Supplementary Materials for

Extending wind profile beyond the surface layer by combining physical and machine learning approaches

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Table S1

Figure S1

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Table S1. Power law exponent of various terrain.

Terrain type	Power law exponent
Lake, ocean, and smooth hard ground	0.10
Foot high grass on ground level	0.15
Tall crops, hedges, and shrubs	0.20
Wooded country	0.25
Small town with some trees and shrubs	0.30
City area with tall buildings	0.40
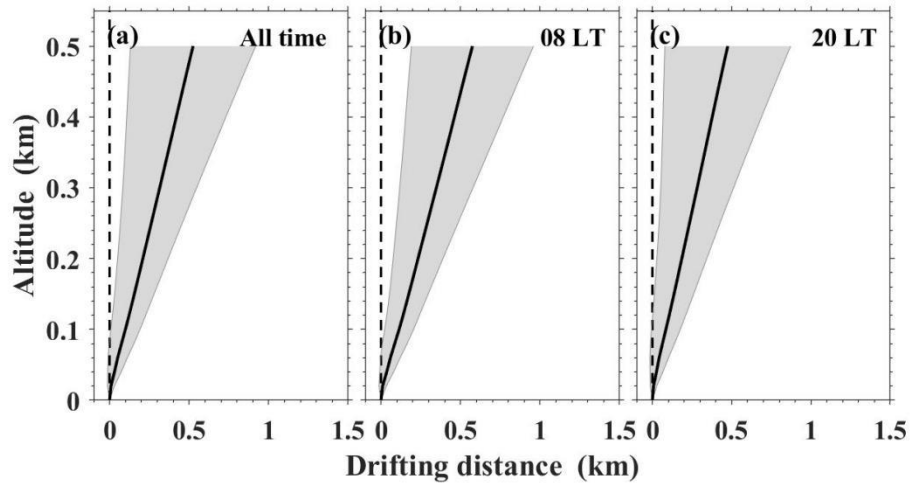
Figure S1. The drifting distance of RS observations over China. Black line represents mean drifting distance between the coordinates of RS and observation stations. Corresponding color shading areas represent the standard deviation.
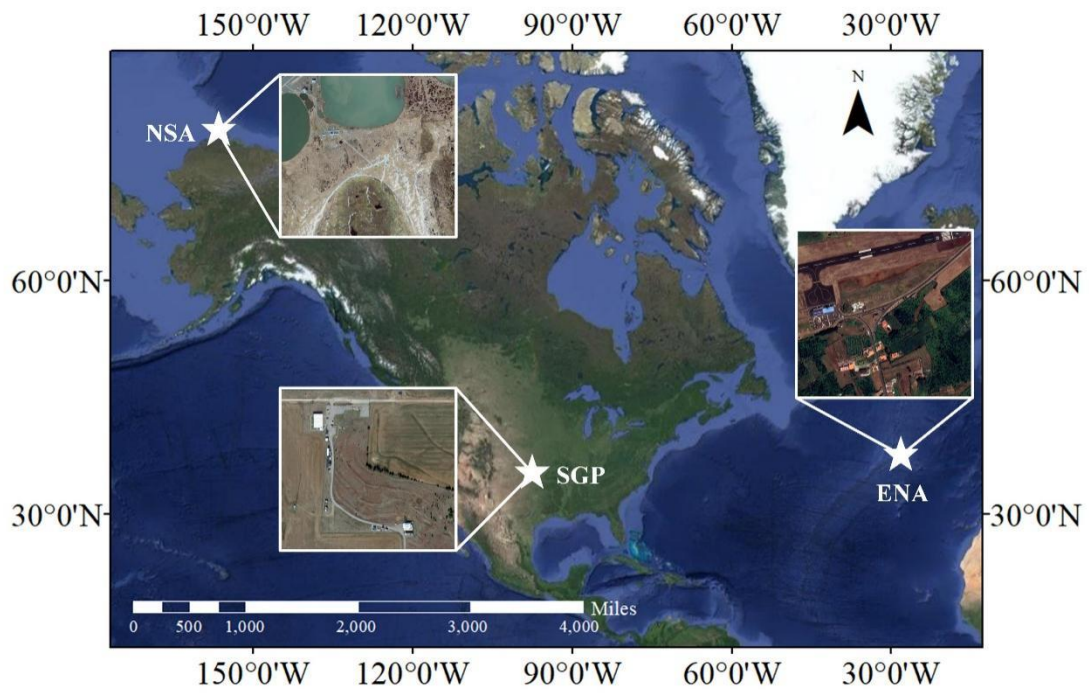
Figure S2. Geographical distribution and surface land cover type of three ARM station.
The surface type photo is provided by Google Earth (© Google Maps).
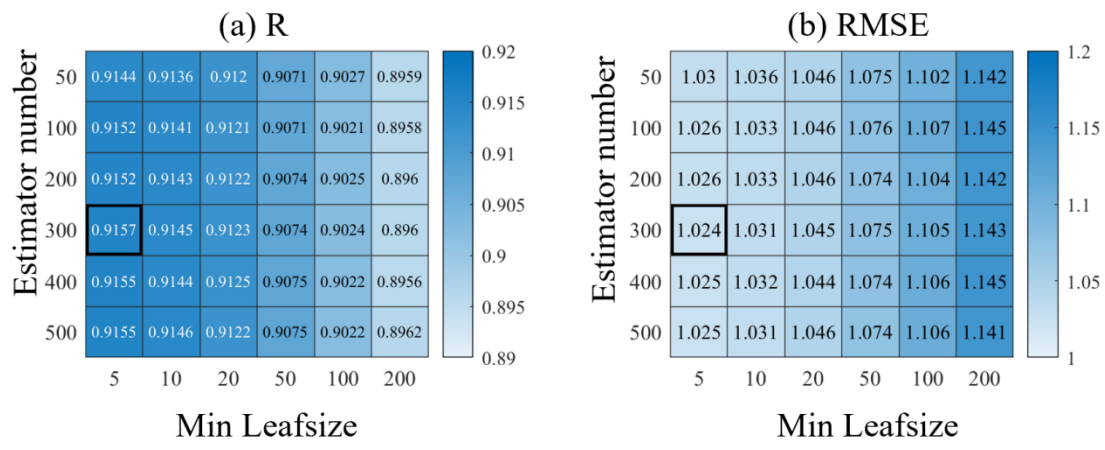
Figure S3. The (a) R and (b) RMSE distribution of RF with different parameters.
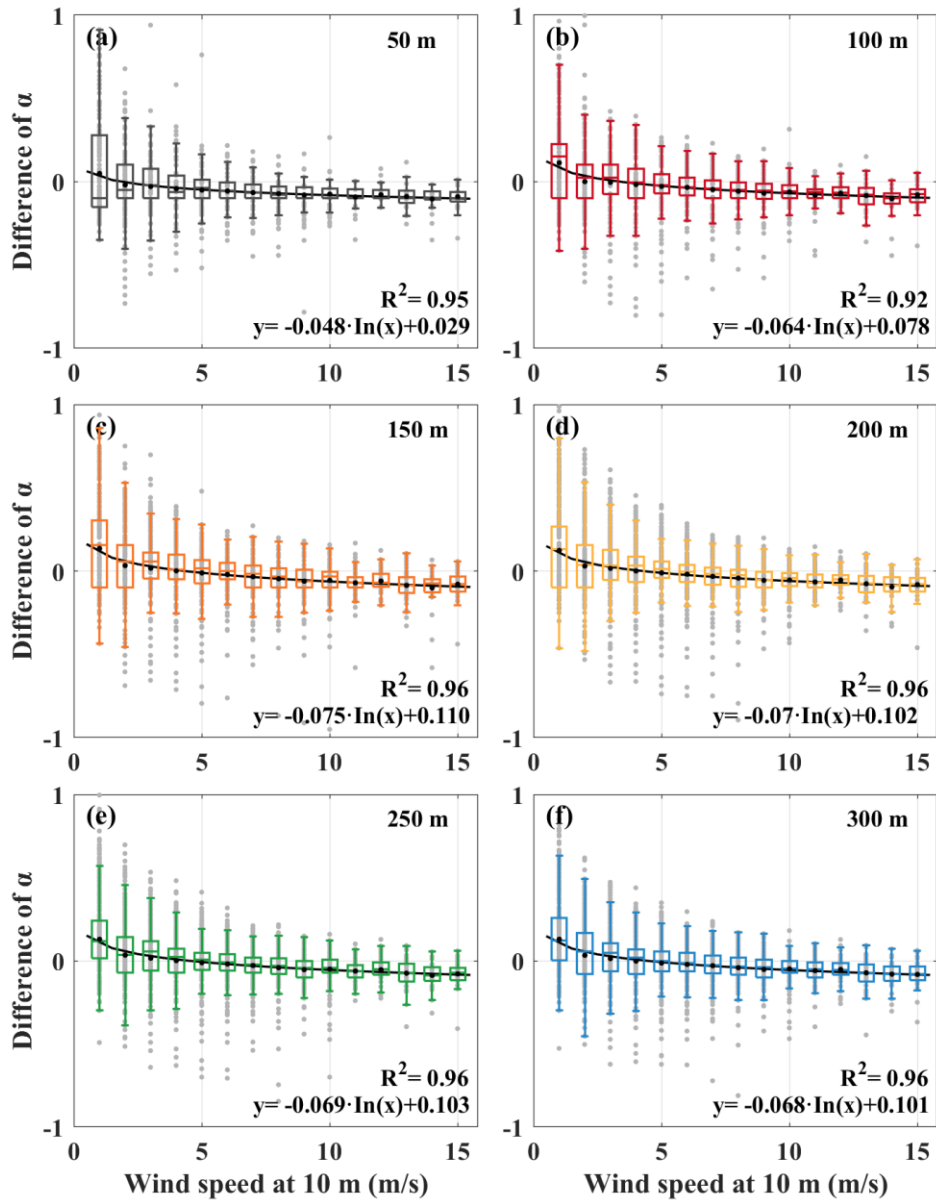
Figure S4. The α bias (assumed value minus observed value) as a function of surface wind speed at (a) 50 m, (b) 100 m, (c) 150 m, (d) 200 m, (e) 250 m, and (f) 300 m.
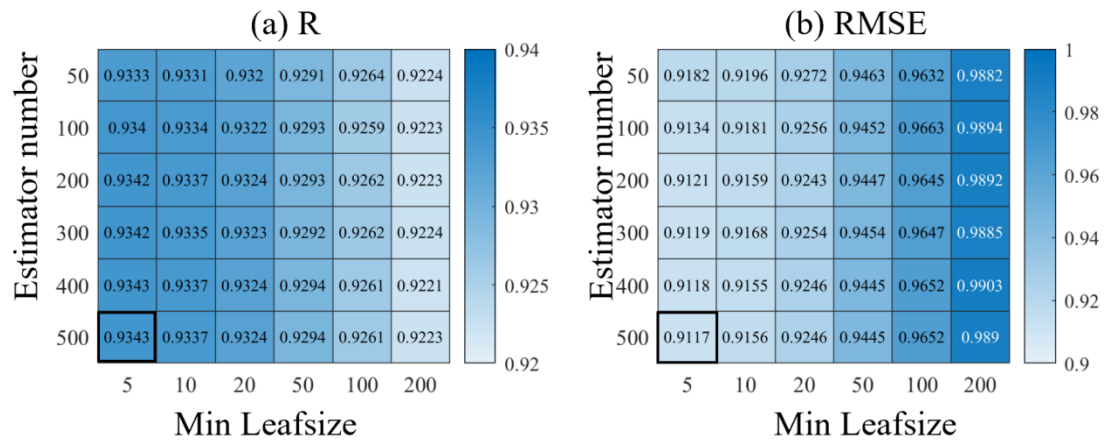
Figure S5. The (a) R and (b) RMSE distribution of Phy-RF with different parameters.
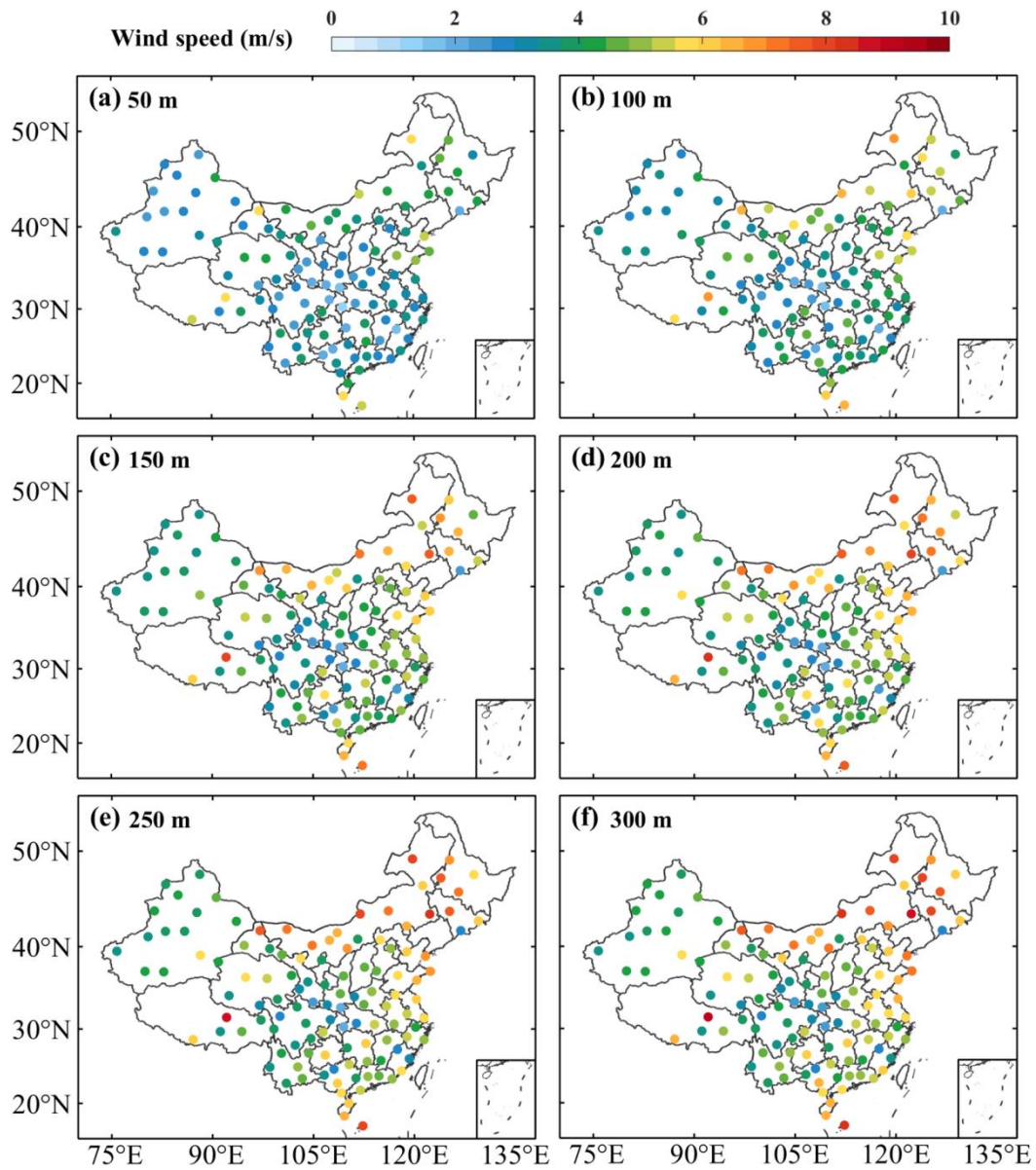
Figure S6. The spatial distributions of the estimated wind speed by the Phy-RF model over 120 radiosonde stations in China at different heights: (a) 50 m, (b) 100 m, (c) 150 m, (d) 200 m, (e) 250 m, (f) 300 m.
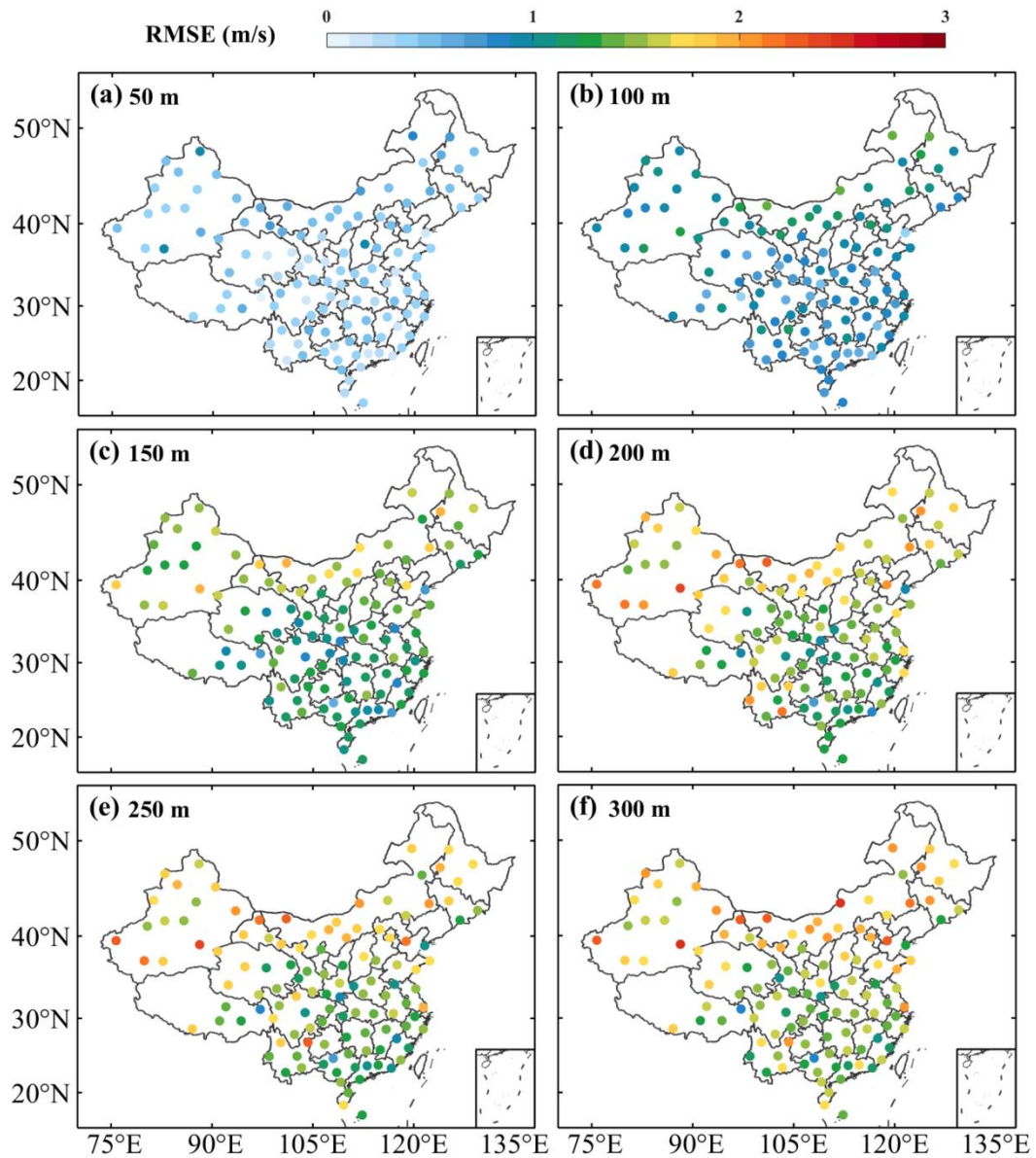
Figure S7. The spatial distributions of the RMSE between the estimated wind speed and observed wind speed for the Phy-RF model over 120 radiosonde stations in China at different heights: (a) 50 m, (b) 100 m, (c) 150 m, (d) 200 m, (e) 250 m, (f) 300 m.
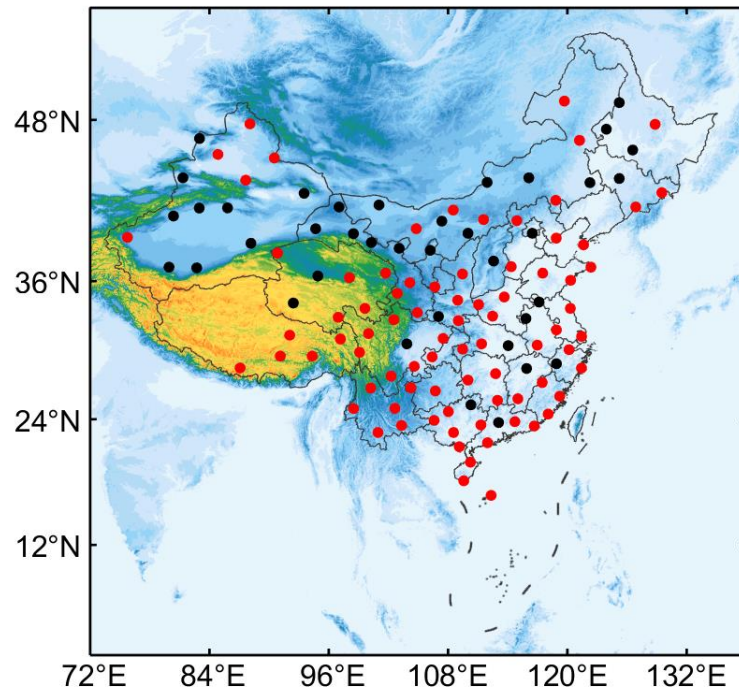
Figure S8. Geographical distribution of the radiosonde stations in China. Colorbar represents elevation. Red and black dots represent plain and highland sites, respectively.