

climateprediction.net progress so far...

Sylvia Knight, Duncan Ackerley, Tolu Aina, Myles Allen, Carl Christensen, Mat Collins, Nick Faull, Dave Frame, Ellie Highwood, Jamie Kettleborough, Andrew Martin, Neil Massey, Claudio Piani, Bob Spicer, Dave Stainforth, ... and about 90,000 other people worldwide!



climateprediction.net



climate*prediction*.net

- The Goals:
 - To harness the power of idle PCs to help quantify uncertainty in predictions of the 21st century climate.
 - To improve public understanding of the nature of uncertainty in climate prediction.
- The Method:
 - Invite the public to download a full resolution, 3D climate model and run it locally on their PC.
 - Use each PC to run a single member of a massive, perturbed physics ensemble.
 - Provide visualization software and educational packages to maintain interest and facilitate school and undergraduate projects etc.



Sources of Uncertainty

Basic sources of uncertainty in climate forecasts:

- **Incomplete knowledge of the initial state of the system**
- **Uncertainty in future forcings**
- **Uncertain models - poor/incomplete representation of the physical processes that govern the climate**



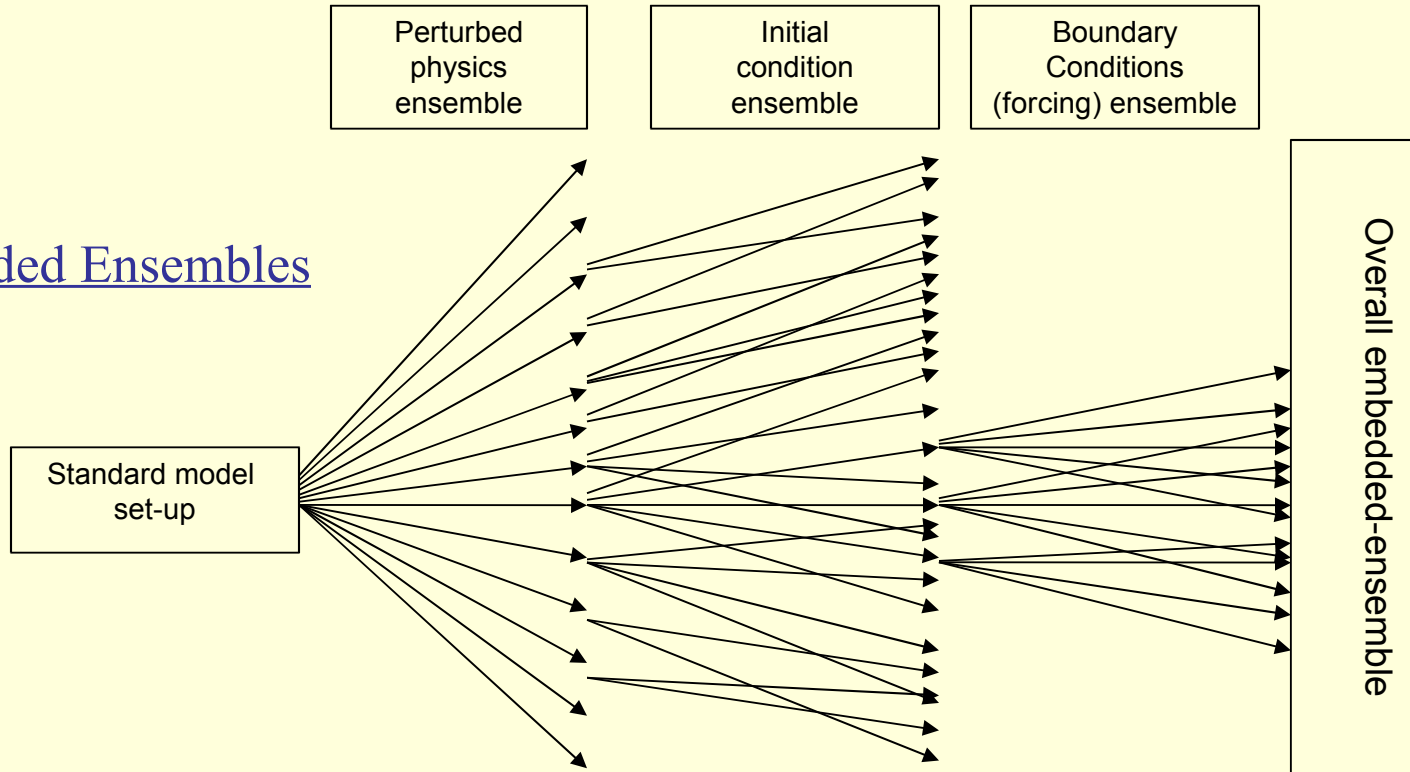
The climateprediction.net approach to forecast uncertainty

- **climateprediction.net targets uncertainty in the initial state of the atmosphere by running the same model several (~10) times with different initial states (initial condition ensembles)**
- **climateprediction.net targets uncertainty in future forcings by running many different solar, sulphate and greenhouse scenarios (forcing ensembles)**
- **climateprediction.net targets model uncertainty by altering the model's physics (perturbed physics ensembles)**

To systematically explore model uncertainty requires large numbers of simulations, due to the non-linear interaction of parameters. Hence the need for climateprediction.net to carry out such an ensemble.

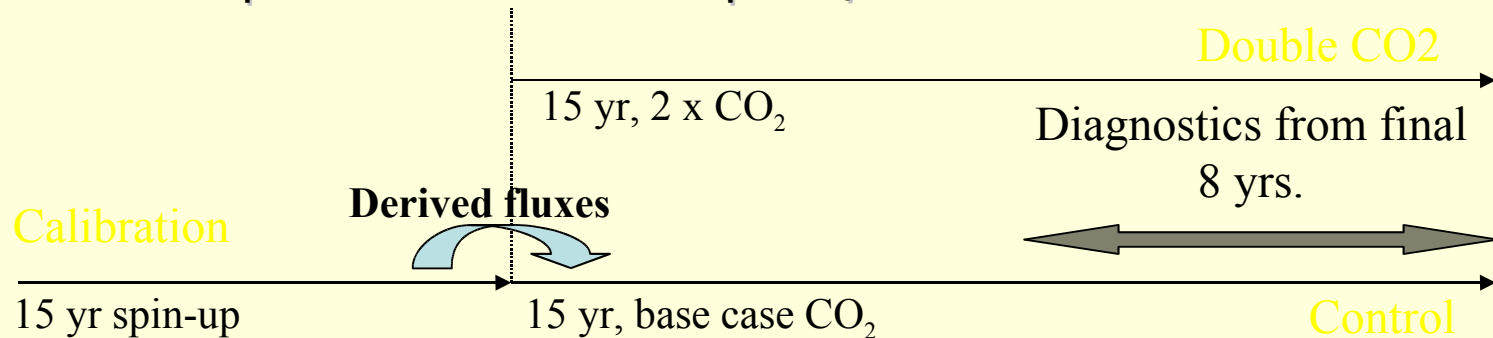


Embedded Ensembles



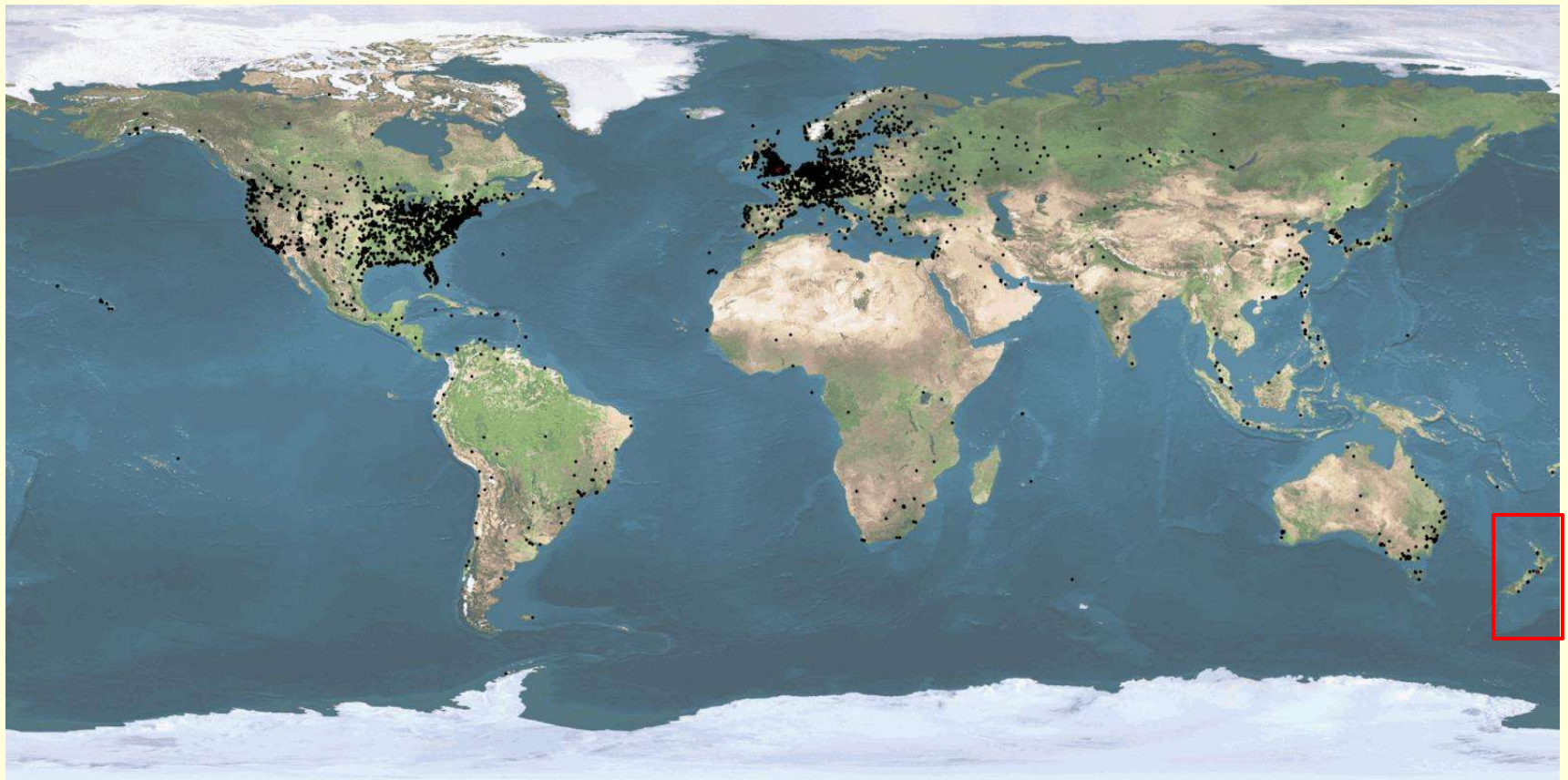
Experiment Design

- Expts 1: GCM with **thermodynamic ocean**. (HadSM3)
 - Aim: To identify parameter combinations which have little effect on the mean climate but a large effect on climate sensitivity.
 - Evaluate perturbations to atmosphere/ocean fluxes.



- Expt 2: **Fully coupled model**. (HadCM3 - the "coupled" model)
 - Distribute pre-packaged simulations of 1950 -2050.
 - Downweight or eliminate runs which compare badly with observations.
 - Re-distribute the surviving versions to simulate 2000-2050.

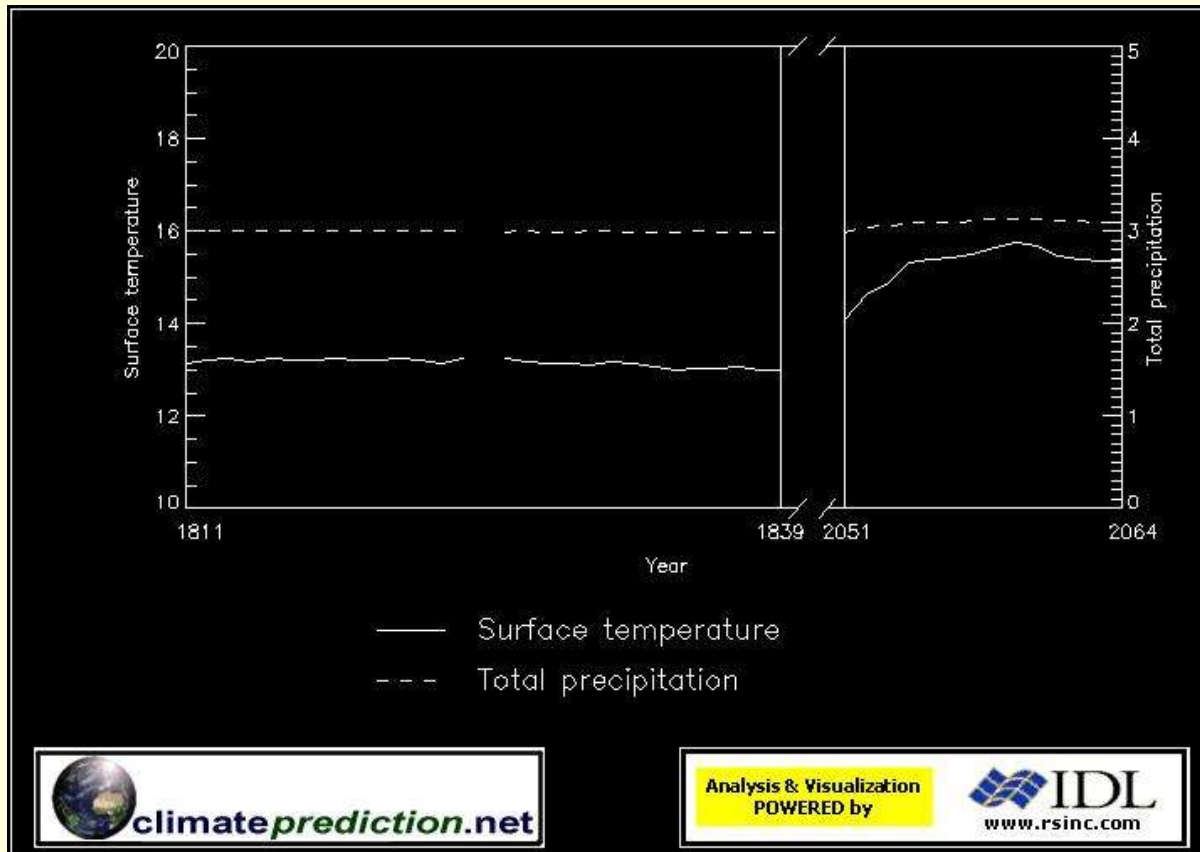




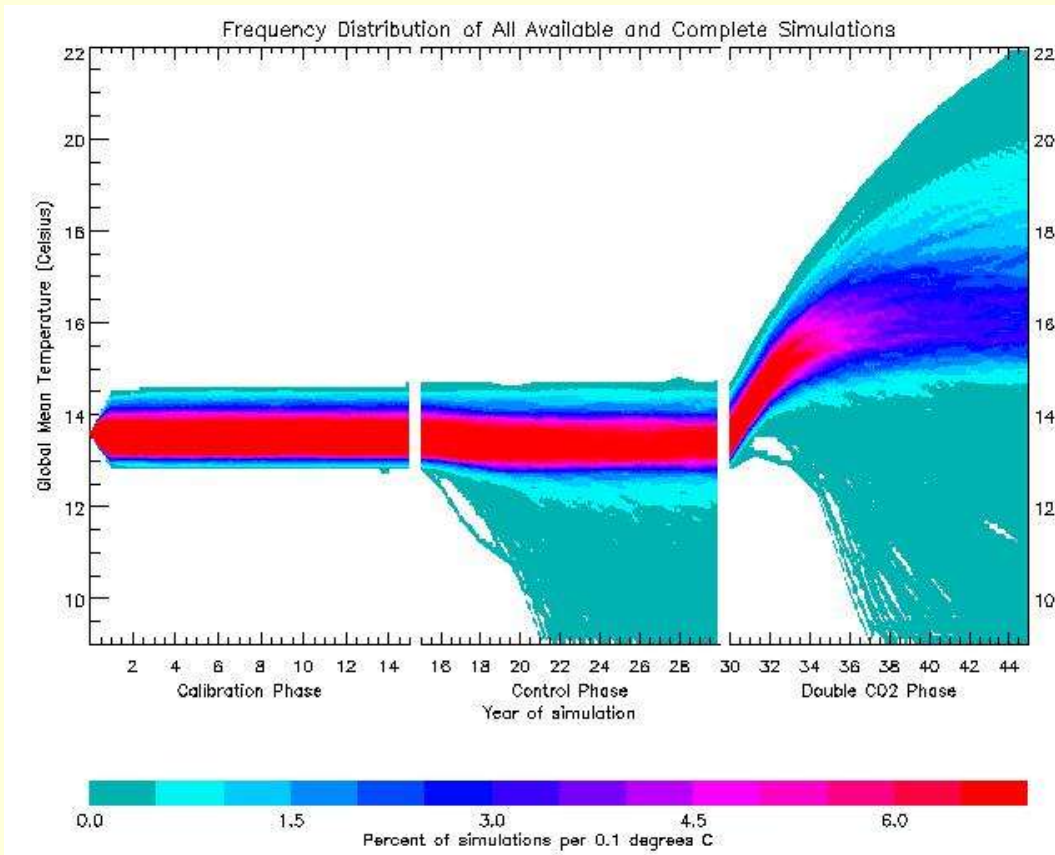
Since September 2003,
90,000 participants in 142 countries have
completed 42,000 45 -year GCM runs
computed 3 million model years
donated 8,000 years of computing time



Experiment 1



Results so Far



- 1000 bigger ensemble than has ever been achieved so far
- Sampled more extreme sensitivities than have ever been seen before



Results so Far

- Initial analysis shows that the model runs fine on a 32bit PC (Windows, Linux, Mac).
- Analysis of duplicate runs and initial condition ensembles validates experimental integrity
- Analysis of subset of the ensemble shows that changes in model physics add, generally, non-linearly, necessitating the large ensemble approach
- Analysis of ensemble against observations shows we can't rule out high sensitivity (10K) models



The Website



The screenshot shows a Netscape browser window titled "ClimatePrediction.Net gateway : Tiscali 10.0". The address bar displays "http://www.climateprediction.net/index.php". The website header features the "climateprediction.net" logo, a "Model Download" button, and a "Search Site" button. A navigation menu on the left includes links for Home, Home - main, International, About, Climate Science, Participant pages, My cp.net, Project News, Results, Press Info, Open Uni. Course, Schools, and Contact & Support.

The main content area is titled "Join the climateprediction.net experiment!" and includes a call to action: "Click [here](#) to help us predict the climate of The Day After Tomorrow!". Below this, there are sections for "What is climateprediction.net?", "Why?", and "What do we want you to do?".

The "News" sidebar lists several items:

- User of the week [July 26 2004]
- climateprediction.net open day [10/10/04]
- New Visualisation Package [10/10/04]
- over 2 million model years! [10/10/04]

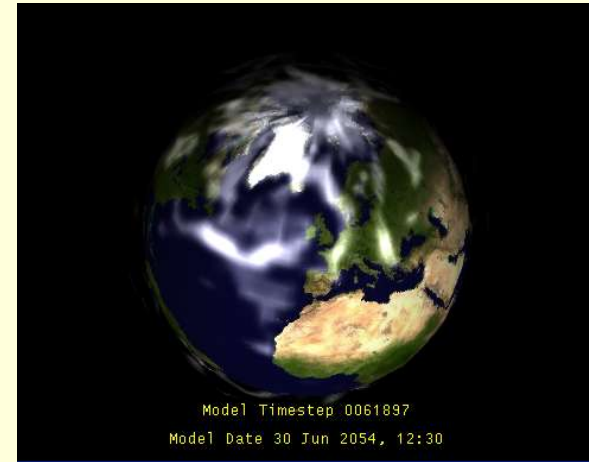
The "Experiment Status" sidebar provides the following data:

Experiment Status	
Total model years	2240946.178
Tricking machines	11396
Completed standard runs	32210
Completed THC runs	237
Last updated	26-Jul-2004 07:46:22

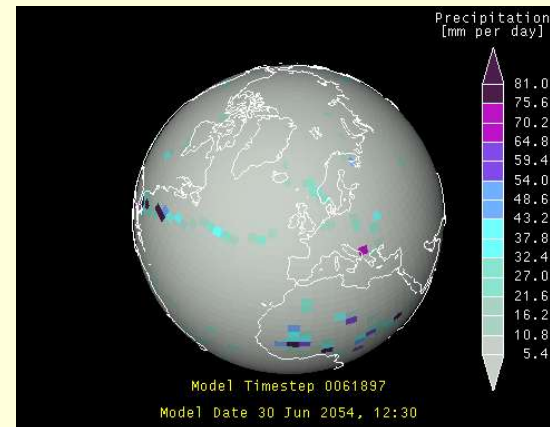
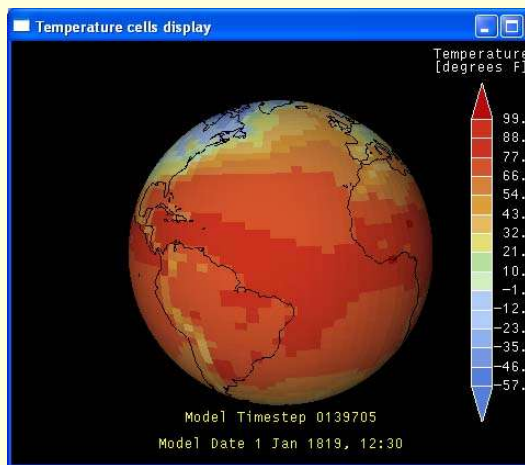
The footer of the browser window shows the URL "http://www.climateprediction.net/project.php" and the "Internet" icon.



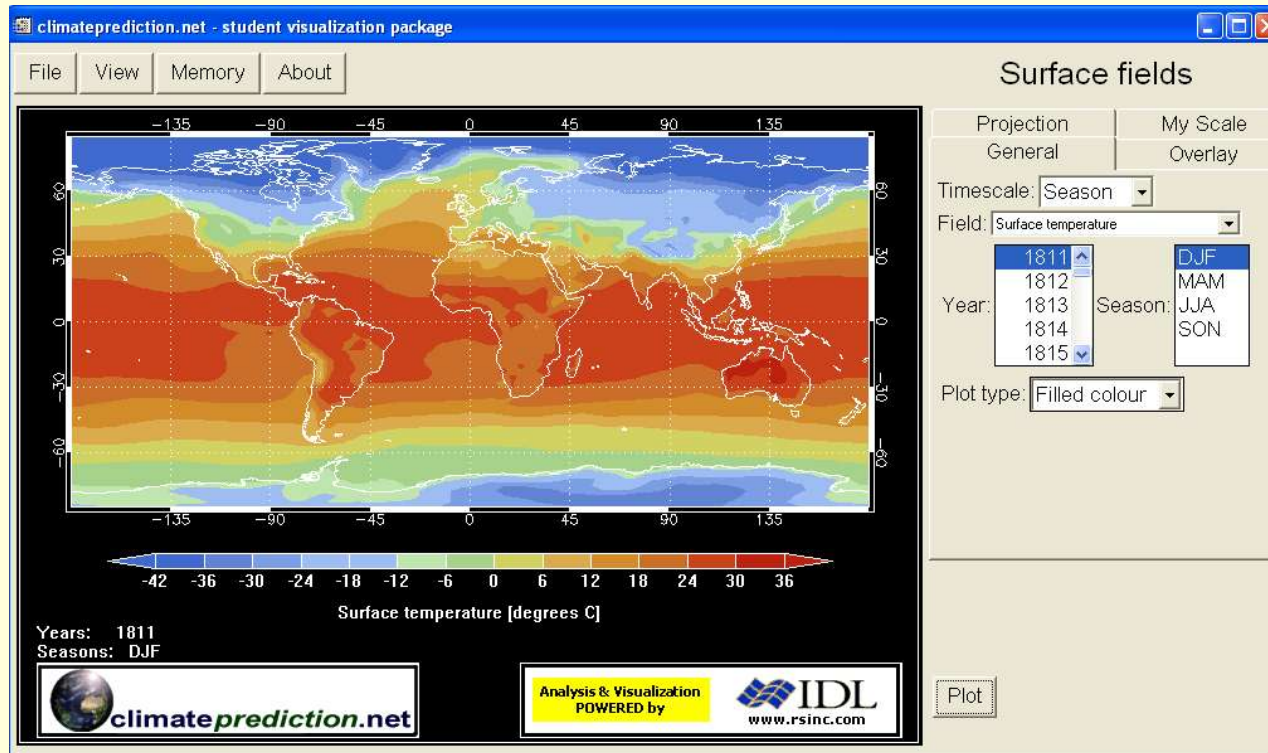
Client and Simple Visualisation

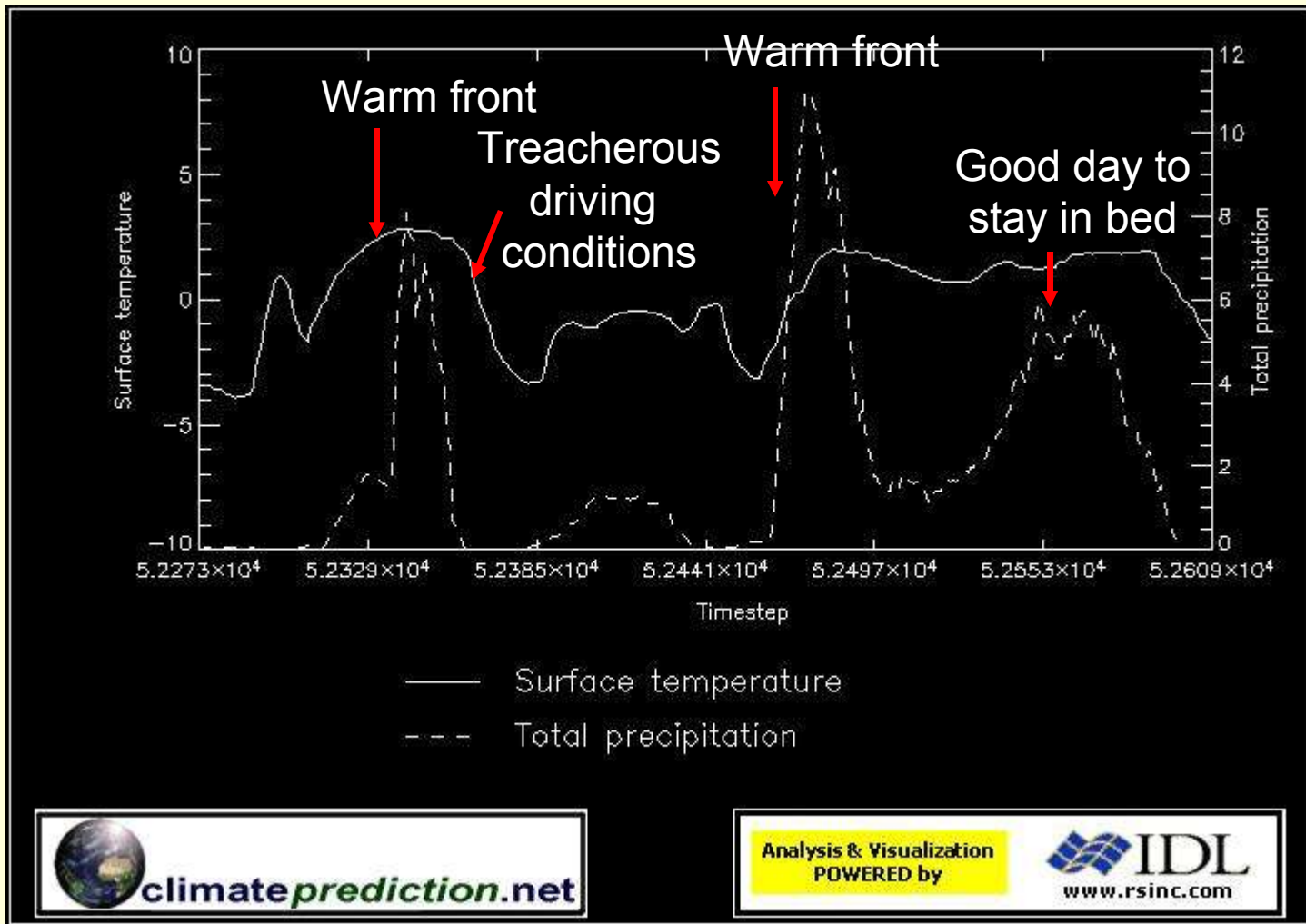


Watch the modelled climate change over hours, days, weeks...



Student Visualisation Interface





11th-18th December 1828, London



Materials for the Open University



Short course on Weather and Climate Modelling

Prof. Bob Spicer

May 2005

- Weather and Climate Models
- The Earth's Heat Engine
- The Earth's Atmosphere
- Your Model Results



climateprediction.net

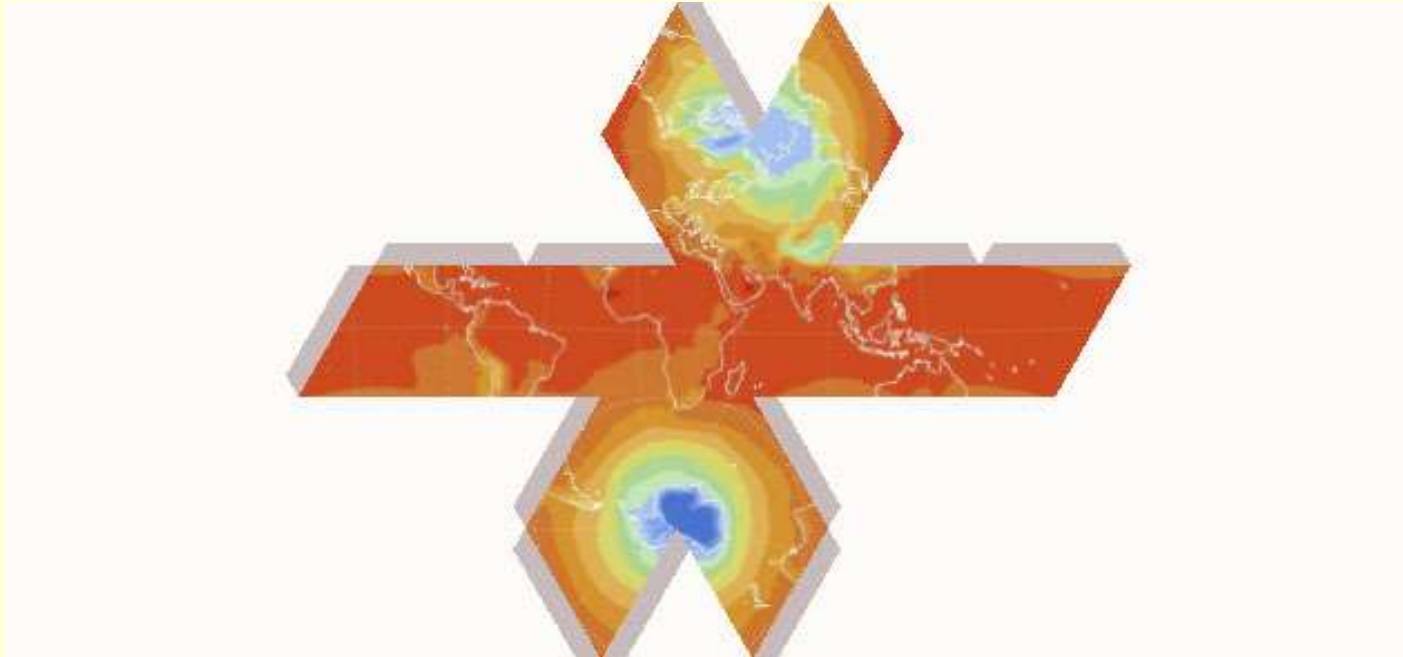


Schools Materials

- 14 +
- U.K. Syllabus specific materials
- Reproduce existing materials in a format suitable for classroom teaching
- Easy to use for teachers
- Encourage schools to join the experiment
- Unique, distinct and genuinely useful
- **Models** and **Prediction** rather than climate change



For younger students...

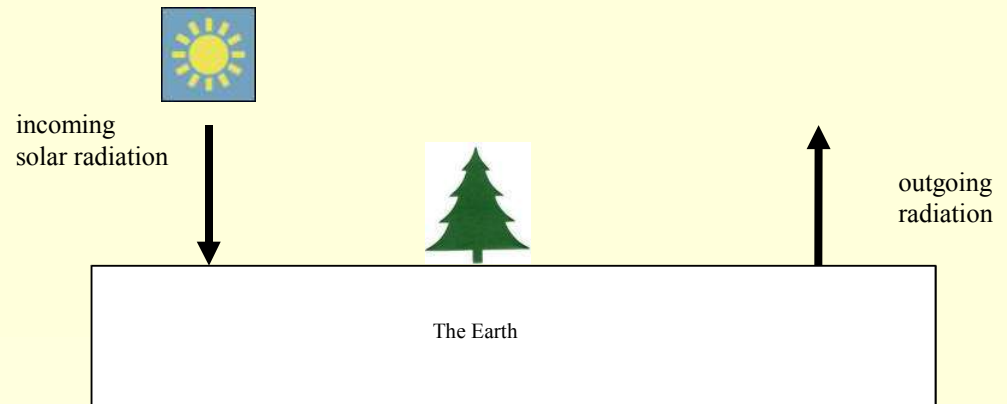


climateprediction.net

flaming pear 

For older students...

- Variety of simple climate models – involving dice, excel, bottles of water, calculators..
- Discussion excercises, role playing
- Investigating weather and climate
- Analysis of numbers, data sets..
- Exploring *climateprediction.net* results



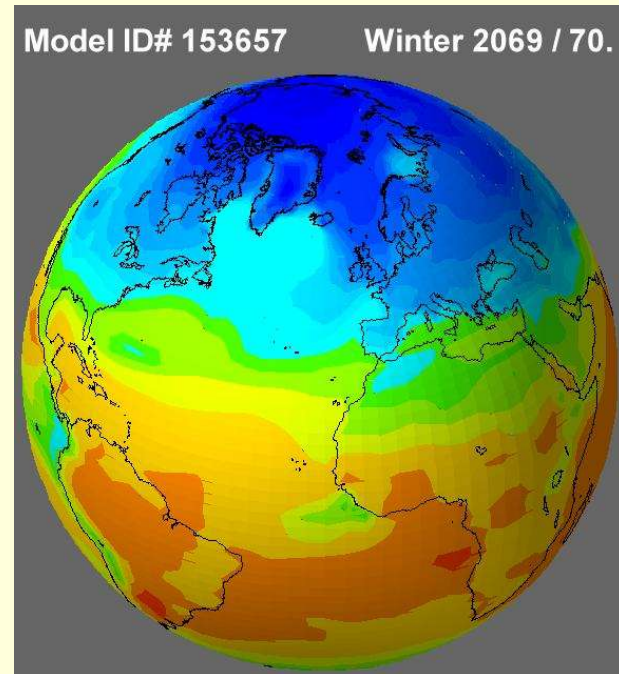
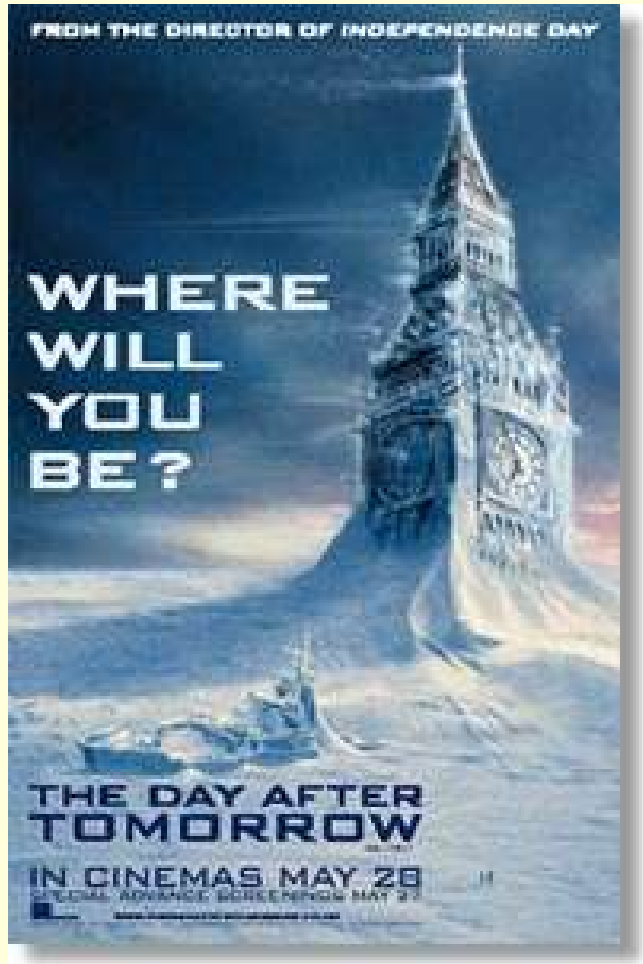
BOINC

Berkeley Open Infrastructure for Network Computing

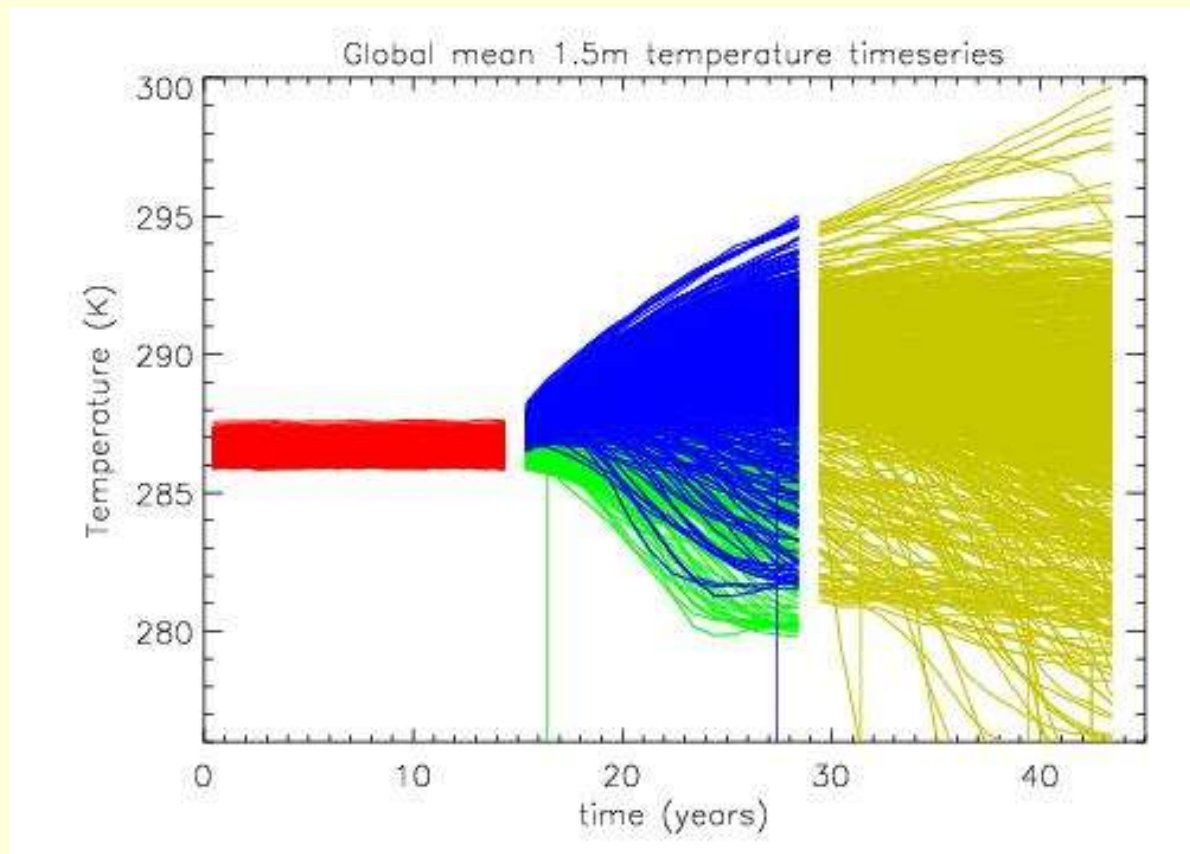
- Linux, Mac as well as Windows
- Screensaver
- Participate jointly in SETI@home, protein folding...
- Much simpler for other GCMs to be included



The Day After Tomorrow



THC experiment results

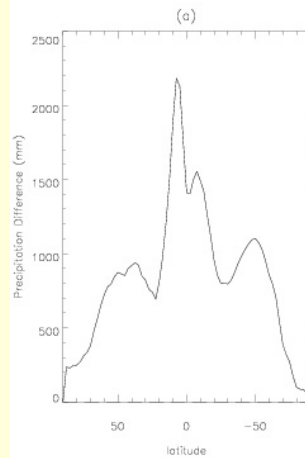


1700 4 phase runs returned so far..

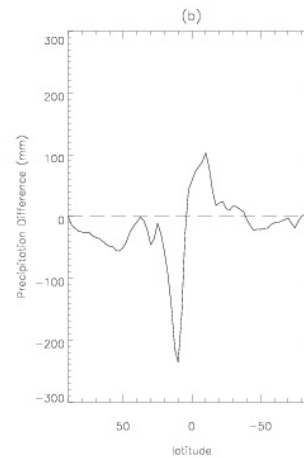


Sulphur Cycle experiment

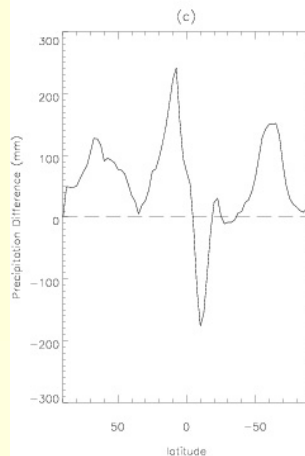
control



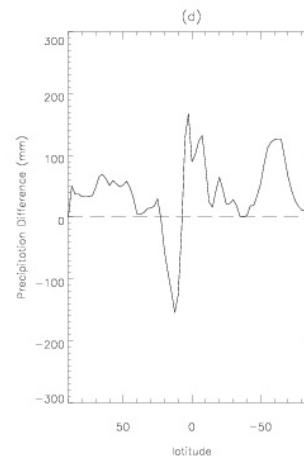
Anthropogenic SO₂



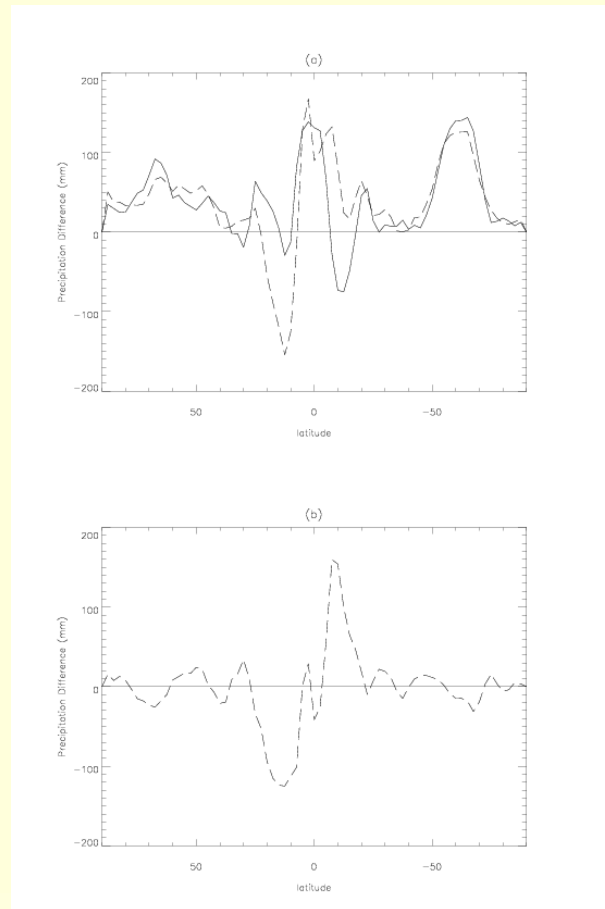
Double CO₂



Double CO₂ +
Anthropogenic SO₂



Sulphur Cycle experiment



Plans for the near future

Analyze the results!

Look in especial detail at the high sensitivity runs

Sulphur cycle launch – December 2004 (need a volcanic eruption!)

Experiment 2 – fully coupled model – mid 2005?

With New Zealand: adapt code to identify synoptic features – storm tracks
regional modelling
e-science – web based learning devices



Plans for the more distant future...

Climateprediction.eu ?

Regional models – PRECIS?

High resolution ocean experiments?

Palaeo-*climateprediction.net*?

High heat uptake experiment

MIT-ocean experiment

RAPID climate change experiments



Coming soon...



climateprediction.net