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Antarctic extreme high temperatures across seasons and their response to advection

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Antarctic extreme high temperatures impact the cryosphere, with very warm extremes driving surface melt on ice shelves. Here, we analyse temperatures exceeding the 90th percentile of the temperature distribution, focusing on the associated circulation patterns and radiation anomalies. ERA5 reanalysis data show high air pressure / positive geopotential height anomalies related to the occurrence of warm extremes. The highest temperature during warm extremes appears on the periphery of high-pressure systems, consistent with anticyclonic advection. Autumn and winter exhibit stronger warm extremes due to the transport of warm and moist air. In summer, the weak meridional gradients of TOA downward solar radiation flux and surface air temperature contribute to weak temperature anomalies by advection of anomalously warm air. Warm extremes are associated with positive longwave radiation anomalies in all seasons, but with negative shortwave radiation anomalies at the surface except during polar night. These relationships are verified by station observations. Our results confirm that Antarctic warm extremes are mostly driven by meridional advection of warm air, and suggest that these warm air masses are predominantly moist and cloudy.