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Turbulent enhancement ratios used for characterizing local emission sources in a complex urban environment

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S1. Wind rose analysis of the fieldsite for the long-term campaign

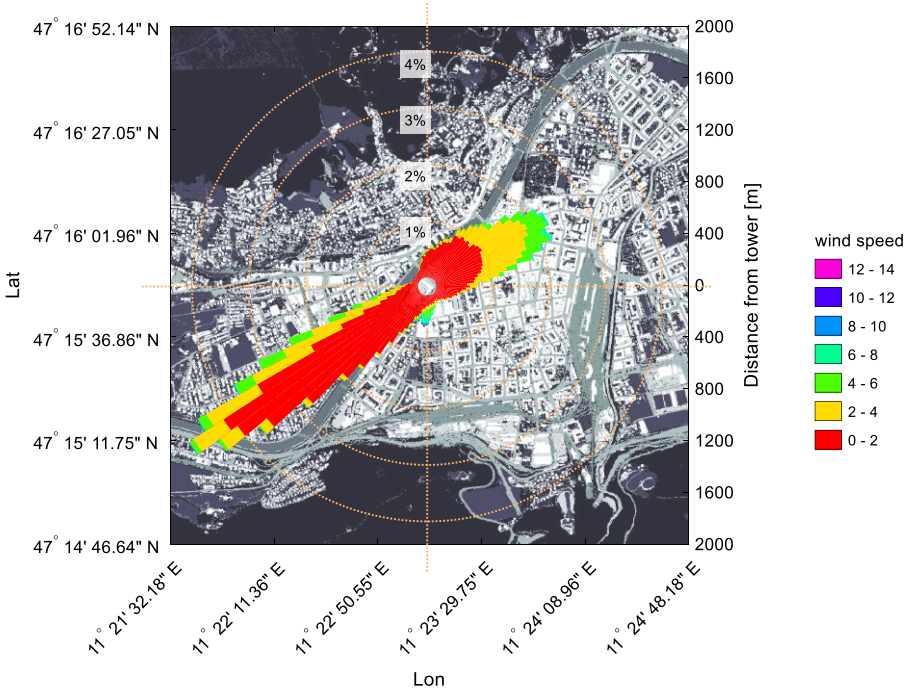

Figure S1: Wind rose plot for the IAO field site during the long-term campaign. The orientation of the coloured bars indicate the predominant wind directions, while the length of each bar represents the frequency of occurrence (orange dashed circles assist in quantification). Wind speeds range from 0 m/s (red) to 14 m/s (magenta), with each colour corresponding to a specific wind speed interval. The base layer shows the city of Innsbruck, with the IAO flux tower positioned at the centre of the image. (Land use map adapted from Ward et al. (2022))

S2. Turbulent Flux Footprint of the fieldsite for the long-term campaign

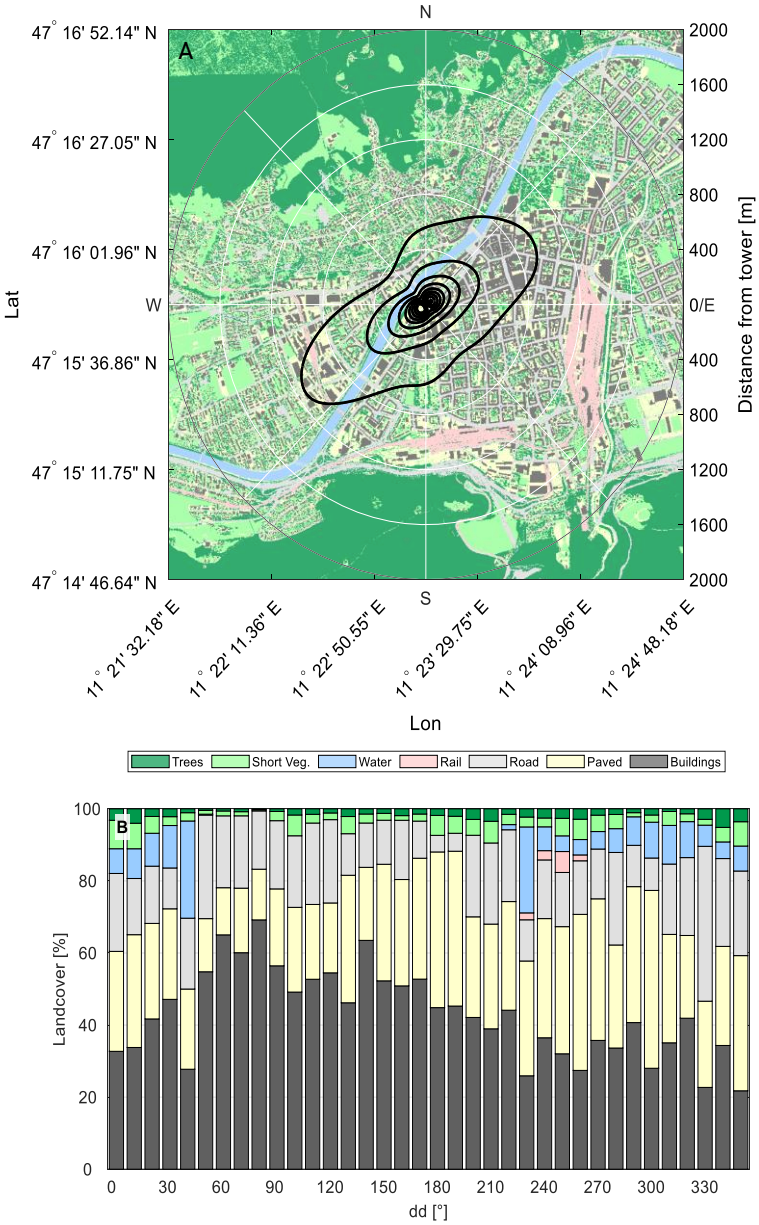

Figure S2: (A) Climatological flux footprint analysis based on Kljun et al. (2015). The background layer depicts a land use map with a dimension of 4 x 4 km and a resolution of 1 m, derived from data provided by the government of Tyrol. The centre of the domain marks the location of the IAO flux tower. The isolines represent the flux source area in 10 % increments, ranging from 10 % to 90 %. White circles indicate distances from the centre of the image at 200 m intervals and the black circle the maximal distance of 2000 m (B) Land use statistics at the IAO, weighted by the climatological flux footprint in 10 ° intervals. (Land use map adapted from Ward et al. (2022))

S3. Stability and crosswind analysis for lockdown and non-lockdown periods

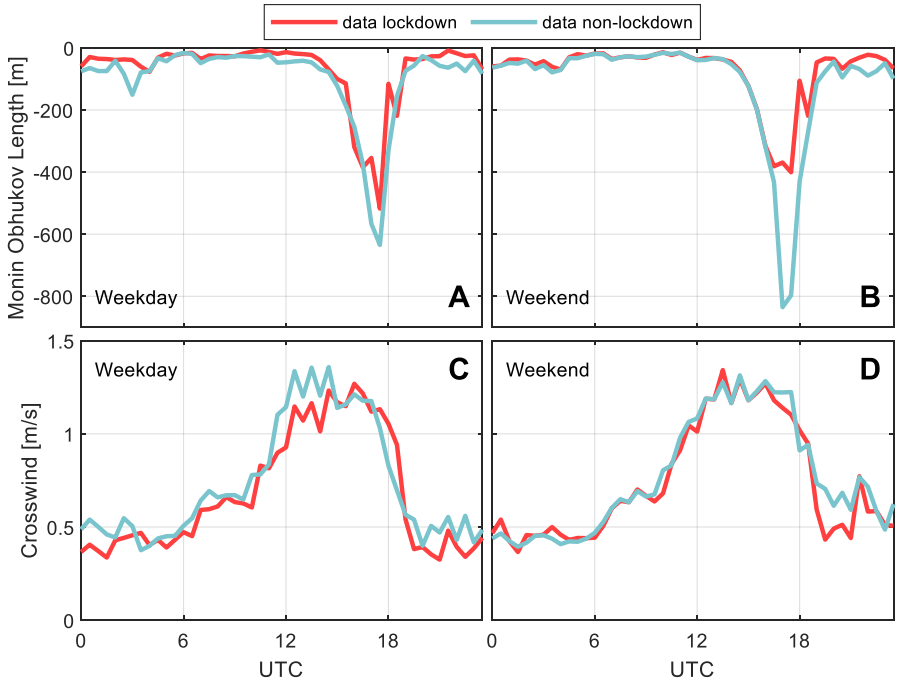

Figure S3: (A, B) Comparison of the average stability (represented by the Monin-Obukhov length) between the lockdown period (red) and non-lockdown period (turquoise) on a half-hourly basis for weekdays (left panel) and weekends (right panel). (C, D) Similar to (A, B), but showing the crosswind for the same periods.

S4. Turbulent enhancement ratio analysis for valley down and valley up wind sectors

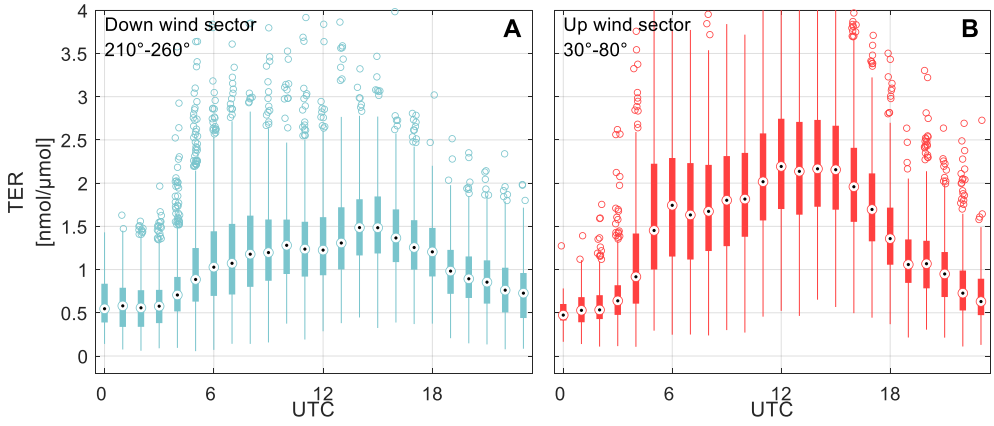

Figure S4: Boxplot of the diurnal TER on a half-hourly basis for the valley downwind sector (A: 210°–260°) and the valley upwind sector (B: 30°–80°) over the entire campaign duration. Black dots represent median values, circles indicate outliers, and the bars the interquartile range and the overall distribution.

References

Kljun, N., Calanca, P., Rotach, M. W., and Schmid, H. P.: A simple two-dimensional parameterisation for Flux Footprint Prediction (FFP). Geosci. Model Dev., *8*(11), 3695–3713. https://doi.org/10.5194/gmd-8-3695-2015, 2015.

Ward, H. C., Rotach, M. W., Gohm, A., Graus, M., Karl, T., Haid, M., Umek, L. and Muschinski, T.: Energy and mass exchange at an urban site in mountainous terrain - the Alpine city of Innsbruck. Atmos. Chem. Phys., 22(10), 6559–6593. https://doi.org/10.5194/acp-22-6559-2022, 2022.