Session: Ice sheet mass budget
Oral presentation

Tidal motion and ice velocity at ice front of Ronne Ice Shelf as observed with ERS interferometry

E. Rignot
Jet Propulsion Laboratory
Email: eric@adelie.jpl.nasa.gov

D. MacAyeal
The University of Chicago
Email: drm7 @midway .uchi.edu

ERS images of the two end points of the ice front of Ronne Ice Shelf were processed to obtain interferograms which reveal the rate of deformation of the ice shelf, due to tides and viscous creep, and the mechanisms of iceberg formation. A time series of ERS data acquired in Feb 1992, in both ascending and descending mode, and with a 3-day time interval, reveal the velocity of the ice shelf on the western flank of Berkner Island and surrounding Hemmen Ice Rise (HIR). To minimise the contamination of the interferometric phase by the tidal signal, multiple interferograms were combined to synthesise a longer temporal baseline than that provided by the ERS repeat-pass cycle. Using differential interferometry, we also mapped the grounding zones of the ice shelf and obtained a time series of observations of the tidal signal. A similar exercise was performed along the Lassiter coast, on the western side of the Ronne Ice Shelf using ERS tandem data acquired in 1995/1996.

Several interesting aspects, common to both ends of the ice front, are deduced from the ERS data. First, the amplitude images provide high-resolution details about the size and articulation of rotating ice blocks - or rafts - and sea-ice filled crevasses torn through the ice shelf in the proximity of the ice front. Second, interferometric differential displacements indicate that tidal forcing from the ocean tends to wobble the ice shelf rather than linearly deform it. This phenomena may be associated with the progressive advection of tidal waves underneath the ice shelf, combined with possible resonant modes of oscillation involving the distinct geometry of the sub-ice-shelf ocean cavity. Third, the rotation of ice blocks is clearly revealed in the wake of Hemmen ice rise as well as along Lassiter coast. This rotation, however, is annealed in the tidal displacements. This result means that the mechanisms controlling raft rotation are not tidal but due to the viscoelastic deformation of the ice shelf. A companion paper discusses the comparison between predictions from a finite-element model with the ERS interferograms which confirm clues about the flow regime of the ice shelf revealed by the ERS radar data.