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To how much extent does the backscatter Lidar observation characterize thermal plumes in the convective boundary layer?

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The backscatter signal of aerosols observed by a Lidar is often used as a proxy for thermal plume activities in the convective boundary layer. However, the relationship between the vertical velocities (a more direct measure of thermal plumes) observed by a Doppler Lidar and the former turns out to be not so simple.

The Lidar backscatter signals more precisely represent a combination of the two different quantities: the number concentration and the size distribution of particles at a given altitude. The size of particles depends on local relative humidity. As a result, the backscatter signal changes within a thermal due to both for relative humidity and particle concentration gradients. Furthermore, it is observed that the relative humidity influence could be even stronger than the particle concentration variability. The present talk shows, by analyzing the measurements by backscatter and Doppler Lidars at IPSL/LMD, that the correlation between the backscatter signal and the Doppler-shifted vertical velocity could even change a sign, depending on the synoptic situations.