Comments to the Author:

The authors have made a set of substantial additional analyses to improve the article, which are well represented within the scope of the manuscript. They addressed most of the reviewer comments adequately and proposed changes accordingly in their revised article. Also included explicit statements to support the significance of the study, which were missing in the earlier version. The title of the manuscript is changed to best match the content of the manuscript.

Requested revision: clarify the following issue.

Fig.4 in acp-2020-540-AC2-supplement.pdf:

Panels (a and b): The model's performance (temperature and wind speed) is too GOOD here (even R becomes 1 in (a))!

Is it because of data assimilation/nudging as explained in Sect. 2.1 (preprint version)?

["We also used the surface analysis nudging and observation nudging options to assimilate the National Centers for Environmental Prediction (NCEP) operational global upper-air (ds351.0) and surface (ds461.0) observation weather station data ...."]

If authors use the data from these sites for data assimilation, it is not proper to present Fig. 4a-c(+Fig.S2a-c) as part of the model evaluation.

Figure R1 shows the location of the World Meteorological Organization (WMO) surface and upper-air meteorological stations over Paris contained in the data assimilation process of the NCEP operational global weather observation subsets used in the WRF-OBSGRID program (https://rda.ucar.edu/datasets/ds461.0/#metadata/detailed.html?_do=y). These stations are operated by Météo-France, the official meteorology and climatology service in France. The assimilated meteorological observations include: i) the measurements of 2 m temperature, 10 m wind and moisture fields from seven surface stations, ii) the radiosondes at 12-houly intervals at the Trappes station.

The meteorological data at the SAC station used in the model-observation comparison (Fig.4 and Fig.S2) **are not included in the data assimilation/nudging process.** The SAC tall tower is operated by Laboratoire des Sciences du Climat et de l'Environnement (LSCE), CEA/CNRS/OVSQ for the purpose of conducting scientific research. This station is equipped with high-precision CO2/CO/CH4 analyzers with two air inlets placed at 15 and 100 m above ground level respectively. It is part of the ICOS atmosphere network measuring the atmospheric greenhouse gas concentrations in Europe. The SAC station is also equipped with meteorological instruments at 10, 40, 60, 80 and 100 m above ground level to measure various meteorological variables, e.g. air temperature, wind speed and wind direction, humidity. These data sets are available upon request, but are not included in the WMO global network. Similar as the SAC station, the CDS CO2 monitoring station is also complemented by continuous meteorological measurements at 34 m above ground level.

The statistics for model-observation comparison of temperature and wind at SAC station are good. This may be due to the fact that: i) SAC is a suburb station and little influenced by the urban effects, ii) the measurements are taken at 100 m above ground level, iii) The correlation coefficient for temperature is also driven by the annual and seasonal variations that are accurately constrained in the model. In order to address the reviewer concern, we also made a model-observation comparison

at the CDS station which is located at the center of Paris (Figure R2). The meteorological instruments for wind and temperature at CDS were installed in January and March 2016 respectively, so that no observations are available at the beginning of the year. As expected, the performance for the modeled meteorological fields in urban areas is not as good as that in suburbs. The analysis of the MBE shows that the wind speeds are overestimated by WRF, with a bias of 1.49 m/s for afternoon and 0.97 m/s at night at CDS. The wind speed bias at SAC is 0.96 m/s for afternoon and 0.68 m/s at night. The correlation coefficient for temperature at CDS is also at a good score (0.99), but the values of RMSE (1.42℃) and MBE (-1.15℃) are inferior to those at SAC (0.44 ℃ and 0.06 ℃) during the daytime.

In general, the simulated daytime and nighttime meteorological fields agree reasonably well with observations both for the urban and for the suburb areas. Given that the model-data validation at CDS brings a similar conclusion on the good model performance as the diagnostics made at SAC, we feel that there is no need to add Figure R2 in the revised manuscript.

We have added the following text in section 2.2 in the revised manuscript:

“Let us remind that the meteorological data at the SAC station are not included in the data assimilation process of the NCEP operational global weather observation subsets used in the WRF nudging program (section 2.1). They could therefore be considered as independent observations for the evaluation of the model performance in simulating the meteorological fields.”

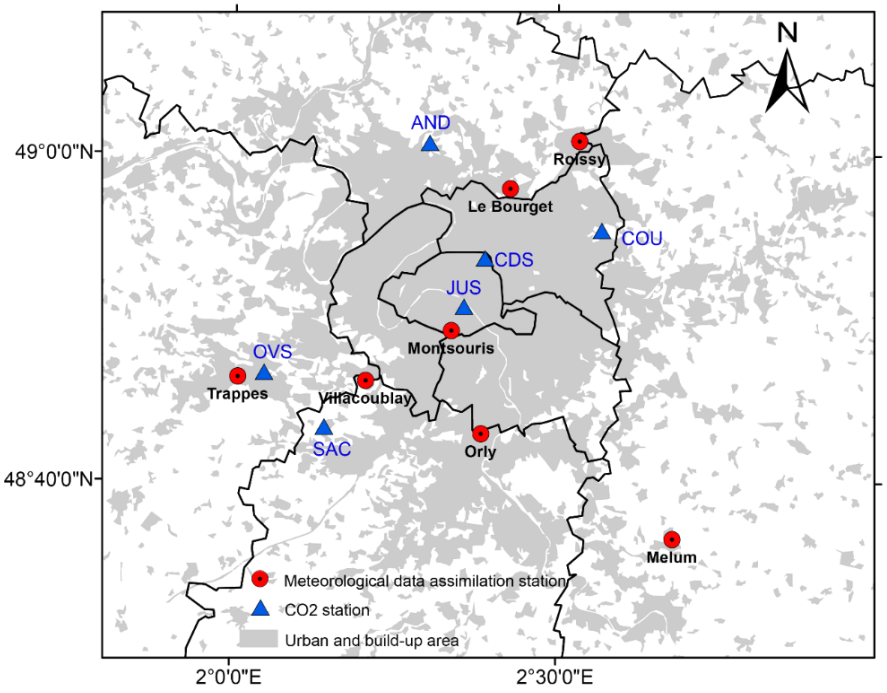

Figure R1. Distribution of the CO2 in situ and meteorological stations. The grey areas are the urban and build-up areas drawn from the CORINE land cover dataset at its native resolution of 250 m. The red dots are the WMO surface and upper-air meteorological stations contained in the data assimilation process of the NCEP operational global weather observation subsets used in the WRF-OBSGRID program. The blue triangles are the CO2 in-situ stations. The SAC station and CDS station are also equipped with meteorological instruments to measure the air temperature, wind speed and wind direction.

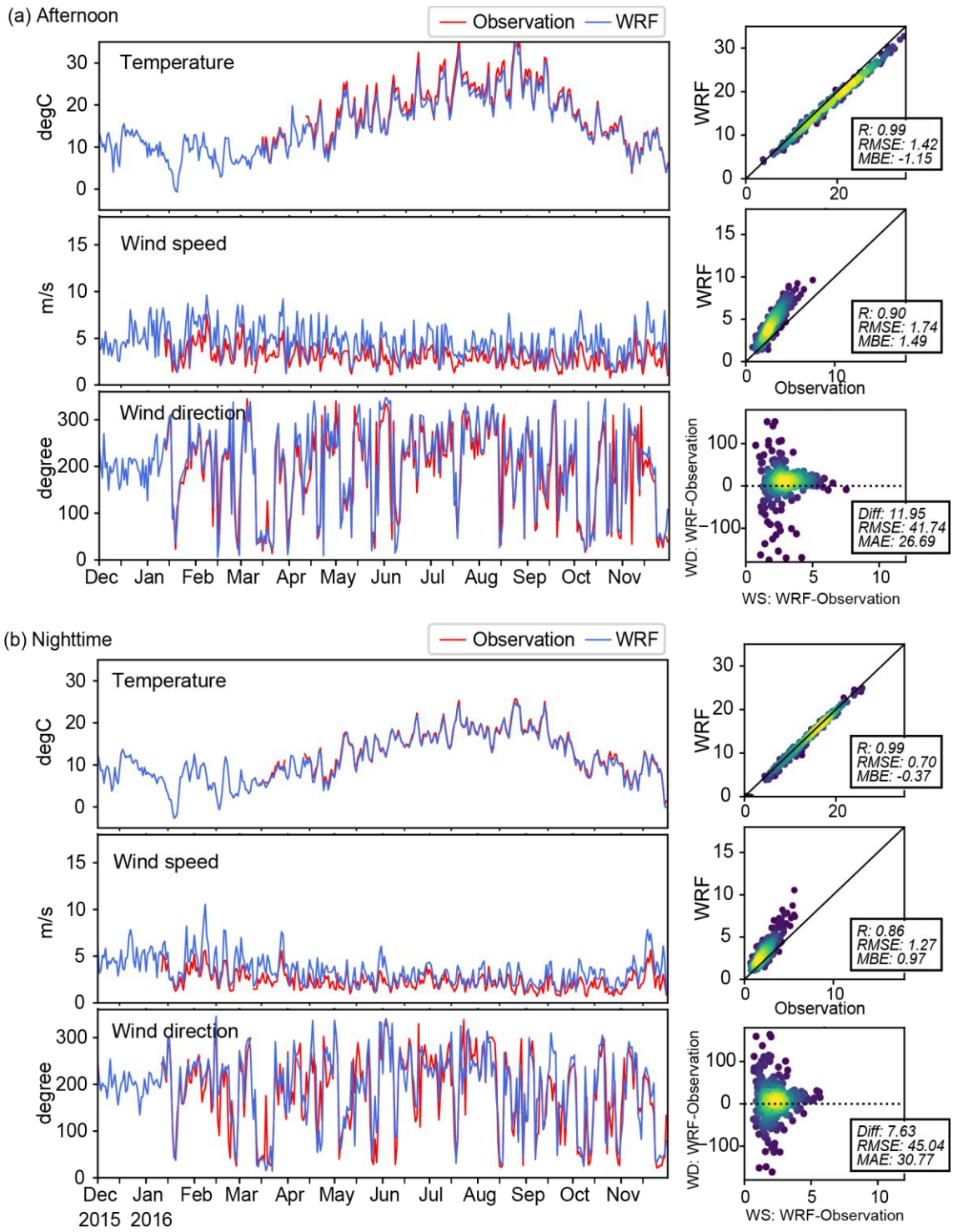

Figure R2. Time series of the daily (a) afternoon mean (11-16 UTC) and (b) nighttime mean (21-05 UTC) observed and BEP_MYJ modeled temperature, wind speed and wind direction at CDS station.