Response to SC C5538: 'Ice Melt, Sea Level Rise', Mauri Pelto, 03 Aug 2015

Thank you, there are a number of useful points made in this commentary.

We do not expect the Antarctic nonlinear response can be approximated by a doubling time indefinitely, but it does seem plausible up until West Antarctic ice begins to be depleted. That is the reason that we cut off at a maximum sea level rise of 5 m, because West Antarctica could supply much of that. We also would not expect doubling would continue up until 5 m were reached, i.e., the shape of the mass flux of course would not be expected to be an exponential that reaches a sharp peak and then falls to zero. Instead the mass loss would likely reach a peak and then decline. Of course if the GHG forcing keeps increasing other sources will come into play, but perhaps with different characteristic growth times, as they may not be as vulnerable with retrograde beds. The reason that we use a simple exponential and drop instantly to zero is that it allows us to note inertial, feedback and recovery effects independent of a forcing.

It is true that there is a wide range of behavior of the different Antarctic basins. However, the mass loss rate of the Amundson sea sector, the primary drain for the West Antarctic ice sheet, exceeds the net mass loss rate of the entire continent. So a principal question is how fast can its rate of mass loss increase. At present it is increasing with a doubling time of about 10 years. This topic is discussed in 'Predictions Implicit in "Ice Melt" Paper and Global Implications' written by James Hansen and Makiko Sato in response to SC C6361, which is also available at http://www.columbia.edu/~jeh1/mailings/2015/20151012_IceMeltPredictions.pdf.

The variation in mass loss rate from one sector of Antarctica to another is shown quantitatively in Fig. 3 of Velicogna, et al. (GRL 41, 8130-8137, 2014). Queen Maud Land, e.g., is gaining mass at a substantial rate. That mass gain may not continue, or it switch to mass loss, if GHGs continue to increase rapidly and yield a cooler Southern Ocean that reduces transport of water vapor to the continent.