

Nocturnal Surface Urban Heat Island over Greater Cairo: Spatial Morphology, Temporal Trends and Links to Land-Atmosphere Influences

Ahmed M. El Kenawy^{1,2,*}, Mohamed Hereher^{1,3}, Sayed M. Robaa⁴, Matthew F. McCabe⁵, Juan I. Lopez-Moreno⁶, Fernando Domínguez-Castro^{7,8}, Islam M. Gaber¹⁰, Talal Al-Awadhi¹, Ali Al-Buloshi¹, Noura Al Nasiri¹, Salim Al-Hatrushi¹, Petra-Manuela Schuwerack⁹, Dhais Peña-Angulo⁶, Mohamed M. Abdelaal² and Sergio M. Vicente-Serrano⁶

¹ Department of Geography, Sultan Qaboos University, Al Khoud, Muscat 123, Oman;

meldesoky@squ.edu.om, mhereher@gmail.com (M.H.); alawadhi@squ.edu.om (T.A.); Buloshis@squ.edu.om (A.A.); noure@squ.edu.om (N.A.); salim.alhatrushi@gmail.com (S.A.)

² Department of Geography, Mansoura University 35516, Mansoura, Egypt; mohamedaa@mans.edu.eg

³ Department of Environmental Sciences, Damietta University, New Damietta 34511, Egypt

⁴ Department of Astronomy, Space Science and Meteorology, Faculty of Science, Cairo University 1261, Cairo, Egypt; robaa@sci.cu.edu.eg

⁵ Division of Biological and Environmental Sciences and Engineering, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia; Matthew.McCabe@kaust.edu.sa

⁶ Instituto Pirenaico de Ecología, Campus de Aula Dei, Avda. Montañana, Zaragoza 50059, Spain; nlopez@ipe.csic.es (J.I.L.M.); dhaispa@gmail.com (D.P.A.); svicen@ipe.csic.es (S.M.V.S.)

⁷ Aragonese Agency for Research and Development Researcher (ARAID), Zaragoza 50018, Spain; fdominguez@unizar.es

⁸ Department of Geography, University of Zaragoza, Zaragoza 50009, Spain

⁹ University of Plymouth at Britannia Royal Naval College, Dartmouth, Devon TQ6 9EN, UK; pschuwerack@gmail.com

¹⁰ GIS Specialist and MA Student, Department of Geography, South Valley University, Qena Branch, Qena 83523, Egypt; islam mohamed1606@gmail.com

* Correspondence: kenawy@mans.edu.eg

Received: 23 October 2020; Accepted: 25 November 2020; Published: date



Figure S1. Spatial distribution of the dominant LCLU types in Greater Cairo in 2018. The road network and water channels are illustrated separately in the right panel.

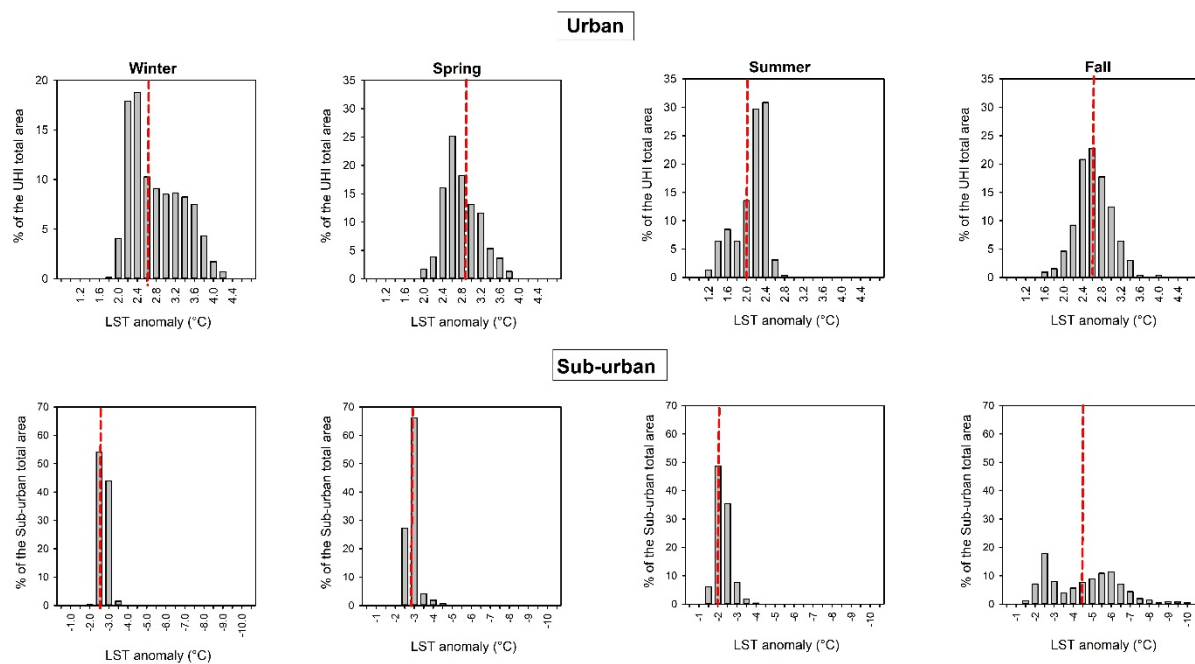


Figure S2. Averaged intensity of nighttime LST anomaly over urban and sub-urban areas from 2003 to 2019. The vertical dotted line indicates the mean for all grids.

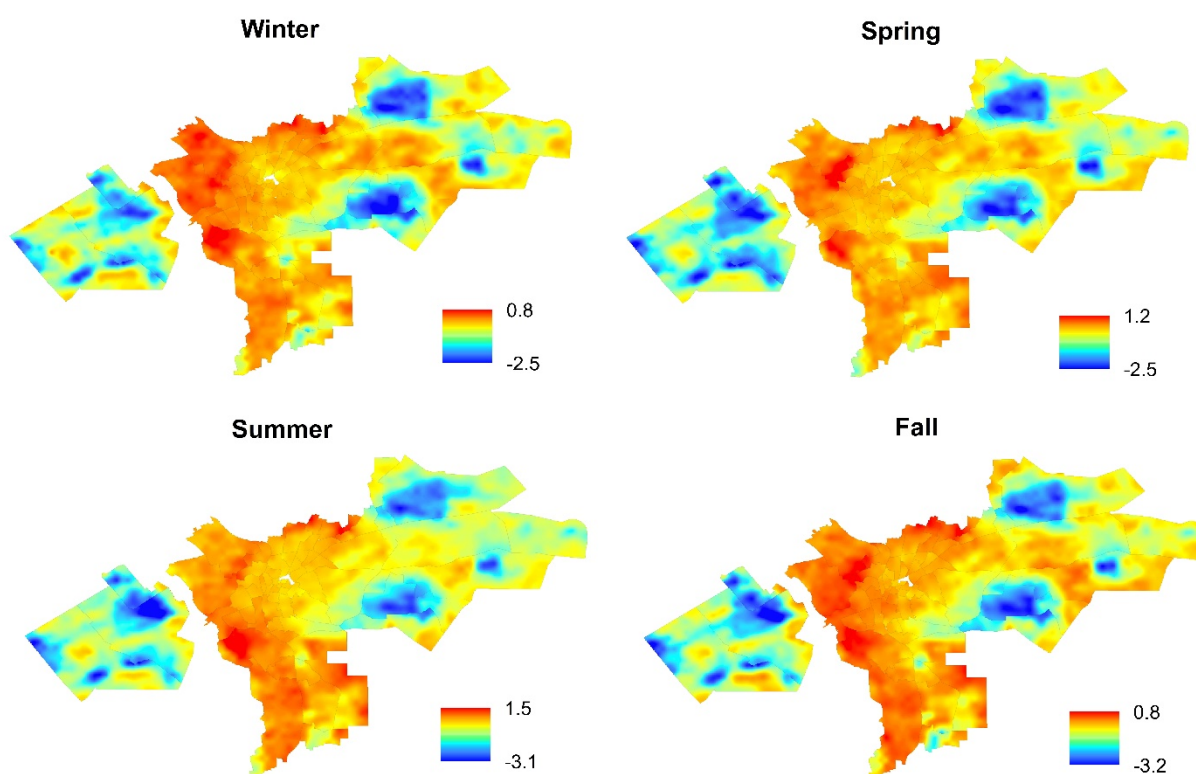


Figure S3. Seasonal changes (%/decade) of albedo between 2003 and 2019.

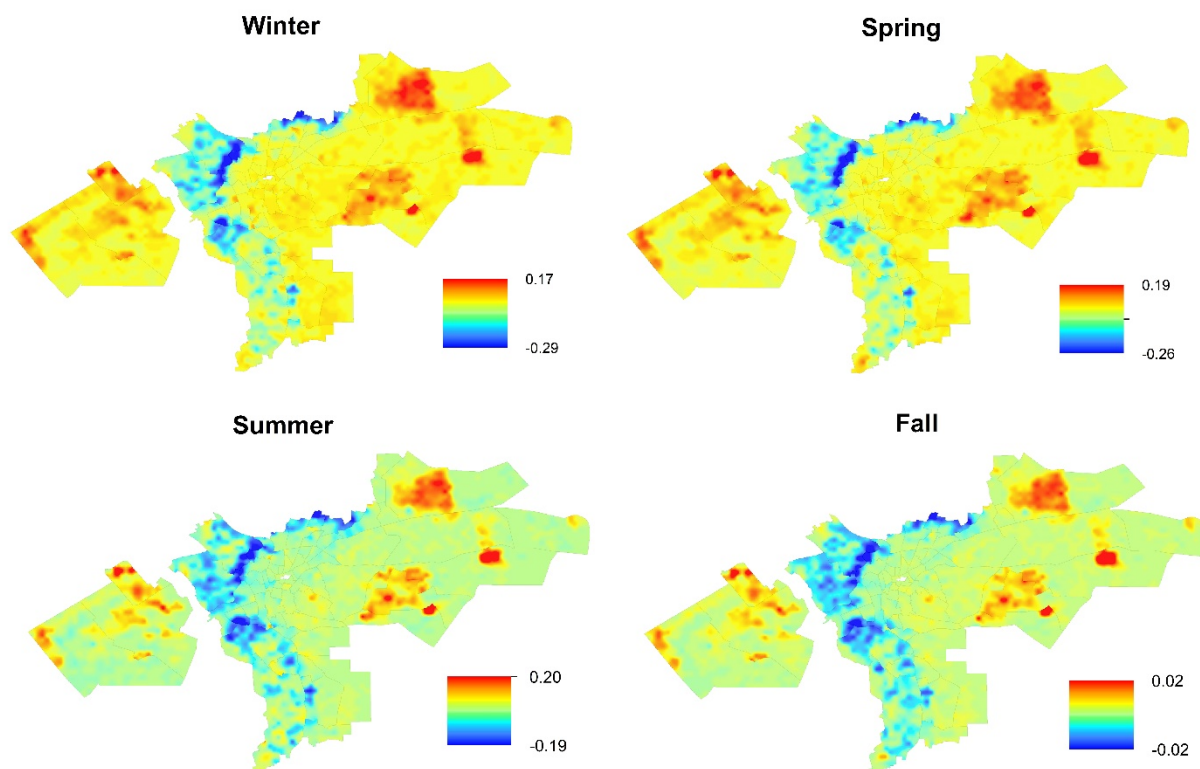


Figure S4. Seasonal changes (index unit/decade) of NDVI between 2003 and 2019.

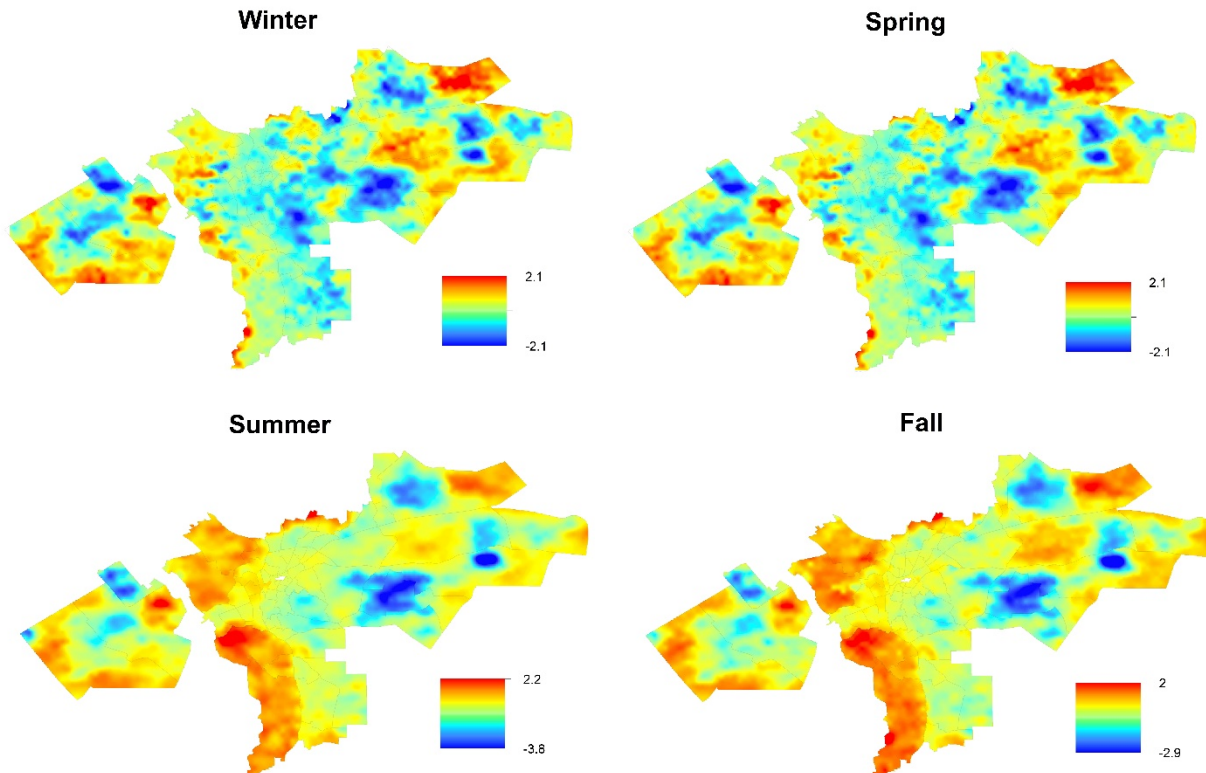


Figure S5. Seasonal changes ($^{\circ}\text{C}/\text{decade}$) of daytime LST between 2003 and 2019.

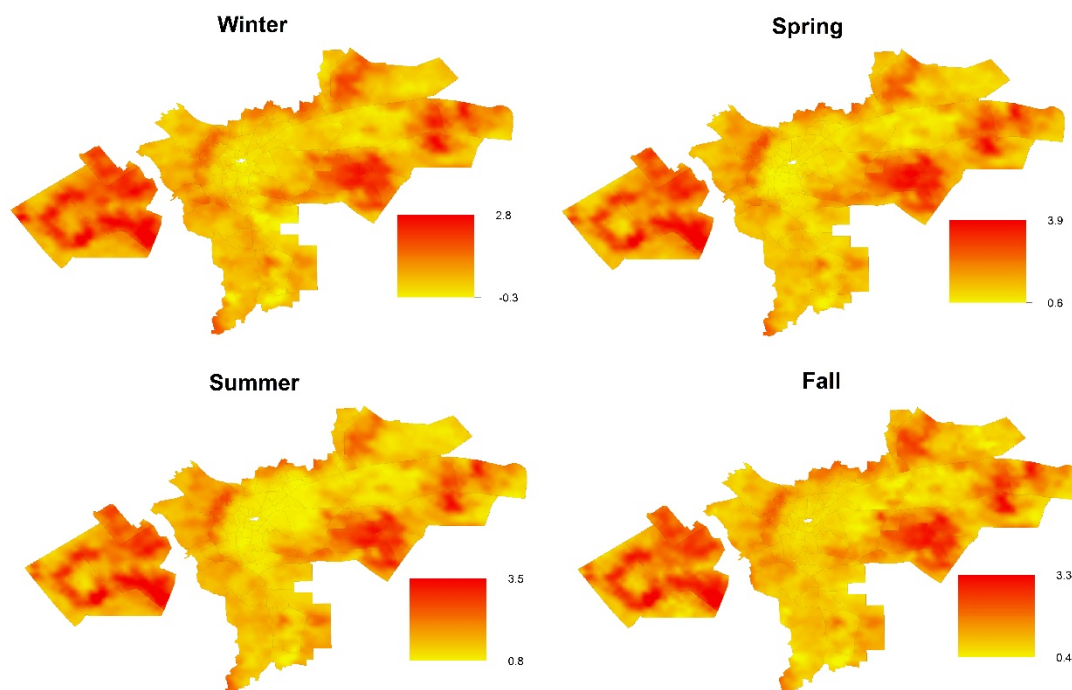


Figure S6. Seasonal changes (°C/decade) of nighttime LST between 2003 and 2019.

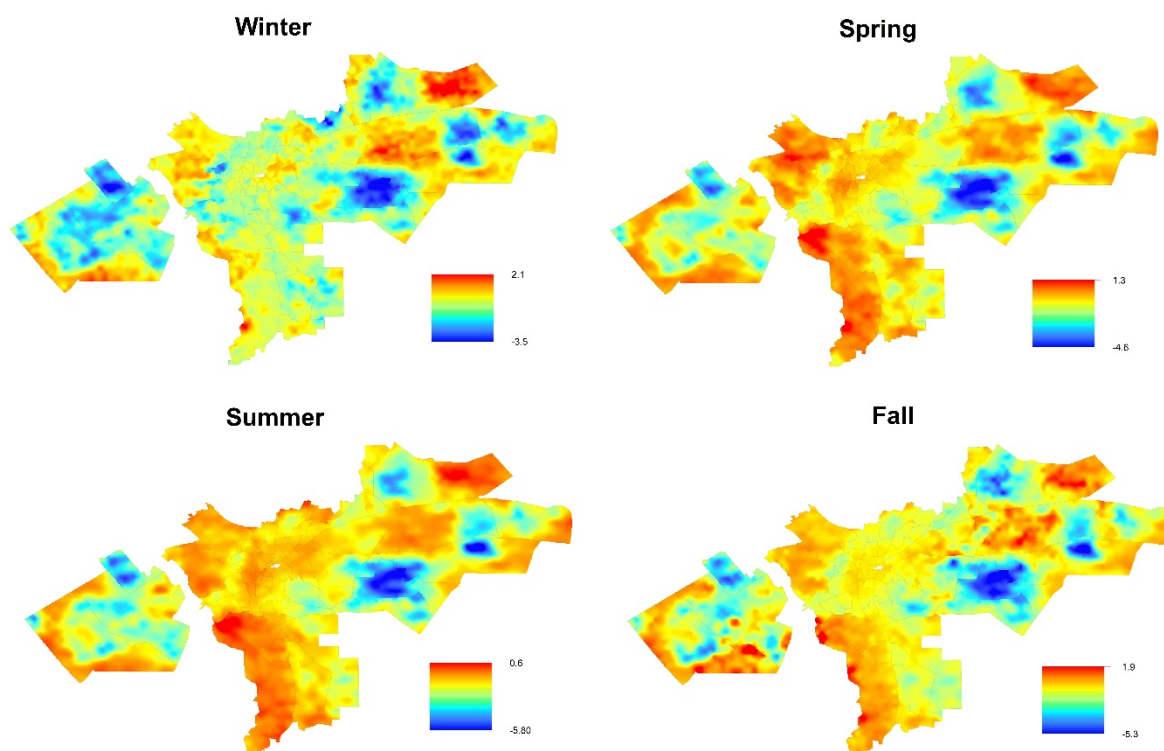


Figure S7. Seasonal changes (°C/decade) of DTR between 2003 and 2019.