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Earth System
Dynamics
Discussions

Interactive comment on "Estimation of the climate feedback parameter by using radiative fluxes from CERES EBAF" *by* P. Björnbom

Anonymous Referee #2

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Main comments

This paper evaluates the rate of change of radiation at the top of the atmosphere (TOA) with change in surface temperature during a number of recent EL-Nino Southern Oscilllation (ENSO) events. The author shows that an approximately linear relationship is between changes in temperature and TOA radiation if the latter is lagged by 7 months. The slope is found to be 5.5Wm^{-2}+/_0.6Wm^{-2}K^{-1} which the author equates with "the climate sensitivity parameter". The subject is topical and important, but politically controversial.

The relationship between TOA fluxes has been discussed by Spencer and Brasewel l (2010, 2011), Lindzen and Choi (2011) and Dessler (2010, 2011) amongst others, including the showing of phase plots and investigating the lags between the two vari-

ables. The main innovation here, as noted by the author seems to be the more linear nature of the phase plots obtained by using a lag of 7 months and restricting the observations to periods of strong ENSO variation, which may be interesting but not a substantial advance

The author's discussion of the interpretation of their results is unclear to me, in particular regarding what relationship, if any, "the climate sensitivity parameter" derived here has on the long term equilibrium response to increases in greenhouse gases. This leaves the paper open to misinterpretation. The "climate sensitivity "was originally conceived as a way of characterising the simulated equilibrium global mean temperature response to changes in radiative forcing (usually doubling atmospheric carbon dioxide concentrations). The method devised by Gregory et al 2004 was created to enable modellers to estimate this parameter from short transient experiments, and the method was validated by comparing results with equilibrium studies using the same model. However, it has not been shown that estimating the climate sensitivity from shorter term predominately regional oscillations such as ENSO gives any insight to the value of long global sensitivity to increases in greenhouse gases in models, let alone the real world (see for example, Dessler, 2013).

In view of the above, I find the paper in its current form unsuitable for publication. It is possible that a much shorter note based on Figures 1,2 and 3a and a more careful discussion of how "the climate sensitivity parameter) can and cannot be interpreted might be publishable .

Additional comments

Title, abstract and throughout the text. etc. As noted above, a strong caveat is required if the term "the climate feedback parameter" is used on these timescales. Since the author has carefully selected out periods on ENSO variability, a more accurate title might be "Estimation of the radiative damping parameter on ENSO timescales. . . .." or "radiative damping of ENSO . . . " .

Page 27 line 9 You should point out Gregory et al 2004 considered long term externally forced monotonically warming experiments in contrast to the short term quasi oscillatory variations considered here.

Page 27 line 18 Rather than duck the issue completely, some discussion of the difficulties in trying to relate short term observations to equilibrium climate sensitivity is needed to put the results in perspective (eg see Dessler 2013)

Page 30 line 12 If I read Spenser and Brasewell correctly, this was only true for 4 out of 18 models.

Section 3. Some indication of the uncertainties in the radiation and temperature data and their impact on the results is needed- in particular I suspect the changes in the global mean temperature estimates on these short timescales are not far outside the uncertainties in estimating global mean temperature

Page 30 line 27 How sensitive are results to averaging period (why 13 months?) or other data manipulation?

Section 5.1 I feel much of this could be relegated to supplementary material.

Section 5.2 I didn't find this convincing – Gregory et al (2004) consider a sustained positive radiative forcing which gave a monotonic temperature increase, here the changes are oscillatory in both driving force (ocean circulation) and temperature. Also, the temperature changes are about 0.2C here (and substantial measurement uncertainty) whereas in the model studies the temperature changes are much larger and there is no measurement uncertainty

Section 5.5

Note that the pronounced regional distribution of changes in cloud, temperature and humidity are like to be very different to those expected with a global scale warming due to increases in greenhouse gases (see for example Dessler, 2013), which make ENSO a questionable analogue for estimating climate sensitivity. You should also reference

Forster and Gregory (2006), Gregory and Forster (2008) who apply the method to observational data to estimate climate sensitivity or transient climate sensitivity

I didn't find the original supplementary material helpful.

Figure 1 What is the range of uncertainty in the global mean temperature and changes in net radiation ?

Figure1 Given the dominance of ENSO variations over much of this period, it would be helpful to include a plot of an ENSO index (eg the Multivariate ENSO index)

Figure 2 , 3 – it would be useful to have some indication of the time progression of the points- eg label every 6^{th} point.

Additional References

Dessler, AE, 2013. Observations of climate feedbacks over 2000-2010 and comparison to climate models. J Clim, 26, 333-342.

Forster P M and J M Gregory, 2006. The climate sensitivity and its components derived from Earth Radiation budget data. J CLim ,19, 39-52.

Gregory, J M and Forster, P M, 2008. Transient climate response estimated from radiative forcing and observed temperature change. J Geophys Res, 113,D 232105. Doi:10.1029/2008JD01045

Interactive comment on Earth Syst. Dynam. Discuss., 4, 25, 2013.