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An abrupt transition in the Antarctic sea ice–ocean system

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Over the past decade, Antarctic sea ice extent exhibited a sequence of record maxima, followed by a rapid decline in 2015/16, and record minima since. In this presentation, we show that this sudden and remarkable ice loss marks an abrupt transition from a high to a low ice state that cannot be explained by year-to-year variability. Instead, it is most likely associated with a longer term variability arising from ice–ocean feedbacks. The abrupt transition was preceded by a multi-decadal increase in persistence and variance of the sea ice anomalies, an increasing upper Southern Ocean density stratification, and an accumulation of heat at the subsurface; suggesting a decoupling of the surface from the subsurface ocean. During this period, the sea ice anomalies shifted from being structured predominantly regionally and seasonally to a largely circumpolar and interannual regime. In 2015/16, the upper ocean density stratification in the ice-covered region suddenly weakened, leading to a release of heat from the subsurface, contributing to the sea ice decline during winter. Our analysis suggests that the sudden sea ice loss in 2015/16, and the persisting low ice conditions since, arose from a systematic change in the physical state of the coupled circumpolar ice–ocean system. This change will have wide implications for global climate, ecosystems, and the Antarctic Ice Sheet.