Atmospheric drivers of Antarctic heatwaves: from the March 2022 event to a climatology

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Abstract

In March 2022 an unprecedented heatwave occurred in Antarctica, breaking global temperature anomaly records, and impacting the Antarctic cryosphere. Previous studies have shown that this extreme event was associated with an intrusion of warm and moist air masses from the extratropics into high latitudes at the upstream flank of a poleward protruding ridge. We study the Antarctic heatwave from the perspective of an amplifying and breaking Rossby wave in a poleward direction of the eddy-driven jet and show that this atmospheric process steered exceptionally warm and moist air masses into the heart of the Antarctic continent. Building on previous studies pointing to the influence of enhanced tropical convection over the Indian Ocean preceding the Antarctic heatwave, we demonstrate a systematic climatological relationship between the Madden-Julian Oscillation and Antarctic heatwaves. An active MJO in phase 1 and 2 is followed by poleward and eastward propagating Rossby wave activity over the southern Indian Ocean, ridge extension into East Antarctica, and increase occurrences of extreme heat near the surface. These research findings form the basis for a climatological analysis aiming to elucidate the atmospheric drivers of Antarctic heat extremes.

Keywords: Antarctic hot extremes, Rossby waves, moist air intrusions

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