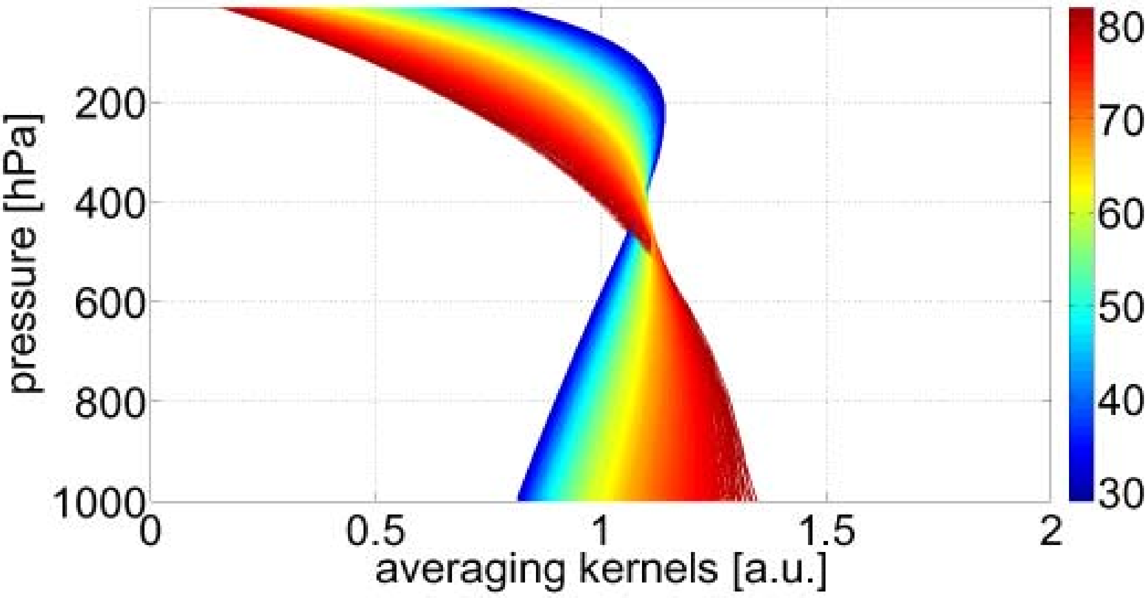

Fig. 7. CO_2 averaging kernels for the presented Białystok FTS measurements color coded for different solar zenith angles.
The averaging kernels have no distinct maximum and are constant to first approximation within the troposphere and vary primarily due to different solar zenith angles.

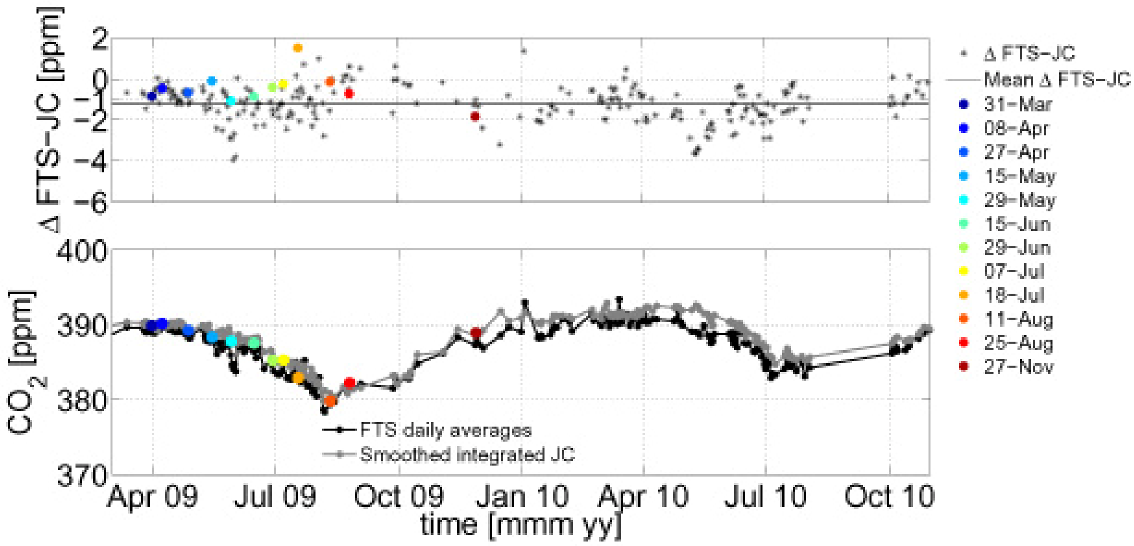

Fig. 8. Upper panel: The difference between the Białystok FTS daily averages and the corresponding integrated model data. The black line indicates the mean difference. The integrated low aircraft measurements, extended above the aircraft ceiling by the model are given color coded for the different overpasses (Sect. 5.2). Bottom panel: the integrated model data of the Jena CO_2 inversion (JC) in comparison with the FTS time series.

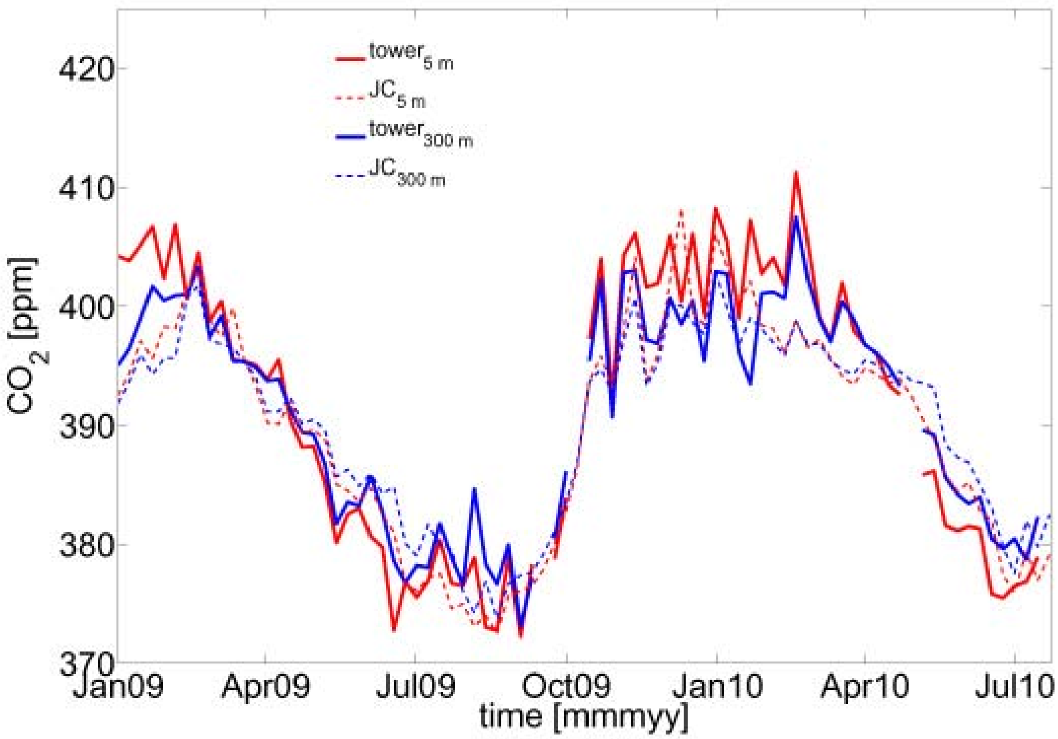

Fig. 9. The JC model output at the lowest and highest level of the tall tower (5 m, 300 m). Weekly averages of daytime measurements between 12:00 p.m. and 03:00 p.m. are compared. The Jena CO_2 inversion captures the seasonal cycle at both levels to the first order, whereas especially in the winter the higher level is better captured.

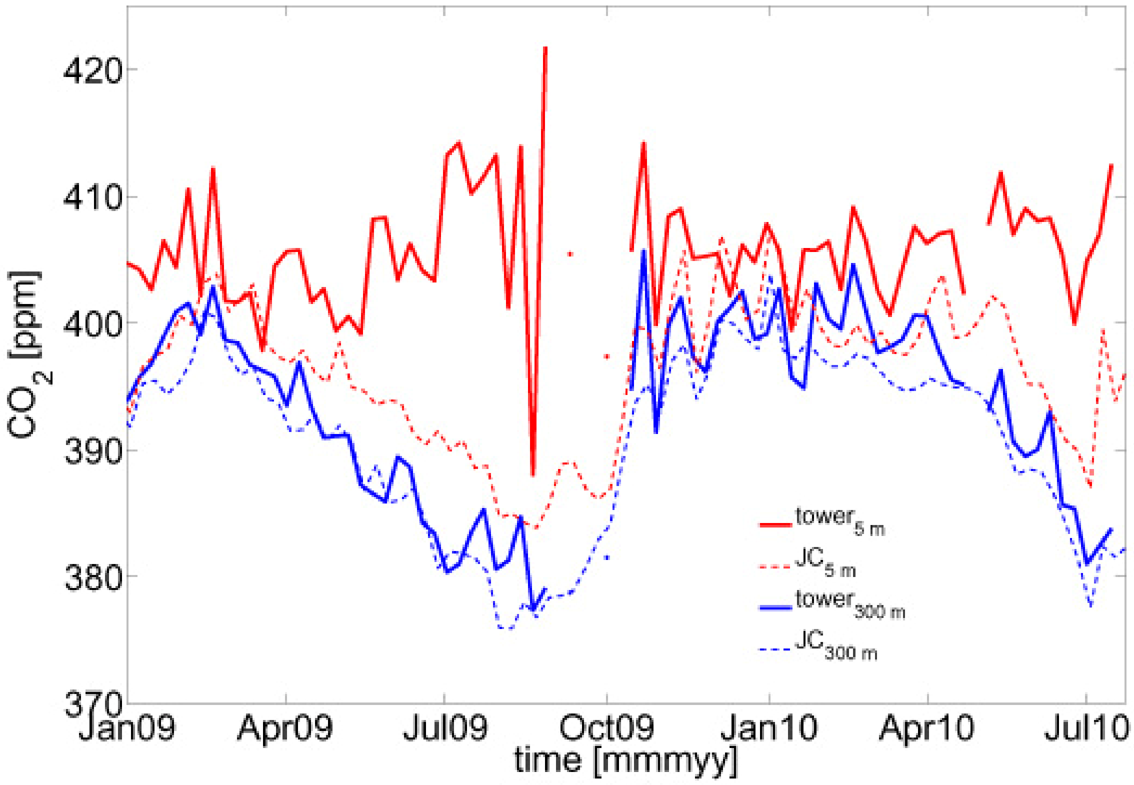

Fig. 10. The JC model output at the lowest and highest level of the tall tower (5 m, 300 m). Weekly averages of nighttime measurements between 00:00 a.m. and 05:00 a.m. are compared. The model captures the seasonal cycle at the upper level, but fails to simulate the nighttime CO_2 accumulation at the ground.

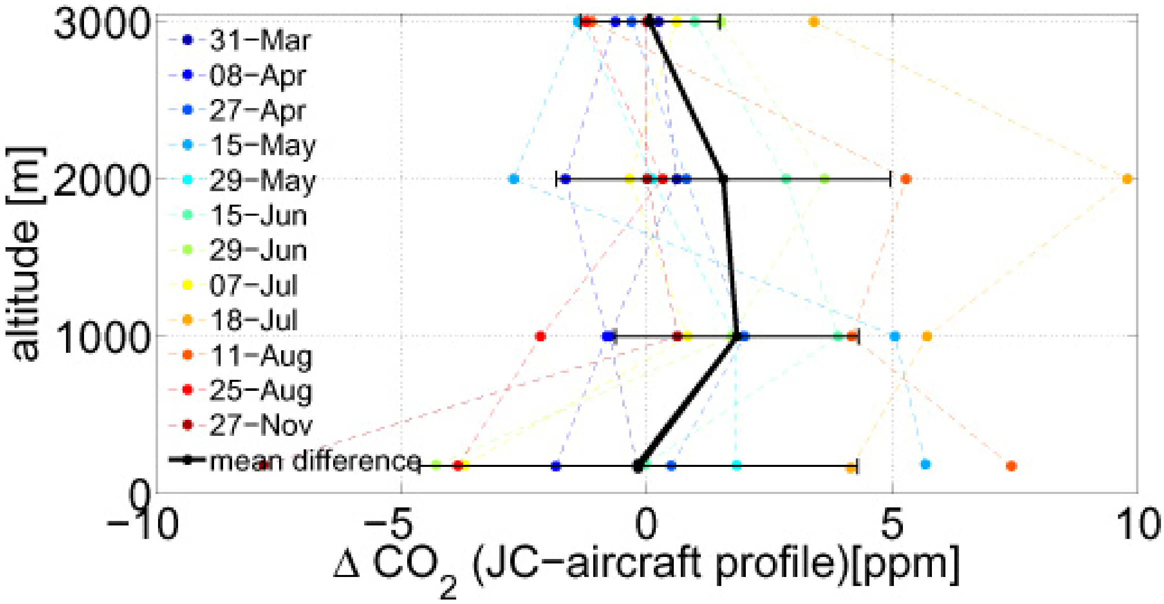

Fig. 11. Difference between the model profiles and contemporary low aircraft profiles on the common pressure-grid used for the integration in Sect. 5.1. For the analyzed time period overall 12 low aircraft profiles up to 2.8 km were conducted, shown color-coded for each overpass. The mean of the differences is given with a black line. At the ground and in 3 km, the JC model captures the CO_2 on average and significantly overestimates it in 1 and 2 km.