Supplement

Figure S1: Daily average CO_2 concentrations between the original GreenLITE™ data and the CDS measurement. The shaded area indicates the 30 inter-chord range.
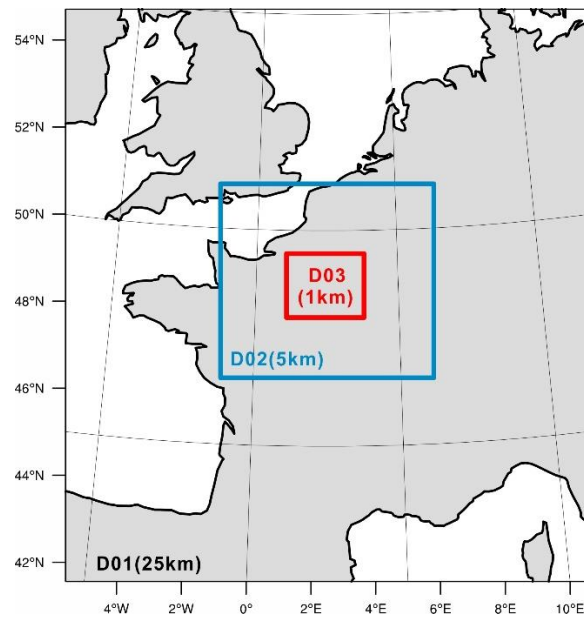
Figure S2: WRF-Chem domain settings.

(Data source: the continent-ocean boundary is from the NCAR Command Language (NCL) Ncarg4_1 database)

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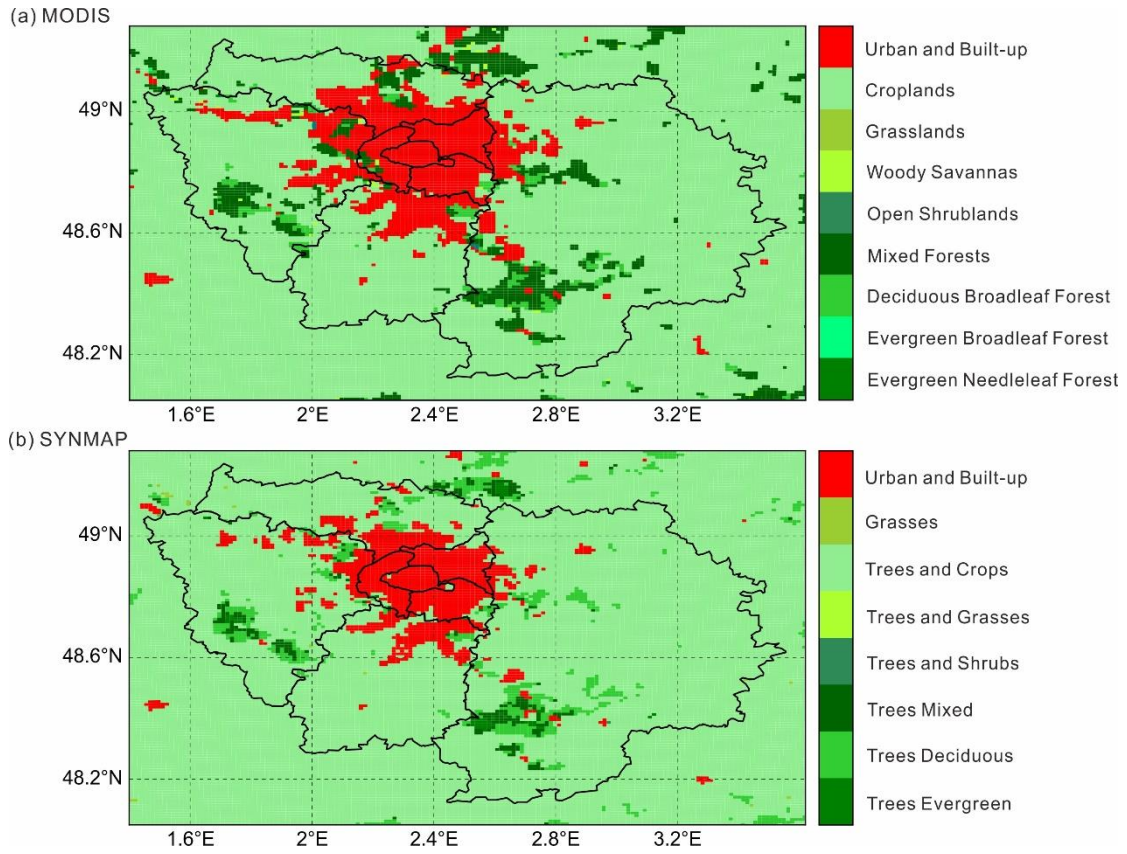
Figure S3: Dominant land use categories over the IdF region of Domain 03 from (a) MODIS database used in the WRF model and (b) SYNMAP database used in the VPRM model. Note that in the VPRM, it is the fractional vegetation coverage for a given grid cell covered by the respective land cover classes.
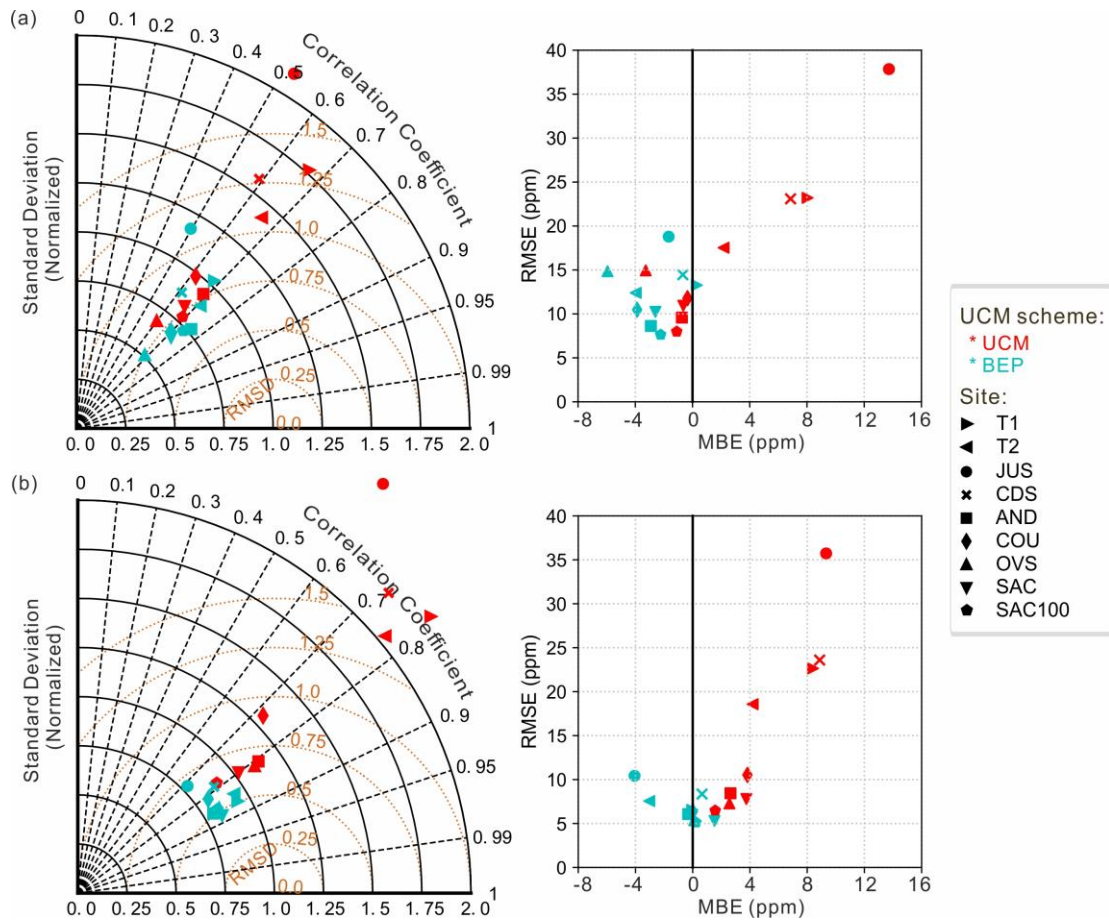
Figure S4: Normalized Taylor diagram (left) and RMSE versus MBE (right) for simulated (a) all hourly and (b) hourly afternoon (11-16 UTC) CO$_2$ concentrations from December 2015 to November 2016. The colors of markers indicate 2 different urban canopy schemes with UCM in red and BEP in cyan. In the Taylor diagram, normalized standard deviation is on the radial axis; Correlation coefficient is on the angular axis; Orange dashed lines indicate RMSD.
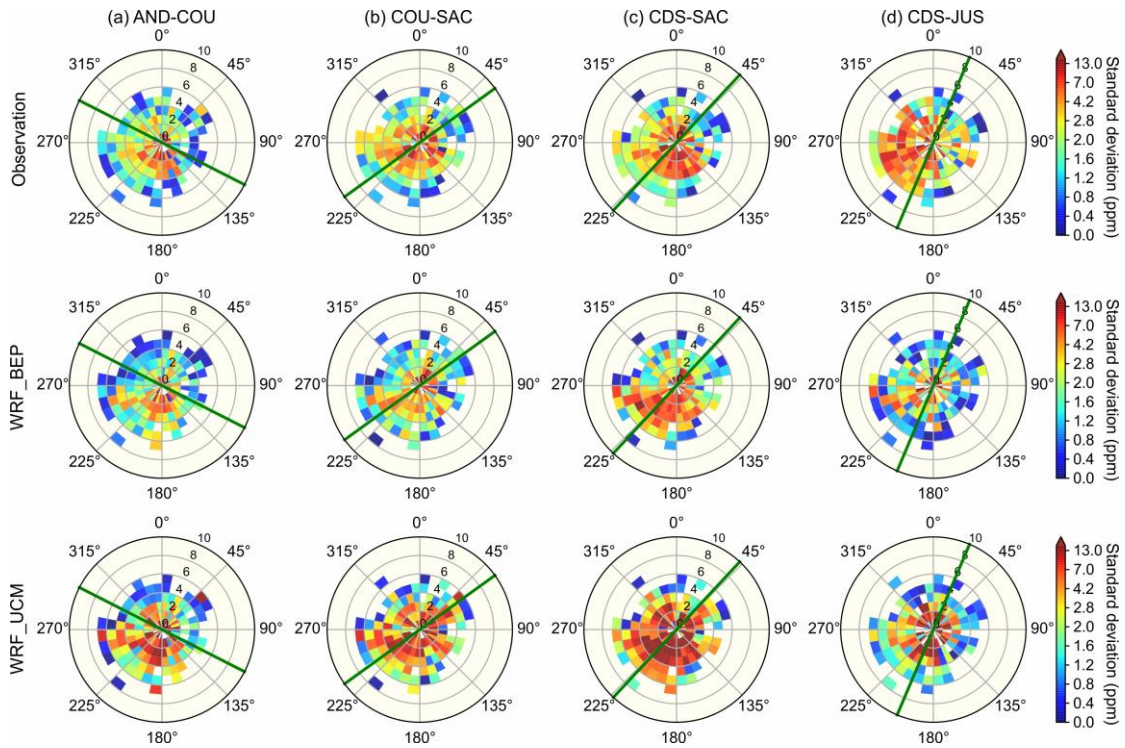
Figure S5: Standard deviations of spatial differences in CO$_2$ concentration between two stations of the in-situ network accounting for wind speed and direction. Only the afternoon (11-16UTC) data are used. The top row shows the observations, whereas the other two rows show the two simulations (UCM, BEP). The green line indicates the direction defined by two in-situ stations.
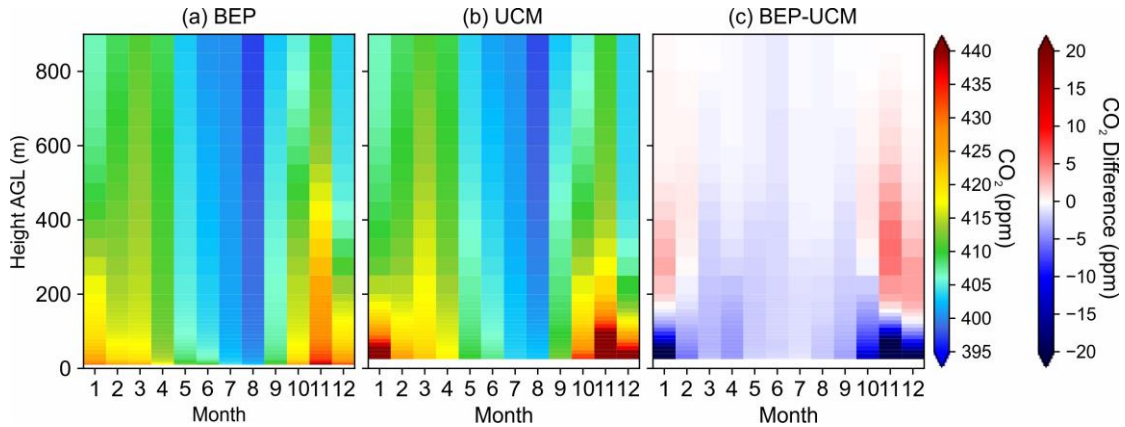
Figure S6: Vertical distributions of CO$_2$ concentrations during afternoon (11-16 UTC) at transceiver T2 (also JUS) for 12 calendar months for two simulations (a) BEP, (b) UCM, and (c) their differences.
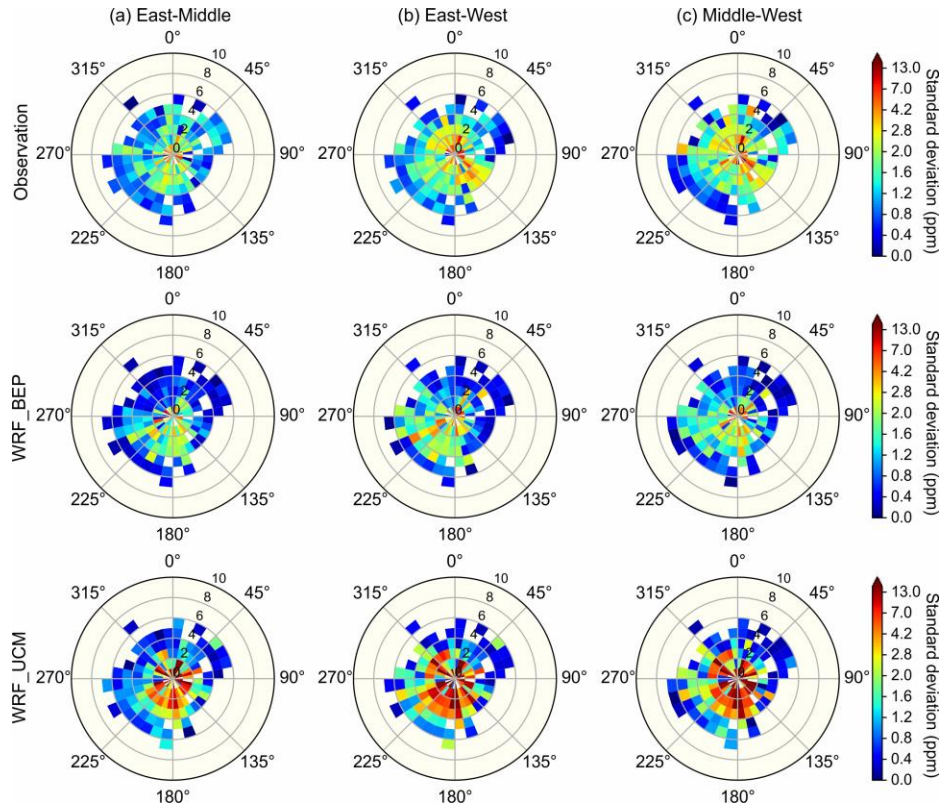
Figure S7: Standard deviations of spatial differences in CO_2 concentration between (a) east-middle, (b) east-west and (c) middle-west parts of the GreenLITE™ T1 measurement accounting for wind speed and direction. Only the afternoon (11-16UTC) data are used. The top row shows the observations, whereas the other two rows show the two simulations (UCM, BEP).