

High-density surface observations of a local climate around Kyotanabe Campus of Doshisha University

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Kyotanabe Campus of Doshisha University is located in Kyotanabe city, southwestern part of Kyoto prefecture, where the paddy fields and farms spread around, the Kidugawa river flows on the east side, and Mt. Kannabi rises on the west side. The population of Kyotanabe city is about 66 thousands, and the plain areas around the railway stations, which are connected to Kyoto, Osaka, and Nara, have been developed as urban districts. Kyotanabe Campus is located on the hill in the west side, and its elevation is about 50 meter higher than the plain areas. In this study, we have constructed a temporally and spatially dense surface observation network to investigate the local climate around Kyotanabe Campus using compact meteorological instruments called KY-logger (NT system design).

Surface air temperature, relative humidity, and air pressure were observed by KY-loggers for the period from November 12th to 30th in 2015 at time intervals of one second at 14 observation sites within a circular area of a 1.4 km radius centered at Kodo station of Kintetsu line. A weather station MetPak (Gill company) was installed at one of the observation sites, that is in Kyotanabe Campus, and the data observed by MetPak were compared with those by KY-logger at the same site, and were used for the verification of air pressure of KY-loggers. The dependence of temporal variations of surface air temperature and pressure reduced to mean sea level (PMSL) on the observation sites has been examined during the nighttime on fine weather days, using the data densely observed by KY-loggers together with the meteorological data observed by AMeDAS in Kyotanabe (Automated Meteorological Data Acquisition System) and the downward infrared irradiance observed at the top of the building in Kyotanabe Campus. The AMeDAS in Kyotanabe is about 3.4 kilometers away from Kyotanabe Campus in the north-northwest.

The differences in air temperature and relative humidity observed by KY-logger and MetPak at the same site are within ± 0.3 degree Celsius and $\pm 3\%$ RH during the nighttime and within ± 1 degree Celsius and $\pm 5\%$ RH during the daytime, respectively. Air temperatures and relative humidities observed by two KY-loggers at the same site with a height difference of about 1 meter each other show approximately the same temporal variations, respectively. It is confirmed that the difference in surface air pressure observed by the two is almost a constant value, which corresponds to their height difference. During the nighttime on the fine weather days, the air temperature at the sites in Kyotanabe Campus decreases with time more slowly than those in the plain areas, and the PMSL at the top of hill in Kyotanabe Campus becomes relatively low by approximately 0.2 hPa compared to that in the plain areas. During the nighttime on the calm fine weather days, when the surface wind was extremely weak and the downward infrared irradiance was steadily small, the atmospheric phenomena that air temperature suddenly dropped 0.5-1 degree Celsius in 30 minutes were sometimes observed. This sudden temperature drop occurs in succession from low elevation places, the plain areas, to high elevation places, Kyotanabe Campus.

These results imply that high-density observations with KY-loggers are useful for a detailed investigation of local climate.

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