

UHI-Stream: A User-Friendly, Cloud-Based Tool for Rapid Analysis of Urban Heat Island Effect Changes Anywhere On Earth

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The term “Urban Heat Island” (UHI) effect describes the phenomenon where urban environments exhibit higher air temperatures than their rural counterparts, a difference that is especially pronounced at night. This effect arises from the greater capacity of urban materials and man-made structures, such as buildings and pavements, to absorb, store, and then re-radiate heat compared to natural materials and landscapes.

First identified over two centuries ago, the UHI effect is still subject of research to understand, measure, and mitigate its impacts on society as a whole, and in particular on economic activities and public health. Although traditionally the prerogative of specialists, the UHI is also attracting increasing interest among citizens. However, not all have the necessary technical expertise or infrastructure access to source relevant data (from in-situ measurements, satellite remote sensing or numerical models), process it efficiently, synthesize it and interpret the changes over time or between different locations.

The UHI-Stream tool was specifically developed to bridge this gap and quickly analyze temperature differences between two points anywhere on Earth’s by leveraging EGI compute and storage resources (owned by CESNET) and ERA5-Land reanalysis data (available from 1950, as part of the Copernicus Climate Change Service). The corresponding hourly 2m air temperatures are streamed from S3 buckets, processed on-the-fly and visualized as annual heat-maps or animations spanning user-defined time-frames.

Conveniently hosted on RoHub as a FAIR (Findable, Accessible, Interoperable, and Reusable) Executable Research Object, UHI-Stream is expected to be further converted into a Galaxy tool with a Graphical User Interface as part of the EuroScienceGateway project, potentially incorporating additional features to help users pinpoint representative urban and adjacent rural areas, or account for more grid cells.

In summary, UHI-Stream is poised to become a valuable asset in urban climatology studies, enabling easier identification of UHI patterns and estimating climate impacts on a regional scale. The tool’s versatility in analyzing any two geographic points enhances its usefulness beyond the mere urban-rural context, allowing for comparative analyses of temperature changes across diverse locales, regardless of their relationship.

Topic

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