The Intellectual Property rights to all Foreground Intellectual Property shall be co-owned by the Consortium Members.

5.2.2 CNRS shall be responsible for applying for, obtaining and maintaining the relevant patent protection and/or any other form of Intellectual Property protection and the cost shall be shared between the Consortium Members.

5.2.3 The Consortium Members shall grant to each other a world-wide, royalty free licence, free of charge, to install, use, further develop, sub-license, copy and distribute the Foreground Intellectual Property under an appropriate version of the CeCILL Licence.

5.2.4 Consortium Members distributing code relating to NEMO System shall only distribute recent versions of the Reference code or sets of modifications from (i.e. changes to) recent Reference versions of the code.

5.3 Foreground Intellectual Property created and contributed by another Party

5.3.1 Consortium Members shall ensure that any Party submitting Software to the NEMO System Team for use in the further development of the NEMO System:

i) has assigned the Foreground IPR to Consortium Members.

Or

ii) has granted Consortium Members a world-wide, irrevocable licence, free of charge, to install, use, further develop, sub-license, copy, distribute and store the Foreground Intellectual Property.

5.3.2 Consortium Members will ensure that any such Software is subjected to an agreed quality control process and work standards, before integration with the NEMO System.

5.4 Access rights to the public

The Consortium will make available to all Parties (including Consortium Members) the Reference code under an appropriate version of the CeCILL Free Software Licence. Any Party distributing NEMO System must distribute the Reference code, including the Source Code as part of the distribution package.

5.5 Configurations and Full Configurations

The Intellectual Property rights for model Configurations and Full Configurations (as defined in Article 1) are not covered by this Agreement.

Article 6. Acknowledgement of consortium

Publications and communications which make use of the NEMO System should provide acknowledgement of "use of the NEMO System (www.locean-ipsl.upmc.fr/NEMO)".

Article 7. Consortium Members employees

7.1 Employees of Consortium Members may perform work within the scope of this Agreement in the buildings of another Consortium Member only with the permission of both Consortium Members. Employees working at another Consortium Member's establishment must conform to the rules and procedures of that establishment.

7.2 Each Consortium Member shall be responsible for the payment of salaries to their employees, together with all the necessary social and tax obligations of the employer.

7.3 Each Consortium Member is responsible for the necessary insurance cover for their employees.

Article 8. Confidentiality

8.1 During the Term of the Agreement and for a period of five (5) years thereafter, the Consortium Members shall treat as confidential any information which is designated as confidential by the disclosing Consortium Member by an appropriate stamp, legend or any other notice in writing, or when disclosed orally, has been identified as confidential at the time of disclosure and has been promptly (thirty (30) days at the latest) confirmed and designated in writing as confidential information by the disclosing Consortium Member.

8.2 Accordingly, each Consortium Member undertakes that:

i) the receiving Consortium Member shall not use any such information for any purpose other than in accordance with the terms of this Agreement, and
ii) the receiving Consortium Member shall not disclose any such confidential information to any third party except with the disclosing Consortium Member's prior written consent, and
iii) such information shall neither be copied, nor otherwise reproduced nor duplicated in whole or in part where such copying, reproduction or duplication have not been specifically authorised in writing by the disclosing Consortium Member.

8.3 The confidentiality obligation stipulated above shall not apply to information for which the receiving Consortium Member can prove that it :

i) had a public nature prior to its communication by the disclosing Consortium Member or fell within the public domain after such communication but through no fault of its own;
ii) was already in its possession at the time of signature of this Agreement;
iii) is received from a third party without any breach of any secrecy obligation;
iv) is subsequently developed by or for the receiving Consortium Member independently of the confidential information received from the disclosing Consortium Member;
v) had to be communicated to comply with applicable laws or regulations or with a court of administrative order provided that insofar as reasonably possible the receiving Consortium Member shall have informed the disclosing Consortium Member of such need and shall have complied with the disclosing Consortium Member's reasonable instructions designed to protect the confidentiality of such information.

8.4 The Consortium Members shall contractually impose the same obligations on all of their employees or any other person working for them who may have access to confidential information, to the maximum extent and for the maximum duration authorised by law, including upon the end or the termination of their employment.

8.5 Any proposed publication or communication by one of the Consortium Members, in connection with all or part of the Project is required to be submitted to the other Consortium Members.

To this end, a brief description and the subject of the proposed publication or communication shall be submitted to the other Consortium Members. The Consortium Members shall have a period of one (1) calendar month from the date of receipt of the proposed publication or communication to object to the publication/communication. Beyond this period, this consent shall be deemed to have been given.

This objection may consist in a request that the publication or communication be postponed if, in its opinion, real and serious reasons require this, especially if the information contained in the proposed publication or communication should be the subject matter of industrial property protection.

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However, none of the Consortium Members may withhold their consent to publication or communication upon the expiry of a period of six (6) calendar months.

8.6 Nothing contained in the above paragraphs shall prevent:

i) the submission of a thesis to examiners in accordance with the normal regulations and practice of the public bodies subject where appropriate to such examiners being bound by confidentiality provisions;

ii) the obligation of personnel assigned to the Project to issue a scientific activity report for the State or administrative organization it belongs to. This communication shall not constitute a public disclosure, but will be an internal communication to the Consortium Member.

8.7 Some Consortium Members have obligations under laws such as the Freedom of Information Act to disclose information including confidential information held by them. Consortium Members must endeavour to consult with other Members before making a decision to disclose confidential information held as a consequence of this Agreement.

Article 9. Changes to the consortium

9.1 Inclusion of a new Consortium Member

9.1.1 By joining the Consortium, a new Consortium Member agrees to contribute resources to the Work-Plan of the NEMO System Team as defined in Articles 2 and 3.

9.1.2 The entrance into the Consortium of a new Consortium Member shall become effective after a unanimous vote of the Steering Committee and on the date of the signature by all the Consortium Members of an amendment.

9.1.3 No change to the Agreement shall be requested by a new Consortium Member before they join.

9.1.4 New Consortium Members may take part in discussions of the Work-Plan up to six months before their commitment of resources to the NEMO System Team begins.

9.1.5 A new Consortium Member shall be granted Access rights to the Background and Foreground IPR on the same conditions as the other Consortium Members (Articles 5.1 and 5.2). The new Consortium Member will have co-ownership of the code developed from NEMO from the date of signature of the amendment mentioned in article 9.1.2.

9.2 Grounds for Excluding a Consortium Member

Without prejudice to any other rights or remedies open to the Consortium, the Steering Committee may after a unanimous vote of the Steering Committee, minus the vote of the concerned Consortium Member, in favour of termination, and via a written notice served on the Consortium Member, terminate a Consortium Members membership of the Consortium, if the Consortium Member;

i) is in material breach of any of the terms of this Agreement and, where the breach is capable of remedy, the Consortium Member fails to remedy such breach within 30 days' service of a written notice specifying the breach and requiring it to be remedied; or

ii) in the opinion of a majority of the Steering Committee, is incompetent, commits any act of gross or persistent misconduct and/or neglects or omits to perform any of its duties or obligations under this Agreement; or

iii) fails or refuses after written warning from the Steering Committee to carry out the duties or obligations reasonably and properly required of it under this Agreement; or

iv) ceases to operate its business or undertaking;

9.3.Withdrawal of a Consortium Member

Any Consortium Member may request to terminate its participation in this Agreement, by giving three months prior written notice of termination to the other Consortium Members, by registered mail with acknowledgement of receipt, indicating the reasons for termination.

9.4 Withdrawal, exclusion of a Consortium Member

9.4.1 The withdrawing or excluded Consortium Member agrees to treat as confidential all confidential information, as defined in article 8, for a period of five (5) years from the date of its withdrawal or its exclusion, and agrees not to apply for any patent or other proprietary right over any information, subject to its own information, it may have had knowledge of in connection with its participation in the Consortium.

9.4.2 Any Consortium Member withdrawing or excluded from the Consortium automatically relinquishes the Access Rights granted under 5.2 and the co-ownership of any future Foreground IPR developed under this Agreement after the date of withdrawal or exclusion. The withdrawing or excluded Consortium Member may be granted Access Rights to future code developed from NEMO, under a suitable version of the CeCILL Free Software Licence.

9.4.3 The other Consortium Members retain the ownership of their Background and Foreground IPR and their Access Rights granted under 5.1 to use the Background IPR of the departing Consortium Member.

9.4.4 The Consortium Member withdrawing or excluded from the Consortium shall honour its financial commitments up to the effective date of its withdrawal or exclusion.

Article 10. Liability

No Consortium Member shall be responsible to another for indirect or consequential loss or damages such as but not limited to loss of profit, loss of revenue, or loss of contracts.

The total limit of liability of a Consortium Member towards other Consortium Members collectively in respect of any and all claims of liability shall not exceed that Consortium Members' contribution as detailed in Article 3.1.

Subject always to such other undertakings and warranties as are provided for in this Consortium Agreement, each Consortium Member shall be solely liable for any loss, damage or injury to third parties resulting solely from the performance of its Work Plan.

Article 11. Term

This Agreement will become effective when signed by all the Consortium Members, for a term (the'Term') of five (5) years unless terminated by the Consortium Members by mutual consent. The Agreement may be renewed at the end of the Term by way of an amendment signed by all the Consortium Members.

Article 12. Entire agreement

This Agreement and the schedules shall constitute the entire agreement among the Consortium Members in respect of the Project, and supersede all previous negotiations, commitments and documents concerning the Project including any memorandum of understanding among the Consortium Members which relate to the Project.

Article 13. Transfer or assignment

No Consortium Member shall assign or otherwise transfer partially or totally any of its rights or obligations under this Agreement.

Article 14. Language

This Agreement is drawn up in the English language, which shall govern all documents, notices and meetings, for its application and/or extension or in any other way relative thereto.

Article 15. Applicable law

This Agreement shall be construed according to and governed by the French Law.

Article 16. Relationship of Consortium Members

16.1 The relationship of the Consortium Members is exclusively that of independent contractors and nothing contained in this Agreement shall be construed

as creating any partnership, joint venture or agency relationship between the Consortium Members.

16.2 Each Consortium Member recognises that is has no authority to and agrees that it will not, make or give any contract, representation, warranty, undertaking or other commitment on behalf of another Consortium Member save as expressly authorised in writing by the other Consortium Member.

Article 17. Settlement of disputes

All disputes or differences arising from this Agreement which cannot be amicably resolved by the Steering Committee shall be finally settled through arbitration in Paris under the Rules of Arbitration of the International Chamber of Commerce (ICC). Arbitral proceedings shall be conducted in the English language.

The arbitration award, if providing for damages, shall include interest from the date of any breach or other violation of this Agreement.

The arbitration award shall be final and binding upon the Consortium Members, not subject to appeal, and honoured by the Consortium Members without having resort to any court; however, if the award is not carried out voluntarily and without delay, it shall be referred to and enforced by any court having jurisdiction over the subject matter or any of the Consortium Members or their assets.

Article 18. Signature of special contracts

Special contracts may be concluded among the Consortium Members for any issue not covered by the provisions of this Agreement.

Article 19. Amendments

Amendments or changes to this Agreement shall be valid only if made in writing and signed by all of the Consortium Members.

Article 20. Severability

Should any provision of this Agreement prove to be invalid, or subsequently become invalid, whether in whole or in part, it shall not affect the validity of the remaining provisions of this Agreement. In such a case, the Consortium Members shall negotiate a valid and practicable provision which most nearly fulfils the purpose of the invalid provision.

Article 21. General provisions relating to termination

21.1 This Agreement may be terminated by the unanimous mutual written agreement of all the Consortium Members.

2.1.2 The provisions of this Agreement relating to liability, confidentiality, intellectual property rights and publications shall survive the Term or termination of

this Agreement for any reason whatsoever to the extent needed to enable the Consortium Members to pursue the rights and remedies provided for therein.

2.1.3 For the avoidance of doubt, termination or withdrawal shall not affect any rights or obligations incurred prior to the date of the termination.

INTENDING TO BE LEGALLY BOUND, the Consortium Members have executed this consortium agreement in 4 original copies.

Authorised to sign on behalf of the CENTRE NATIONAL de la RECHERCHE SCIENTIFIQUE

By (signature): La déléguée régionale pour la Souscription Paris B

Name (block letters): Liliane FLABBÉE

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE Délégation Paris B 16, rue Pierre et Marie Curie 75005 PARIS

Position:

Date : 07 DEC. 2007

Authorised to sign on behalf of MERCATOR OCEAN

By (signature): MERCATOR OCEAN Le Directeur

Name (block letters): Pierre BAHUREL

Position:

Date: 14 DEC. 2007

MERCATOR

MERCATOR OCÉAN
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Schedule1

NEMO Team actions for 2008

Plan

Introduction

For NEMO to remain competitive with other ocean models it is essential that we develop **and** implement good strategies both for coordination and management and for scientific and technical development. This will become particularly important as the NEMO community continues to grow. We must review on an annual basis the strategies outlined below and the progress made in implementing them.

This document results from the NEMO Developers Committee meeting hold in May 2007 and is based on the *"NEMO system objectives for 2007"* document. Its aim is to:

1- Give a first guess of priorities in terms of developments and updates integration

2- Propose a strategy for coordination and management

This document is roughly structured as follows: the first part describes the System management work (user assistance, "regular" bug-fix, integration of updates, documentation). The second part describes the developments planned for the NEMO System Team during year 2008. In Annex A are listed a non exhaustive list of on-going developments all around the community, and Annex B sums up the developments chosen for the NEMO System Team prior to the 2007 Developers Committee advices.

Note:
P_NEMO = NEMO team in Paris (IPSL+INSU+?My_Ocean) (~160+40+40 week/year)
E_NEMO = NEMO team in Exeter (Met Office) (~40 week/year)
T_NEMO = NEMO team in Toulouse (MERCATOR-ocean) (~40 week/year)
S_NEMO = NEMO team in Southampton (NOCS) (~40 week/year)

The overall manpower of NEMO team is ~260 weeks/year. It could reach 360 weeks/year in 2008.

I. NEMO team outline (280 weeks + 40 (INSU) + 40 (My_Ocean?))

I.1 User assistance (P_NEMO): 10 weeks

Work: (1) mail and phone answers.
(2) Newsletter, Update of FAQ web pages and tutorial talks.

I.2 "Regular" bug-fix (P,T NEMO): 12 weeks

Status: a standard form is provided to users and the FLYSPRAY software and interface are installed. It appears to work fairly well.

Work: Fast response to all bug reports.

I.3 In-core, on-line documentation. 6 weeks

Status: in-core documentation already exists. On-line documentation ("How to use NEMO", "How to settle a model configuration","Reference configuration") has to be improved. LIM and TOP (TRP+PISCES+LOBSTER) paper documentation are almost ready, and a first draft of OPA paper documentation exist.

Work: • Documentation of new functionalities.
• Tutorials

I.4 Developments and Updates integration: 250 + 40 weeks (+ 40 My_Ocean?)

Work:

- Updates: Implementation and final validation of developments made in the community; expected inputs are numerous.
- Developments: elaboration and implementation in the reference new functionalities

Strategy for 2008:

As conclusion of last year, we notice an increasing number of users leading naturally to a large amount of developments implying a large integration delay into the Reference. Though following the last Developers Committee we defined the general system consolidation as the criteria of priority for the selection of developments and updates:

simplification of the system management for the team:

- Better system management
- Standard validation procedure (to reduce time implementation of developments)
- Simplify architecture of the code
- Improve interactions between NEMO Consortium Members

simplification for the developers:

- Make easier the procedure of integration of their developments
- Better coordination between the Reference code and their own developements

simplification for the users:

- Documentation
- Better handle of the whole system

II. NEMO Team developments and updates in 2008

In this section we provide the list of the actions planned for 2008. They are regrouped into the following six categories: (1) All system components ; (2) Surface Module ; (3) Ocean ; (4) Sea-ice ; (5) Biogeochemistry ; (6) AGRIF ; and (7) Assimilation – Adjoint.

1. All the system components (165 + 40 weeks)

1.a. Documentation

• **Paper documentation (P_NEMO 5w, E_NEMO 3w)** Status: Ongoing. Priority: High

Status: LIM and TOP (TRP+PISCES+LOBSTER) paper documentation are almost ready, and a first draft of OPA paper documentation exist.

Work: Paper documentation: achievement of OPA, TOP and LIM reference manual. This will be reviewed and updated at the Met Office.

• **New web site (P_NEMO 40w)** Status: To be done. Priority: High

Status: NEMO web site organisation, functionality and design have to be improved for better interaction with the users.

Work: the whole structure off the site has to be re-defined and rewritten using new tools.

2.b. Environment

• **Code management (P_NEMO 4w, E_NEMO 3w).** Status: Ongoing. Priority: High

Adoption of modern code management tools, i.e. switch from CVS and Flyspay to SubVersion and Trac. Ad hoc support for the Paris team will be provided by the team in Exeter who have experience with FCM

Work: its generalisation to all platforms and the associated documentation.

• **Developer toolkit (P_NEMO 6w, E_NEMO 6w).** Status: Ongoing. Priority: High

A tools (script package) have to be created that allow the compilation and run of the standard configurations in different test cases (mono versus multi-processor, restartability,…) with check of performance and in core memory requirement …) using a few command on a given computer. The tool has to be documented on a web page so that developers can easily test/validate their own developments. It should become the first step toward a "developer tool kit". It should be implemented after the modification of the environment (FCM). *Already done:* bit-comparison option (E_NEMO), and a first implementation of a script that launch automatically the series of tests (P_NEMO). A beta release will be implemented at Exeter for testing and feedback.

Work: (1) Define, implement, and document the update procedure.

(2) Ensure the distributed memory reproducibility for all the components (still 1 small bug in sea-ice…).

(3) Creation of a mpp_sum that gives exactly the same results in single and multi-processor runs (send the whole vector on one processor prior to the sum computation).

(4) Test in an environment outside Paris, (R Hill, Met Office)

• **Configuration toolkit (My_Ocean 40w).** Manpower asked to FP7. Priority: High if Manpower available

Objective: Create a user-friendly interface, the tools, and the documentation associated to the creation of a new configuration, and especially configurations defined as a zoom of an ORCA configuration. The tools include the generation of a grid, a bathymetry, an initial state, a forcing data set, and open boundary conditions. Manpower will be demanded in the My_Ocean FP7 European project (MCS) to build the tool.

Work: Define, implement and document the configuration toolkit.

• **ORCA2-LIM based on NEMO (P_NEMO 24w).** Status: To be done. Priority: High

Demand from French institutions to document and illustrate the changes from the OPA8 to NEMO of the ocean and ice components of the 2 french coupled systems (LMDz-NEMO and ARPEGE-NEMO).

Work: (1) 2 runs: forced with a mean seasonal cycle over 2,000 years (mean state) and forced with a 1958-2004 interannual forcing (interannual variability)
(2) A series of runs (starting from the NEMO physics down to OPA8 physics (TKE, Tides, Partial steps, …) not necessary with both mean seasonal and interannual forcing. (P_NEMO)

• **Reference configurations (P_NEMO 3w).** Status: Ongoing. Priority: Medium

Which set of standard configurations should be used as NEMO tutorial, developer validation and benchmark purposes? Existing configurations: ORCA2-LIM, ORCA2-LIM plus a south Africa AGRIF zoom, GYRE, and GYRE benchmark. This is not sufficient to illustrate the existing or forthcoming system potentiality. On-line and off-line tracers, as well as the different types of vertical coordinate are missing.

Work: Define and document the set of standard configurations.

S_NEMO have a ORCA1_LIM configuration available for consideration as a reference configuration. This configuration can be supplied with high frequency surface forcing using an interpolation on-the-fly method (2w).

2.c. Input Output Manager (IOM)

• **Output part of IOM (P_NEMO 18w).** Status: To be done. Priority: High

The strategy defined is built on the use of catalogues that are dynamically created and written once for all at the end of step. The temporal mean is no more performed in the IO library, but is done in NEMO. The write itself will use the new IOIPSL module, or a dimg routine. There is many improvements associated with this strategy. One example, a call to iom_put (i.e. a write into a catalogue) can be done anywhere in the code. This will greatly improve the code readability and will allow easy output of local variable.

Work: - Implement the new output and test it.
- Add new output type (cumulative, zoom…)
- Add a friendly user interface (namelist, xml file ??)
- Add an option to manage I/O in share memory computing

• **CF compliance (E_NEMO 2w).** Status: To be done. Priority: Low

Ensure the CF compliance of all the NEMO NetCDF outputs. (S Adams, Met Office)

• **Online diagnostics (T_NEMO 3w).** Status: done. Priority: Medium

• **NetCDF4 IO option (S_NEMO 4w).** Status: Ongoing. Medium

NetCDF4 offers the opportunity to employ dataset chunking and compression algorithms to greatly reduce the volume of data written out by NEMO without any loss of precision. Furthermore, existing tools and applications require only minor modifications to work with the new format. NOCS have a project underway to add support for NetCDF4 to IOM and to evaluate its effectiveness in an ORCA025 configuration.

• **Parallel IO (S NEMO 4w).** Status: To be done. Medium

NetCDF4 also offers support for parallel file I/O via MPI-IO. If the overheads of using NetCDF4 prove to be acceptable then the project will be extended to investigate the options for using the parallel IO facilities to greatly reduce the number of output files produced during each run.

2.d. Parallelisation

• **Timing (P_ NEMO 2w).** Status: huge additional work. Priority: Medium

Objective: be able to have the CPU time by module on computed where it is not included as a compile option. This is required in order to further improve model performance on such computers.

Status: This has been done by MERCATOR on the dynamics on v1 version.

Work: adapt the work to last NEMO release on the whole code.

• **Merge of inimpp and inimpp2 (P_NEMO 3w).** Status: Ongoing. Priority: medium

Objective: Simplify the mpp code by suppressing the duplication of the mpp initialisation depending on the suppression of land processor or not.

Work: provide a single module replacing mppini and mppini_2.

2. *The Surface Module (LBC)* (43 weeks)

• **Creation of SBC (P_NEMO 12w).** Status: written, not validated. Priority: High

Objective: completely revisit the architecture and the way the forcing is specified in NEMO. The strategy is to create a user-friendly surface module that can be run in stand-alone mode. The module will include sea-ice call and manage forced run with bulk or flux and coupled runs. It will have a user-friendly interface controlling all the options (type of bulk, restoring in SST or SSS, runoffs, freshwater budget control, etc…). *Status*: a prototype has been written together with its documentation. It must be intensively tested before in incorporation in the system.

Work: Achieve the development, integration into the reference and validation

• **On-line interpolation (P_NEMO 1w, T_NEMO 3w, S_NEMO 6w).** Status: ~ready. Priority: High

Objective: forcing fields provided at lower resolution are interpolated on-line. Useful for high resolution runs and AGRIF zoom. T_NEMO and S_NEMO offer different solutions:

Status: (1) developed at MERCATOR on NEMO v1.

Work: Adapt the module to NEMO v2 and to the new surface module + incorporation in the reference.

Status:(2) Developed at NOCS: An on-line interpolation method that interpolates directly from data on an atmospheric grid onto the ocean grid has been developed at NOCS.

Work: Code changes have been incorporated into the latest NEMO code at NOCS but external procedures (such as off-line computation of the interpolation weights) need to be documented.

• **MEMO bulk formulae (T_NEMO 3w).** Status: Ongoing. Priority: Medium

MEMO is an iterative bulk formulae adjusted using many intensive oceanic cruises (POMME, SEMAPHORE, TOGA_COARE,…). *Status*: it is currently being implemented and tested in NEMO (MERCATOR).

Work: Achieve the test phase and adapt it to the surface module.

• **OASIS-3-4 with several Atmospheres. (IPSL, P_NEMO 6w, E_NEMO 5w, CERFACS…)** Status: Ongoing. Priority: Medium

Objective: Introduce in NEMO an OASIS interface that can be used with major european atmospheric models (ARPEGE, ECHAM, HadAm, LMDz) Status: developed at Kiel for ECHAM 5. Adapted to ARPEGE by CERFACS. On going work at IPSL with LMDz and HadAm.

Work: Merge the different approaches, adapt it to the surface module, and create a generic user-interface.

Provide input on requirements for interfacing to HadGAM (including for using CICE in NEMO) and test generic user-interface to ensure it reproduces functionality of existing coupling code (R.Hill and C.Harris, Met Office)

• **Interface to CICE (E_NEMO 5w)** Status: Ongoing. Priority: Medium

Another sea-ice model, CICE, is currently been interfaced with NEMO. The interface will be returned to the NEMO reference code

Work: CICE calls from NEMO (and associated changes to code for coupling to the atmosphere) to be finalised, reviewed and tested (including varying the frequency at which CICE is called) once the new surface module is available. Provide documentation. (C. Harris, Met Office)

• **Diurnal Cycle (P_NEMO 2w)** Status: To be finalized. Priority: **Medium**

The introduction of the diurnal cycle in forced mode as coded by D. Bernie in OPA8 will be adapted to NEMO and the new surface module.

3. *The Ocean* (OPA, 51 weeks)

3.a. Architecture

• **Merge of TRP and TRA (P_NEMO 6w).** Status: To be done. Priority: High

Objective: It is proposed to merge the passive and active advection-diffusion routine. This will significantly reduce the work of maintenance and offer more choice of advection scheme on passive tracers. The work consists in first, then put ts. arrays and last

Work: (1) replacing T & S 3D arrays by 4D arrays throughout the code
(2) put the 4D arrays as input argument of advection and diffusion routines.
(3) optimisation of the new modules.

• **Rewriting of ldfdyn, ldftra & ldfeiv (P_NEMO 3w).** Status: To be done. Priority: Low

Objective: The LDF directory (i.e. lateral diffusion in the ocean) includes modules that are not well designed: existence of .h90 files, errors in the grid size dependency, obscure way to specify space/time dependency from namelist parameters, … The specification of eddy viscosity and diffusivity as well as eddy induced coefficient has to be rewritten.

Work: (1) suppression of .h90 files
(2) bug free grid-size dependency
(3) meaningful namelist parameters
(4) account for Visbeck coefficients

3.b. Schemes

• **BDY (E_NEMO 2w, T_NEMO 2w, P_NEMO 1w).** Status: ready. Priority: High

Flow relaxation scheme to managed open boundary condition. Developed and tested in periodic channel (J. Chanut), Tested on "real" configurations (Atlantic-arctic model) (Met Office). Status: ready for incorporation.

Work: put into the reference the first package, documentation, adaptation for sea-ice, allow it to work when using either explicit either splitting free surface

• **Improvement of OBC (T_NEMO 6w).** Status: ongoing . Priority: Low

Revisit Open Boundary Condition implementation, including both architecture and schemes.

3.c. Advection

• **Problem with UBS (P_NEMO 1w).** Status: ready. Priority: Medium

The UBS advection scheme generates noise on the vertical when used without isopycnal diffusion operator. This is not the case in ROMS. There should be a problem in its implementation.

Work: find the origin of the problem and fix it

• **Optimisation of TVD (P_NEMO 1w).** Status: ready. Priority: Medium

A faster nonosc routine has been developed for TVD scheme. It reduces the total CPU time of ORCA05 by ~5%.

Work: incorporate in the reference

• **4th order(E_NEMO 1w, P_NEMO 1w).** Status: ready. Priority: Medium

A 4th order centered advection scheme has been implemented (Met Office).

Work: Put into the reference code and finalize documentation. Perform, sensitivity study to the specification of boundary conditions. (C. Harris, Met Office + P_NEMO)

• **PPM (T_NEMO 1w, P_NEMO 1w).** Status: ready. Priority: Medium

A positive PPM advection scheme have been implemented (MERCATOR). It is ready for incorporation.

Work: Add namelist control and put in the reference

• **Time-splitting on the vertical (P_NEMO 2w).** Status: ~ready. Priority: Medium

A time-splitting technique has been introduced on CEN2 and TVD scheme to reduce the model time step when high vertical resolution is used (LOCEAN). It has to be implemented on the other advection scheme and put in the reference.

Work: phase with the reference with namelist control parameter

3.d. Physics

• **Improved TKE. (T_NEMO 3w, LOCEAN 2w).** Status: ongoing work. Priority: High

Improvement of TKE parameterization.

Status: Several developments have been performed and validated: (1) physics: addition of wind steering, Langmuir cells, change in the surface boundary condition (LOCEAN, LEGI). (2) numeric: more accurate and consistent computation of production and destruction of TKE (MERCATOR, LOCEAN). Last tests and documentation is underway.

Work: end of debugging (Prandl number case)

Tests in ORCA2-LIM and NATL4 and documentation

• **Implementation of the GOTM suite of turbulence schemes (E_NEMO 3w, POL).** Status: to be started. Priority: Low

The GOTM suite of turbulence schemes will provide a range of options and is expected to be particularly important in shelf seas applications, where testing has shown with GOTM the thermocline and frontal positions can be improved over MY2.5 type schemes.

Work: the code needs implementing as a vector code. Initial stages of work will include implementing in a 1D context

• **Griffies isopycnal operator (E_NEMO 3w, S_NEMO 4 w).** Status: Ongoing Priority: Medium

Griffies et al. (1999) isopycnal diffusion operator that ensures the decrease of the variance of the field on which it is applied (Met Office, NOCS).

Work: Review existing code. Examine model sensitivity to different options for tapering the isopycnal slopes at the ocean surface and decide which options to make available in the reference code. Make any changes necessary due to ldftra structural changes described in 2a above. Update LDF chapter of NEMO manual accordingly. (C.Harris, Met Office + G. Nurser, NOCS)

• **Visbeck coefficient (E_NEMO 3w).** Status: Ongoing. Priority: Medium

Visbeck formulation for the computation of the isopycnal thickness diffusion coefficient.

Work: Review existing code and test (including in conjunction with changes to tapering in Griffies isopycnal scheme). Make any changes necessary due to ldftra structural changes described in 2a above Provide documentation. (C.Harris, Met Office)

• **Tide potential (T_NEMO 4w).** Status: ~ready. Priority: Medium
Tide potential. *Status*: has been developed at MERCATOR. Validation is currently been done. Should be ready for incorporation.
Work: achieve the validation + put in the reference
• **Pressure gradient scheme testing (E_NEMO 1w, POL).** Status: to be started. Priority: High
Testing of the pressure gradient schemes within NEMO for shelf seas applications will be undertaken. Options not presently available within NEMO will also be investigated if the present suite is not suitable for applications on the NW European continental shelf.
Work: different schemes will be tested and the results assessed.

4. *The Sea-Ice* (LIM, 25 weeks)

• **LIM 3.0 thermodynamics (LLN, T_NEMO 4w, P_NEMO 4w).** Status: ~ready Priority: High
LIM3 includes : (1) A representation of the ice thickness distribution. This includes a scheme of transport in thickness space using linear remapping and mechanical redistribution by porous ridging and rafting.; (2) Multi-layer energy and salt-conserving thermodynamics ; and (3) an elastic-viscous plastic rheology in C-grid, which is easily parallelizable, since explicit (but not yet parallelized).

LIM3 is running now on the NEC-SX8 at IDRIS. Nevertheless, additional tests will be performed until the end of June before the transfer to NEMO System Team. The plugs (salt/heat fluxes) between LIM3 and OPA9 are basically the same as what they were between LIM2 and OPA9.

An effort have been made to code everything as it should within the NEMO standards. Nevertheless, check by the NEMO System Team is wellcome. Ten routines (over the 50 LIM3) require a vector optimisation, and parallelization and coupled-version of the code should be checked too.

Work: Achieve the validation (LLN)
Vector optimisation (P_NEMO)
MPP implementation (P_NEMO)

• **C-grid rheology in LIM 2.0 (LLN, T_NEMO 4w)** Available 01/2008 Priority High
LIM3 is expected to be more time consuming than LIM 2.0. It thus can be useful in current applications to incorporate the more efficient C-grid elasto-visco-plastic rheology of LIM 3 into LIM 2.

Work: Adaptation to MPP computing and optimisation.

• **LIM 2.0 dynamics: optimisation (P_NEMO 1w).** Status: ready. Priority: Medium
A faster coding of limrhg and limadv modules has been developed (P_NEMO, HLRS). It reduces the total CPU time of ORCA05 by ~5%.
Work: incorporation in the reference

• **Sea-Ice inside the ocean (S_NEMO 2w). Status:** Planned work
Incorporate embedded sea-ice into the upper ocean. Currently, the sea-ice is placed outside the ocean with no mass exchange but only with virtual salt flux exchanged between ocean and sea-ice. This configuration is unphysical and leads

to inaccurate simulation of the fluxes. The implementation of the sea-ice embedded into the ocean will be commenced . (G Madec and Ye Aksenov)

• **Ice thermodynamics improvement (S_NEMO 10w). Status:** Planed work

To improve simulations of the sea-ice concentration sea-ice lateral melting and partitioning of the ocean heat into basal and lateral components will be introduced. The sea-ice formation due to snow-to-ice conversion will be applied for the freezing conditions only, improving ice volume simulations in Southern Ocean (Ye Aksenov).

5. *Biogeochemistry* (TOP, 15 weeks)

• **Trends diagnostics. (LOCEAN, P_NEMO 2w).** Status: Ongoing Priority: High

A trend diagnostics similar to what has been done on T-S has been implemented for TRP. The diagnostics is almost achieved for LOBSTER (LOCEAN, C. Deltel), This should be incorporated in the same time than the previous point. PISCES must follows.

• **LOBSTER in F90 (LOCEAN-UBO, P_NEMO 5w).** Status: Ongoing Priority: High

The whole TOP has to be written in Fortran90. While the transport component (TRP) is now in Fortran90, the two biogeochemical components are still in fortran77. Status: The re-writing of LOBSTER is almost achieved (LOCEAN, C. Deltel). PISCES must follows.

Work: Achieve LOBSTER rewriting

• **Merge of TRP and TRA (P_NEMO 2w).** To be done. Priority: Medium

Work: this step can be done after the merging of T/S in the dynamical part: use the TRA advection & diffusion modules in TRP. Cf. the ocean (OPA)

• **OFF-line tracer revision (P_NEMO 6w).** Status: to be done. Priority: Low

The off-line tracer code has to evolve: the initialisation phase of passive and active tracers have to share as much as possible modules to significantly decrease the code maintenance. The whole code has to be reorganized with impact on structure of the dynamic part.

6. *AGRIF* (13 weeks)

• **Vectorization of AGRIF (P_NEMO 4w, LJK).** Status: to be done. Priority: High

The efficiency of AGRIF has to be improved on vector computer. Furthermore, it is not obvious to configure the code with AGRIF. Both aspects require a significant among of work.

• **AGRIF with sea-ice (P_NEMO 1w, S_NEMO 8w).** Status: to be done. Priority: Medium

Today AGRIF cannot be used in areas with sea-ice. Adding sea-ice capability in AGRIF should be done on LIM 3, so in 2008 or later. Nevertheless, it is possible to use an AGRIF zoom in the ocean and consider the sea-ice as part of

the forcing computed at low resolution.

This should come after the integration of the new surface module. Work is underway at NOCS

7. *Assimilation – Adjoint* (11 weeks)

• **Observations operator code (E_NEMO 2w)** Status: Ongoing. Priority: High

This will allow the interpolation of model points into observation space to allow assimilation to take place in observation space, reducing interpolation errors.

Work: code to be implemented and tested in Orca025 (Matt Martin, Met Office)

• **Increments application (E_NEMO 3w)** Status: Ongoing. Priority: High

Code to apply data assimilation increments within NEMO, allowing NEMO to be used in assimilative mode will be coded, implemented and tested.

Work: code to be implemented and tested in Orca025 (Matt Martin, Met Office)

• **TAM Development using TAPENADE (INRIA, LJK, P_NEMO 6w)**
Status: Ongoing. Priority: High

TAM Development for NEMO, using TAPENADE (automatic adjoint compiler). Today TAPENADE has been implemented and is able to generate the adjoint of OPA as a whole. This requires some modifications in OPA that has to be incorporated in the system. Further developments are required to be able to generate the linear tangent and adjoint of each modules separately. In addition, the addition of TAM in the system needs the set up of tutorials and at least one reference experiment.

Work: Adjustment of NEMO reference code to TAPENADE
Adapt to TAPENADE to each modules
Develop tutorials & test cases

Annexe B: 2008 actions table

Work description	Status	Who	Time (Weeks)					Priority
	Ongoing		P	E	T	S	O	

With: P=NEMO team in Paris, E=NEMO team in Exeter, S=Southsoupton team, T=NEMO team in Toulouse, O=Others

1. All system components

Users support								
User assistance	Usual	P_NEMO	10	-	-	-	-	High
Regular bugfix	Usual	P_NEMO	10		2	-	-	High
On-line documentation	Usual	P_NEMO	6	-	-	-	-	High
Environment								
Paper documentation	Ongoing	P_NEMO	5	3	-	-	?	High
New Web Site	To be done	P_+E_NEMO	40		-	-	-	High
Code management (FCM)	Ongoing	P_NEMO	4	3	-	-	-	High
Developer tool kit	Ongoing	P_NEMO	6	6	-	-	-	High
Configuration tool kit	To be done	P_NEMO (MCS)	40	-	-	-	-	High
ORCA2-LIM based on NEMO	To be done	P_NEMO	24	-	-	-	-	High
Reference configurations	To be done	P_+S_NEMO	3	-	-	2	-	Medium
Input / Output								
Output part of IOM	To be done	P_NEMO	18	-	-	-	-	High
CF compliance	To be done	E_NEMO	-	2	-	-	-	High
Additional online diagnostic	Done	T_NEMO	-	-	3	-	-	Medium
NetCDF4 + parallel IO option	To be done	S_NEMO	-	-	-	8	-	Medium
Parallelism								
Timing	Partly done	P_NEMO	2	-	-	-	-	High
Merge inimpp and inimpp_2	Ongoing	P_NEMO	3	-	-	-	-	Medium
TOTAL **Marine Core Service**			131 +40	14	5	10	-	

2. Surface modules

Creation of SBC	Ongoing	P_NEMO	12	-	-	-	-	High
On-line interpolation	~Ready	T_+S_+P_NEMO	1	-	3	6	-	High
MEMO bulk formulae	Ongoing	T_NEMO	-	-	3	-	-	?Medium
OASIS with several atmosphere modelsAtmosphere model	To be done	P+E_NEMO/others /E-NEMO	6	5	-	-	-	Medium
Interface to CICE	To be done	E_NEMO	-	5	-	-	-	Medium
Diurnal cycle		P_NEMO	2	-				Medium
TOTAL			21	10	6	6		

3. Ocean (OPA)

Architecture								
Merge of TRA and TRP	To be done	P_NEMO	6	-	-	-	-	High
Rewriting of ldfdyn & ldftra	To be done	P_NEMO	3	-	-	-	-	Low
Schemes								
BDY	On going	E_+T_NEMO	1	2	2	-	-	High
Improvement of OBC	To be done	T_NEMO	-	-	6	-	-	Low
Advection								
Problem with UBS	To be done	P_NEMO	1	-	-	-	-	Medium
TVD optimisation	Ready	P_NEMO	1	-	-	-	-	Medium
4th order	Ready	P_+E_NEMO	1	1	-	-	-	Medium
PPM	Ready	??P_NEMO	1	-	1	-	-	Medium
Time-splitting on vertical advection	~Ready	P_NEMO	2	-	-	-	-	Medium
Physics								
Improved TKE	~Ready	P_+T_NEMO	2	-	3	-	-	High
GOTM	To be done	E_NEMO (POL)	-	3	-	-	-	Medium
Visbeck eiv coefficient	Ongoing	E_NEMO (POL)	-	3	-		-	Medium?
Griffies Isopycnal operator	Ongoing	E_+S_NEMO	-	3	-	4	-	Medium
Tide potential	Ongoing	T_NEMO	-	-	4	-	-	Medium
Pressure gradient schemes testing	To be done	E_NEMO (POL)	-	1	-	-	-	Medium
TOTAL			18	13	16	4	-	

4. Sea-ice (LIM)

LIM 3.0 thermodynamics	~Ready	P_NEMO + LLN	4	-	4	-	8	High
C-grid rheology in LIM 2.0	To be done	T_NEMO + LLN	-	-	4	-	4	High
LIM 2.0 optimisation (limrhg+limadv)	Ready	P_NEMO	1	-	-	-		Medium
LIM3 advanced thermodynamics	To be done	S_NEMO	-	-	-	10	-	Medium
LIM 3 embedding within the ocean	To be done	S_NEMO	-	-	-	2	-	Medium
TOTAL			5	-	8	12	12	

5. Biogeochemistry (TOP)

Trend diagnostics	Ongoing	P_NEMO+LOCEAN	2	-	-	-	1	High
TOP in F90	Ongoing	P_NEMO+LOCEAN	5	-	-	-	2	High
Merge of TRP and TRA (cf. OPA)	To be done	P_NEMO	2	-	-	-	-	Medium
OFF-line tracer revision	To be done	P_NEMO	6	-	-	-		Low
TOTAL			15	-	-	-	3	

6. AGRIF

Usability-efficiency of AGRIF	To be done	P_NEMO	4	-	-		4	High
AGRIF with sea-ice	To be done	S_NEMO	-	-	-	8	-	Medium
TOTAL			4	-	-	8	4	

7. Assimilation - Adjoint

Observations operator code	Ongoing	E_NEMO	-	2	-	-	-	Medium
Increments application	Ongoing	E_NEMO	-	3	-	-	-	Medium
TAM Development using TAPENADE	Ongoing	Sophia + LJK + P_NEMO	6	-	-	-	8	High
TOTAL			6	5		-	8	

TOTAL			**200 + 40**	**42**	**43**	**40**	-	

II. Strategy for Coordination and Management

1. Motivation

The coordination and management of NEMO need to be improved because:

- the Paris team is very stretched at the moment in replying to issues and preparing new releases
- the teams outside Paris need to be able to support the Paris team more effectively
- the present approach to managing the system team in Paris is unlikely to be effective for managing a team distributed across 4 organisations
- the operational teams in particular need to know when new releases will be available and what they will contain

Some of the new members joining the NEMO System Team (e.g. the Met Office) have considerable experience in working within large coding systems to which many teams contribute. It is essential to share experience on practical approaches and to start to put in place the coordination and management approaches which NEMO will need.

2. Proposals for improvements (to be discussed)

1. A more explicit work-plan

In order to allow effective planning, the contributions proposed by each Consortium Member should be specified whenever possible in terms of SMART deliverables; SMART meaning Specific, Measurable, Achievable, Realistic and Time-bound. It takes some effort to specify such deliverables but they have a number of advantages:

(a) each group will have a clear idea of what the others intend to deliver
(b) the plans are more likely to be achieved than less explicit ones
(c) the underlying priorities and objectives will have been considered
(d) it is easier to identify issues affecting progress when expected progress is clearly defined
(e) at the end of the year it will be clearer whether the plans have been met – so the planning for next year can be adjusted appropriately.

Having clearly defined SMART deliverables makes planning of the introduction of changes considerably more straightforward, particularly where multiple interacting changes are being introduced. It should be noted that SMART objectives are intended as an aid to planning, not as a performance measurement tool.

2. Introduction of Time-tabled Release Cycles

Having a clearly defined release cycle aids groups in planning their contributions and their use of the versions post-release. Clearly a time-tabled release cycle and a more explicit work-plan would work well together.

3. Standards for contributions to NEMO

Agreed standards for reviewing, testing and documentation of code changes for NEMO would improve efficiency and might avoid unnecessary conflicts. Coding standards for NEMO are

already in place, and these should be reviewed and amended if necessary to ensure that the standards result in code being delivered to the NEMO System Team in the most appropriate manner. Two sets of standards should be defined: one for members of the NEMO System Team and one for other teams.

4. Methods for code management and testing

It would help the NEMO System Team to be more efficient if all the teams were using some common methods for code management, with a common repository structure. The Met Office use FCM (Flexible Configuration Management) repositories and wish to ensure that all changes in these are made relative to the Paris trunk.

A web-based tool to monitor developments to NEMO being made by the NEMO System Team and the wider user community would also assist efficiency. For each development it should include: a brief S&T description of the change to the code; who is doing it; in which version it will be included; who will review it when; who will test it when; who will document it when.

A coordinated approach to testing within the NEMO System Team using the developers' tool kit would also improve efficiency.

The overall aim of use of common methods should be to enable the distributed NEMO System Team members to be able to provide code to the Paris team with appropriate testing and structure that allows the code to be immediately included in the central code repository.

5. Refinement of Developers' Committee

It would be helpful if at least some sessions of the Developers' Committee focused more tightly on what should be included in future release cycles. The organisation (e.g. chair and membership) of these sessions should be reviewed to ensure this.

6. System Team Priorities

The order of priorities of the NEMO System Team is defined in the Agreement. This order and subsequent compliance to it should be checked.

3. Proposed Approach

Some special meetings of the NEMO System Team should be convened to agree on a number of steps for improving the coordination and management. The meetings should:

(a) consider the above proposals and any others the teams wish to suggest
(b) agree on a short-list of proposals to implement this year
(c) agree on the details of how to implement the short-listed proposals and a timetable for implementation
(d) produce a summary of what has been agreed and copy it to the Steering Committee

The plans should be finalised by the end of March 2008.

It is proposed that each of the Consortium Members devote at least 6 man-weeks of this year's contribution to the NEMO System Team to this activity.

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Schedule 2

Members of Committees and NEMO Managers in 2008

2.1 Members of the Steering Committee

- for CNRS : Patrick MONFRAY
- for MERCATOR OCEAN : Pierre BAHUREL
- for the MET OFFICE : Mike BELL
- for NERC NOCS: Adrian NEW

2.2 NEMO Scientific Leader, NEMO Project Manager and NEMO System Team Coordinator

The NEMO Scientific Leader is: Gurvan MADEC
The NEMO Project Manager is: Claire LEVY
The NEMO System Team Coordinator is: Claire LEVY

2.3 Members of the Developers Committee

Name	e-mail adress	Institution
Olivier Aumont	Olivier.Aumont@ifremer.fr	LPO (France)
Helene Banks	helene.banks@metoffice.gov.uk	Met Office (UK)
John Siddorn	john.siddorn@metoffice.gov.uk	Met Office (UK)
Rachid Benshila	Rachid.Benshila@lodyc.jussieu.fr	LOCEAN-IPSL(France)
Arne Biostoch	abiastoch@ifm-geomar.de	IFM-GEOMAR (Germany)
Eric Dombrowsky	Eric.Dombrowsky@mercator-ocean.fr	Mercator Ocean (France)
Edmée Durand	Edmee.Durand@mercator-ocean.fr	Mercator Ocean (France)
Thierry Fichefet	fichefet@astr.ucl.ac.be	UCL (Belguim)
Claire Lévy	Claire.Levy@ locean-ipsl.upmc.fr	LOCEAN-IPSL(France)
Gurvan Madec	Gurvan.Madec@locean-ipsl.upmc.fr	LOCEAN-IPSL(France)
Olivier Marti	Olivier.marti@cea.fr	LSCE_IPSL(France)
Anne Marie Tréguier	Anne.Marie.Treguier@ifremer.fr	LPO (France)
Adrian New	anw@noc.soton.ac.uk	NOCS (UK)

2.4 Composition of the NEMO System Team

In 2008:

Name	Percentage of time	Institution
Rachid Benshila	100	CNRS Engineer
Romain Brusini	100	CNRS Engineer
Christian Ethé	20	CNRS Engineer
Claire Lévy	100	CNRS Engineer – System Team Coordinator
Sébastien Masson	50	CNAP
Marie-Alice Foujols	10	CNRS Engineer
Marina Lévy	10	CNRS Researcher
Gurvan Madec	10	CNRS Research Director
Claude Talandier	100	CNRS Engineer
Edmée Durand	100	Mercator Ocean NEMO officer
Ian Culverwell	30	Met Office
Richard Hill	20	Met Office
Alistair Sellar	30	Met Office NEMO officer
Dave Storkey	20	Met Office
Andrew Coward	20	NERC NOCS
Steven Alderson	30	NERC NOCS
George Nurser	20	NERC NOCS
Yevgeny Aksenov	30	NERC NOCS

Schedule 3
Components of the OPA and NEMO Systems

Components included in the OPA 8.2 System

- source codes: an ocean general circulation model (OPA_SRC), its tangent linear and adjoint model (TAM_SRC, not implemented yet), on/off-line ocean tracer and biochemistry models (TOP_SRC) and a sea-ice model (LIM_SRC).
- a built-in interface to the OASIS couplers and IOIPSL library
- scripts to compile, create executables and run the experiment on target platforms.
- pre- and post-processing tools built on IDL (INTERP, REVTERP, SAXO) to configure input files and analyse output files.
- standard configurations, including a tri-polar global ocean (ORCA2). These are provided for illustrative purposes enabling one to verify that the code flow is correct.
- a configuration control system (based on CVS at starting point)
- on-line and off-line documentation of the model formulation and codes
- a web server (the NEMOweb sever) for documentation and access to the reference version of the system

Components included in the NEMO 9.0 System (on 1st Jan 2006)

- The present first release of NEMO includes three engines (or components):OPA9 - the new version of the OPA ocean model. The code has been re-written in FORTRAN90 and includes a few additions in terms of physics and numerics
- LIM2 - the new version of the Louvain-la-Neuve sea-ice model . The code has been re-organised and re-writen in FORTRAN90.
- TOP1 - a transport component based on OPA9 tracer advection-diffusion equation (TRP) and a biogeochemistry model which include two components: LOBSTER and PISCES.
- TAM1: the linear-tangent and adjoint of the System is under implementation from OPA8 and will be added. It is a part of the NEMO system design

Current version of the CECILL licence agreement (on 1st Jan 2006)

Version 2 of the CECILL licence agreement will be used in 2006. This agreement is available at: http://www.cecill.info/index.en.html

The following interpretation of the implications of the CECILL licence for other software to which NEMO may be coupled (through coupling systems such as PRISM and FLUME) has been agreed by the CeCILL legal team. For simplicity the situation is described for coupling between NEMO and an atmosphere model but the interpretation applies to coupling to any other models.

1. For the simple case in which the coupler code, the atmosphere model code and the NEMO code are run as separate executables, then as they use separate address spaces the coupler and the atmosphere model codes are external modules (see CeCILL

version 2, article 6.3) and the terms of the CeCILL version 2 agreement do not apply to the coupler or the atmosphere model codes.

2. Some couplers are being developed to enable NEMO and atmosphere model codes to be run within a single executable. The models will communicate with each other by calling "put" routines (to provide data to the other model) and "get" routines (to get data from the other model). These routines will enable the source codes of the NEMO, coupler and atmosphere models to retain their independence.
(a) if only the source code for NEMO (including calls to the "put" and "get" routines), the atmosphere code and the coupler code are distributed to third parties then the atmosphere and coupler codes will not come under the terms of the CeCILL version 2 agreement and may be distributed using other licences.
(b) if the executable of the coupled model were distributed under the CeCILL version 2 licence then the source code of the atmosphere model and the coupler would become subject to the CeCILL version 2 licence as internal modules of NEMO.

Schedule 4
Background Intellectual Property

Centre National de la Recherche Scientifique

NEMO is an *ocean modelling framework* which is composed of 'engines' nested in an 'environment'. The 'engines' provide numerical solutions of ocean, sea-ice, tracers and biochemistry equations and their related physics. The 'environment' consists of the pre- and post-processing tools, the interface to the other components of the Earth System, the user interface, the computer dependent functions and the documentation of the system.

The initial version of NEMO is based on version 8.2 of OPA. It is described below and is called the "reference version of the NEMO system". It consists of:

- source codes: an ocean general circulation model (OPA_SRC), its tangent linear and adjoint model (TAM_SRC, not implemented yet), on/off-line ocean tracer and biochemistry models (TOP_SRC) and a sea-ice model (LIM_SRC).
- a built-in interface to the OASIS couplers and IOIPSL library
- scripts to compile, create executables and run the experiment on target platforms.
- pre- and post-processing tools built on IDL (INTERP, REVTERP, SAXO) to configure input files and analyse output files.
- standard configurations, including a tri-polar global ocean (ORCA2). These are provided for illustrative purposes enabling one to verify that the code flow is correct.
- a configuration control system (based on CVS at starting point)
- on-line and off-line documentation of the model formulation and codes
- a web server (the NEMO web sever) for documentation and access to the reference version of the system