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2 Figure S1: The 24-hour scatter density map compared with the actual 10-meter wind speed. (a) 10-fold 3 cross-validation training set of lightGBM model in February 2022, (b) 10-fold cross-validation validation set of lightGBM model in February 2022, (c) WRF forecasts in December 2021, (d) lightGBM model forecasts 5 in December 2021, (e) WRF forecasts in January 2022, and (f) lightGBM model forecasts in January 2022.

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Figure S2: The 24-hour scatter density map compared with the actual 10-meter wind speed. (a) 10-fold
cross-validation training set of XGBoost model in February 2022, (b) 10-fold cross-validation validation set
of XGBoost model in February 2022, (c) WRF forecasts in December 2021, (d) XGBoost model forecasts in
December 2021, (e) WRF forecasts in January 2022, and (f) XGBoost model forecasts in January 2022.



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12 Figure S3: The 24-hour scatter density map compared with the actual 10-meter wind speed. (a) 10-fold 13 cross-validation training set of RF model in February 2022, (b) 10-fold cross-validation validation set of RF 14 model in February 2022, (c) WRF forecasts in December 2021, (d) RF model forecasts in December 2021, (e) 15

WRF forecasts in January 2022, and (f) RF model forecasts in January 2022.





17 Figure S4: The 24-hour scatter density map compared with the actual 10-meter wind speed. (a) 10-fold 18 cross-validation training set of DBN model in February 2022, (b) 10-fold cross-validation validation set of 19 DBN model in February 2022, (c) WRF forecasts in December 2021, (d) DBN model forecasts in December





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22 Figure S5: The 24-hour scatter density map compared with the actual 10-meter wind speed. (a) 10-fold 23 cross-validation training set of MLP model in February 2022, (b) 10-fold cross-validation validation set of 24 MLP model in February 2022, (c) WRF forecasts in December 2021, (d) MLP model forecasts in December 25





Figure S6: The 24-hour scatter density map compared with the actual 10-meter wind speed. (a) 10-fold cross-validation training set of VMD-PCA-XGBoost model in February 2022, (b) 10-fold cross-validation validation set of VMD-PCA-XGBoost model in February 2022, (c) WRF forecasts in December 2021, (d) WMD-PCA-XGBoost model forecasts in December 2021, (e) WRF forecasts in January 2022, and (f) VMD-PCA-XGBoost model forecasts in January 2022.



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Figure S7: The 24-hour scatter density map compared with the actual 10-meter wind speed. (a) 10-fold cross-validation training set of VMD-PCA-DBN model in February 2022, (b) 10-fold cross-validation validation set of VMD-PCA-DBN model in February 2022, (c) WRF forecasts in December 2021, (d) VMD-PCA-DBN model forecasts in December 2021, (e) WRF forecasts in January 2022, and (f) VMD-PCA-DBN model forecasts in January 2022.



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Figure S8: The 24-hour scatter density map compared with the actual 10-meter wind speed. (a) 10-fold cross-validation training set of VMD-PCA-MLP model in February 2022, (b) 10-fold cross-validation validation set of VMD-PCA-MLP model in February 2022, (c) WRF forecasts in December 2021, (d) VMD-PCA-MLP model forecasts in December 2021, (e) WRF forecasts in January 2022, and (f) VMD-PCA-MLP model forecasts in January 2022.

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Figure S9: In Experiment 1, 24-hour scatter comparison of forecast wind speed and actual wind speed of
WRF, lightGBM, XGBoost, RF, DBN and MLP models in different months respectively. ((a), (b), (c), (d), (e),
(f), (g) and (h) respectively represent September 2021, October 2021, November 2021, March 2022, April

- 48 2022, May 2022, June 2022 and July 2022.)
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Figure S10: In Experiment 2, 24-hour scatter comparison of forecast wind speed and actual wind speed of WRF, VMD-PCA-lightGBM, VMD-PCA-XGBoost, VMD-PCA-RF, VMD-PCA-DBN and VMD-PCA-MLP models in different months respectively. ((a), (b), (c), (d), (e), (f), (g) and (h) respectively represent September 2021, October 2021, November 2021, March 2022, April 2022, May 2022, June 2022 and July 2022.)