運用機率擬合方法優化系集地面風速預報

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摘 要

　　由決定性預報至採用系集預報系統之系集平均，對於天氣系統的可預報度雖獲得改善，但卻因為系集平均而損失對於極端值的預報能力或因系集系統模組設定而產生預報偏差。以地面風速而言，現行系集各成員經調校後對於地面風速仍略有高報。本研究將透過機率擬合方法，藉由整合各別成員風速預報之空間分佈，經重新排序後，與其他各成員相同排序之數值組成分群，由分群中取中位數或最小值，以求改進系集平均風速高估之誤差特性，並修正機率擬合產品之機率密度函數分布於中風速(2-6 m/s)多報及弱風(0-1 m/s)少報之預報偏差。

　　本研究分析個案為 2019 年 8 月全月與 2020 年 7 月單周之每日上午 8 點進行初始化之預報資料，在兩個分析個案中，以分群中取分群最小值之系集機率擬合產品能獲得最佳之預報能力。2019年 8 月的 31 個校驗個案中，系集機率擬合產品可降低原始系集平均預報之平均誤差(ME)達 50%並改進方均根誤差(RMSE)達 24%；2020 年 7 月單周 9 個預報個案中，系集機率擬合產品較原始系集平均預報之 ME 降低達 77%且改進 RMSE 達 19%。由此兩個研究個案中顯示，藉由機率擬合方法運用於系集地面風速之優化，可獲得一致性的改進效益。

關鍵字：系集預報、機率擬合、風速預報

Optimizing the Ensemble Wind Speed Forecast with Probability Matched Mean Method

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Abstract

　　The ensemble mean forecast of an ensemble system will enhance the predictability than the deterministic forecast. However, an ensemble mean forecast might miss the extreme value for it was averaged from the ensemble member as well as it can be biased resulted from the configuration of the ensemble system. For the ensemble wind speed forecast of the WRF Ensemble Prediction System (WEPS), the individual member as well as ensemble mean forecast had demonstrated an over-forecast in 10-m wind speed. A probability match mean method was applied to reconstruct the probability density function of wind speed base on the ensemble mean wind speed forecast. First, sorting the forecast wind speed for each member and collecting the same rank from the ensemble members to be a new group. Within the new group, we demonstrated 3 kinds of probability matched strategies (mean/medium/minimum): (1) calculate mean value; (2) get the medium value; (3) get the minimum vale of the new group. Finally, to replace the ensemble mean wind speed forecast with the value of the new group.

　　This study demonstrated the benefits of probability match mean in 2 events, one is a month in August, 2019 and the other is a week in July, 2020. The verification indicated that the probability matched method with getting the minimum in the new group have the best performance. Comparing with the original ensemble mean wind speed forecast, the probability matched wind speed can improve the mean error about 50% to 77% as well as reduce the RMSE about 19% to 24 %。In addition, the probability density function of the probability matched products can reduce the frequency of moderate wind (2-6 m/s) and increased the frequency of light wind (~1 m/s).The former was highly forecast in the original ensemble mean wind speed and the latter was less. To sum up, the probability match method can successfully reconstruct the probability density function and improve the wind speed forecast.

Keywords: Ensemble forecast, Probability Matched Mean, Wind speed forecast.