Mapping urban heat hotspots and vegetation distributions

Background & Relevance:

Today more than half of the world's population resides in urban areas. These areas are particularly affected by major heatwaves, which frequently cause heat-related deaths. Urban air temperatures are substantially higher than corresponding temperatures in the surrounding rural areas. This so-called urban heat island (UHI) effect is expected to increase with ongoing global warming. To mitigate this effect vegetation strongly modulates the surface UHI intensity via evaporative cooling. Urban surface temperature distributions, trends and changes can be mapped using Landsat satellites. The same applies to urban vegetation cover using Landsat and Sentinel-2. The main objective of this MSc thesis is to quantify spatial and temporal variations in urban surface temperatures and vegetation. Such information should be considered for urban planning and help to define potential risk areas. This thesis provides the opportunity to gain extensive experience in (1) processing optical & thermal satellite data in the Earth Engine, (2) statistical data analysis, and (3) advancing urban planning.

Study area:

Space: Selected global urban areas
Time: 1984 - today

Data Input:

- Landsat 5/7/8/9 (LST data in 100 m)
- Sentinel-2 (vegetation data in 10 m)
- World urban areas, World Settlement Footprint
- Copernicus land cover

Analysis tasks:

- Extract land surface temperatures (LST) and vegetation cover time series in urban
- Quantify urban LST distributions, trends and extremes
- Quantify urban vegetation distributions and trends

Objectives:

- Improved understanding of remote sensing contributions to urban planning
- Develop an Earth Engine App displaying urban heat states, changes and risks

Links & References:

- https://medium.com/google-earth/how-5-cities-plan-to-use-tree-canopy-to-fight-climate-change-4c673f01686a
- https://insights.sustainability.google/labs/treecanopy
- https://yceo.yale.edu/research/global-surface-uhi-explorer

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