Responses to the comments

Thanks for your kind comments for our manuscript to Atmospheric Measurement Techniques (ID: https://doi.org/10.5194/egusphere-2024-1006). We appreciate your valuable comments and suggestions to improve it. With regard to your comments and suggestions, we wish to reply as follows:

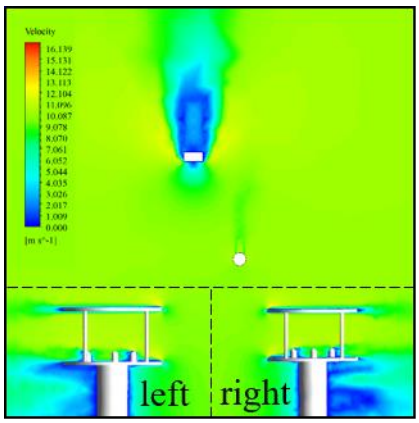
Responses to the Reviewer 1

Reviewer #1: The manuscript presents a PD-BX method to address the shadow effects of catenary pillar and improve the wind speed measurements along the high-speed railway lines. The RMSE of railway anemometer was reduced, providing enhanced accuracy and reliability of wind measurement. The manuscript is well written, and all figures are clear. Please see my comments and suggestions for minor edits below.

General comments:

1. The CFD model was performed under a standard state at 25 °C, and I assume the dry condition. However, under extreme wind conditions, e.g. strong thunderstorms, relative humidity would be high, and heavy rain is also expected. How does authors' model perform under such extreme conditions? Also, in real world, it requires quick response of wind speed under such extreme conditions. How long does it take for authors' model from data processing to wind speed results?

√Response: We sincerely thank the Editors/Reviewers' warm work earnestly and hope that the correction will meet with approval. And We have found that there is little literature on considering other meteorological factors for anemometers in extreme weather, so your opinion is very important to us. As for the results of humidity, the results are shown in Figure 1.



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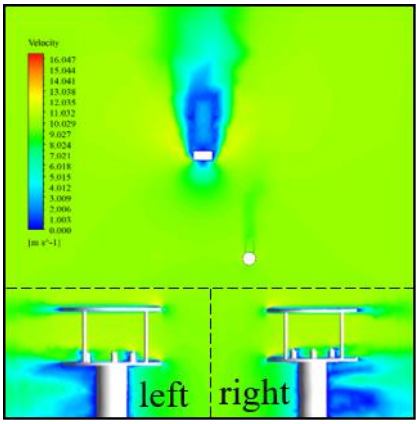

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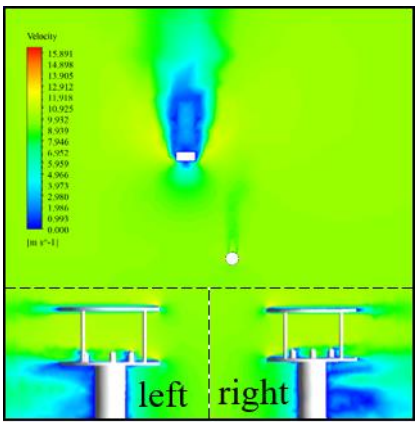

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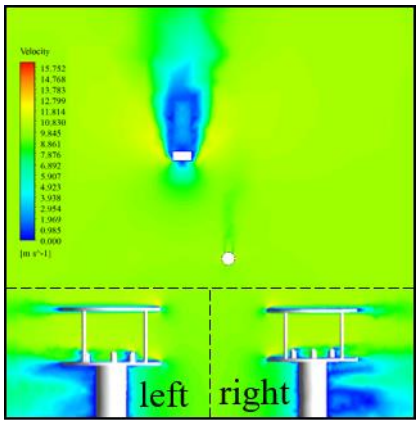

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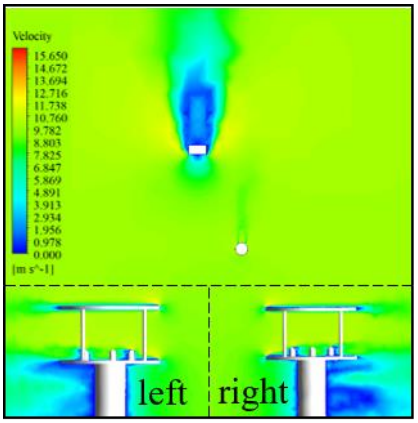

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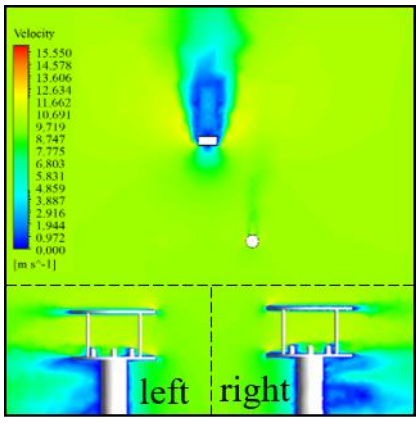

(e) 100%

Figure 1. Cloud images of railway anemometers with different humidity levels, with a wind speed threshold set at 10m/s.

It can be concluded from Figure 1 that the wind field changes with the variation in humidity, with the minimum value in the basin decreasing as humidity increases. According to Table 1, the measurement results of the anemometer decrease with the increase in humidity, with an error of about 0.2%. However, this error is much smaller

than the case when obstructed by the contact network, and even smaller than the internal shadow effect.

Table 1. Measurement results of the anemometer under different humidity and wind speed conditions in the flow field

humidity	10m/s	15m/s	20m/s	25m/s	30m/s
0%	9.93	14.87	19.84	24.81	29.80
20%	9.91	14.78	19.77	24.74	29.69
40%	9.87	14.72	19.68	24.66	29.56
60%	9.84	14.68	19.64	24.59	29.47
80%	9.79	14.61	19.59	24.45	29.38
100%	9.77	14.58	19.54	24.41	29.30

Furthermore, wind speed measurements were not affected by temperature and air pressure. The aforementioned experiments will be arranged in Section 4.1, described as simulating the anemometer's measurement conditions in extreme environments to improve the comprehensiveness of the study. The conclusions will not cause significant changes to the main structure of the article. In the dynamic experiments, the response time varies with wind speed and is approximately the distance from the anemometer to the contact grid support divided by the ambient wind speed, while temperature, air pressure, and humidity have little effect on this response time. （see lines 209-214 in the revised paper）

2. Based on the PD-BX method, authors reduced the uncertainty of wind velocities caused by catenary pillar. Beside velocities, anemometer can also detect wind directions. Do catenary pillars lead to uncertainties of wind directions, e.g. shadow effects. If so, can we also use this PD-BX method to correct the wind directions?

√Response: We agree that making wind revisions will help improve the accuracy of railroad anemometers' measurements in windy fields. However, according to the current technical specifications and standards of China's high-speed railroads, railroad wind observation only focuses on wind speed, i.e., if the wind speed reaches the alarm

threshold for more than 10 seconds, the train will be instructed to decelerate or stop moving into the section. At this stage, the demand for wind direction for high-speed railroad traveling safety is relatively small. However, with the expansion of the scale of China's high-speed railroad, the demand for wind direction monitoring of high-speed railroad is gradually increasing. We are committed to advancing high-speed railroad wind correction experiments in real time based on the specific needs of the railroad.