4.058 Short-term variations in atmospheric constituents associated with local front passage over Fukuoka, an urban area in Japan, observed by a 3-D coherent Doppler lidar and in-situ tracer measurements.

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Abstract:

Local fronts, such as sea-breeze fronts, play an important role not only in a meteorological aspect but also for pollutant transport/mixing, in urban areas in particular. Due to the difficulty of measurement of three-dimensional (3-D) wind fields, there are few studies focusing on spatial and temporal variations in aerosol and gas compositions associated with local front passage. At the end of November 2016, a 3-D coherent Doppler lidar was installed in Fukuoka city (33.55N, 130.37E), an urban area in Japan, and 3D-wind fields have been continuously measured since then. Two local fronts, having typical density current structure, were observed on 3 May and 29 June 2017. Ground surface atmospheric constituents (aerosol, black carbon (BC), carbon monoxide (CO), ozone (O_3), and sulfur dioxide) and meteorological parameters indicated a step-like change during the passage of fronts. Concentrations of BC and CO, supposed to be surface origin, were increased at the passage. However, O_3 content, which could be higher at higher altitude, decreased. Two case studies indicate that the temporal change of surface atmospheric constituents is strongly affected by vertical mixing as well as the vertical scale (depth) of the front.