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# Two decades of Antarctic coastal-change revealed by satellite imagery and deep learning

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Antarctica's coastline is constantly changing by moving glacier and ice shelf fronts. The extent of glaciers and ice shelves influences the ice discharge and sea level contribution of the Antarctic Ice Sheet. Therefore, it is crucial to assess where ice shelf areas with strong buttressing forces are lost. So far, those changes have not been assessed for entire Antarctica within comparable time frames.

We present a framework for circum-Antarctic coastline extraction based on a U-Net architecture. Antarctic coastal-change is calculated by using a deep learning derived coastline for the year 2018 in combination with earlier manual derived coastlines of 1997 and 2009. For the first time, this allows to compare circum-Antarctic changes in glacier and ice shelf front position for the last two decades. We found that the Antarctic Ice Sheet area decreased by -29,618±1,193 $km^2$ in extent between 1997-2008 and gained an area of 7,108±1,029$km^2$ between 2009 and 2018. Retreat dominated for the Antarctic Peninsula and West Antarctica and advance for the East Antarctic Ice Sheet over the entire investigation period. The only exception in East Antarctica was Wilkes Land experiencing simultaneous calving front retreat of several glaciers between 2009-2018. Biggest tabular iceberg calving events occurred at Ronne and Ross Ice Shelf within their natural calving cycle between 1997-2008. Future work includes the continuous mapping of Antarctica's coastal-change on a more frequent temporal scale.