

EGU22-8960

<https://doi.org/10.5194/egusphere-egu22-8960>

EGU General Assembly 2022

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Antarctic ice tongue collapse triggered by loss of stabilizing land-fast sea ice

Rodrigo Gomez Fell¹, Wolfgang Rack¹, Heather Purdie¹, and Oliver Marsh²

¹University of Canterbury, School of Earth and Environment, Gateway Antarctica, New Zealand

(rodrigo.gomezfell@pg.canterbury.ac.nz)

²British Antarctic Service, Cambridge, United Kingdom

The complete length of Parker Ice Tongue (18 km or 41 km²) calved in March 2020. This event occurred at the same time as repeated full summer break-outs of surrounding land-fast sea ice. Our results showed that periods of continuous ice tongue growth coincided with extended periods of land-fast sea ice coverage for at least the past 60 years. We also found that seasonal variations in the ice tongue dynamics were linked to variations in the local land-fast sea ice extent. A complete Antarctic ice tongue calving right at the grounding line has not been reported before.

Based on the analysis of satellite images and aerial photographs we determined Parker Ice Tongue length variations for the last 65 years. We found that the average growth of Parker Ice Tongue has been ~193 m/y⁻¹. If we assume a constant growth rate, a break-off event of the magnitude observed has not occurred in the last 169 years.

We used a Sentinel-1 SAR image sequence to create a 2017-2020 time series of surface ice velocities. We found a significant inverse correlation between fast ice extent and ice tongue velocities ($R = -0.62$; $R^2 = 0.39$). The short summer period, characterized by decreased land-fast sea ice extent, showed around 11% higher velocities compared to winter. This supports the idea that fast-ice extent can influence ice tongue dynamics seasonally.

Here we showcase the vulnerability of Parker Ice Tongue once left exposed to oceanic processes, which poses questions about the fate of other ice tongues if land-fast sea ice decreases more broadly in the future.