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Impact of a large isolated city on the mixed layer height during different weather conditions

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Understanding how cities impact the atmospheric boundary layer is crucial for many processes such as air-pollution dispersion and concentrations, and is therefore important as part of weather and climate modelling. To improve modelling of those dynamic processes observation are critical as they inform development and evaluation of models, and enhance delivery of services to citizens and the management of urban infrastructure, which is vulnerable to different strengths of heat and pollutant exposure.

During a year-long field campaign from Autumn 2021 to Autumn 2022 a comprehensive set of ground-based remote sensing observations were gathered in Berlin, Germany. These allow us to explore the impact of a large city on the regional atmospheric boundary layer. The campaign, undertaken within the European Research Council funded *urbisphere* project, involved a grid-like network of instruments in the densely built-up city centre, with ground-based remote sensing (e.g. automatic lidars and ceilometers ALC, Doppler-wind lidars) for mixed/mixing layer height (MLH) detection. Additional instruments were located along two perpendicular rural-urban-rural transects, with existing instruments in the city and surrounding region complementing the network. During Intensive Observation Periods (IOP) in spring and summer 2022 radiosonde releases within and outside the city during selected days allow air temperature, humidity and wind-distribution profiles in the atmospheric boundary layer to be investigated.

This contribution showcases how an urban environment modifies the dynamics and convective cloud properties under varying regional-scale weather conditions. We focus on case studies for different synoptic conditions to show the extent of impact of a large city on the MLH within and beyond the urban area, including urban-rural contrasts, upwind-downwind effects, and intra-urban variability of MLH.