# Time-dependent Strain-rate Fields Forecast Rift Propagation: Case Study on the Brunt Ice Shelf, Antarctica

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Full thickness fractures in ice shelves, known as rifts, propagate when there is sufficient energy to generate new surfaces. The energy available for rift propagation is a function of the stress state within the ice shelf, which is related to the observable strain rates through a constitutive relation, typically implemented as Glen's Flow Law. On the Brunt Ice Shelf, the recent propagation of multiple active rifts provides an excellent setting to improve intuition on the processes, drivers, and effects of rifts through the framework of the surface stresses. Here, we use remote sensing observations to estimate spatiotemporal variations in the strain rate and velocity fields, providing observational constraints on the rate of rift propagation and the intensification of stresses near the rift tip. Using the observational record of Sentinel-1A/B synthetic aperture radar, we are able to identify critical moments of rift development through derived strain rates prior to any optical indicators from imagery. This approach is a promising method to interpret the controls on rift propagation in a mechanistic framework, highlighting the benefit of strain rates as reliable inferences for changes on ice shelf surfaces. Deriving strain rates with high spatiotemporal resolution allows us to reliably forecast the location of rift propagation. This work provides a useful indicator for future dramatic changes on Antarctic ice shelves and emphasizes the utility of strain rate observations.