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Improved estimates of sensible heat flux by a large aperture scintillometer with the use of real-time Bowen ratio

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An algorithm to estimate a space-averaged sensible heat flux by a large aperture scintillometer (LAS) is improved with the use of real-time Bowen ratio determined by temperature and relative humidity measured at 2 heights observed over the rooftop of the 20 m building located at an urban residential area in Seoul, Korea. The optimal universal stability function for unstable stratification suggested by De Bruin et al. (1993) is selected from many well-known stability functions by comparing the sensible heat flux by LAS with that by eddy covariance method. At urban residential area, monthly mean Bowen ratio shows a minimum in July and a maximum in December, it is highly correlated to absolute humidity in air, while diurnal variation shows a maximum in the afternoon due to large sensible heat flux during the daytime. It is found that smaller Bowen ratio in July makes friction velocity smaller by 0.8 %, friction temperature smaller by 6 %, Monin-Obukhov length scale larger by 4 %, temperature structure function smaller by 8 %, and universal stability function larger by 2 %. As a result, it makes sensible heat flux smaller by 6 %.

Keywords: Bowen Ratio, Large Aperture Scintillometer, Monin-Obukhov similarity, Sensible heat flux, Urban residential area, Weather Information Service Engine.