

Extraordinary polar low developments in the southern Pacific Ocean during the 2022 YOPP-SH
winter spatial observing period

Jorge Carrasco
Universidad de Magallanes

Polar mesoscale cyclones (PMCs) were defined by the European Polar Low Working Group as those cyclonic cloud features with a diameter less than 2000 km that develop poleward of the main polar front. This definition includes the meso-a and meso-b-scale cyclonic vortices, with diameters ranging between 200 and 2000 km and 20 and 200 km, respectively. The further definition indicates that the polar lows (PL) are those cyclonic-mesoscale weather systems that develop in the maritime environment whose diameter is less than 1000 km with near-surface wind exceeding 15 ms⁻¹, of short-lived, usually less than 24 hours. However, intense PL can have a lifetime of up to 36 hours. They are of common occurrence in the northern hemisphere, mainly during the winter. On the other hand, climatological satellite-based studies suggest that PLs also occur in the ice-free areas of the southern oceans, but year-round, including those of similar characteristics to their northern hemisphere counterparts.

The main challenges in the study of PLs have been the fact that atmospheric models and reanalysis do not always succeed at representing observed PLs. Consequently, their spatiotemporal distribution and the dynamic/physical mechanisms involved in their formation and subsequent development are poorly understood. During the winter 2022 YOPP campaign, satellite imagery observation allowed us to identify the initial mesoscale cyclonic comma-cloud features that developed into synoptic scale frontal clouds observed in the southern Pacific Ocean. This gives us the opportunity to conduct a qualitative evaluation of atmospheric models and reanalyze the initial phase of the mesoscale cyclones and analyze the mechanisms behind their formations and subsequent developments.