313

AMERY ICE SHELF RIFT PROPAGATION

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Rifts in the Antarctic ice shelves are large through-cutting fractures that penetrate the entire ice thickness. These rifts can grow to hundreds of kilometres long, eventually forming the boundary from which large tubular bergs detach. Despite the important role that iceberg calving plays in the mass balance of the Antarctic ice sheet (icebergs account for up to two-thirds of the mass lost), very little is known about the forces involved in their initiation and subsequent propagation.

We present a summary of our findings for a major active rift system found near the front of the Amery ice Shelf, East Antarctica, based on extensive field work campaigns during the summer seasons of 2002-2003 to 2004-2005. Using an array of GPS and seismic instrumentation, our observations show strong clustering of icequakes along the rift axis, extending far ahead of where the rift tip is visible on the surface. Most of these events occur during episodic “swarms” of seismicity that last several hours with typical recurrence intervals of 1-2 weeks. We also observe rapid rift widening during the seismic swarms which leads us to believe that these events are related to rapid bursts of rift propagation. Serendipitously, our array was deployed one week before the Dec 26 Sumatra earthquake and there is clear evidence of the event in both our GPS and seismic records.

The episodic behaviour of the rift system is also modulated by a seasonal character, as evidenced by a time series of rift lengths measured using satellite imagery. Rifts propagate at “quasi-steady” rates over a summer period (Sept-April) but show marked slowing during the winter period (April-Sept). Possible causes for this summer-winter effect are discussed.