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Linking synoptic flow and city dynamics: PANAME observations of the Paris urban boundary layer

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Atmospheric boundary layer dynamics form in response to synoptic flow and surface-atmosphere exchanges. Over cities, the complex roughness and additional heat from storage and anthropogenic emissions clearly affect atmospheric stability, with implications for heat risk and pollution dispersion. This work examines how the specific dynamics of the Paris region urban atmosphere interact with the synoptic flow using observations from a dense measurement network.

The interdisciplinary PANAME initiative is a framework coordinating the synergy of numerous projects that are studying the Paris atmosphere using both numerical modelling at various scales and novel observations. The measurement network not only includes dense surface station measurements and turbulent flux towers, but also ground-based atmospheric profile remote sensing and additional radiosonde measurements within the city. This work exploits observations from automatic lidars and ceilometers (ALC), Doppler wind lidars (DWL), and microwave radiometers (MWR) that are operated along a suburban-urban transect to collect simultaneous profiles of air temperature, wind, turbulence, and aerosol characteristics at high vertical and temporal resolution. The continuous observations from a network of compact ground-based remote sensing instruments are shown to be extremely valuable for an improved understanding of the complex processes that govern the urban atmosphere as they are highly variable in space and time.

The complex dynamics of the urban atmospheric boundary layer are explored through advanced measurement products, such as low-level jet characteristics and mixed layer heights. We evaluate how different indicators of atmospheric stability from synergy of multiple remote sensing profile data can portray the spatial and temporal variations in urban boundary layer dynamics. The work highlights the importance of atmospheric boundary layer dynamics as a crucial driver for near-surface conditions.