Supplement to 'Aerosol composition, air quality, and boundary layer dynamics in the urban background of Stuttgart in winter'

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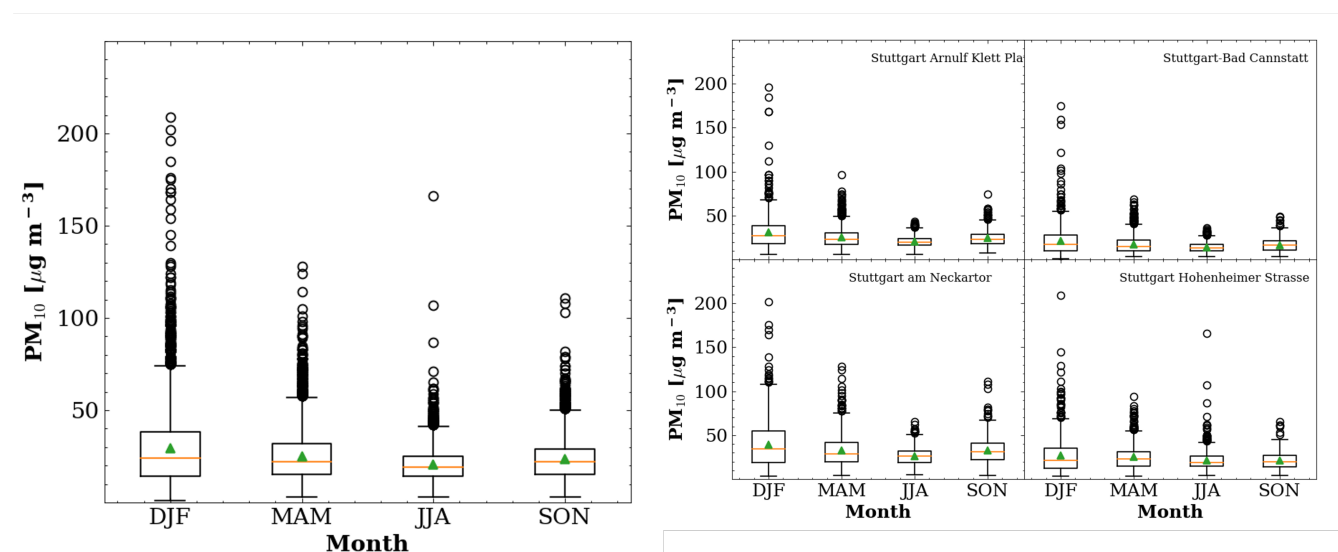
Figure S1. Seasonal average of PM_{10} measured in four LUBW monitoring stations in Stuttgart (left) and average of those four stations (right) for ten years data from 2011 to 2021.
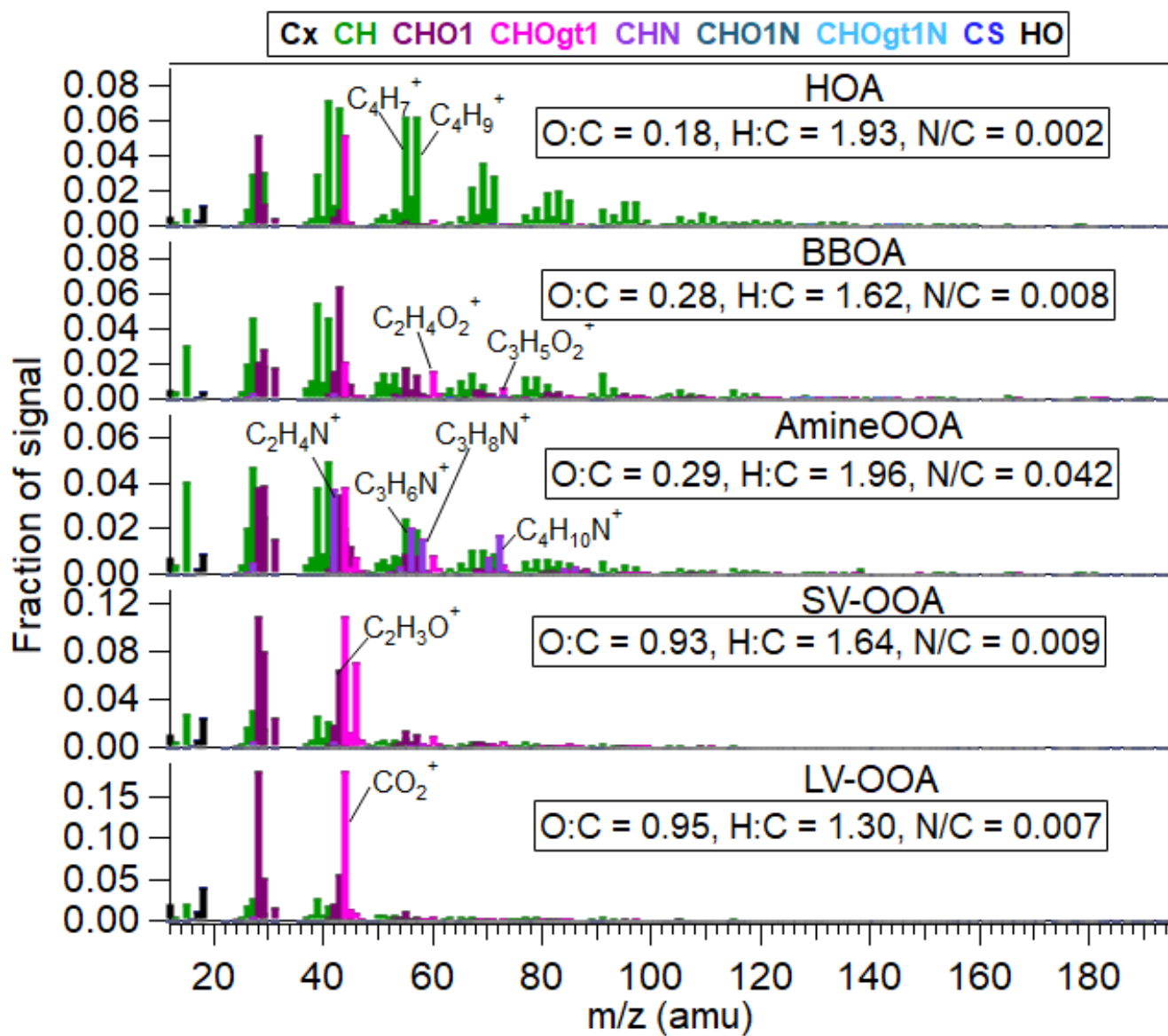
Figure S2. Mass spectra of five organic aerosol factors determined by PMF analysis of mass spectra from the aerosol mass spectrometer (AMS).
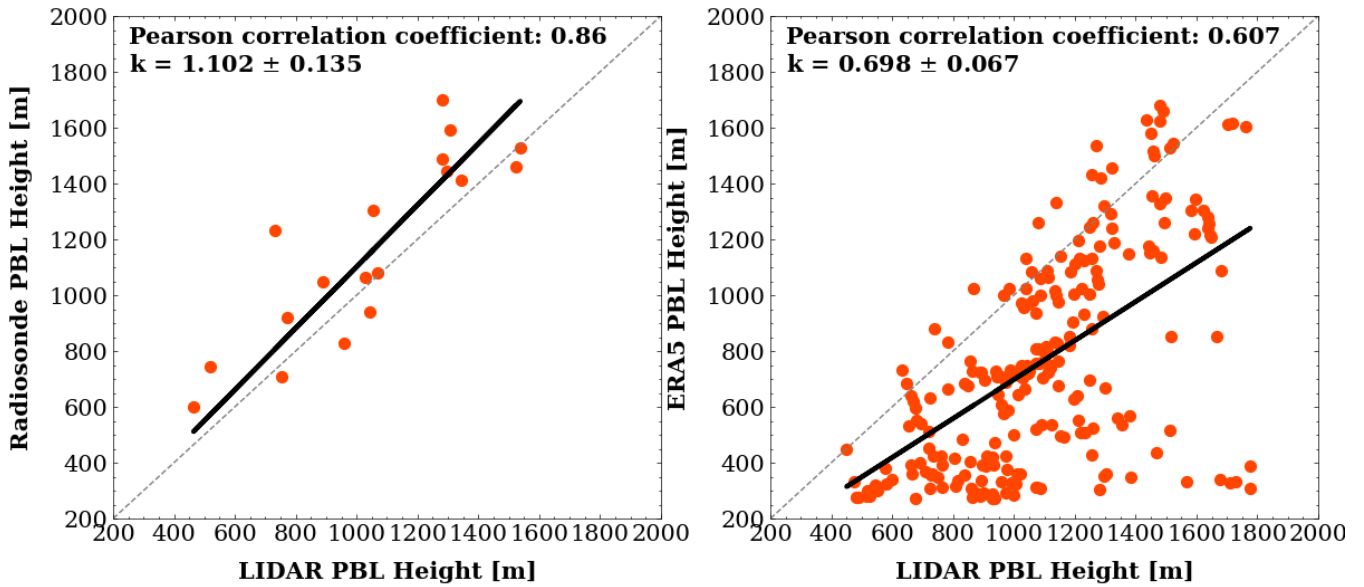
Figure S3. Correlation of boundary layer heights retrieved lidar and radiosonde measurement (left) as well as comparison between lidar measurement and ERA5 dataset (right).
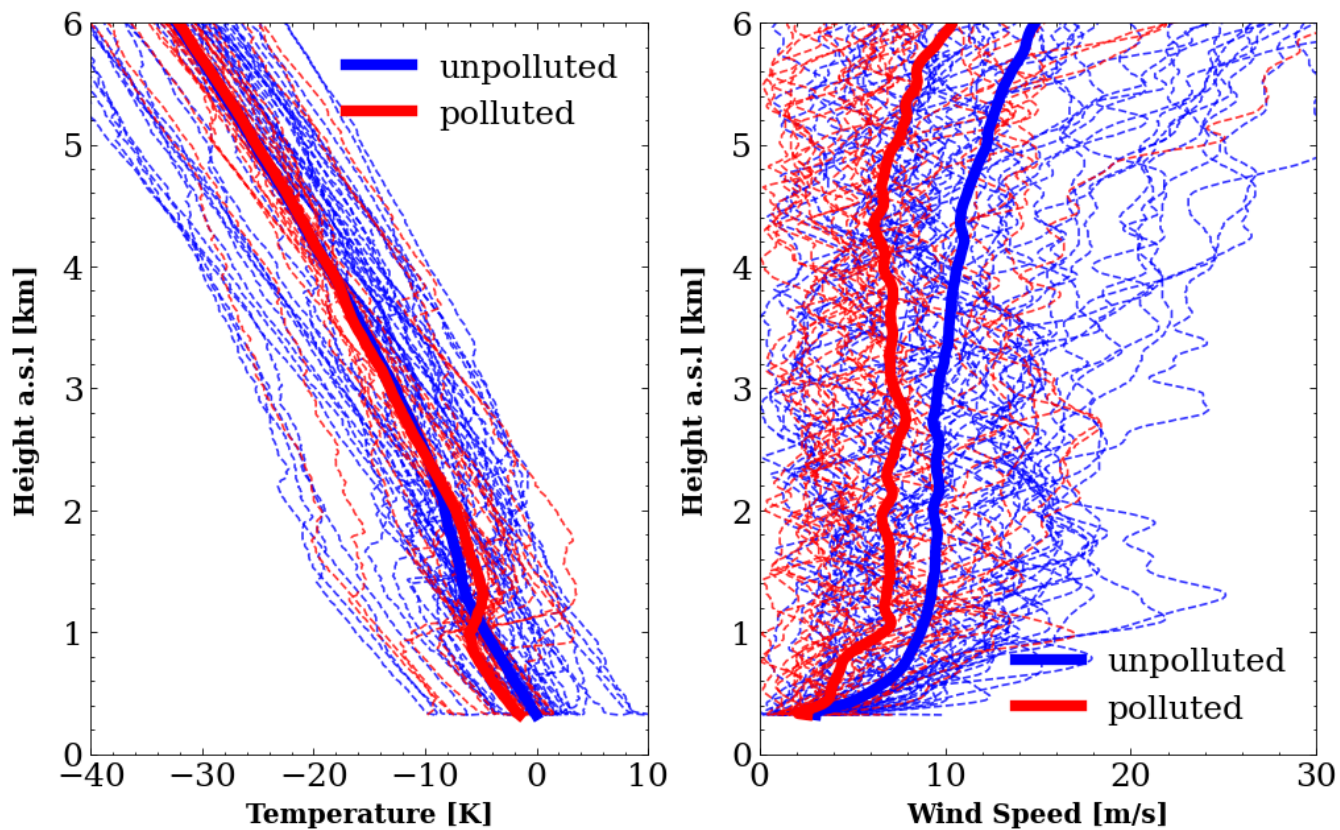
Figure S4. Vertical profiles of temperature and wind speed measured by radiosonde for polluted and unpolluted periods. (The PM_{10} concentration is larger than ambient air quality standards for the European Union (25 $\mu g/m^3$) is indicated as polluted period, while otherwise unpolluted period.)
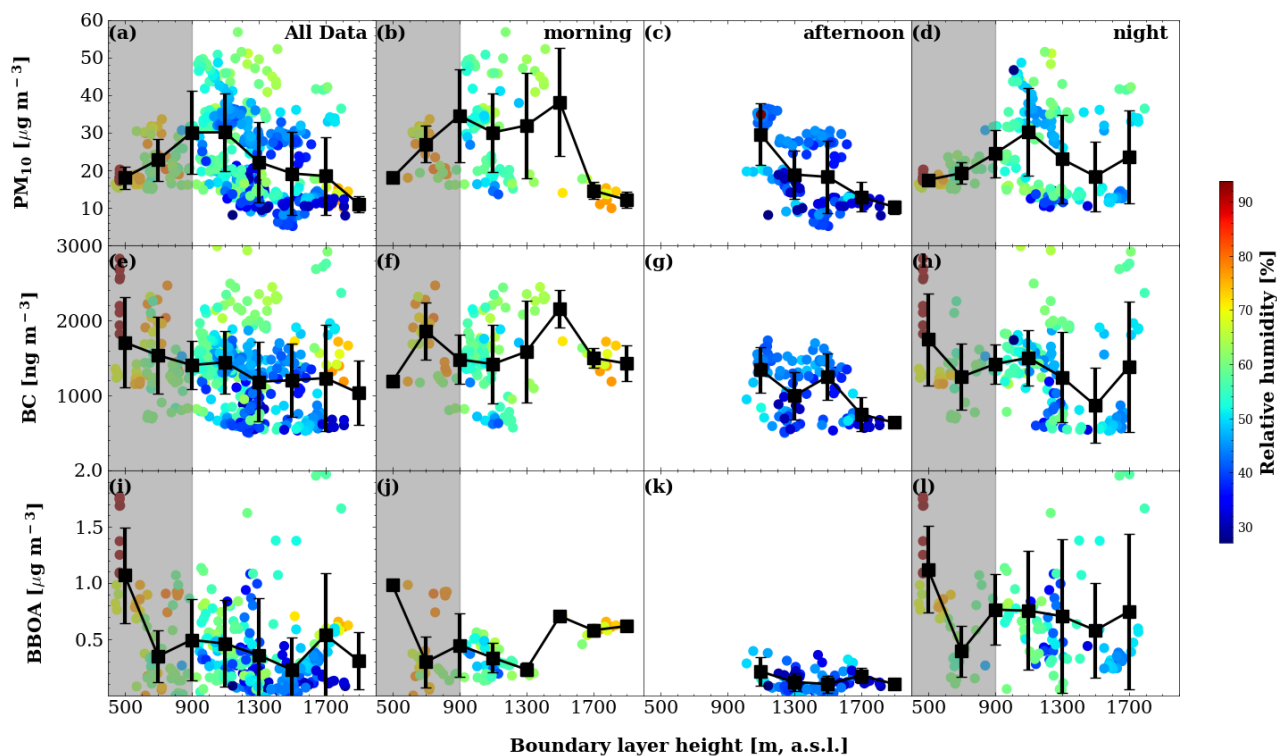
Figure S5. The correlation between boundary layer heights and PM_{10} concentrations (upper row), black carbon (middle row), as well as biomass burning organic aerosol (BBOA) concentrations for four different time periods. (All times (a, e, i), early morning (04:00 - 10:00 UTC) (b, f, j), afternoon (12:00-18:00 UTC) (c, g, k), and night (18:00 - 04:00 UTC) (d, h, l) from February 5th to March 5th, 2018 in Stuttgart. The color of the scatter point indicates relative humidity. The grey shaded area indicates typical PBL heigths of the SBL with strong temperature inversion.
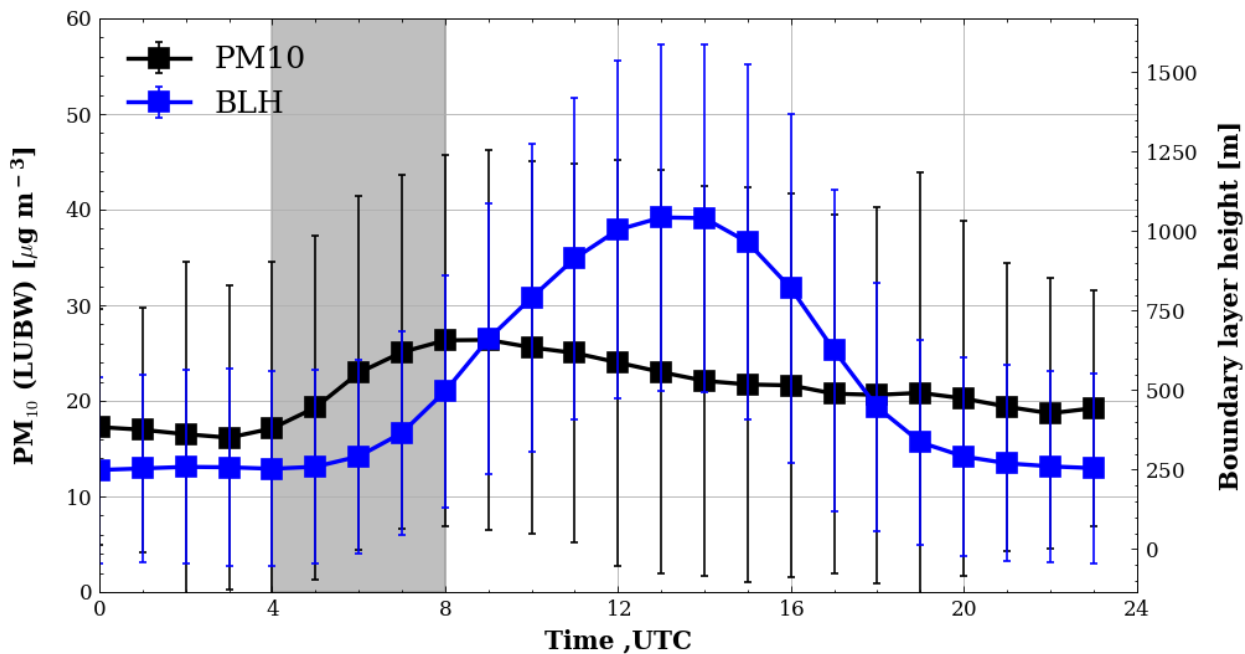
Figure S6. Diurnal variations of PM_{10} concentrations and boundary layer heights (BLH) based on two years data from January 1st, 2020 to January 1st, 2022 in Stuttgart. PM_{10} concentrations are hourly reported data by Landesanstalt für Umwelt Baden-Württemberg (LUBW 2019) and the boundary layer heights are from ERA5 data. The grey shaded time interval shows strongest correlation between BLH and PM10.
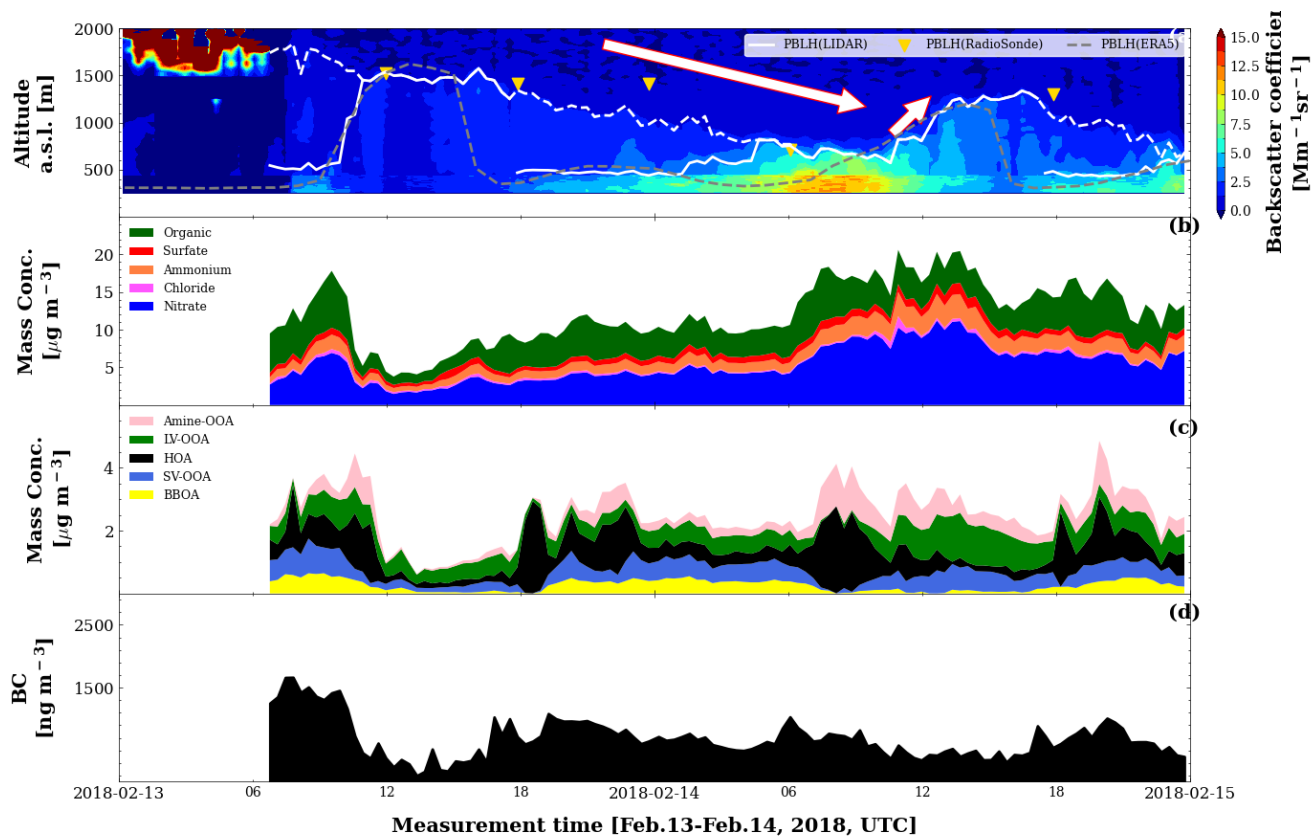
Figure S7. Time series of backscatter coefficients from lidar measurements (contour plot), the boundary layer heights from lidar measurement (white solid line), the ERA5 dataset (grey dashed line), and DWD radiosonde (yellow triangle) as well as residual layer heights retrieved from lidar (white dashed line) (a), the normalized aerosol mass concentrations (b), normalized five-factor positive matrix factorization (PMF) solutions of organic aerosol(c), normalized black carbon concentrations (d) for case 1 from February 13th to February 14th, 2018.
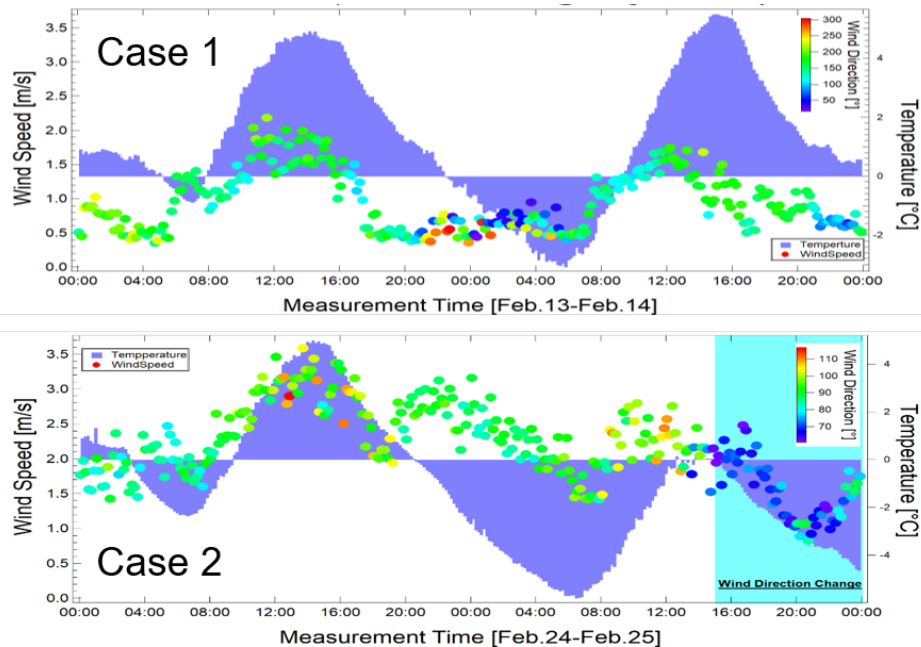
Figure S8. Time series of ground-level temperature and wind for case 1 (upper panel) and case 2 (bottom panel).
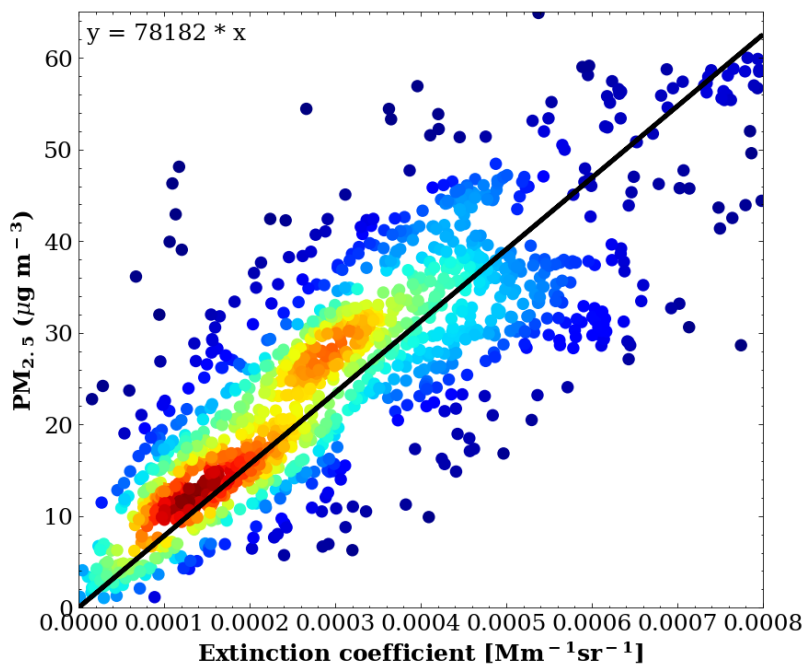
Figure S9. Correlation of ground-level extinction coefficients from lidar retrieval and PM_{10} concentrations from Fidas200 measurements from February 5th to March 5th, 2018 in Stuttgart.