2026 PAMIP Webinar Series
April 30th at 3:00 pm (GMT)

Unprecedented 2024 East Antarctic winter heatwave driven by polar vortex weakening and amplified by anthropogenic warming

Date: Apri 30th, 2026
Time: 3:00 pm (GMT)

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In July–August 2024, East Antarctica experienced the most intense winter heatwave in the 46-year satellite record. In Dronning Maud Land, surface air temperatures stayed more than 9°C above the climatological mean for over two weeks, which is highly unusual for such a cold and typically stable region. This event raises two key questions: what physical processes can generate such extreme warmth in Antarctica, and to what extent is human-induced climate change already influencing events like this? In this talk, I will present a multi-model, multi-method attribution framework designed to address these questions from different angles. I begin with regional climate model storyline experiments, then complement these with flow analogue analysis, and finally incorporate large-ensemble probabilistic attribution. The results suggest that a pronounced weakening of the stratospheric polar vortex triggered a quasi-barotropic high-pressure anomaly. This circulation pattern helped drive intense atmospheric river intrusions, enhancing poleward transport of heat and moisture and explaining roughly half of the observed surface warming. Across methods and models, we find a generally clear fingerprint of anthropogenic influence. Human-induced warming increased the intensity of the event by about 0.7°C and more than doubled its likelihood in today's climate. Looking ahead, extreme winter heatwaves like this are likely to become more frequent and more intense under future emissions scenarios. Overall, these findings show that anthropogenic warming is not only shifting the mean state of the Antarctic climate, but also reshaping the likelihood of the most extreme events in the coldest regions of the planet.

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