Wind Driven Ocean / Ice Interactions during the Ross Sea Region Deglaciation

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Geological evidence and modelling experiments suggest that the removal of ice shelves from marine based ice sheets can lead to catastrophic collapse. Roosevelt and Ross Islands are thought to be stabilization anchors for the Ross Ice Shelf and thus the West Antarctic Ice Sheet.

The Roosevelt Island Climate Evolution (RICE) project recovered a 763m deep ice core during 2011-2013 from Roosevelt Island, at the northern edge of the Ross Ice Shelf. The ice at Roosevelt Island is grounded 210m below sea level and accumulates in situ, with the Ross Ice Shelf flowing around the rise. High resolution

radar surveys show a well-developed Raymond Bump at the divide of the ice dome. The RICE age model is developed using high resolution methane data tied to the WAIS Divide ice core record, supported with annual layer count, tephra ages and a glacial flow model.

Here we show data spanning the past 30ka and discuss reconstructions of sea surface and air temperature, sea ice extent, atmospheric circulation patterns, and ice shelf grounding line retreat. An ensemble of sensitivity modelling experiments is used to determine thresholds for the removal of ice on Roosevelt Island and correlated grounding line and ice volume changes of the Ross Ice Shelf and the West Antarctic Ice Sheet.

Our data suggest that the delayed onset of the Ross Ice Shelf grounding line retreat during the deglaciation was driven at least in part by the early onset of deglaciation in West Antarctica as recorded in the WAIS ice core. The Ross Ice Shelf grounding line started to retreat rapidly with the initiation of an ice shelf cavity. Atmospheric circulation changes precede the onset of the Antarctic Cold Reversal (ACR) by about 200 years. Maximum sea ice extent is reached at the termination of the ACR and is maintained into the early Holocene, a time period of rapid atmospheric warming and circulation changes.