Title:   Numerical Model investigation of Crane Glacier response to collapse of the

Larsen B ice shelf, Antarctic Peninsula.

In March 2002, the Larsen B Ice Shelf disintegrated catastrophically. Many of the glaciers that fed the ice shelf are observed to have experienced increased rates of ice discharge and front retreat but the response is neither uniform nor universal.  At one end of the range is the large response of Crane Glacier, which has sped up 3-fold from (~500 m a$^{-1}$ to ~1500 m a$^{-1}$) in its downstream reach and by late 2006 thinned 150 meters since ice shelf collapse.  Between March 2002 and early 2005, Crane Glacier's calving front retreated by about 11.5 km and is now oscillating about that position.

Here, the dynamic response of Crane Glacier to ice shelf collapse is investigated using a finite element model of momentum balance along a profile down the trunk of Crane Glacier.  Assuming that the glacier was near equilibrium with its boundary conditions before ice shelf collapse, observed pre-collapse flow is used to tune the model. The model is then used to perform stress perturbation experiments to investigate the instantaneous response of the glacier to the removal of the ice shelf.  The response has two components, a minor dynamic change due to the stress perturbation as ocean and air replace the ice shelf at the downstream end of the glacier, and a large increase in the sliding speed, together with an increase in downstream stretching.  The magnitude of the modeled instantaneous speedup has a 14% absolute difference to the observations and the instantaneous thinning rate associated with the change in downstream stretching is of the same order of magnitude as observations.