Rift formation and growth on the Ross Ice Shelf

Ian Joughin
Jet Propulsion Laboratory
California Institute of Technology
M/S 300-235
4800 Oak Grove Drive
Pasadena, CA 91109

Doug MacAyeal
Department of Geophysical Sciences
University of Chicago
5734 S. Ellis Ave.
Chicago, IL 60637
773-702-8027 (o)
773-752-6078 (h)
drm7@midway.uchicago.edu

The Antarctic ice sheet sheds much of its mass via the calving of large icebergs. The fronts of the Ross and Filchner-Ronne ice shelves, which produce large tabular icebergs, calved three large icebergs in the year 2000 that, collectively, contained roughly twice the annual accumulation for all of Antarctica. Several other large calving events occurred in 2001-2002, including the dramatic breakup of the Larsen B ice shelf. Located much further south than the Larsen, the Ross and Filchner-Ronne ice shelves are believed to be more stable in that it would take a rise in summer temperatures of several degrees to produce surface meltwater in the quantities that are believed to have contributed to the demise of the Larsen.

Calving events along a given section of the ice front occur decades apart, making it difficult to obtain sufficient observations to statistically separate the natural variability typical of a stable ice shelf from any longer term trend. It thus becomes necessary to better understand the process of tabular iceberg calving to develop the ability to determine whether individual events are "normal" or signify a response of the ice sheet/shelf system to climate change.

The process of calving from the large ice shelves appears to be driven by the formation and propagation of large-scale ice-shelf rifts that become iceberg detachment boundaries. We have collected interferometric synthetic aperture radar observations (InSAR) of the actively growing rift system on the western side of the Ross Ice Shelf that gave rise to iceberg C19 in May 2002. Our analysis of these data suggests that the rifts open at a steady rate, largely in response to the stresses present in the ice shelf.