Geophysical Research Abstracts
Vol. 17, EGU2015-10240, 2015
EGU General Assembly 2015

Ice dynamic contribution to sea-level rise from the Antarctic Peninsula over the next 300 years

Clemens Schannwell (1,2), Nicholas Barrand (1), Richard Hindmarsh (2), and Valentina Radic (3)

(1) School of Geography, Earth and Environmental Sciences, University of Birmingham, Birmingham, UK (cxs400@bham.ac.uk), (2) British Antarctic Survey, Natural Environment Research Council, Cambridge, UK, (3) Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, Vancouver, British Columbia, Canada

Ice shelves fringing the Antarctic Peninsula (AP) ice sheet have collapsed or retreated in response to rapid regional climate warming. This removal of ice shelves has led to speed-up and subsequent dynamic thinning of outlet glaciers, contributing to sea-level rise (SLR). The British Antarctic Survey Antarctic Peninsula Ice Sheet Model (BAS-APISM) was used to simulate the grounded ice sheet response to future ice shelf collapse over the next 300 years. BAS-APISM solves the linearized shallow ice approximation, permitting low computational cost and a large ensemble of scenario calculations. To simulate the ice-dynamic SLR contribution from the AP, the timing of future ice shelf collapse events are estimated by tracking thermal limits of ice shelf viability (-5°C and -9°C mean annual isotherm) in IPCC global climate model (GCM) ensemble temperature projections. If the ice shelf collapses, a grounding-line retreat is applied to each drainage basin feeding into the ice shelf. Temperature fields from 14 different GCMs with two emission scenarios (RCP4.5 and RCP8.5) are used. Grounding-line retreat scenarios at individual outlet glacier drainage basins are derived using a new parameterization based on multivariate linear regression. A total of 210 ice shelf nourishing basins are modelled. Owing to the linearized ice sheet model, each drainage basin can be modelled individually and SLR contributions from each drainage basin are then simply summed over all basins. Each individual ice shelf nourishing drainage basin was simulated using the ice shelf collapse timing of 14 GCMs with two emission scenarios and tracking the pair of ice shelf viability limits in each GCM. This amounts to $\sim$22000 simulations for all 210 ice shelf nourishing drainage basins. Simulations throughout the GCM and emission ensembles result in SLR of between $\sim$2 and $\sim$17 mm, depending on the timing and collapse state of individual ice shelves. The results highlight the critical role of George VI Ice Shelf in regulation of future SLR from the AP ice sheet.