On the Effects of Urban Areas on Thermally-Driven Circulations in an Idealized Alpine Valley

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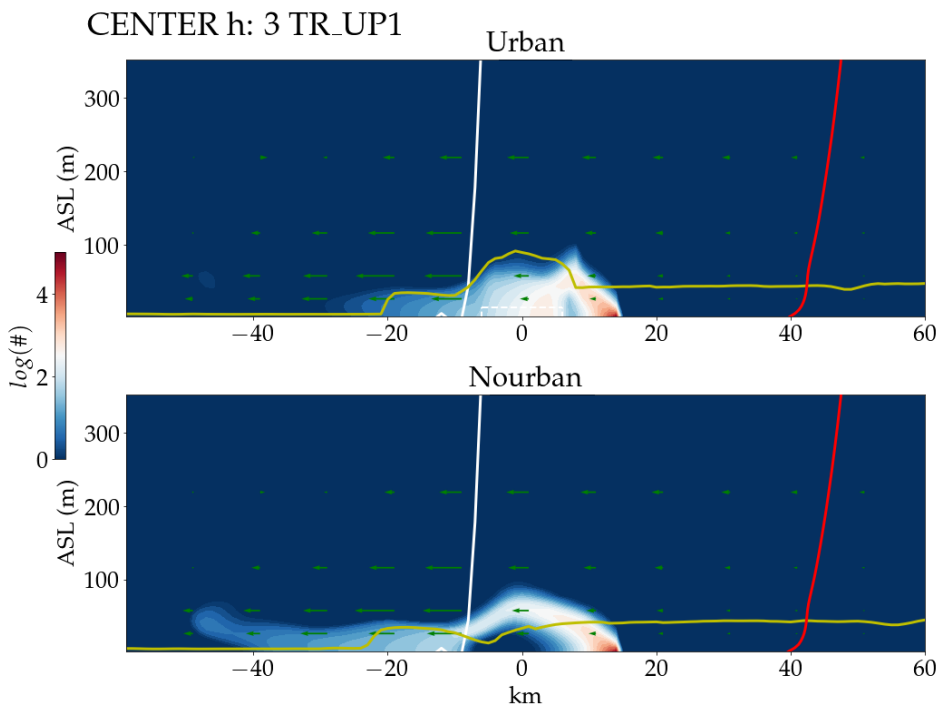

Denver, January 10, 2023

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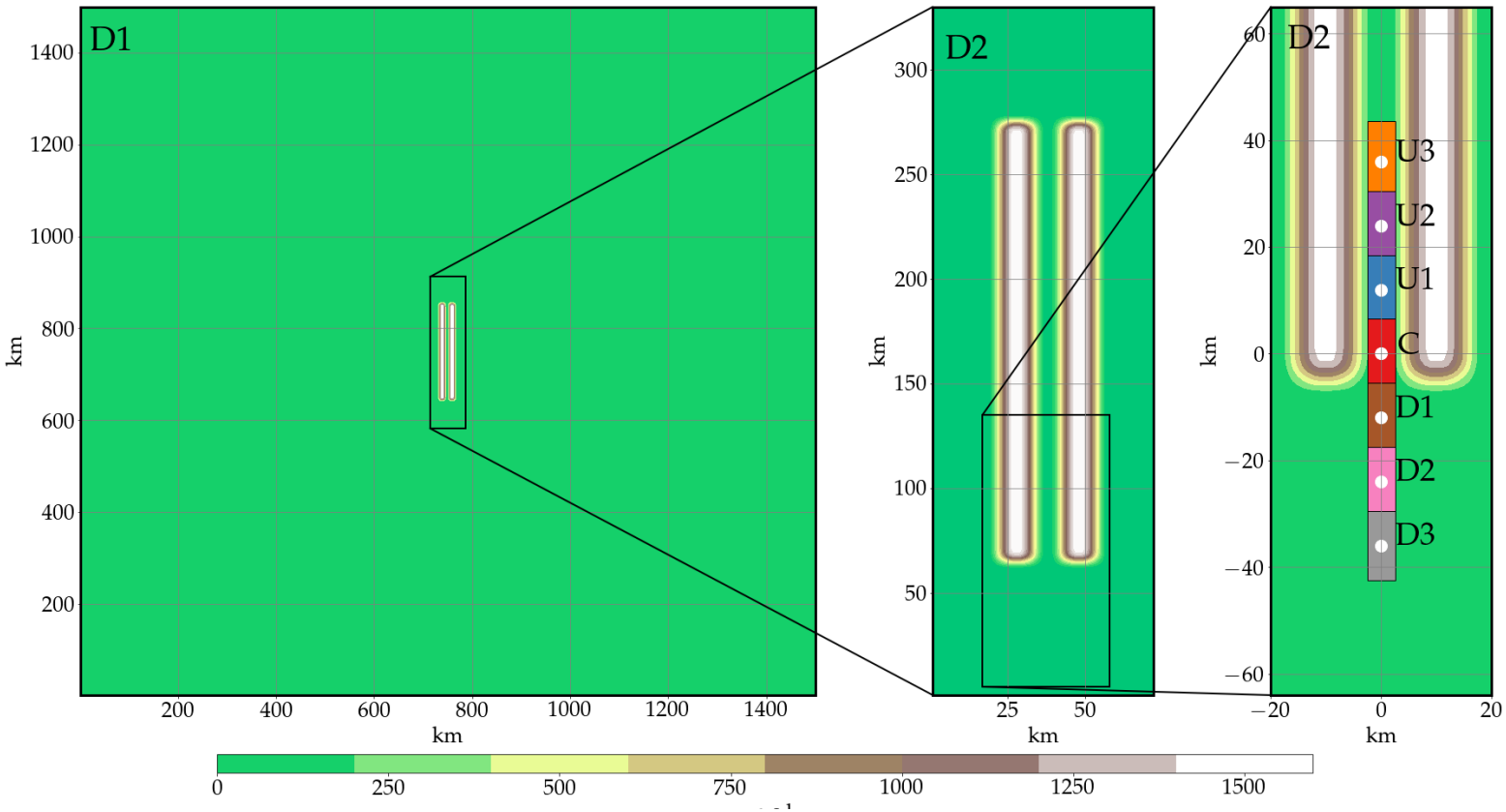
How?

Employing **idealized** simulations with the WRF model, starting from a benchmark **nurban** simulation.

Set up - DOMAINS

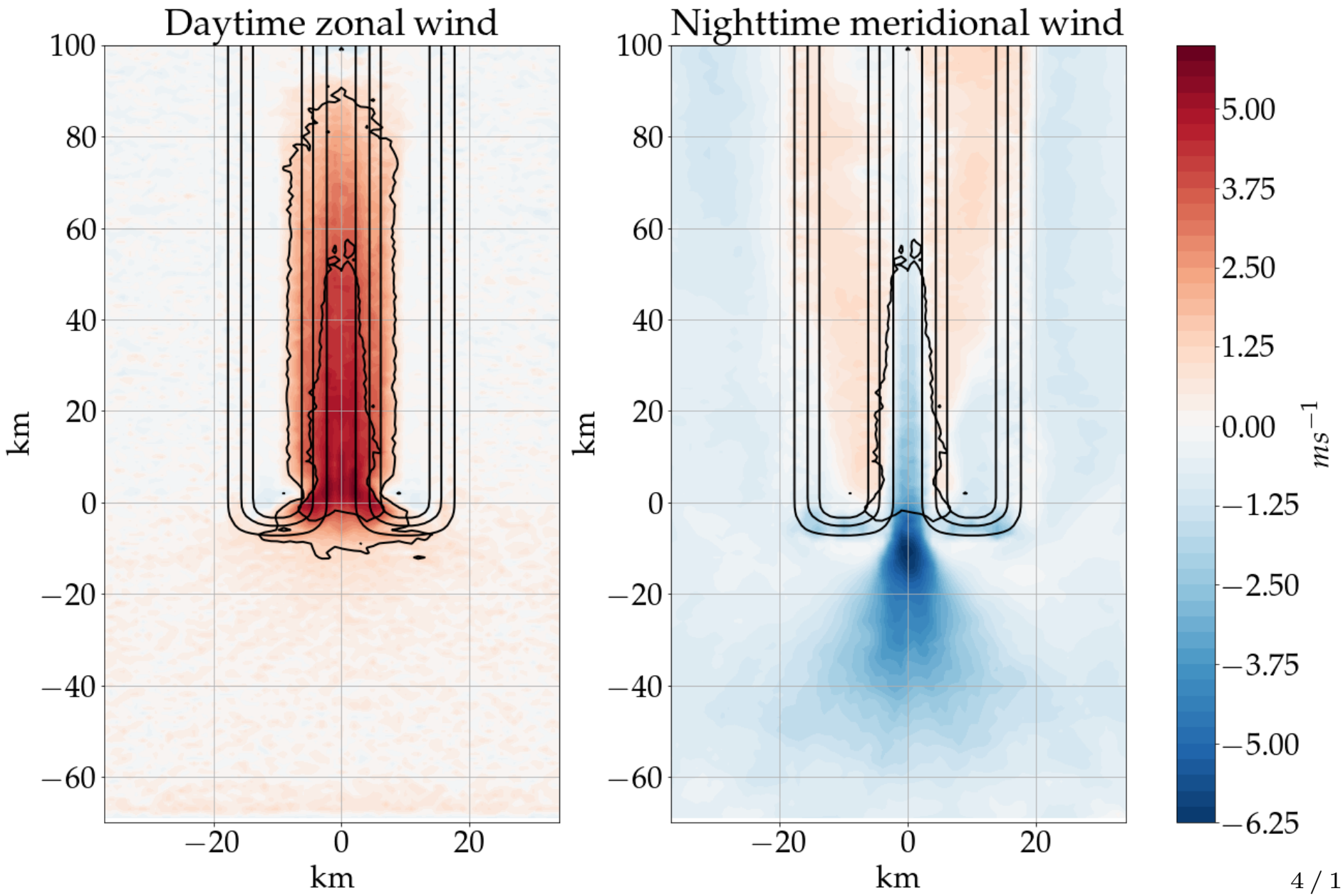


$$\Delta X_1 = 3 \text{ km}, \Delta X_2 = 1 \text{ km}$$

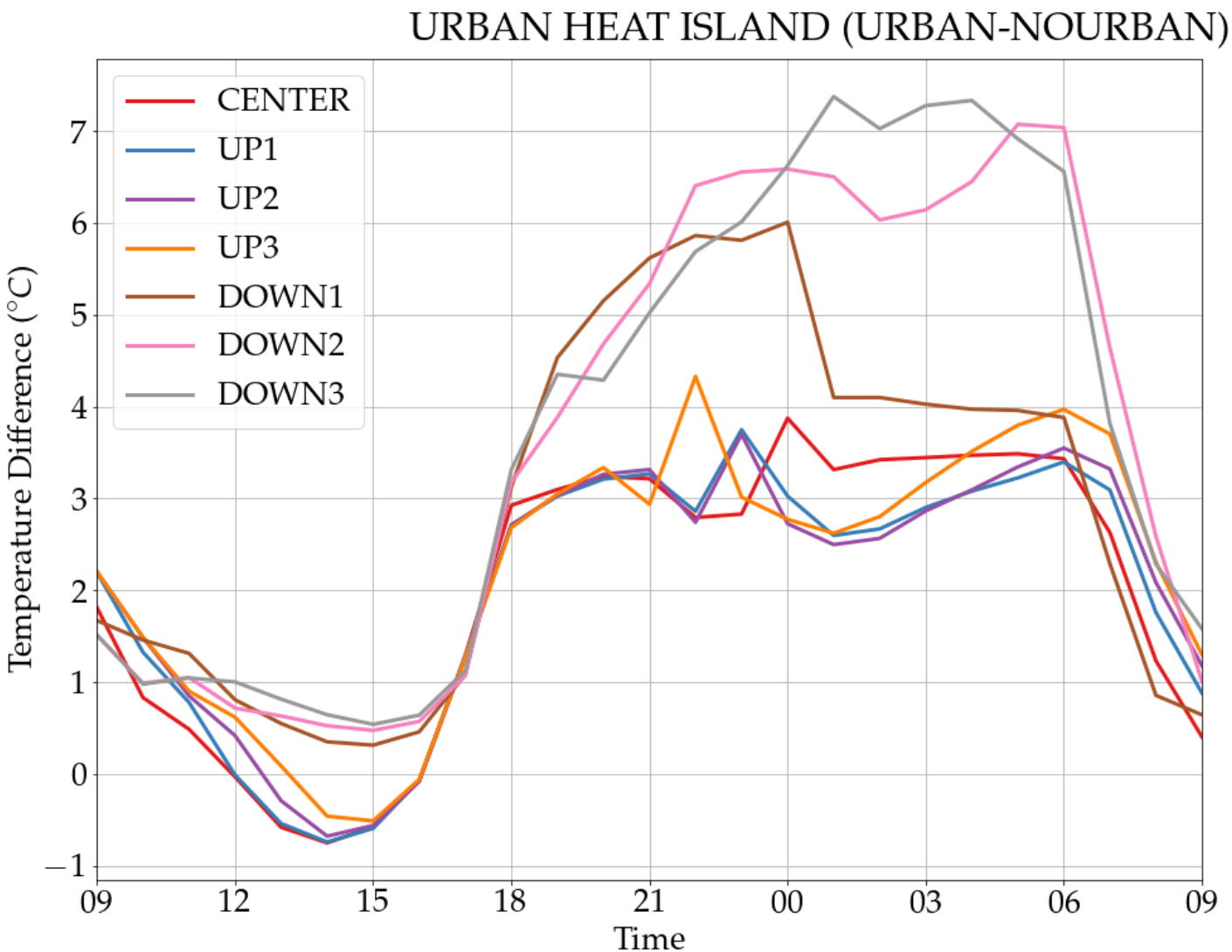
WRF set-up

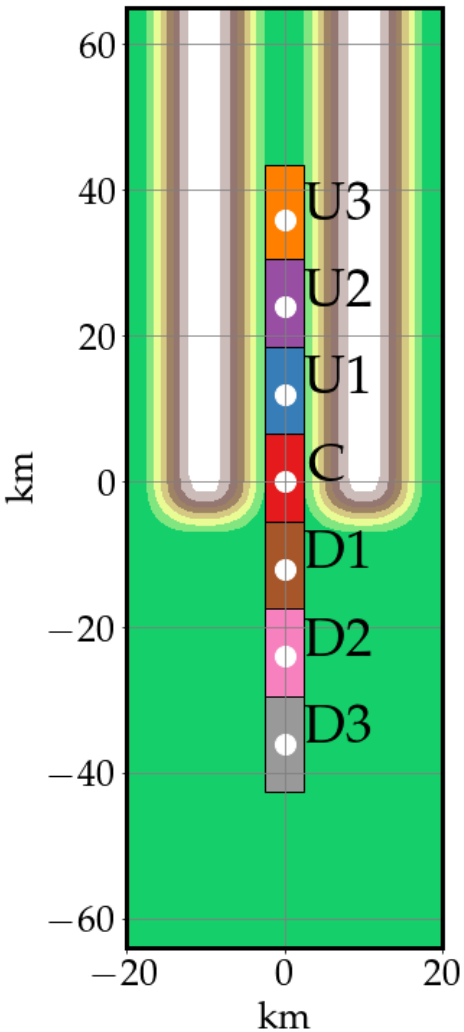
- 36 hours of simulation starting the 20^{th} of March
- Δz = from 5 m (surface) to 400 m (at 12000 m)
- IC: $V_0 = 0$, $U_0 = 0$, stable atmosphere
- NO Coriolis force, microphysics scheme
- Lat=46° N Lon=11° E
- $k - \varepsilon - \theta^2$ PBL scheme (Zonato et al., 2022, soon available in WRF)
- BEP +BEM urban canopy parameterizations
- coupling between BEP+BEM and $k - \varepsilon - \theta^2$ (Zonato et al., 2022, under review QJRMS)
- 13×5 km cities with 15×15 m buildings

Valley thermal circulation - ASTER project

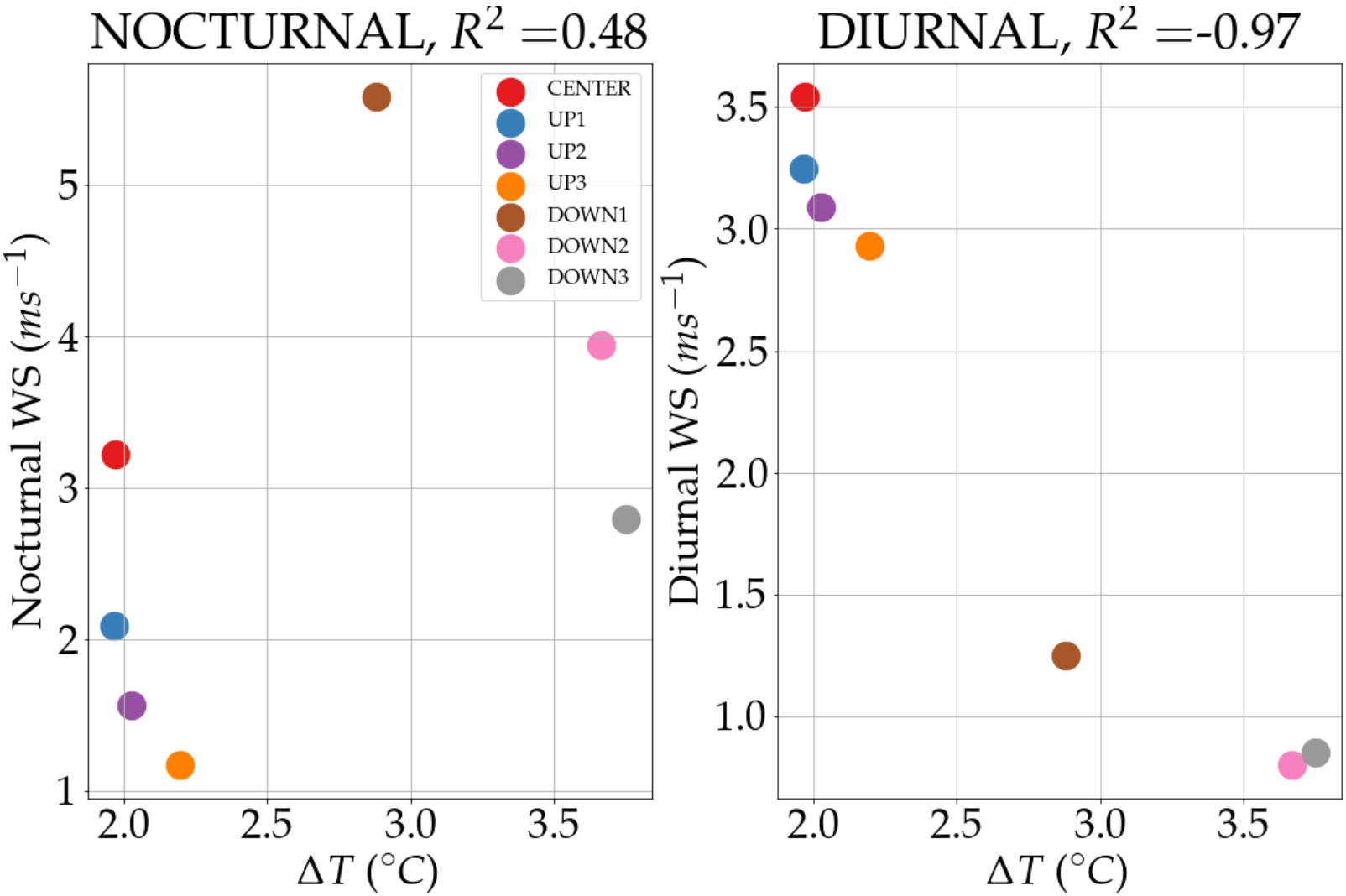


Urban Heat Island - City position dependence

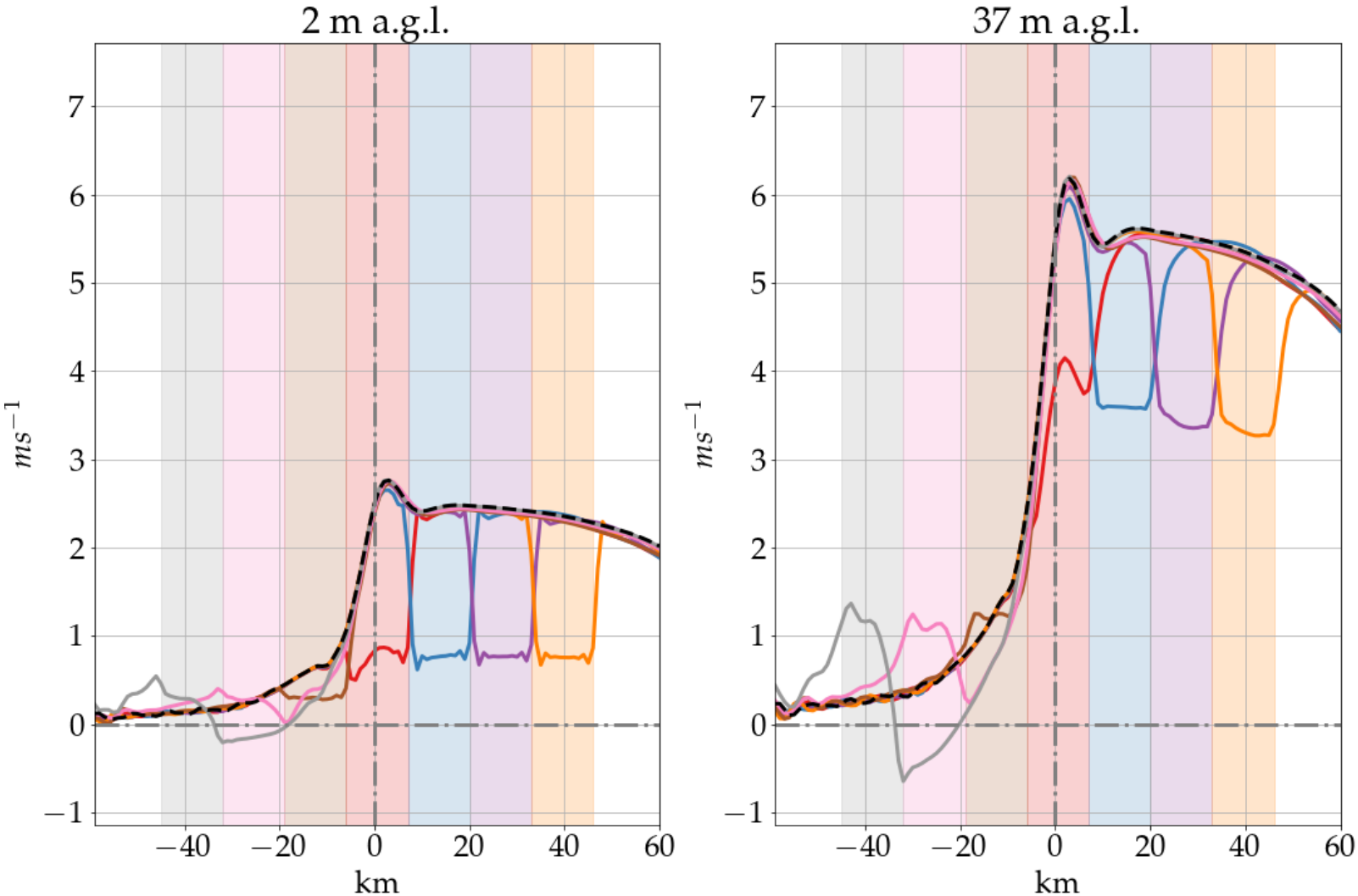




Correlation UHI/Thermally driven wind



Daytime valley winds



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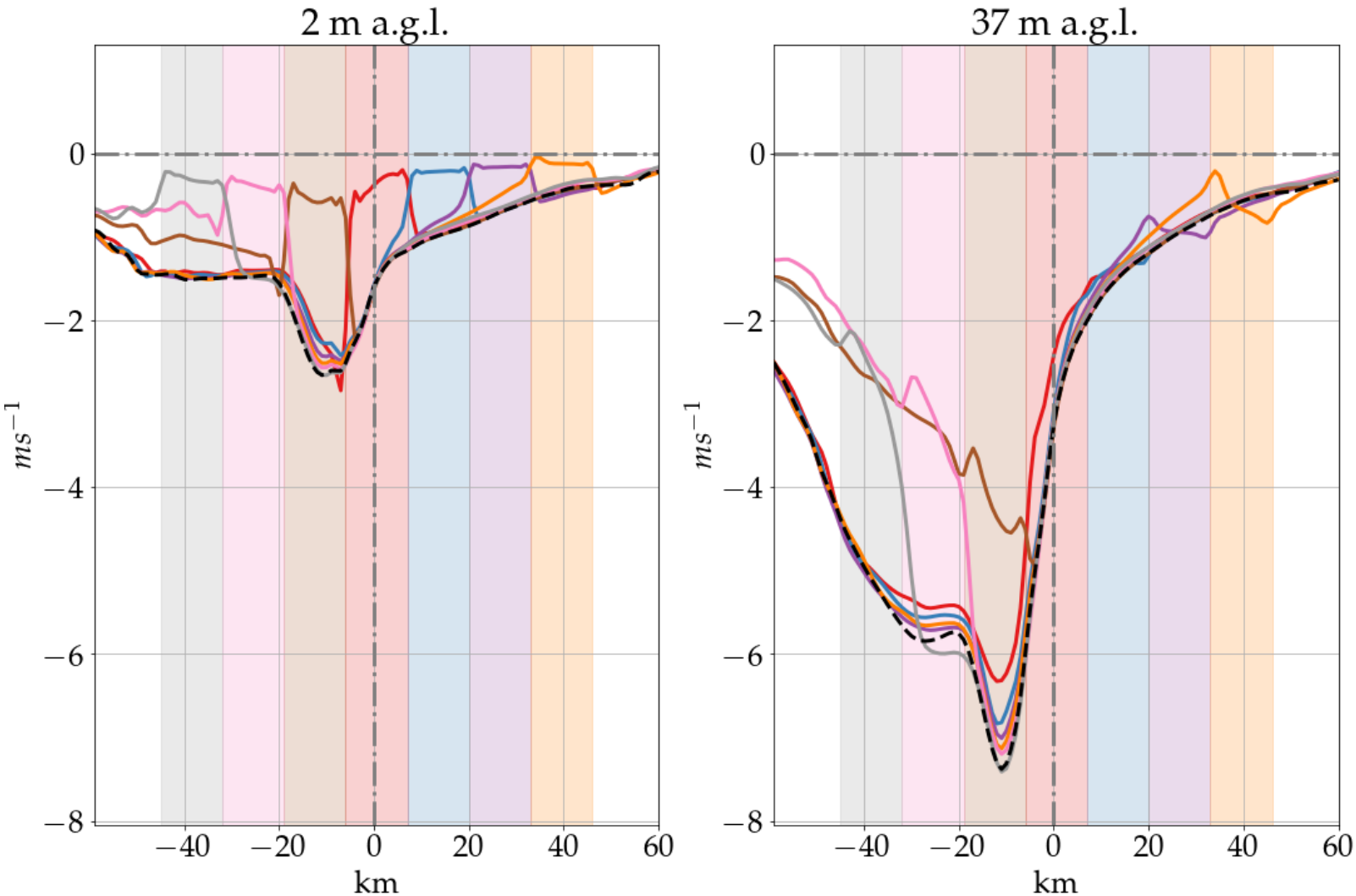
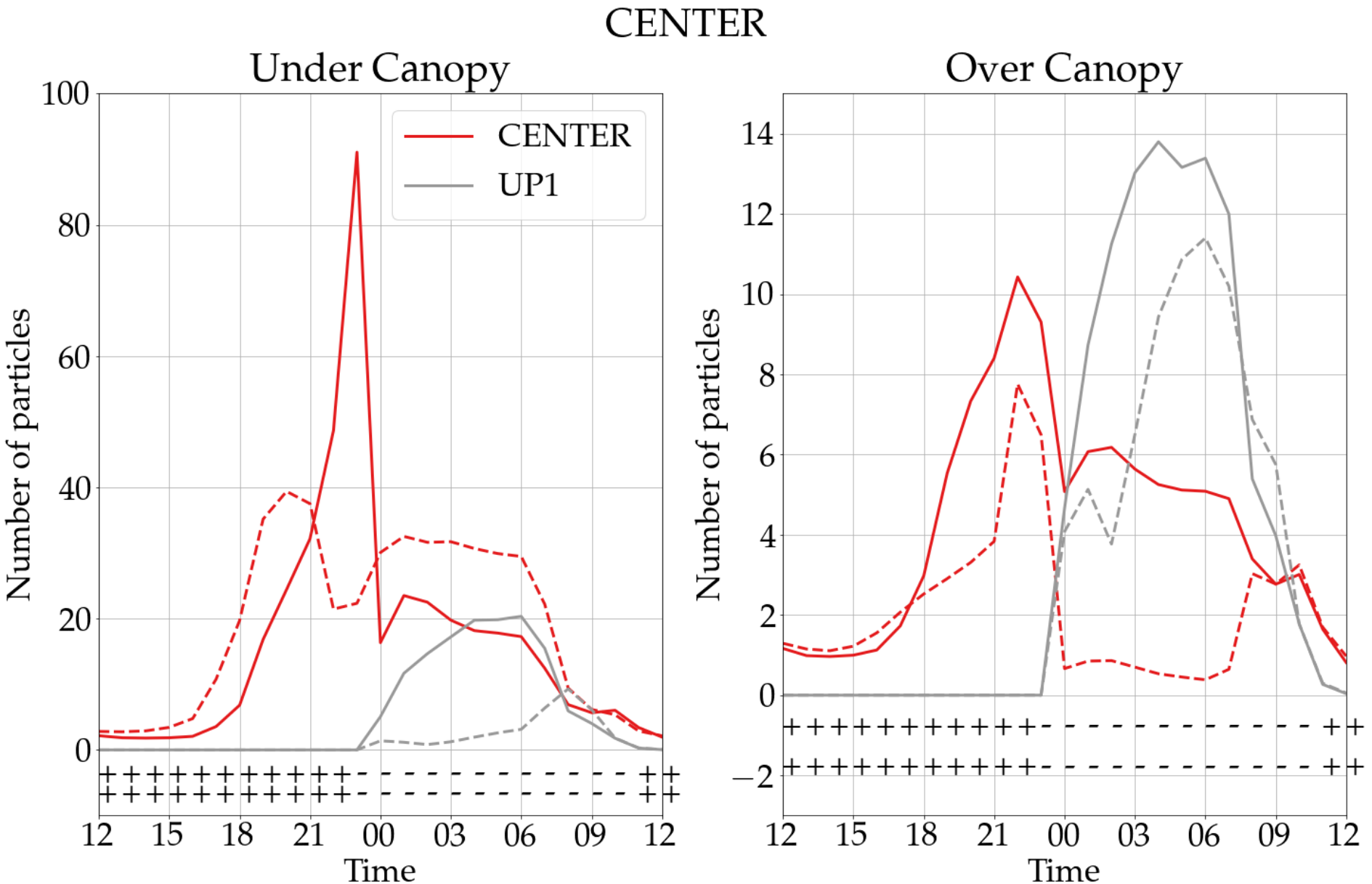
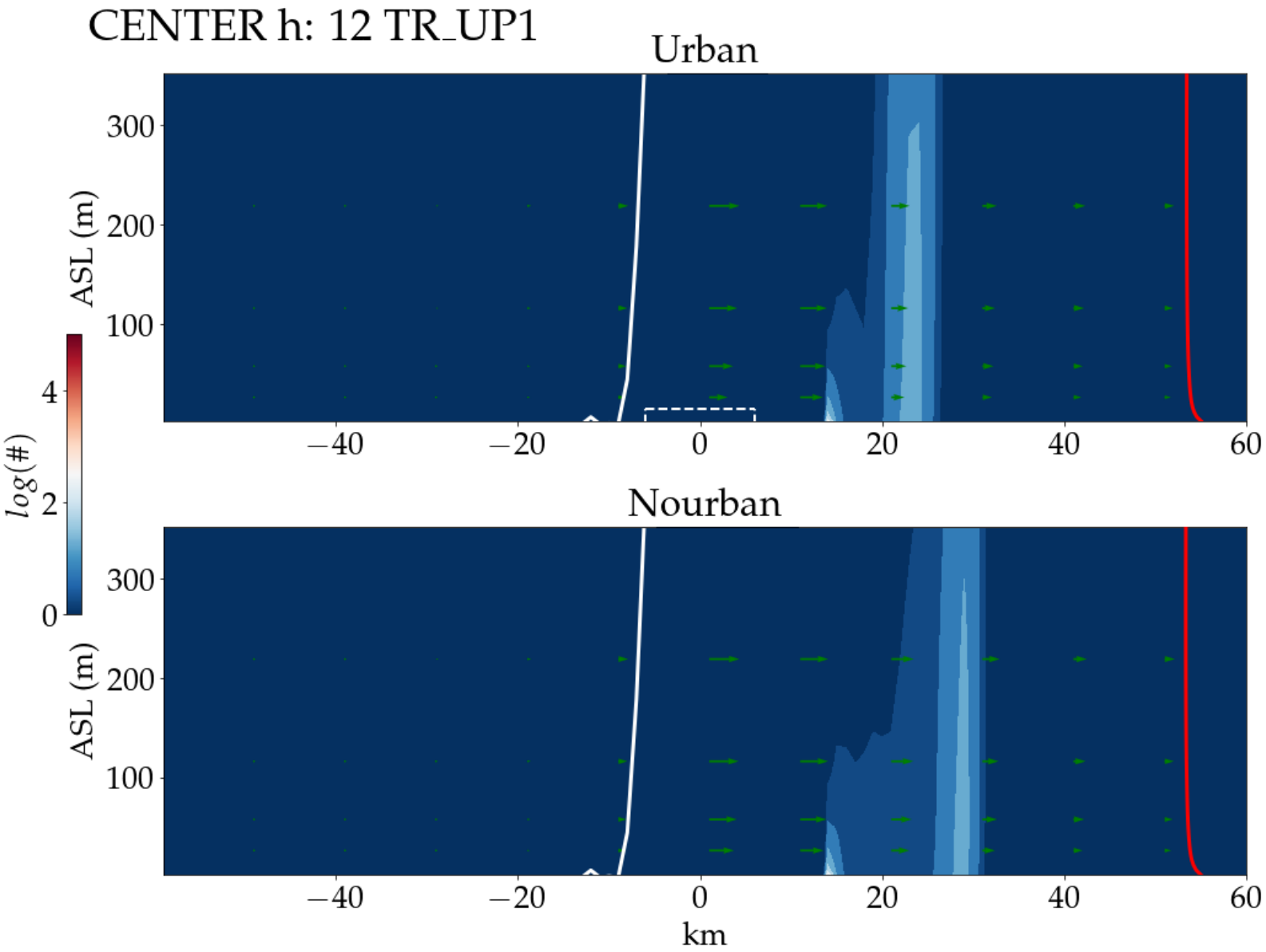


Tracer timeseries



Along valley tracers dispersion - tracer outside city



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1) A. Zonato, A. Martilli, P. A. Jimenez, J. Dudhia, D. Zardi, and L. Giovannini. *A new $k-\varepsilon$ turbulence parameterization for mesoscale meteorological models.* Monthly Weather Review, 2022.

2) A. Zonato, A. Martilli, J. L. Santiago, D. Zardi, and L. Giovannini. *On a new one-dimensional $k-\varepsilon$ turbulence closure for building-induced drag*, Under review at QJRMS.

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