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Understanding the Amundsen Sea Low

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The Amundsen Sea Low (ASL) is a climatological low pressure system located between 170-300 ° E and 60-75°S and is a key component of the non-zonal climatological circulation at high southern latitudes. With reanalysis output identifying that climatologically the low in the Amundsen Sea is the deepest of three mean sea level pressure (MSLP) centres observed around Antarctica. The ASL strongly modulates West Antarctic climate with impacts on sea ice extent, temperature and precipitation, via its controlling influence on the variability of the meridional wind field. It has also been shown to have a significant influence on the atmospheric circulation in the Ross Sea region and to strongly modulate temperature and moisture advection over the Antarctic Peninsula.

Previous work has demonstrated strong relationships between the depth of the ASL and cyclone densities in the region. However, interestingly a recent review identified that it is not easy to relate the storm density and depths of the cyclones to the climatological ASL, since the climatological location of the ASL does not occur at a clear maximum of storm activity. This study examines output from the ERA-interim reanalyses around Antarctica to further understand the contributors to the climatological pattern, partially in an effort to identify whether a more physically meaningful ASL depth index (normally simply defined as the monthly minimum MSLP) can be created. In this effort, storm track data derived from the ERA-Interim reanalysis and mean sea level pressure data bandpass filtered to accentuate synoptic scale variability are first examined. The contribution of persistent positive anomalies in the mean sea level pressure (defined as 8hPa positive anomalies from the climatological mean for a period of 5 days) in the region surrounding the Amundsen sea is also examined to identify whether blocking plays a role. Finally, the frequency of persistent negative anomalies (defined as a negative 8hPa occurring for 5 days or longer) is also examined around Antarctica and in the vicinity of the Amundsen Sea. We show that these persistent positive and negative anomalies likely contribute to the ASL depth.