Atmospheric Drivers of Coastal and Open-Ocean Polynyas around Antarctica

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Polynyas, or ice-free regions within the sea ice pack, are a common occurrence around Antarctica. Coastal polynyas, such as the Terra Nova Bay Polynya (TNBP) on the western side of the Ross Sea just off Victoria Land, are primarily driven by the strong katabatic winds that descend from the Antarctic Plateau. Open-ocean polynyas, such as the Weddell Polynya, are generally triggered by ocean dynamics. However, warm and moist low-latitude air intrusions, sometimes in the form of atmospheric rivers (ARs), also modulate the extent of both polynyas. In this talk, the role of such events on the TNBP and Weddell Polynyas are investigated. In 55% of the days when the TNBP polynya exceeds its 2010-2017 mean, warm and moist air intrusions play a role in its expansion, as seen in *in-situ* observations. Sea-ice drift speeds of more than 25 km day-1 clear the ice offshore and promote the widening of the polynya starting from the coastal areas. Prior to the two large Weddell Polynya openings in November 1973 and September 2017, persistent ARs impacted the site, leading to a more than 10□C increase in surface and air temperature and a 250 W m-2 increase in the downward longwave radiation, which result in sea-ice melt and lead to the development of the polynya. This study stresses the need to consider the effects of ARs and storms on the Antarctic sea-ice environment and ecosystem, both in coastal areas and in the ice pack in the Southern Ocean.