

The Role of Atmospheric Rivers in Antarctic Sea Ice Variations

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Antarctic sea ice variations are affected by moisture and heat from low- and mid-latitudes, more than 90% of which are transported by atmospheric rivers (ARs). This study employs the ERA5 reanalysis and satellite observations to detect all the ARs over the Antarctic sea ice and analyze the general contributions of ARs on sea ice changes from 1979 to 2020. Though AR frequency is low in all seasons, ARs give rise to intense sea ice reduction at a rate of more than 10%/day in marginal ice zone. Thermodynamic processes of sea ice dominate the AR-induced variations, associated with anomalous atmospheric conditions during ARs. Warm, moist and cloudy weather causes considerable melting by enhancing sensible heat flux in cold seasons but has restrictive influences in summer due to blocked solar radiation. Heavy precipitation during ARs is also nonnegligible, especially during the summer melt.