Icy in the Office; Hot in the Bedroom
(A Climate Sensitivity Experiment on Linux PCs)

Www.climateprediction.Com/academic

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The climateprediction.com project:

The climateprediction.com project aims to perform million member ensemble integrations of a climate model. Each member of the ensemble will have a different representation of the physical processes in the atmosphere and ocean and a different forcing scenario. The distribution of the responses of the ensemble members will demonstrate which physical processes have most impact on the climate system (as represented by the model) and will be used to estimate the uncertainty in predictions of climate change.

The million member ensemble of complex climate models is beyond the capability of most current computer systems. The aim of climateprediction.com is to use idle time on home and office PCs.

The academic release:

In order to maximise participation the main climateprediction.com experiment will be released under Windows. A preliminary, and much smaller scale, release will be to the academic community and will run under Linux. It is this release that is the focus of this poster. The preliminary experiment will test the response of a version of the UK Climate model with different parameter values for the cloud and precipitation physics to doubled CO2.

The academic release is designed to provide experience in several areas :

- What is the sensitivity of the model to the values of cloud and precipitation parameters?
- Most climate models are run on super computers with 64-bit precision. How different is the climate in a 32-bit PC environment?
- What is the best way to handle and analyse data from such large ensembles of a 3 dimensional coupled climate model?

Generating an Ensemble:

An important factor in determining the response of the climate system to anthropogenic or natural forcing is the strength of cloud feedbacks. The representation of cloud processes in climate models is an area with inherent difficulties and uncertainties. Studying the response of the model to different values for some of the cloud parameters focuses on model physics to which the climate response is sensitive and about which there are large uncertainties.

The experiment will run with ensemble members which have different values for the following parameters:

- Critical Relative Humidity (a parameter related to the assumed cloud cover distribution in a grid box)
- Accretion constant (related to the growth of rain droplets and as a consequence the lifetime of clouds)
- Condensation nuclei concentrations (affecting the water holding capacity and lifetime of clouds)
- Ice fall velocity

If low, medium, and high values are taken for the four parameters then the possible combinations generate a 81 member ensemble for release to the academic community.

The model used for the assessment of the sensitivity of the climate system to the cloud and precipitation parameters will be an atmosphere model coupled to a slab ocean already used at the Met Office (HadSM3). The use of a slab ocean allows for ocean-atmosphere feedbacks, but avoids the long integration times needed with a full ocean. The model integrations performed for each ensemble member are shown in figure 1.

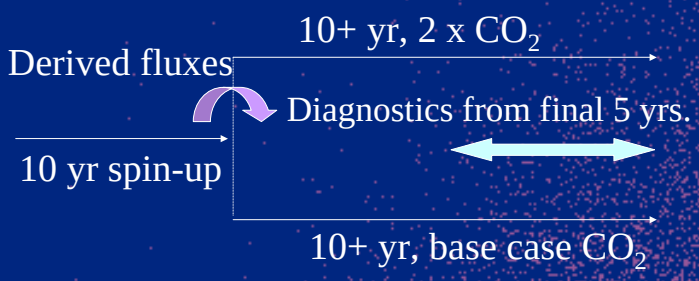

Figure 1: Integration phases for each ensemble member

One of the aims of the initial release is to verify the climate of the model integrated on a 32 bit machine is comparable to the same model run on a 64 bit machine. Figure 2 shows the atmosphere-ocean heat flux convergences calculated on a Linux PC and a Cray super computer for the same basic model. The fields are similar, though more quantitative comparisons are obviously needed.

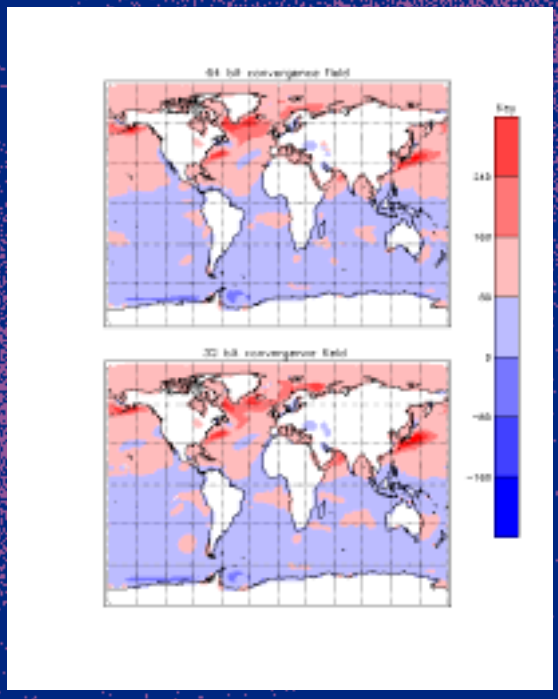

Figure 2: Comparison of the heat convergence fields from 64 bit and 32 bit model integrations.

The model executable and initial conditions have all been packed into a tar file for distribution. The running model will need about 100MB disk space and the thirty years of model integration will take about three months to run at low priority on a PC.

The distribution of the experiment to the academic community will be early in 2001. If you have a Linux PC and want to be involved keep an eye on http://www.climateprediction.com/academic.