



A multi-decadal climatology of North Pacific Polar Lows Employing Dynamical Downscaling

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The 6-hourly 1948-2010 NCEP 1 re-analyses have been dynamically downscaled for the region of the North Pacific. With a detecting-and-tracking algorithm a climatology of North Pacific Polar Lows has been constructed. This derived climatology is consistent with the limited observational evidence in terms of frequency and spatial distribution. The climatology exhibits strong year-to-year variability but weak decadal variability and a small positive trend. A Canonical Correlation Analysis describes the conditioning of the formation of Polar Lows by characteristic seasonal mean flow regimes, which favor, or limit, cold air outbreaks and upper air troughs.

We dynamically downscale the gridded large scale synoptic field of the NCEP 1 re-analysis data for the region of the North Pacific. Following the study of North Atlantic Polar Lows by Zahn and von Storch (2008b), this is done by running a regional climate model (RCM) continuously for 63 years during which the NCEP1 re-analyses are available. In a previous study, we demonstrated that most of the individual cases of Polar Lows can be well reproduced [Chen et al., 2012]. We use this downscaled data base for investigating trends and variability of Polar Low occurrences in the North Pacific and their linkage to the large scale circulation situation over the last 63 years. For the first time a multi-decadal RCM downscaling has been presented with the purpose of deriving a climatology of Polar Lows in the sub-polar North Pacific.

The 1948-2010 climatology shows large inter annual variability, but little decadal variability of Polar Low occurrences and no significant long-term changes in the North Pacific region.

The results of Canonical Correlation Analysis shown there is a close relationship between the time mean MSLP patterns and the Polar Low density. Anomalous flows from cold surfaces were found to support the large-scale synoptic environment of Polar Low formation.