

## ***Interactive comment on “Climate sensitivity in the Anthropocene” by M. Previdi et al.***

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Received and published: 11 October 2011

Comments on the paper by Previdi

1) I think this paper has some important points and after revision can be a useful contribution, but had a very hard time with its present form because of the many things that are left undefined, or defined in a non-standard manner. I think these problems can be dealt with but major editing is needed. More care needs to be taken in defining and discussing fast and slow feedbacks, and the distinctions between them. This is key to the paper and needs a clear paragraph explicitly devoted to it, near the front of the paper. Clouds and water vapor respond within days or less to changes in surface temperature. But sea ice changes can take place over several years. Changes in mixed layer ocean temperatures can occur within a decade or so, but the deep ocean requires many hundreds of years to warm up (and changes in ocean temperatures can

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in turn affect cloud distributions). In the abstract and elsewhere, it is not correct to say that only cloud and water vapor changes are included in current estimates of climate sensitivity and that these are ‘fast’. Climate sensitivity includes slower responses of the ocean (decades to centuries). Please correct the abstract (and elsewhere e.g. page 534, lines 4-5), decide what you want to call ‘fast’ and say how fast is fast (days? Years? Decades? Century?), and be clear about what the models do regarding the ocean.

2) What you want to call ‘slow’ are processes involving the distribution of vegetation and of the great ice sheets, which may take multiple millennia to evolve; please state this up front. I don’t think this quantity should be called the climate sensitivity, since sensitivity has a clear meaning: it is the climate response for a doubling of CO<sub>2</sub> concentration. It is confusing and unhelpful to communication of climate change to incorporate CO<sub>2</sub> concentration changes due to climate system feedbacks into this definition. The quantity you are discussing could be called ‘earth system sensitivity’ or something similar; please choose a name.

3) The paper should introduce the concept of efficacy on lines 18-24 of page 532. Alternative definitions of common terms will confuse the non-expert reader. Please stick to standard definitions throughout and then say what you want to do differently, why you think a different definition is useful, and then provide a new name.

4) page 533, line 10-11. There is little evidence that ice sheet changes are important for climate sensitivity on timescales of decades during interglacials, nor is it clear that vegetation changes are. Please provide a more balanced statement.

5) page 533, line 15. Please make clear that the changes in ice sheets and vegetation are expected to be important on timescales of millennia – but may not be so on shorter time scales.

6) page 536, line 1. The reason it has not received greater consideration may not simply be that the models can’t handle it, but rather that it is expected to occur very

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slowly. Please correct. Also, please be clear that the paleo data cannot be used to imply a rapid response – those data tell you what happened but it doesn't tell you how fast it happened.

7) Evidence for meter per century sea level rise is largely restricted to transitions from cold to warm climate states, when a great deal of ice is available to melt (much of which is at low elevation); the current state is quite different. Please make appropriate changes to explain this, in several places on page 536.

8) The high end of carbon feedbacks is associated with a great deal of warming. Please make this clear on page 537.

9) The description of the carbon cycle is good. It would be helpful to further discuss the very long lifetime of a portion of the CO<sub>2</sub> (Archer's work). This would clarify that the carbon can last long enough to produce the earth system response, even if the climate system feedbacks (e.g., ice sheet change) take a long time.

10) The paper is a review. That's ok, but it is a little limited on the number and balance in the references. I'd like to see some more extensive review, e.g. on issues such as timescales of the decay of the ice sheets, where there is a range of views.

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Interactive comment on Earth Syst. Dynam. Discuss., 2, 531, 2011.