

Observational Analysis of an Atmospheric River Impacting the Antarctic Peninsula During the Winter YOPP-SH Special Observing Period

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The Year of Polar Prediction in the Southern Hemisphere (YOPP-SH) aims to improve the weather forecasts for Antarctica. The project is centered around the winter Special Observing Period (SOP) that spanned April 15 - August 31, 2022. During the SOP, Targeted Observing Periods (TOPs) featured extra radiosondes launches to capture intense weather events, such as major oceanic cyclones and atmospheric rivers (ARs).

The first TOP period was May 9-16, 2022. There was a sequence of three AR events and we focused our study on the first one on May 10. In the forecast, this event was classified as an AR1 based on the Center for Western Weather and Water Extremes (CW3E) AR scale. An excessive amount of moisture was transported by the AR into the Antarctic Peninsula (AP) region, along with high temperatures, abundant precipitation, and strong winds.

The soundings of three northern peninsula stations, Escudero (62°20'S, 58°96'W), Vernadsky (65°15'S, 64°15'W) and Rothera (67°34'S, 68°08'W), were analyzed to investigate the AR. The ERA5 global reanalysis was used to explore the spatial structure of the AR. Comparisons between the soundings and ERA5 showed that ERA5 accurately represented temperature, specific humidity, wind speed and wind direction, but was not so realistic for relative humidity.

On May 10, a low pressure system moved into Bellingshausen Sea with warm moist air advection to the AP from the north-northwest direction. At 1200 UTC, the relative humidity soundings for all three stations show high moisture content (60-100%) at low levels. The peak of the moist intrusion by the AR was observed at this time. Moreover, both observations and reanalysis display low relative humidity values (~30%) at the stations around 2700 m overlying the moist air layer. This happened due to a narrow dry slot oriented along the Antarctic Peninsula near 700 hPa likely reflecting air of stratospheric origin. The observations imply that air with stratospheric characteristics is penetrating deep into the troposphere. The synoptic event combines moist precipitating areas and dry descending air in a complicated pattern.