Propagation of Error and The Reliability of Global Air Temperature Projections

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Abstract: General circulation model (GCM) global surface air temperature projections are accurately simulated using the equation, $\Delta T = f_{\text{co}} \times 33K \times (F_0 + \Sigma \Delta F)/F_0 + b$, indicating projections are just linear extrapolations of GHG forcing. Linear uncertainty propagates as the r.s.s.e. CMIP5 models average ±12% theory-bias error in total cloud fraction (TCF), equating to ±4 W/m² long wave cloud forcing uncertainty in the energy state of the projected atmosphere. Propagated TCF uncertainty is always much larger than the projected global air temperature anomaly, reaching ±15°C in a 100-year projection. CMIP5 projections thus have no predictive value.

Introduction

Propagation of error, a standard measure of predictive reliability, is applied to CMIP5 GCM global air temperature projections. A valid lower limit of physical accuracy is presented.

1. The Fractional wve Greenhouse Effect of CO₂

The GH fractions below are relevant to GCMs, and are not represented as physically characteristic of climate.

Global cloud fraction=0.67 [3]; the modeled fraction and 46 $\sigma$ confidence limits as in IPCC 4AR SPM.5 and TS.32.

CMIP5 error correlation matrix, lag-1 R, and RMS Uncertainty

None is unique; None is reliable.

2. The Structure of GCM Air Temperature Projections

GCM air temperature projections can be modeled as:

$$\Delta T = 0.42 \times 33K \times (F_0 + \Sigma \Delta F)/F_0 + b$$

where $F_0$ is the total GHG forcing of projection year zero, and $\Delta F$ is the increment of GHG forcing in the $n$th year.

Air temperature anomaly projections: Panel a. 1% annual increase in atmospheric CO₂ [4]; eq. 1. Panel b. SRES A2 scenario; eq. 1. Eq. 1 produces completely credible air temperature trends.

Generalized eq. 2:

$$\Delta T = \int_0^t f_{\text{co}} \times 33K \times (F_0 + \Sigma \Delta F)/F_0 + b$$

reproduced all 54 realizations of the SRES A2, A1B, and B1 projection scenarios in the IPCC 4AR, made using 21 CMIP3 GCMs: $f_{\text{co}}$ and $b$ are GCM-dependent.

3. CMIP5 Global Cloud Fraction Error

CMIP5 LCF error means that the thermal state of the atmosphere cannot be modeled to better accuracy than ±4W/m²; ±110² confidence limits in each and every projection step. The Figure below provides a typical propagation of CMIP5 LCF error.

The Reliability of Air Temperature Projections: the SRES scenarios

Each scenario lays within the 1σ confidence limits of all the others. None is unique; None is predictive; None is reliable.

References


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