Why ENSEMBLES is important

ENSEMBLES directly addresses key objectives of the two most important international agencies formulating climate change policy.

UN - Kyoto Protocol
(unfccc.int/essential_background/convention/items/2627.php).
The European Council has approved the 1997 UN Kyoto Protocol on climate change. ENSEMBLES will fulfill the following objectives of the Protocol:

- provide the best available scientific information and assessment of climate change and its impacts
- reduce uncertainties in knowledge of the climate system and in the adverse impacts of climate change
- promote education and training, and increase public awareness of climate change.

IPCC (www.ipcc.ch/)
The Intergovernmental Panel on Climate Change (IPCC) represents the consensus view of global climate scientists. ENSEMBLES responds to the following recommendations of the IPCC Third Assessment Report (2001):

- provide inputs for policy makers on the assessment of dangerous interference with the climate system
- identify and address relevant research, and gaps in knowledge, about climate change scenarios and impacts
- develop methodologies to assess impacts.

Find out more . . .

ENSEMBLES started in September, 2004 and will be funded for five years. This brochure is the first of several and is designed to introduce you to ENSEMBLES, give an overview of the project, and point you towards other sources of information. The work to date has consisted of starting the programme of model runs, developing appropriate analytical techniques, and setting up Web sites. Please visit the ENSEMBLES Web site for more detailed information, document downloads, links to RT Web sites, and to follow the latest developments. Contact details are given below:

ENSEMBLES Web site: www.ensembles-eu.org

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Project Members

Australia: Bureau of Meteorology Research Centre

Austria: International Institute for Applied Systems Analysis

Belgium: Université Catholique de Louvain

Czech Republic: Czech Hydrometeorological Institute, Charles University - Faculty of Mathematics and Physics, Ústav fyziky atmosféry Av ČR

Denmark: Danish Meteorological Institute, Danish Institute of Agricultural Sciences

Finland: Finnish Meteorological Institute, Finnish Environment Institute

France: Météo-France, Centre National de Recherches Meteorologiques, Centre National de la Recherche Scientifique (including IPSL, LMD, LSCE, LGGE), Société Civile CERFACS, CLIMPACT, Electricité de France, Ecole Normale Supérieure - Paris, Société de Mathématiques et de Sciences Humaines, Université Joseph Fourier

Germany: MPG represented by Max-Planck-Institut für Meteorologie, Universität Hamburg, University of Applied Sciences Stuttgart, Deutscher Wetterdienst, Freie Universität Berlin, GKSS Forschungszentrum Geesthacht GmbH, Institut fúr Meereskunde, University of Stuttgart, Potsdam Institute for Climate Impact Research, Universität Kassel

Greece: National Observatory of Athens, Aristotle University of Thessaloniki

International: European Centre for Medium-Range Weather Forecasts, The Abdus Salam International Centre for Theoretical Physics, Joint Research Centre of the European Community - Institute for the Protection and Security of the Citizen

Italy: Istituto Nazionale di Geofisica e Vulcanologia, Agenzia Regionale Prevenzione e Ambiente dell'Emilia-Romagna, Servizio IdroMeteorologico, Consiglio Nazionale delle Ricerche, Department of Agronomy and Land Management, University of Florence, Fondazione Eni Enrico Mattei

Netherlands: Royal Netherlands Meteorological Institute, National Institute for Public Health and Environment

Norway: Center for International Climate and Environmental Research - Oslo, Norwegian Meteorological Institute, Nansen Environmental and Remote Sensing Center, University of Oslo

Poland: Research Centre for Agricultural and Forest Environment, Polish Academy of Sciences

Romania: National Institute of Hydrology and Water Management, National Meteorological Administration

Spain: Fundación para la Investigación del Clima, Instituto Nacional de Meteorológia, Universidad de Cantabria, Universidad de Castilla-La Mancha

Sweden: Swedish Meteorological and Hydrological Institute, Lunds Universitet

Switzerland: University of Fribourg, Swiss Federal Institute of Technology Zurich, Institut Universitaire Kurt Boesch, Federal Office of Meteorology and Climatology

UK: Met Office - Hadley Centre for Climate Prediction and Research, University of Reading, University of Bristol, University of East Anglia, London School of Economics, London School of Hygiene and Tropical Medicine, University of Liverpool, Chancellor Masters and Scholars of Oxford University

USA: The Trustees of Columbia University in the City of New York

ENSEMBLES

January 2005

ENSEMBLE based predictions of climate changes and their impacts

Funded by the European Commission and co-ordinated by the Hadley Centre for Climate Prediction and Research at the UK Met Office, ENSEMBLES is an ambitious project developed to quantify the uncertainty in long-term predictions of climate change.

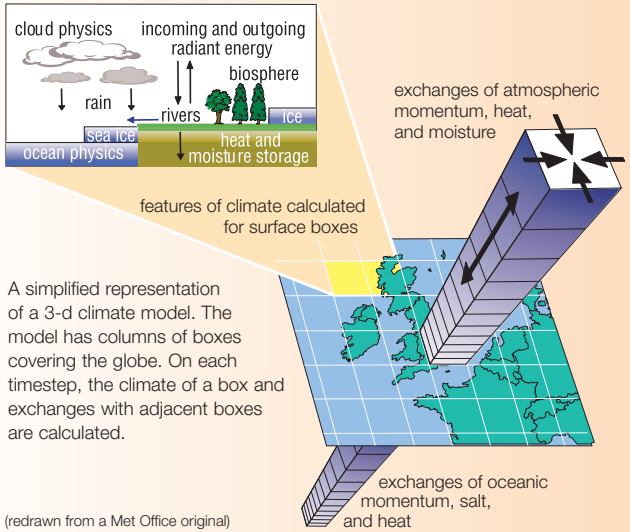
ENSEMBLES uses the collective expertise of 66 institutes to produce a reliable quantitative risk assessment of long-term climate change and its impacts. Particular emphasis is given to probable future changes in climate extremes, including storminess, intense rainfall, prolonged drought, and potential climate 'shocks' such as failure of the Gulf Stream.

To focus on the practical concerns of stakeholders and policy makers, ENSEMBLES considers impacts on timeframes ranging from seasonal to decadal and longer, at global, regional, and local spatial scales.

This research is supported by the European Commisssion under the 6th Framework Programme 2002-2006, Priority Global Change and Ecosystems

Simulating Climate

Future climate can be realistically simulated by computer models of the Earth-atmosphere system. Using known starting conditions, and mathematical approximations to physical processes, models calculate the response of climate to 'forcing' such as changes in the amount of atmospheric carbon dioxide. Model calculations are performed at 'timesteps', say every 5 minutes of simulated time, which take only a few seconds of actual time to run. At the end of each simulated day, the model saves data, such as air temperature, wind speed etc., to hard disk. A typical run for a global climate model may be for 200 - 300 simulated years and can take several months to complete.



A simplified representation of a 3-d climate model. The model has columns of boxes covering the globe. On each timestep, the climate of a box and exchanges with adjacent boxes are calculated.

(redrawn from a Met Office original)

Unfortunately, there are uncertainties in the starting conditions and in the representation of atmospheric physics. Also, a single model run can only give one version of the likely climate response to forcing such as global warming. To address these problems, the model is run several times with the same forcing, but varying the starting conditions a little on each run. The ensuing 'ensemble' of results gives good estimates of the uncertainty in the prediction using standard statistical techniques. Predictions based on ensembles from more than one model are even more reliable. Scientists in ENSEMBLES are also developing alternative methods of improving the reliability of predictions.

ENSEMBLES uses several models to quanitfy various aspects of uncertainty in climate prediction. These will be used by impacts specialists to produce risk assessments for climate change impacts over Europe including: rising sea level, changes in the frequency and extent of drought, heat waves, flooding, storminess, and forest fires. The results will be of great practical value to policy makers and stakeholders, and will be disseminated for public interest through informative Web sites, leaflets, and articles aimed at those with more limited scientific experience.

ENSEMBLES Objectives

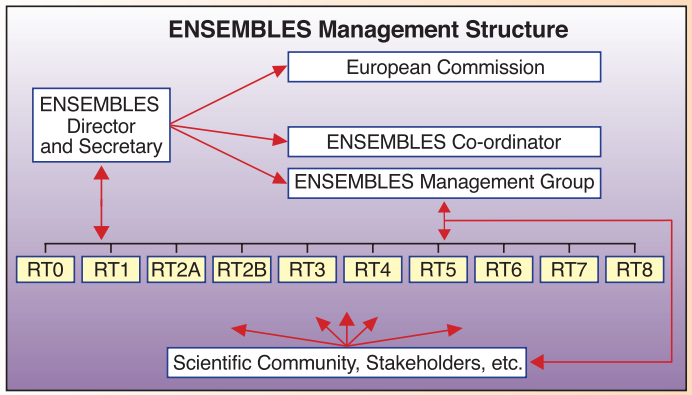
1) Develop an ensemble prediction system based on state-of-the-art, high resolution, global and regional Earth System models developed in Europe, and validated against quality controlled, high resolution gridded datasets for Europe. The prediction system will, for the first time, produce a reliable, objective, probabilistic estimate of uncertainty in future climate on seasonal to decadal and longer timescales.

2) Quantify and reduce uncertainty in the model representation of physical, chemical, biological and human-related feedbacks in the Earth System (including water resource, land use, and air quality issues, and carbon cycle feedbacks).

3) Maximise the exploitation of the results by linking the outputs of the ensemble prediction system to a range of applications, including agriculture, health, food security, energy, water resources, insurance and weather risk management

ENSEMBLES Organisation

With such a big research project (66 partners) it is necessary to have a well-defined management structure. ENSEMBLES is organised on the basis of the Research Themes (RTs) outlined below. Each RT has managers and sub-managers and regular meetings are organised both within the RTs and between the RT managers and the project co-ordination team.

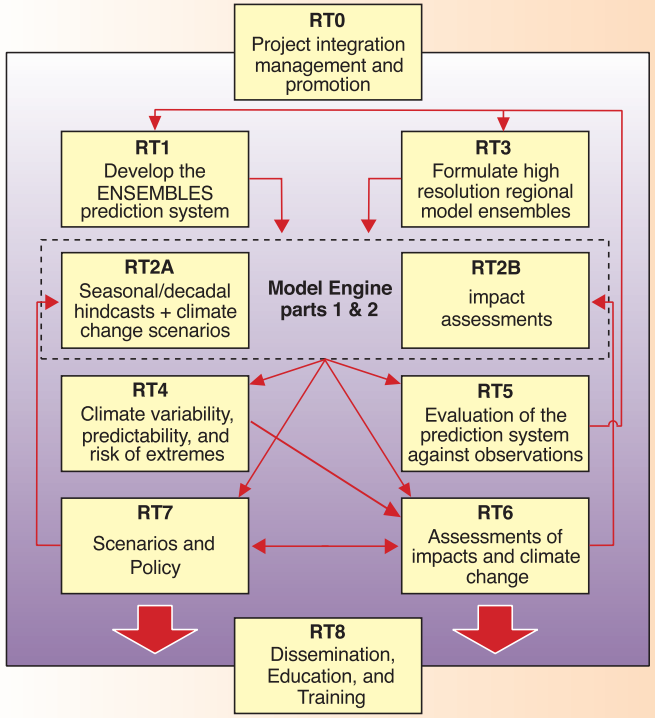


RT1 - Development of the global ensemble prediction system based on global earth system models developed in Europe

RT3 - Development of a high resolution regional climate model (RCM) ensemble system for Europe and some other region

RT2A - Production of sets of simulations at seasonal-decadal and centennial timescales using the global ensemble prediction system

Interaction between the RTs



RT2B - Production of regional climate scenarios for impacts assessments using the high resolution RCM ensemble system and downscaling methods to add value to the global ensemble prediction system

RT4 - Advancement of our understanding of the basic science issues focussing on the processes governing climate variability and change, climate predictability and the probability of extreme events

RT5 - Independent comprehensive evaluation of the ENSEMBLES simulations against observations/analyses

RT6 - Assessments of the impacts of climate change by integrating process models of impacts on the global environment into earth system models, linking impact models to probabilistic scenarios of climate change, and maximising skill in the impacts models at seasonal-decadal timescales

RT7 - Adoption of scenarios of greenhouse gas emissions, land use change and adaptive capacity with and without greenhouse gas emission reduction policies, and testing the sensitivity of these scenarios to climatic change

RT8 - Support for the ENSEMBLES community by disseminating results emerging from the other RTs, along with education and training through short courses and exchange programs

RT0 - Provision of overall co-ordination of the project to ensure that the project is well integrated, managed and promoted