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Direct evidence for a 20th Century decline in Southern Ocean sea ice

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Since satellite records began in the 1970s, a small expansion of sea ice area around Antarctica has been observed, in stark contrast with the large decrease seen in the Arctic region. This expansion is difficult to reconcile with the observed rise in global temperatures and appears at odds with the ice loss simulated by climate models over the same period. Efforts to elucidate the driving mechanism are hampered by a short observational record, with little information available prior to the advent of satellite observations. Here we use direct observations recovered from logbooks of early explorers and routine shipping reports (1900 to 1953) to shed new light on the position of the ice edge. The data reveals that the early 20th century sea ice extended 3.1° (2.6° – 3.3° for 5–95% confidence interval) further north ($\sim 100\%$ more extensive) than the present day. This finding re-frames the 20th century as a period of overall long-term sea ice loss in the Antarctic. The extensive sea ice cover, compared to present, goes hand-in-hand with cooler sea surface temperatures and reduced zonal wind speed in the region, consistent with reduced concentrations of anthropogenic forcing agents (greenhouse gas, ozone depletion) in the early 20th century, and may reflect the unperturbed state of Antarctic sea ice.