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The Impact of Synoptic Weather Types on Birmingham's Urban Heat Island

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This study investigates the characteristics of Birmingham's air and surface urban heat island (aUHI and sUHI) under different synoptic conditions for 2002-2007. The ground-based MIDAS air temperature data at the Edgbaston and Shawbury weather stations are used to derive the aUHI intensity (aUHII). The satellite-derived MODIS/Aqua nocturnal land surface temperature (LST) data under the low cloud cover conditions are used to derive the sUHI spatial patterns and the sUHI intensity (sUHII). Lamb weather types are adopted to assess the variability of the aUHII, using Jenkinson's objective daily synoptic indices. The nocturnal aUHII has been analysed for a combined subset of eleven weather types and the mean nocturnal sUHI for each weather type is assessed. Results presented in this study highlight the characteristics of Birmingham's urban warming. The most frequently occurring weather type, "anticyclonic" (∼20.5%), gives the largest proportion of nocturnal heat island events of 65.1%. The nocturnal sUHII for this weather type reaches a maximum of 4.16°C. The aUHII-sUHII relationship shows a positive linear correlation, with the aUHII being consistently higher than the sUHII. This empirical relationship can be used to develop a generic methodology of deriving the spatial patterns of aUHI. This finding (the lower sUHII than the aUHII) suggests that the satellite-derived urban surface temperature can be "contaminated" by the rapidly cooled roof surfaces, tree tops, parks, and even water bodies (reservoir, canal, etc.).