

Intermittent rift propagation in the Amery Ice Shelf

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The Amery Ice Shelf features five prominent rifts within 30 km of its calving front. Through observation using available MODIS and MISR data, we produce a time series of changes in rift length for the period 2002-2012. We find that all five are actively propagating, but with a complex spatio-temporal pattern of variability in which some rifts propagate in tandem while others appear to tradeoff. Temporal variability in rift propagation is dominated by large episodic bursts. These bursts, analogous to the much smaller propagation events detected from field observations, are not synchronous across all five rifts nor do the timing of propagation events exhibit any correlation with observed proxies for environmental forcing (e.g., atmospheric temperatures, sea-ice extent). However, we find that several propagation events take place after the predicted arrival from tsunamis originating in the Indian Ocean. This is especially apparent following the December 2004 Sumatra earthquake and three other earthquakes in the Sumatra/W. Indonesia area. This connection is bolstered by the observation of similar effects at other ice shelves, e.g., a large iceberg calving after the sudden propagation of two front-initiated rifts at Larsen C after the December 2004 tsunami. In comparing rift propagation at Amery with 67 rifts on 11 other ice shelves around Antarctica, we find that with the exception of the occasional tsunami triggered propagation event, the extreme variability on the Amery Ice Shelf is highly atypical. We postulate that the pronounced activity on the Amery is due to the fact that it last had a large calving event in 1963/64, and is approaching its pre-calved position. This suggests that the AIS is poised for another major calving event and the highly dynamic propagation we observe is the precursor to such an event.