

## Greater future global warming?

December 8, 2017 by ...and Then There's Physics

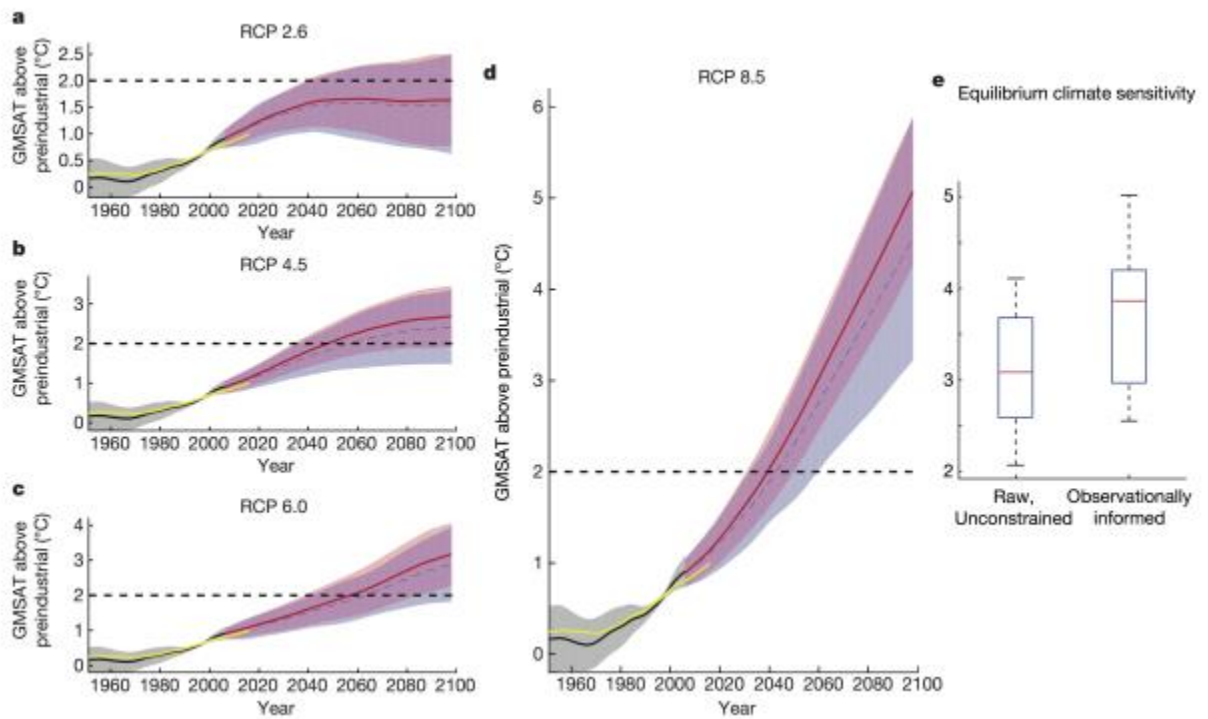
A recent paper by Patrick Brown and Ken Caldeira called greater future global warming inferred from Earth's recent energy budget

Patrick T. Brown, Ken Caldeira. Greater future global warming inferred from Earth's recent energy budget. *Nature*, Dec 2017

The basic idea, though, was to try and constrain the models on the basis of how well they match recent observations. In particular, how well do they simulate top-of-the-atmosphere energy balance (reflected solar radiation, outgoing infrared radiation, and net energy balance). As Patrick's post mentions, these are amongst the most fundamental aspects of global warming.

The key result is shown in the figure below. When you constrain the models on the basis of how well they match these observational constraints (pink band, red line), they project more warming than the unconstrained model results suggest (grey band, dashed line), and the range is slightly reduced. For example, if we follow an RCP4.5 concentration pathway, this would suggest we would warm about as much as suggested by the original RCP6 results.

Also, the mean ECS value from the constrained models is 3.7°C, with a likely range from 3°C to 4.2°C (right-hand panel below).



Credit: Brown & Caldeira (2017)

*‘Our results suggest that achieving any given global temperature stabilization target will require steeper greenhouse gas emissions reductions than previously calculated.’*

*The study “would imply that to stabilize temperature at 2 degrees Celsius, you’d have to have 15 percent less cumulative CO<sub>2</sub> emissions,”*

**Link:**

[Greater future global warming inferred from Earth’s recent energy budget. Patrick Brown’s blog post about his recent paper.](#)

transient warming magnitudes used here. Thus, in an effort to make the present work comparable to previous research, we also show the results of our procedure applied to a predictand of ECS values<sup>6</sup>. We find that the observationally informed ECS prediction has a mean value of 3.7°C (with a 25–75% interval of 3.0°C to 4.2°C) and that 68% of the observationally informed distribution of ECS is above the raw model mean of 3.1°C (Fig. 2e).

**Table 1 | Updated results corresponding to tables 12.2 and 12.3 in chapter 12 of ref. 45**

|   | RCP 2.6   | RCP 4.5  | RCP 6.0   | RCP 8.5   |
|---|---|--|---|---|
| Mean $\Delta T$ 2046–<br>2065 $\pm 1\sigma$ | <b>1.7 <math>\pm</math> 0.3 °C,</b><br>1.6 $\pm$ 0.3 °C | <b>2.3 <math>\pm</math> 0.3 °C,</b><br>2.0 $\pm$ 0.3 °C, | <b>2.1 <math>\pm</math> 0.3 °C,</b><br>1.9 $\pm$ 0.3 °C | <b>2.9 <math>\pm</math> 0.3 °C,</b><br>2.6 $\pm$ 0.3 °C |
| Mean $\Delta T$ 2081–<br>2100 $\pm 1\sigma$ | <b>1.7 <math>\pm</math> 0.4 °C,</b><br>1.6 $\pm$ 0.4 °C | <b>2.8 <math>\pm</math> 0.4 °C,</b><br>2.4 $\pm$ 0.5 °C  | <b>3.2 <math>\pm</math> 0.4 °C,</b><br>2.8 $\pm$ 0.5 °C | <b>4.8 <math>\pm</math> 0.4 °C,</b><br>4.3 $\pm$ 0.7 °C |
| $\Delta T > +1$ °C                          | <b>95%, 94%</b>   | <b>100%, 100%</b>  | <b>100%, 100%</b>                                       | <b>100%, 100%</b>                                       |
| $\Delta T > +1.5$ °C                        | <b>75%, 56%</b>   | <b>100%, 100%</b>  | <b>100%, 100%</b>                                       | <b>100%, 100%</b>                                       |
| $\Delta T > +2.0$ °C                        | <b>15%, 22%</b>   | <b>93%, 79%</b>  | <b>100%, 100%</b>                                       | <b>100%, 100%</b>                                       |
| $\Delta T > +3.0$ °C                        | <b>0%, 0%</b>   | <b>21%, 12%</b>  | <b>71%, 36%</b>   | <b>100%, 100%</b>                                       |
| $\Delta T > +4.0$ °C                        | <b>0%, 0%</b>   | <b>0%, 0%</b>  | <b>0%, 0%</b>   | <b>93%, 62%</b>   |