Review of MS 563 – The treatment of risk and uncertainty in the US Social Cost of Carbon for regulatory impact analysis

General Comments
This paper makes several relevant points regarding the treatment of risk and uncertainty in the three climate integrated assessment models (IAMs) on which the working group (WG) relied to estimate SCC values and how the results of those models were synthesized by the group to present useful information to federal agencies. The paper makes four claims about the process that eventually produced the SCC estimates and I will address each in turn below. Unfortunately, the author does not distinguish between critiques of the models themselves, which should be directed at the model developers, and how the results are used by the WG. In other words, the WG is a consumer of the IAMs and is not in a position to change damage functions or parameter distributions. There are also several unsubstantiated or arbitrary claims that require either citations or more explanation in order to be useful. More generally, the author does not acknowledge the practical realities of the regulatory environment under which the SCC values were estimated. It is interesting and helpful to speculate about the upper tail of the distribution of damages in an academic setting but policy makers are better served by mainstream science and economic analysis.

One more general comment, the paper lacks a proper conclusion to tie the arguments together and provide a coherent recommendation for the WG.

Specific Comments
The author's first claim is that the WG did not go far enough in its exploration of uncertainty about the parameters of the damage functions in the IAMs.
- This is an example of a critique that should be directed at the developers of FUND, DICE, and PAGE rather than the WG.
- As the author later acknowledges, FUND and PAGE treat many damage function parameters probabilistically and the author correctly points out that the model developers are forced to extrapolate the damage functions to temperatures for which we have no data. If the WG were to arbitrarily alter the damage function to allow for higher damages at the same temperatures they would be doing so under the same lack of data but without the peer review process that the IAMs have survived.
- Another point worth mentioning here is that while it is true that we do not have data on damages at high temperatures we don't know what modern economies and other human systems can adapt to. Adaptation is another area of tremendous uncertainty that cuts in the other direction but does not receive a single mention in this paper.

The second claim is that by using an exogenous constant discount rate the WG underestimated the effect of low-probability, catastrophic consumption losses.
- This is a valid argument and one of several reasons for using Ramsey discounting in the simulations the way the author describes.

The third claim is that a simple averaging of the three IAMs necessarily implies two things: First, that the WG adheres to the principle of insufficient reason and second, that the WG is ambiguity neutral.
- The author describes a different interpretation of ambiguity aversion than I am familiar with. The author claims that ambiguity aversion would imply that WG should have given more weight to the model that produces the highest SCC. I would say ambiguity aversion implies the model with more quantitative probabilistic treatment of damages receives the most weight.

The fourth claim is that a quantitative long term target with carbon price set at MAC rather than SCC has the two fold advantage of being more certain that a given target will be met and less uncertainty in the correct price.
- The author acknowledges that setting an optimal target requires knowledge of the SCC but does not seem to give that fact much standing in the rest of his argument.

- If the author could convince the reader that uncertainty in the target (because of an uncertain SCC) is less harmful than uncertainty in the *calculation* of the price (because even if the calculation were precise you would arrive at a suboptimal policy if the target was off) then this section would carry more weight. As it stands, uncertainty in the SCC precludes any economically efficient carbon policy – price or quantity based.

Line-by-Line Comments

Page 4, last paragraph – I don't think the claim that 18 degree warming only results in 50% GDP loss in DICE is relevant. Equilibrium climate sensitivity would have to be well above any conceivable value to reach an increase in average global temperature of 18C over the relevant time horizon. I suggest choosing a lower temperature increase that could be reached by the end of the century with a high but still conceivable climate sensitivity.

Page 4, last paragraph – "While the parameters of the damage function in PAGE are modeled as random, such that damages reach up to around 10% of global GDP when global warming reaches 5°C…" Is that statement based on your own runs of PAGE, the damage function figure in the SCC Technical Document, or some other source? In any case you should make that clear and tell the reader if this is the 95 percentile, the maximum, etc. In other words, what do you mean by, "damages reach up to around 10% of global GDP?"

Page 4, last paragraph – The phrase, "it has equally been argued" is ambiguous and begs for documentation. What constitutes equally? Equal to what, the number of times DICE has been used and cited?

Last sentence on page 4 – "Surely it is at least *possible* that climate damages will exceed 10% of global GDP upon 5° warming." Yes, it is "at least possible" but that is hardly a compelling argument on which to base carbon emissions policy for the United States.

Page 5, second paragraph – "Combining steeply increasing damages with a positively skewed distribution on the climate sensitivity parameter, I …find that the SCC could be hundreds of dollars higher than previously estimated (Dietz forthcoming)." I appreciate that there is a forthcoming paper that describes the analysis but this also seems arbitrary to me. Increasing the slope of the damage function and the skewness of the climate sensitivity parameter can produce any SCC you like. What are these changes based on?