ENSEMBLES Project

Overview

Workshop on “Adaptation to Impacts of Climate Change in the European Alps”

Chris Hewitt, ENSEMBLES Director
Met Office, Hadley Centre

Web site: http://www.ensembles-eu.org
Motivation

Predictions of natural climate variability on seasonal to decadal to centennial timescales, and the human impact on climate are inherently probabilistic due to uncertainties in:

- initial conditions
- representation of key processes within models
- climatic forcing factors

Reliable seasonal to decadal forecasts, and estimates of climatic risk can only be made through ensemble integrations of Earth-System Models in which these uncertainties are explicitly incorporated.

The ENSEMBLES project will provide these probabilistic estimates.
Sources of uncertainty

Effects of natural variability

Future emission scenarios

Modelling of Earth system processes
We can produce a small number of different predictions with little idea of how reliable they might be
Climate Prediction Modelling

From Murphy et al, Nature 2004
Motivation: Ensemble Climate Prediction

- Run ensembles of different climate models to sample uncertainties
- Measure variations in reliability between models using hindcasts
- Produce probabilistic predictions of climate change
- Do this for seasonal to decadal and longer timescales, and global, regional and local spatial scales, for use in a wide range of applications
The ENSEMBLES Project

- 5-year *Integrated Project* supported by EC FP6 funding
  1 September 2004 – 31 August 2009

- 67 partners from across EU, Switzerland, Australia, US
  we welcome requests from new groups to participate on an unfunded basis – currently 11 such groups worldwide affiliated to the project

- Builds upon earlier (FP5) projects
  e.g. DEMETER, MICE, PRUDENCE, STARDEX

- Integrates a wide range of research communities

- Work carried out in Ten Research Themes
1. Develop an ensemble prediction system based on global and regional Earth System models, validated against quality controlled, high resolution gridded datasets for Europe, to produce for the first time, an objective probabilistic estimate of uncertainty in future climate at the seasonal, decadal and longer timescales.

2. Quantify and reduce uncertainty in the representation of physical, chemical, biological and human-related feedbacks in the Earth System.

3. Exploit the results by linking the outputs to a range of applications, including agriculture, health, food security, energy, water resources, insurance. We are aiming to increase availability of scientific knowledge and provision of relevant information related to the impacts of climate change.
end-to-end methodology

1 2 3 4

Seasonal forecast

62 63

Downscaling

1 2 3 4

Application model

non-linear transformation

1 2 3 4

PDF of meteorological variables

0

End-user PDF (e.g., crop yield)

0

PDF of meteorological variables

non-linear transformation

End-user PDF (e.g., crop yield)

Slide courtesy of Francisco Doblas-Reyes
Concluding remarks – innovative work

- Brings together largely separate communities and integrates world-leading European research: s2d, anthropogenic climate change, global modellers, regional modellers (dynamical and statistical downscaling), scientific understanding, evaluation with observations, application modellers to deliver climate impacts, emission scenario developers, training programmes

- Multi-disciplinary approach allows exchange of knowledge, ideas and techniques – for example extensive work on extremes

- Examples of new products:
  - probabilistic methods for use for GCMs, RCMs, impact models, s2d2c
  - gridded observations for Europe with estimate of uncertainty
  - public availability of large datasets
  - on-line tools for users to downscale Ensembles simulations