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Cross-Comparison between Land Surface Temperature from Polar and Geostationary Satellite over Heterogenous Landscape: A Case Study in Hong Kong

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Abstract : Owing to the insufficiency in the spatial representativeness and continuity of in situ temperature measurements from weather stations (WS), the use of temperature measurement from WS for large-range diurnal analysis in heterogenous landscapes has been limited. This has made the accurate estimation of land surface temperature (LST) from remotely sensed data more crucial. Moreover, the study of dynamic interaction between the atmosphere and the physical surface of the Earth could be enhanced at both annual and diurnal scales by using optimal LST data derived from satellite sensors. The tradeoff between the spatial and temporal resolution of LSTs from satellite's thermal infrared sensors (TIRS) has, however, been a major challenge, especially when high spatiotemporal LST data are recommended. It is well-known from existing literature that polar satellites have the advantage of high spatial resolution, while geostationary satellites have a high temporal resolution. Hence, this study is aimed at designing a framework for the cross-comparison of LST data from polar and geostationary satellites in a heterogeneous landscape. This could help to understand the relationship between the LST estimates from the two satellites and, consequently, their integration in diurnal LST analysis. Landsat-8 satellite data will be used as the representative of the polar satellite due to the availability of its long-term series, while the Himawari-8 satellite will be used as the data source for the geostationary satellite because of its improved TIRS. For the study area, Hong Kong Special Administrative Region (HK SAR) will be selected; this is due to the heterogeneity in the landscape of the region. LST data will be retrieved from both satellites using the Split window algorithm (SWA), and the resulting data will be validated by comparing satellite-derived LST data with temperature data from automatic WS in HK SAR. The LST data from the satellite data will then be separated based on the land use classification in HK SAR using the Global Land Cover by National Mapping Organization version3 (GLCNMO 2013) data. The relationship between LST data from Landsat-8 and Himawari-8 will then be investigated based on the land-use class and over different seasons of the year in order to account for seasonal variation in their relationship. The resulting relationship will be spatially and statistically analyzed and graphically visualized for detailed interpretation. Findings from this study will reveal the relationship between the two satellite data based on the land use classification within the study area and the seasons of the year. While the information provided by this study will help in the optimal combination of LST data from Polar (Landsat-8) and geostationary (Himawari-8) satellites, it will also serve as a roadmap in the annual and diurnal urban heat (UHI) analysis in Hong Kong SAR.

Keywords : automatic weather station, Himawari-8, Landsat-8, land surface temperature, land use classification, split window algorithm, urban heat island
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