CATS CENTRE FOR THE ANALYSIS OF TIME SERIES

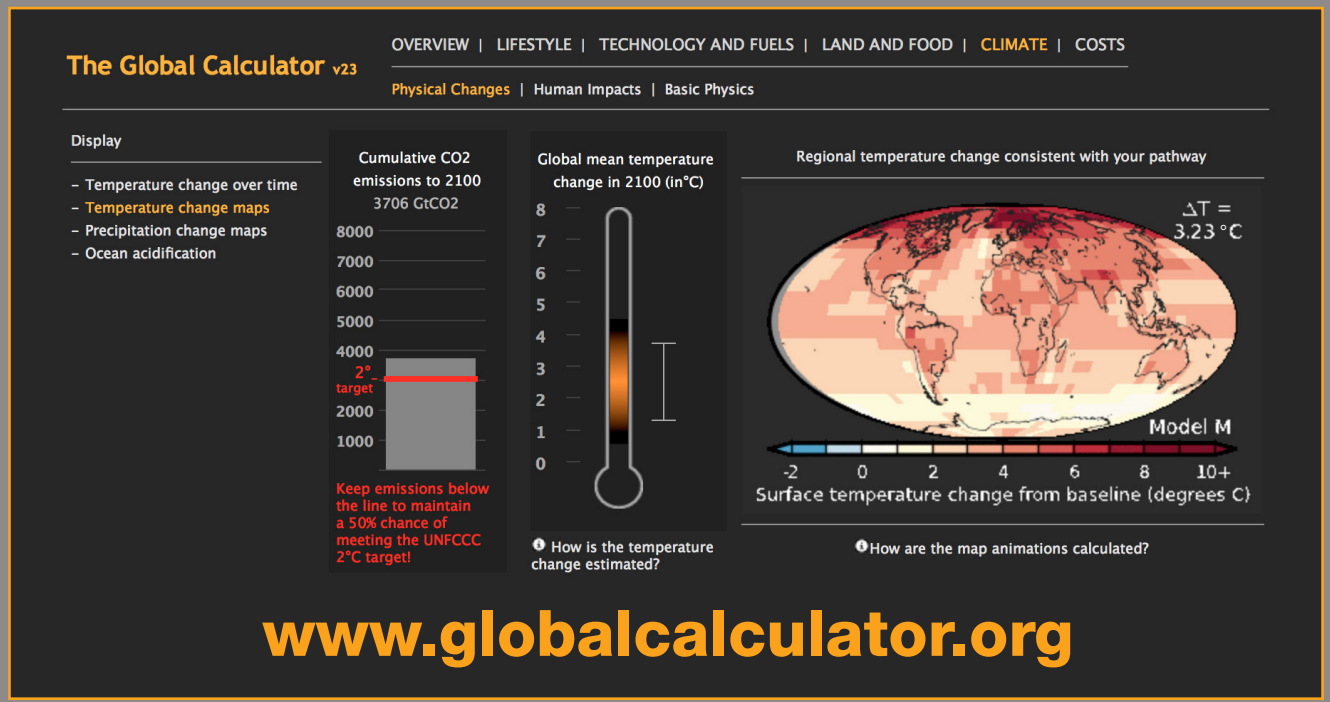
LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

Insights about uncertainty in the **Global Calculator**

The Global Calculator is a free, open source, interactive online tool for exploring the world's future energy and climate choices in a fast, simple and accessible manner. It was created by a collaboration of international partners including LSE CATS.

Given projected emissions to 2100, the Global Calculator aims to display some of the climate consequences in a way that is informative without being misleading. The issues encountered include how to display a range of model results for alternative impact categories, how to present results independent of complex models, and how to cope with model imperfections.

Projecting climate changes based on a time series of greenhouse gas emissions to 2100 necessarily involves some uncertainty. The Global Calculator methodology was developed to communicate a range of plausible outcomes and the robust patterns of expected climatic changes. A range of projected temperature change is shown in a "thermometer" graphic, and the diversity of model outputs consistent with that range is displayed using an animation of global maps.



www.globalcalculator.org

How to display alternative results from multiple models?

- Showing averages over many model runs presents an unrealistically smooth “mean”. A map of this mean is unphysical and fails to reflect the richness of the range of possibilities.
- A grid of alternative outcomes allows direct comparison between models, but is too large to display on the Global Calculator interface.
- An animation showing a selection of relevant outcomes in a repeating loop presents the variation and richness of the runs. This method was chosen.

What map resolution is appropriate?

Numerical integration performed by climate models, like all computational simulations, yield approximations to solutions of the underlying equations. Results are more representative of the target equations when averaged over areas significantly larger than the native grid scale of the model. The map resolution used for all of the Global Calculator displays is intermediate, showing enough detail to distinguish robust patterns.

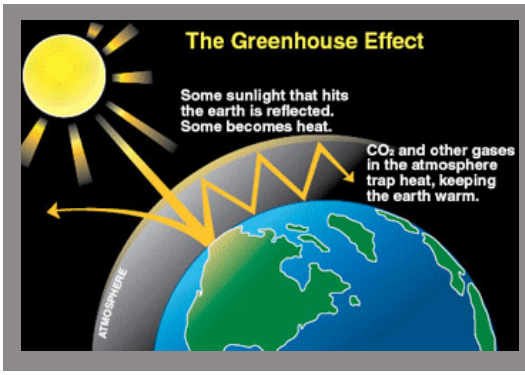
What kinds of impacts should be displayed?

During the project there was much discussion about the types of impacts that would be appropriate to display, with a pull towards human/social/economic impacts as these are the most directly relevant and their consequences are easiest to communicate.

This was balanced against the need to provide robust and reliable projections based on established science, rather than being drawn towards speculative, conditional results or those based on a single study or approach.

Pros and cons of animation format for display of uncertainty

- Visually engaging; draws attention;
- Every map shown is a single self-consistent projection generated by a single GCM;
- Allows rapid comparison of the large-scale outcomes from different models as the same scale is used on every map;
- Model agreement on robust messages (greatest warming over land and over Arctic) is clear;
- Avoids overload of information plotted onto the same maps;
- Avoids focus on one simulation or a single point;
- Hard to compare directly between different models, especially if trying to look at detail;
- Could be misinterpreted as a change over time (hence the intermediate frames reading “Another possible outcome is”);
- Cannot be printed out or shown in static format.



Basic Physics

In order to communicate to those who may be sceptical about the use of large computational models, the “Basic Physics” section considers some order-of-magnitude energy calculations which give a scale to the plausible level of impacts without using any complicated computer models.

The Centre for the Analysis of Time Series (CATS) is a research centre of the London School of Economics and Political Science. We focus on nonlinear analysis methods for decision support in situations of economic and physical significance.

Lead Author: **Erica Thompson** lse.ac.uk/CATS/Home.aspx Series Editor: **Leonard Smith**