Geophysical Research Abstracts
Vol. 21, EGU2019-230, 2019
EGU General Assembly 2019

The Springtime Influence of Natural Tropical Pacific Variability on the Surface Climate of the Ross Ice Shelf, West Antarctica: Implications for Ice Shelf Thinning

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Observational records starting in the 1950s show West Antarctica is amongst the most rapidly warming regions on the planet. Together with increased intrusions of warm circumpolar deep water (CDW) onto the continental shelf due to local wind forcing (the primary mechanism in recent decades), this has resulted in enhanced surface and basal melting of floating ice shelves and an associated acceleration and thinning of West Antarctic outlet glaciers, increasing the rate of global sea level rise. In this study, it is shown that during the austral spring season, significant surface warming across West Antarctica has shifted westward to the Ross Ice Shelf in recent decades in response to enhanced cyclonic circulation over the Ross Sea. These circulation changes are caused by a Rossby wave train forced by increasing sea surface temperatures in the western tropical Pacific in the vicinity of the South Pacific Convergence Zone (SPCZ), which is tied to the springtime shift of the Interdecadal Pacific Oscillation (IPO) to its negative phase after $\sim$1992. While the local wind trends enhance warm air advection and surface warming across the Ross Ice Shelf, the strong easterly component of the wind trends reduces the likelihood for intrusions of CDW onto the continental shelf in this region. This suggests that during spring there are competing mechanisms of surface and basal melting of the Ross Ice Shelf, both of which are closely tied to natural tropical Pacific decadal variability and a potentially important role of the SPCZ. Moreover, that the projected transition of the IPO back to its positive phase in the coming decade, though likely to reduce surface warming on the Ross Ice Shelf, could increase the risk of disintegration of Ross Sea ice shelves due to increased intrusions of CDW and enhanced basal melting.