

# A Relationship between Diurnal Change Patterns of Land Surface Temperature and Spatial Configuration of the Osaka Metropolitan Area Captured by Himawari-8

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Land surface temperature (LST) is a physical quantity that greatly contributes to the formation of an urban thermal environment. Therefore, understanding the spatiotemporal characteristics of LST is necessary for constructing a sustainable urban environment. The spatial distribution relationship between the instantaneous LST and urban land use has been investigated using polar-orbiting satellite/airborne sensors. This study explored how the urban spatial configuration and meteorological field affect the temporal changes of LST by using Japanese geostationary satellite (Himawari-8) sensor.

The study area is the Osaka metropolitan area in Japan and target days are three days that were clear-sky throughout the day in summer (August 12, 2016, July 19, 2018, and August 4, 2018). We used 100 m-mesh urban land use data and ground-based meteorological observation data to examine the urban spatial configuration and meteorological fields, respectively. The temporal changes of LST are the amplitude and phase mainly forming the diurnal change of LST. These two temporal changes were extracted by applying principal component analysis to the diurnal changes of LST represented by the 10-minute LST dataset retrieved from Himawari-8 data.

Our results showed that the spatial variations in the amplitude and phase corresponded to the penetration time and duration of the sea breeze and the thermal inertia of surface materials. Besides, it was found that the LST change during daytime was larger in the high-density low-building areas than in the low-density low-building areas. This result suggests that the increase in building density increases the LST change during the daytime. These findings lead to a deeper understanding of an urban hot environment and are helpful for urban planning to mitigate the deterioration of a hot environment.

Keywords: Land Surface Temperature, Himawari-8, Urban Heat Island