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# Satellite Remote Sensing Investigations into Changing Ice-shelf Extents in the eastern Weddell Sea Sector of Antarctica

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Contemporary glaciological research is increasingly focussed on the long-term stability Antarctic Ice Sheet under different climate change scenarios, where changes to atmospheric and oceanic processes are forecast. The floating ice shelves which extend from the ice sheet are of particular research interest because they exert considerable control over the flow of inland ice and respond relatively rapidly to external forcing mechanisms.

In this study, new ice-shelf extent mapping is undertaken by delineating the calving front of the eastern Weddell Sea Sector of the East Antarctic Ice Sheet, where four of Antarctica's ten largest ice shelves are located. Calving fronts and other lengths of coastline were mapped using an adapted edge-extraction coastline delineation method, entirely within a GIS computing environment, from a suite of remotely-sensed satellite optical (Landsat-series) and synthetic aperture radar (Sentinel-1) imagery. Combined with pre-existing coastline products, a timeseries of ice-shelf areal extent is presented and discussed in the context of known and theorised ice-ocean-atmosphere interactions occurring in the region. In contrast to what is occurring in other regions of the Antarctic Ice Sheet, ice shelves are found to have been synchronously advancing since the 1960s, with only the occasional detachment of large, tabular icebergs causing ice-shelf retreat on sub-decadal timescales. Most recently, total ice-shelf area along the eastern Weddell Sea coastline from Filchner to Fimbul ice shelves, inclusive, has been increasing by c. 550 $km^2$ $yr^{-1}$ between 2009 and 2019.

Examination of climate reanalysis and sea-ice observations suggests that increasing southward surface wind-speed anomalies along the eastern Weddell Sea coastline are facilitating increased sea-ice concentrations at the margins of the ice shelves and it is argued that this may be increasing the ice-shelves' structural integrity, limiting iceberg calving activity. Ulimately, however, the ice shelves in this region are still primarily governed by bed-geometry and internal ice dynamical properties. Although this evidence is indicative of a region of the ice sheet in relative mass balance, the future continuation of identified surface air warming trend will increase the likelihood of increased iceberg calving, or indeed ice-shelf retreat or collapse, aping that perviously observed in the Antarctic Peninsula. Further research is, however, needed to assess what effect warming might have on the large-scale atmospheric processes governing changes to the surface

winds and related sea-ice concentration anomalies, so that better predictions as to the future evolution of these ice shelves and their inland feeder ice streams may be made.