

## **Gradual slowdown and thickening of Fimbulisen ice shelf, East Antarctica, over the past decade**

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Fimbulisen is a fast-flowing (up to  $780 \pm 10 \text{ m a}^{-1}$ ) ice shelf in the Dronning Maud Land region of East Antarctica. Fed by one of the few major outlet glaciers along that coast, Jutulstraumen, the ice shelf has the potential to affect the stability of a considerable part of the inland ice sheet. Here we present evidence of a slowdown and thickening of Fimbulisen over the last decade. We derive ice shelf velocities using synthetic aperture radar (SAR) data from Envisat in 2008 and Radarsat-2 in 2015. We find that the speeds of Fimbulisen have decreased by  $10 \pm 2 \text{ m a}^{-1}$  over the last 7 years, which is confirmed with repeated GPS stake readings from 2010-2011. The slowdown of Fimbulisen coincides with a gradual ice shelf thickening that we infer from ICESat (2003-2009) and CryoSat-2 (2010-2016) altimetry. Available surface mass balance data from Fimbulisen show no clear trends over the past decades, suggesting that ice dynamics is the main explanation for the observed thickening. Considering that Fimbulisen is in a long-term phase of advance after its main tongue calved off in 1967, it is plausible that the slowdown is cyclic and related to the longitudinal expansion of the ice shelf. In support of this theory we have found several uncharted ice rumples and stationary icebergs near the eastern front of the ice shelf, indicating the presence of shallow bathymetry that might affect the ice shelf dynamics considerably in the event of ice shelf grounding or ungrounding.