

Medium-range forecast skill for Arctic Cyclones

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Arctic cyclones (ACs) have environmental and social impacts on the Arctic [1-2]. In this study, we assessed the forecast performance of medium-range ensemble forecasts provided by The Interactive Grand Global Ensemble (TIGGE), regarding the central pressure and position of ACs for the summer (June – August) of 2008 – 2016. Forecast data from five leading numerical weather prediction (NWP) centers were used: the Canadian Meteorological Center (CMC), the European Centre for Medium-range Weather Forecasts (ECMWF), the Japan Meteorological Agency (JMA), the US National Centers for Environmental Prediction (NCEP), and the UK Meteorological Office (UKMO). Ten dominant AC events were detected based on the following criteria: the central pressure of < 980 hPa, the central position of $> 70^\circ\text{N}$, and the areal-mean temperature anomaly at 250 hPa of > 5 K.

In predicting the central pressure of the ACs, the ECMWF has the highest skill in the 0.5- to 3.5-day forecasts, followed by CMC (Fig. 1a). In the 4.5- to 5.5-day forecasts, CMC shows a similar skill to ECMWF, and its 6.5-day forecast shows the highest skill in all the centers. The 2.5-day ECMWF forecast is as accurate as the 1.5-day CMC, JMA and UKMO forecasts. In the 0.5-day forecasts, all the NWP centers except for NCEP have the mean pressure errors of < 3 hPa. The NCEP forecast in the range from 0.5 to 3.5 days ahead shows the lowest skill in predicting the central pressure. Regarding the central position of the ACs (Fig. 1b), ECMWF has the highest skill for the 1.5- to 5.5-day forecasts. These ECMWF forecasts show the 1-day advantage in predicting the central position of the ACs, as well as the central pressure, compared with the other centers. In the 0.5-day forecasts, the mean position error is below 100 km for all the centers and JMA shows the lowest mean error of 25 km. In general, ECMWF has the highest performance in predicting ACs at medium-range timescale.

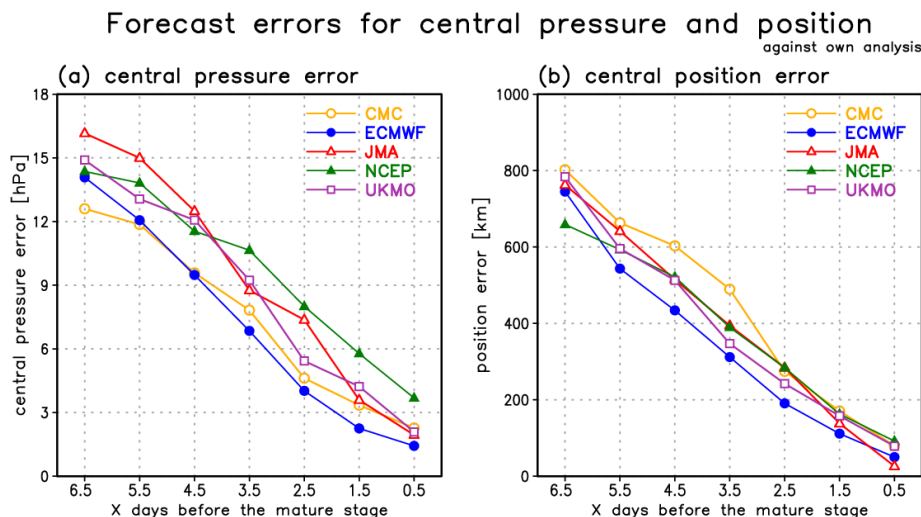


Figure 1. Mean forecast errors in the central (a) pressure and (b) position of ACs in the summer of 2008 – 2016 for CMC, ECMWF, JMA, NCEP, and UKMO ensemble forecasts. The forecasts were verified against their own analysis.

References

- [1] J. Inoue, M. Hori. Arctic cyclogenesis at the marginal ice zone: A contributory mechanism for the temperature amplification? *Geophys. Res. Lett.* **38** (2011)
- [2] V.M. Eguíluz¹, J. Fernández-Gracia, X. Irigoien, C.M. Duarte. A quantitative assessment of Arctic shipping in 2010–2014, *Nature Scientific Reports* **6** (2016)