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Project acronym: ENSEMBLES

Project title: ENSEMBLE-based Predictions of Climate Changes and their Impacts

Instrument: Integrated Project

Thematic Priority: Global Change and Ecosystems

**Deliverable D2B.1**
**Experimental plan for the 25 km RCM ensemble simulations to be carried out in WP2B.1, including the forcing fields that will be used (and how these will be obtained) and a timetable for completion of the simulations**

Due date of deliverable: February 2005
Actual submission date: Version 1 – October 2005; Version 2 – Setember 2006

Start date of project: 1 September 2004          Duration: 60 Months

Organisation name of lead contractor for this deliverable: MPIMET

Revision [2]

| Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006) | | |
|---|---|---|
| **Dissemination Level** | | |
| **PU** | Public | x |
| **PP** | Restricted to other programme participants (including the Commission Services) | |
| **RE** | Restricted to a group specified by the consortium (including the Commission Services) | |
| **CO** | Confidential, only for members of the Consortium (including the Commission Services) | |

**ENSEMBLES RT2B**


**Deliverable D2B.1**


Experimental plan for the 20 km RCM ensemble simulations to be carried out in WP2B.1, including the forcing fields that will be used (and how these will be obtained) and a timetable for completion of the simulations.


**Version 1:  October 2005**
**Version 2:  September 2006**


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# Developments up to October 2005: Version 1 of the deliverable

Within WP2B.1 regional climate change simulations will be carried out in years 3 and 4 of the project. During the first months, the strategic planning of the simulations started, which includes the definition of the simulation domain, the lengths of the simulations, the participating GCMs (delivering lateral boundary conditions for the RCMs) and the RCMs output list. These issues have been discussed mainly within RT2B, RT3, and RT6.

Simulation domain
The following figure shows the simulation domain, which will be used in RT3 for ERA40-simulations on 0.22° and within WP2B.1 to carry out the planned RCM scenarios. The domain includes all of Europe and the horizontal resolution is about 25 km.
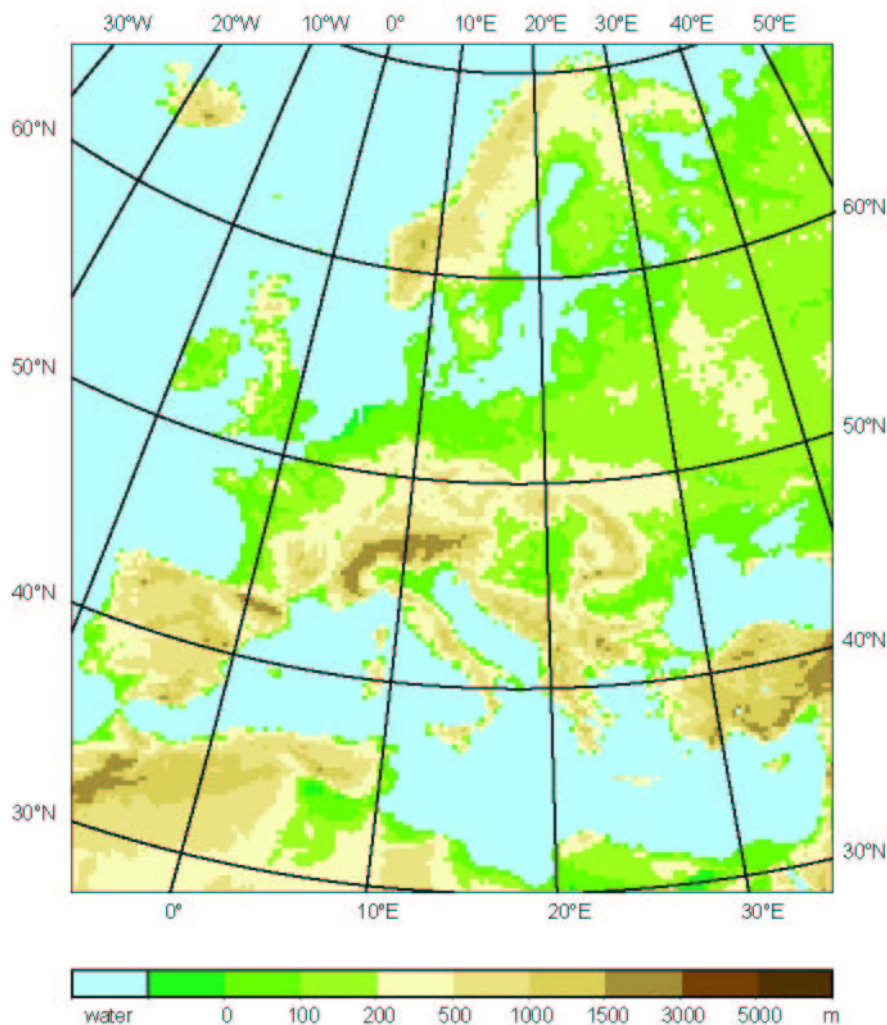


The RCM domain at 25 km resolution to be used for the WP2B.1 RCM runs and the WP3 ERA40@25km RCM runs.

Simulation length

| Institution | Model | Simulation Time |
|---|---|---|
| DMI | HIRHAM | 1950-2100 |
| SMHI | RCA | 1950-2050 |
| KNMI | RACMO | 1950-2050 |
| ICTP | RegCM | 1950-2050 |
| METO-HC | HadRM | 1950-2100 |
| CNRM | ALADIN | 1950-2050 |
| MPI-M | REMO | 1950-2100 |
| UCLM | PROMES | 1950-2050 |
| ETH | CHRM | 1950-2050 |

The table above includes a tentative list of the simulation lengths as they are planned within the individual groups. Here three runs with a length of 150 years each will be carried out and six runs of 100 years each. During the second half of 2005 it turned out that some groups might be able to perform more than one simulation, which will increase the number of ensemble members.

In addition, two more groups would like to participate, who are affiliated partners in ENSEMBLES: C4I from Ireland will carry out a simulation for the period 1950 to 2050 and CUNI from the Czech Republic is eventually planning to do the same. Both partners are in discussion with all partners from WP2B.1.

Within this deliverable it was planned to present a list for the 25 km scenario runs. This list should include a collection of high-resolution simulations, which will be carried out at 25 km resolution; in detail it was planned to deliver a tentative list of the different set-ups for all participating RCMs, which means driving GCM, RCM and IPCC emissions scenario.

During the discussions between the partners performing impact studies and the RCM modellers in the 12 months up to October 2005 it turned out that more detailed information on the performance of the GCMs as well as on the RCMs under ERA-40 driving fields is needed, before the list can be finalized. However, WP2B.1 partners were asked to suggest the runs that they would like to complete if they had a free choice of GCM and emissions scenarios. A first version of this so-called wish list is included at the end of this document (Table 1).

The final version will be established together with RT3 WP3.2 and WP3.3, in which – based on the experience of the performance of RCMs under ERA40 driving fields - a GCM/RCM matrix and weighting scheme will be worked out.

During the meeting in Athens, September 2005 it was decided that a working paper on "D3.2.1, Definition of measures of reliability based on ability to simulate observed climate in hind-cast mode" will be written by the end of Month 18. A first draft was scheduled for the end of November 2005. The paper will include the variables and aspects under consideration, such as moments, trends, physical consistency, acceptability (*e.g.,* maximum biases). Sub-regional measures of variability may be considered, too. Contacts are needed with other RTs and possible cross-RT work on weighting and related issues. The same working group will also consider the issue of how to go from weights to specification of pdf techniques (*i.e.,*

M3.4. Specification of pdf techniques to be tested in ensemble simulations using ERA-40 based hind-casts).

More information on the performance of available GCMs will be established through a working group looking at the IPCC AR4 GCM-simulations. They will address the question on how realistic these are over Europe. The resultant paper will provide the necessary level of detail to inform the final list of RCM scenarios in WP2B.1.

The issue of RCMs being "very similar" as stated in the ENSEMBLES DoW was also discussed in RT3 and RT2B. It is very clear that RCMs are not really similar. This is especially so for extremes, but also for aspects of the mean climate. The implication is that RCMs are not interchangeable and this should be taken into account in the SRES/GCM/RCM-assignments.

As of October 2005, WP3.3 has not yet started, but a new milestone has been included in the DIP for Months 13-30 (M3.6 Month 24: Every RCM is assigned a GCM/emission scenario member to be used as boundary/forcing conditions in RT2B. RCM scenario runs should not start before this date, nor before the 25 km RCM runs are finalised), which includes the final list for the regional climate change experiments in WP2B.1.


## Further developments up to September 2006: Version 2 of the deliverable

During the last few months, lively discussions about the GCM/RCM matrix and the choice of IPCC scenario have taken place within RT3 and RT2B, as well as with parts of other RTs. These discussions have taken place at the RT3, RT2B and ENSEMBLES Management Board meetings, as well as by email.

It has been agreed that all groups will focus on the IPCC SRES A1B scenario.

Furthermore, a two-step approach to the GCM/RCM matrix has been agreed to meet, on the one hand, the urgent need for high-resolution climate change runs within the near future and, on the other hand, sufficient time for in-depth scientific and technical discussion and supporting analyses (e.g., analysis of the appropriate GCM runs) within RT3. In RT3, the optimal GCM/RCM matrix is under development: D3.3.1 – RCM-system for use in RT2B (choice of RCM-GCM combinations and preliminary RCM weights). This deliverable is due at month 30.

In the meantime, WP2B.1 scenario runs will start from Month 25 onwards as originally planned using the first-step GCM/RCM matrix shown in Table 2. This first-step matrix is based on the initial wish-list (Table 1), modified to reflect the current initial proposals from WP3.3 (responsible for the production of D3.3.1). Thus it covers more GCMs, for example.

The compulsory and non-compulsory runs currently proposed by WP3.3 are also indicated in Table 2, along with proposed runs for three groups not formally involved in RT2B, but involved in RT3. It can be seen that there is generally good agreement between the WP2B.1 first-step runs and the current proposals from WP3.3 (though the latter maybe subject to revision).

The first-step matrix indicates the first scenario run (all for the A1B scenario) that will be done by each group (for some this will be the only simulation). All groups who can afford to

run more simulations will be asked to participate in filling the second-step matrix (i.e., D3.3.1). While WP2B.1 groups who wish to proceed with runs of their own choice are of course free to do so, it should be noted that the ENSEMBLES Management Board agreed in May 2006 that:

*"This is on the understanding that precedence should be given to the GCM-RCM matrix to be developed by RT3. Groups starting their run early might need to contribute to another run."*

# Table 1: Proposed simulations with global and regional models: the preliminary WP2B.1 wish list

**Proposed simulations with Global models and Regional models**

| | |
|---|---|
| **Partner** | Name of the partner producing the simulations: for more detail refer to Table 6.9 in the DoW |
| **Period** | period over which the results of the simulation will be available at 6-hourly intervals |
| **Grid resolution** | approximate resolution of the grid where model results are stored grids (R) in ° for Gaussian grids (G), or in °longitude x °latitude for regular grids (R) |
| **Number** | Size of the ensemble of planned simulations |
| **Levels** | number of levels in the vertical where the dynamical variables (U,V,T,q) will be stored at 6-hourly intervals M for storage on model levels, and P for storage on standard pressure levels |
| **Completed** | approximate month.year when the simulations are expected to be completed |
| **Notes** | see explanations below |

**Regional models (RT2B)**

| Partner model resolution Notes | METO-HC HadRMx | MPIMET REMO5.7 25x25km (d) | CNRM ALADIN 20x20 km (c) | DMI | ETH | KNMI RACMO 25x25km | ICTP | SMHI |
|---|---|---|---|---|---|---|---|---|

**Global first stream simulations (RT2A)**

| Partner | Period | Number | Grid Resolution | Levels | completed | Notes | METO-HC | MPIMET | CNRM | DMI | ETH | KNMI | ICTP | SMHI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **C20C3M** | | | | | | | | | | | | | | |
| METO-HC | 1860-2000 | 1 | R:1.25x1.875° | 17 (P) | May-05 | | 1950-2000 | | | | | 1950-2000? | | 1950-2000 |
| MPIMET | 1860-2000 | 3 | G:1.875° | 31 (M) | yes | | 1950-2000 | 1950-2000 | | | | 1950-2000? | 1950-2000 | 1950-2000, one |
| FUB | 1860-2000 | 3 | G:3.75° (T30) | 39 (M) | Feb-05 | (a) | | | | | | | | |
| IPSL | 1960-2000 | 1 | R:2.4x3.75° | 19 (M) | Oct.2004 | | | | | | | | | |
| CNRM | 1860-2000 | 1 | G:2.8125° | 23 (P) | Dec.2004 | | | | 1950-2000 | | | | | |
| CNRM | 1950-2000 | 1 | G:2.8125° | 45 (M) | Dec.2005 | | | | | | | | | |
| NERSC | 1860-2000 | 1 | G:2.8125° | 31 (M) | Dec.2004 | | | | | | | | | 1950-2000 |
| **A1B** | | | | | | | | | | | | | | |
| METO-HC | 2000-2100 | 1 | R:1.25x1.875° | 17 (P) | Mar-05 | | | | | | | 2000-2050? | | yes |
| MPIMET | 2000-2100 | 3 | G:1.875° | 31 (M) | yes | | | 2000-2100 | | | | 2000-2050? | 2000-2050 | yes, one memb |
| DMI | 2000-2100 | 1 | G:1.875° | 31 (M) | Mar. 2005 | | | | | | | | | |
| FUB | 2000-2100 | 3 | G:3.75° (T30) | 39 (M) | Apr-05 | (a) | | | | | | | | |
| IPSL | 2000-2100 | 1 | R:2.4x3.75° | 19 (M) | Dec.2004 | | | | | | | | | |
| CNRM | 2000-2100 | 1 | G:2.8125° | 23 (P) | Jan.2005 | | | | | | | | | |
| CNRM | 2000-2050 | 1 | G:2.8125° | 45 (M) | Dec.2005 | (b) | | | | | | | | |
| NERSC | 2000-2100 | 1 | G:2.8125° | 31 (M) | Jan.2005 | | | | | | | | | yes |
| **B1** | | | | | | | | | | | | | | |
| METO-HC | 2000-2100 | 1 | R:1.25x1.875° | 17 (P) | Dec-05 | | | | | | | | | yes |
| MPIMET | 2000-2100 | 3 | G:1.875° | 31 (M) | yes | | | 2000-2100 | | | | | | yes, one memb |
| FUB | 2000-2100 | 3 | G:3.75° (T30) | 39 (M) | Jun-05 | (a) | | | | | | | | |
| IPSL | 2000-2100 | 1 | R:2.4x3.75° | 19 (M) | Dec.2004 | | | | | | | | | |
| CNRM | 2000-2100 | 1 | G:2.8125° | 23 (P) | Jan.2005 | | | | | | | | | |
| NERSC | 2000-2100 | 1 | G:2.8125° | 31 (M) | Jan.2005 | | | | | | | | | yes |
| **A2** | | | | | | | | | | | | | | |
| METO-HC | 2000-2100 | 1 | R:1.25x1.875° | 17 (P) | Mar-05 | | 2000-2100 | | | | | 2000-2050? | | yes |
| MPIMET | 2000-2100 | 3 | G:1.875° | 31 (M) | yes | | 2000-2100 | 2000-2100 | | | | 2000-2050? | | yes, one memb |
| FUB | 2000-2100 | 3 | G:3.75° (T30) | 39 (M) | Sep-05 | (a) | | | | | | | | |
| IPSL | 2000-2100 | 1 | R:2.4x3.75° | 19 (M) | Dec.2004 | | | | | | | | | |
| CNRM | 2000-2100 | 1 | G:2.8125° | 23 (P) | Jan.2005 | | | | 2000-2050 | | | | | |
| NERSC | 2000-2100 | 1 | G:2.8125° | 31 (M) | Jan.2005 | | | | | | | | | yes |

**Notes**

**FUB (a)** The vertical levels are extending up to 0.01 hPa

**CNRM (b)** Another scenario than A1B can be chosen for storing results on model levels if it is more adapted for regional model simulations

**CNRM (c)** regional simulations at CNRM will be performed from the regional model ALADIN-Climat running inside a variable resolution model forced by SST anomalies from the coupled scenario

**REMO (d)** we will either run one member of each scenario or 3 members of A1B. We are open to run also with other driving GCMs, but only until 2050

# Table 2: The first step WP2B.1 GCM/RCM matrix and relationship with current proposals from WP3.3

| GCM's | RCM's | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | METO-HC | MPIMET | CNRM | DMI | ETH | KNMI | ICTP | SMHI | UCLM | C4I | GKSS | MetNo | CHMI |
| METO-HC | 1950-2100 | | | | 1950-2050 | | | 1950-2050 | 1950-2050 | | | | 1950-2050 |
| MPIMET | 1950-2100 | 1950-2100 | | 1950-2050* | | 1950-2050 | 1950-2050 | | | 1950-2050 | | | |
| FUB | | | | | | | | | | | | | |
| IPSL | | 1950-2050 | | | | | | | | | 1950-2050 | | |
| CNRM | | | 1950-2050 | 1950-2050* | | | | | | | | | |
| NERSC | | | | | | | | 1950-2050 | | | | 1950-2050 | |

☐ 'Contractually-obliged' simulations currently proposed by WP3.3

☐ 'Non-contractually-obliged' simulations currently proposed by WP3.3

☐ Runs currently proposed by WP3.3 for partners not formally involved in WP2B.1

☐ **WP2B.1 first-step runs**

\* One of the DMI runs will be extended to 2100