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# Polar cyclones at the origin of the reoccurrence of the Maud Rise Polynya in austral winter 2017

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This study examines the role of atmospheric forcings in the occurrence of open-ocean polynyas by investigating the case of the austral winter 2017's polynya located in the Lazarev Sea sector to the east of the Weddell Sea, known as the Maud Rise polynya. The ice-free zone appeared in mid-September 2017 and grew to as large as 80,000 square kilometers by the end of October 2017 before merging with the open ocean after the sea ice started to retreat at the beginning of the austral summer. Using a combination of satellite observations and reanalysis data at high spatio-temporal resolution, we found that severe cyclones, occurring over the ice pack, have a deterministic role in creating strong divergence in the sea ice field through strong cyclonic surface-winds leading to the opening of the polynya. The occurrence of intense and frequent cyclones over the ice pack during austral winter 2017 was unusual and it occurred under an enhanced strong positive meridional transport of heat flux and moisture toward Antarctica associated with an amplification of the atmospheric zonal wave 3 and a strong positive SAM index. We found that the opening of the polynya was not primarily due to direct ice melt by thermodynamic effects but rather to strong dynamical forcing by the winds on the sea ice, as in the case of coastal polynyas. Indeed, the meridional transport of heat toward Antarctica occurred over the Weddell Sea sector (i.e. to the east of the Lazarev Sea sector where the polynya is located) whereas the Lazarev sea sector was under the influence of equatorward transport of cold air masses at that time. Our results show that the supply of warm and moist air coming from the west side of the South Atlantic Ocean into the Weddell Sea, significantly increased baroclinic instability and frontogenesis leading to intense and frequent cyclogenesis over the ice pack, far south from the ice edge. After cyclogenesis in the Weddell Sea, these cyclones intensified as they moved eastward spinning over the Lazarev Sea with intensity comparable to the one of the 'very severe' tropical cyclones category in the Saffir–Simpson scale for tropical cyclones classification. The cyclones-induced strong surface-winds led to sea ice divergence, triggering the reoccurrence of the Maud Rise polynya in mid-September 2017. These findings have been published recently in JGR.
Keywords: Antarctica, storms, cyclones, polynya, sea ice, cyclonic winds.