Geophysical Research Abstracts
Vol. 15, EGU2013-1637, 2013
EGU General Assembly 2013

Increased future ice discharge from Antarctica owing to higher snowfall

Ricarda Winkelmann (1,2), Anders Levermann (1,2), Maria A. Martin (1,2), and Katja Frieler (1)

(1) Potsdam Institute for Climate Impact Research, Potsdam, Germany (ricardaw@pik-potsdam.de), (2) Physics Institute, Potsdam University, Potsdam, Germany

Anthropogenic climate change is likely to cause continuing global sea-level rise, but some processes within the Earth system may mitigate the magnitude of the projected effect. Regional and global climate models simulate enhanced snowfall over Antarctica, which would provide a direct offset of the future contribution to global sea level rise from cryospheric mass loss and ocean expansion. Uncertainties exist in modelled snowfall, but even larger uncertainties exist in the potential changes of dynamic ice discharge from Antarctica. Here we show that snowfall and discharge are not independent, but that future ice discharge will increase by up to three times as a result of additional snowfall under global warming. Our results, based on an ice-sheet model forced by climate simulations through to the end of 2500, show that the enhanced discharge effect exceeds the effect of surface warming as well as that of basal ice-shelf melting, and is due to the difference in surface elevation change caused by snowfall on grounded versus floating ice. Although different underlying forcings drive ice loss from basal melting versus increased snowfall, similar ice dynamical processes are nonetheless at work in both; therefore results are relatively independent of the specific representation of the transition zone. In an ensemble of simulations designed to capture ice-physics uncertainty, the additional dynamic ice loss along the coastline compensates between 30 and 65 per cent of the ice gain due to enhanced snowfall over the entire continent. This results in a dynamic ice loss of up to 1.25 metres in the year 2500 for the strongest warming scenario.