# 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:

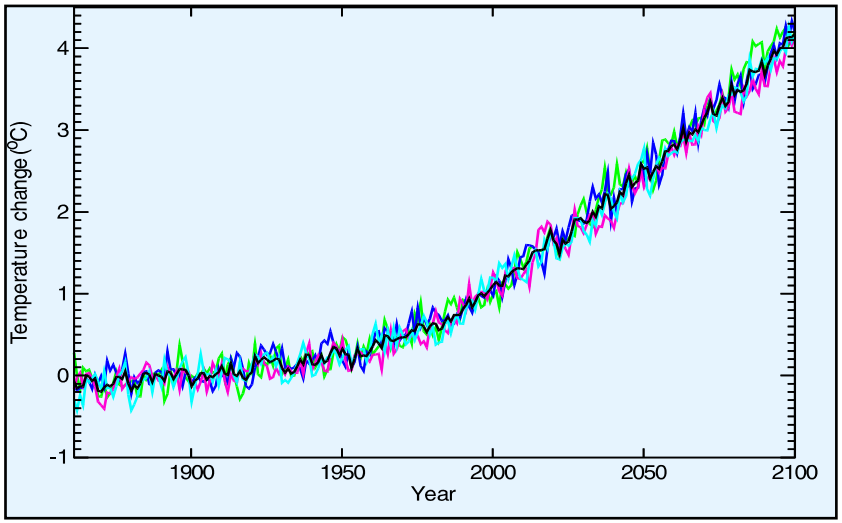
- initial conditions
- representation of key processes within models
- climatic forcing factors

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.

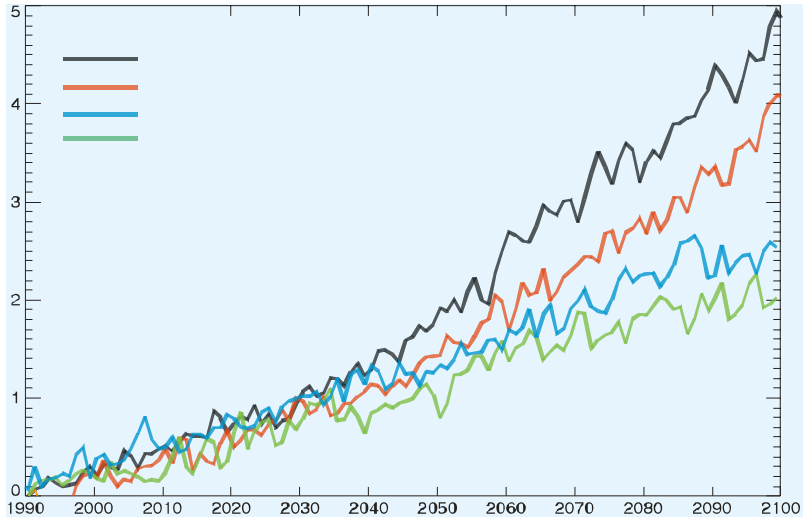
The ENSEMBLES project will provide these probabilistic estimates.

# Sources of uncertainty

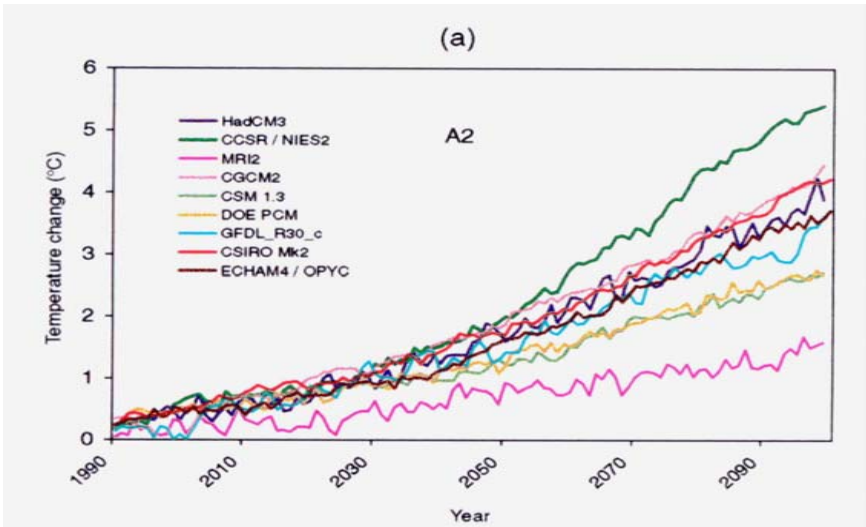
## Effects of natural variability



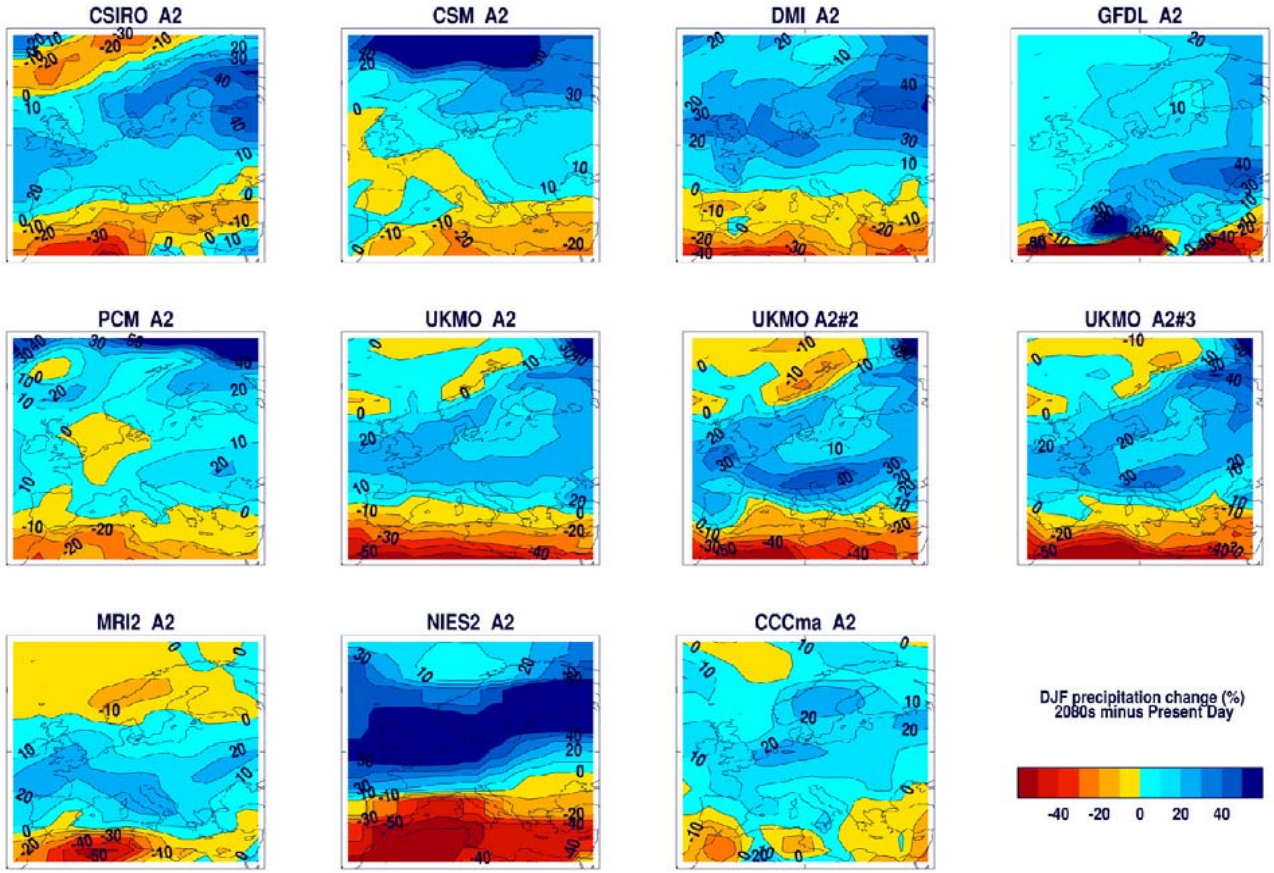

## Future emission scenarios




## Modelling of Earth system processes



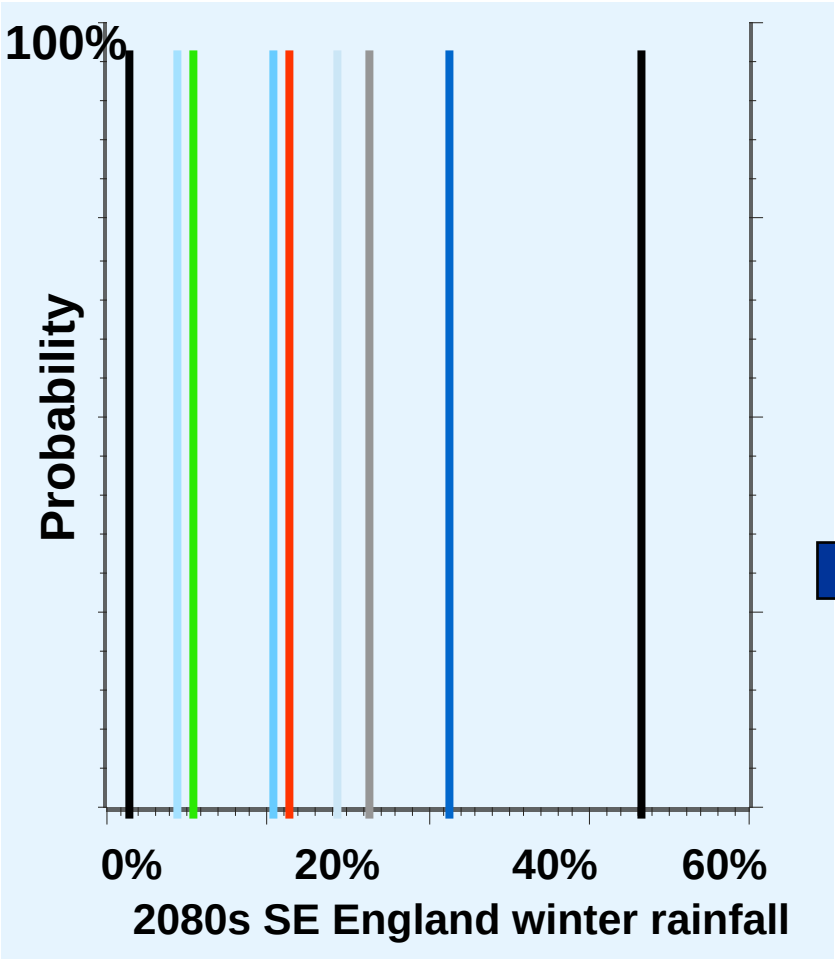
# Current Status of Climate Change Prediction



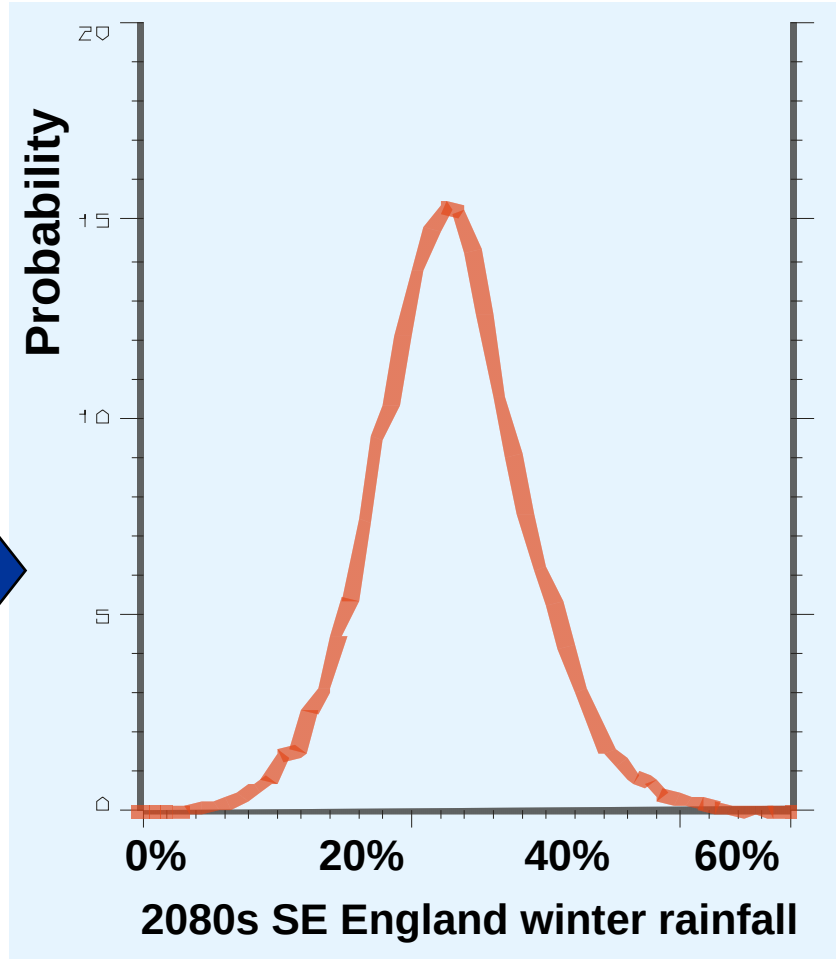

We can produce a small number of different predictions with little idea of how reliable they might be

# Probabilistic Climate Predictions

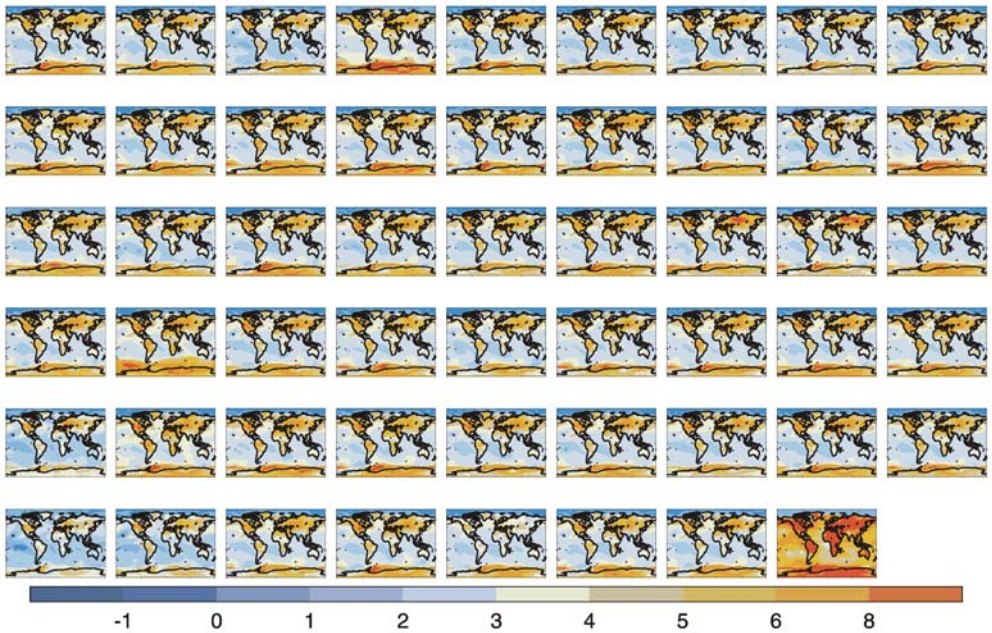
**current position**

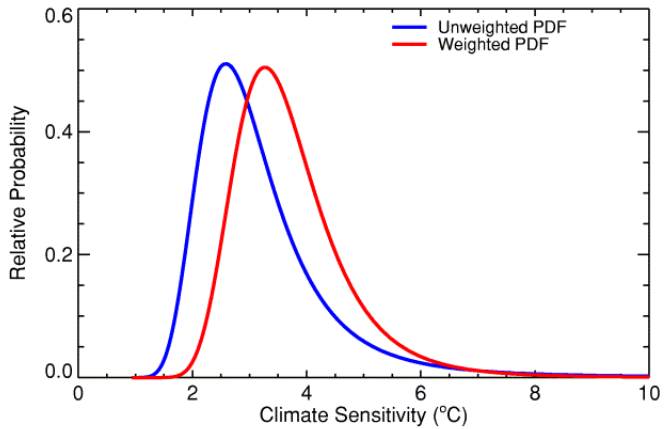



**required position**



# 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

# Strategic Objectives

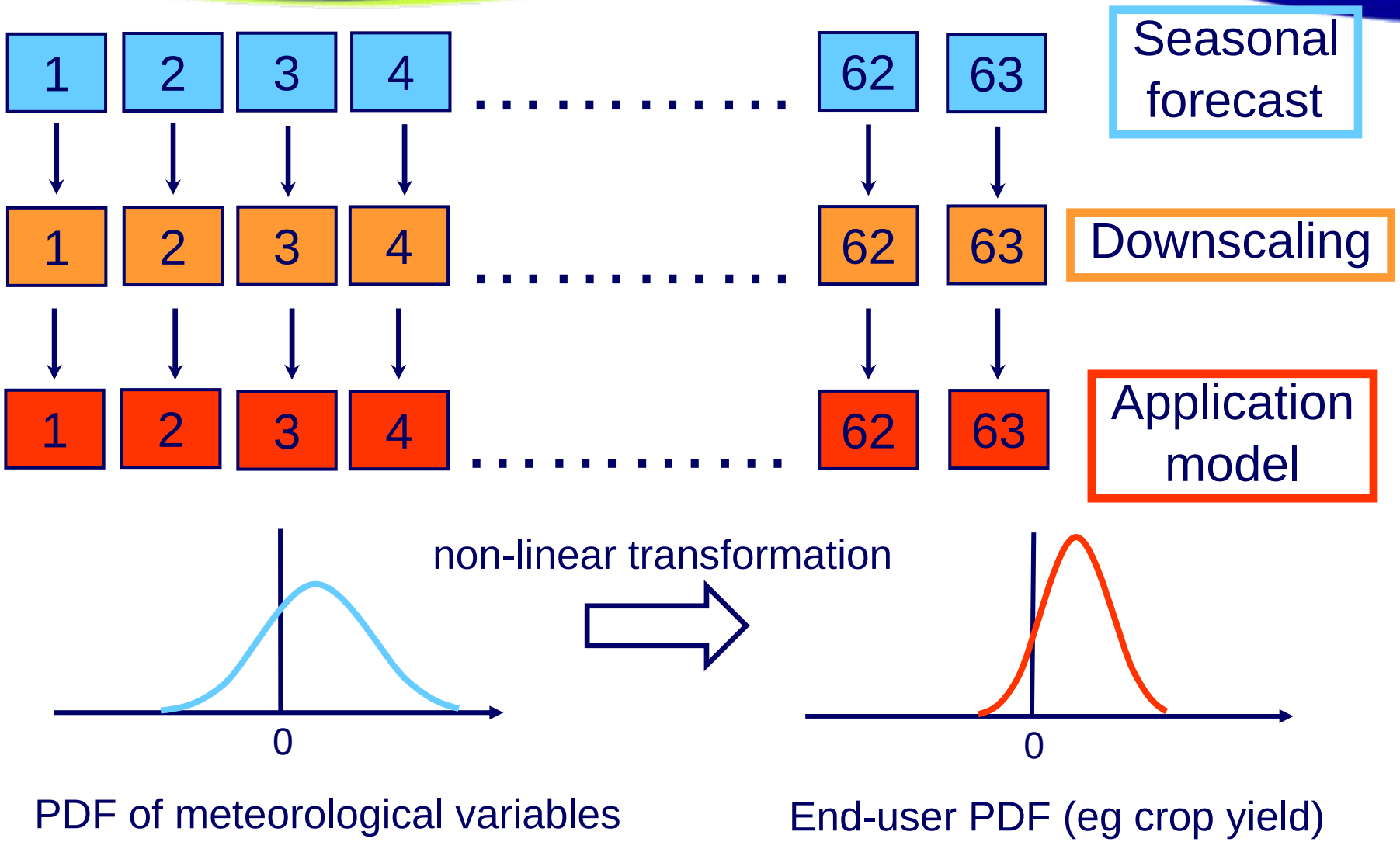
1. Develop an **ensemble prediction system** based on **global** and **regional Earth System models**, **validated** against quality controlled, high resolution **gridded datasets** for Europe, to produce for the first time, an **objective probabalistic estimate of uncertainty** in future climate at 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




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