Master Thesis

A Case study: Evaluating roof insulation using remote sensing thermal data

Residential heating is an important driver of carbon emissions. To reduce emissions in the building sector, one can switch to low-carbon technologies, e.g. electrify, or reduce the consumption itself through improved insulation. Moreover, the adoption of heat-pumps often requires prior improvements to the energy standard of the building.

Aerial imaging and thermal remote sensing data have the potential to give valuable information on the quality of roof insulation. Therefore, they can help localize insufficiently insulated buildings or districts.

This thesis is meant to investigate whether and how high-resolution data based on images gathered from satellites or other airborne sources could support analysis of roof top insulation. The study by Gulbe et al. (2017) provides a starting point to understand the methodology and necessities concerning the data used. Moreover, it provides a point of reference for the analysis conducted in the thesis. Ideally, the student constructs a use case for a city/region and a reasonable period of interest.

Key tasks and objectives of the thesis
- Research high-resolution thermal data
- Analyze the thermal characteristics of roofs in the respective city/region
- Evaluate the usage of thermal data e.g., by relating your findings to other energy-efficiency criteria as reference (heating consumption)
- Discuss the chances and limitations of using thermal data for evaluating home insulation

Your profile
- Student of economics, best with a focus on energy
- Interested in data processing

Literature
- Engstrom, R., J.S. Hersh, D. Locke Newhouse (2017): "Poverty from space: using high-resolution satellite imagery for estimating economic well-being." World Bank Policy Research Working Paper 8284.
- Gulbe, L., Caune, V., Korats, G. (2017): "Urban area thermal monitoring: Liepaja case study using satellite and aerial thermal data". International Journal of Applied Earth Observation and Geoinformation. Volume 63, 45-54.
- Mastrucci, A., O. Baume, F. Stazi, U. Leopold (2014): "Estimating energy savings for the residential building stock of an entire city: a GIS-based statistical downscaling approach applied to Rotterdam". Energy Build. 75, 358–367.
- Muñoz Sabater, J., (2021): ERA5-Land monthly averaged data from 1950 to 1980. Copernicus Climate Change Service (C3S) Climate Data Store (CDS).
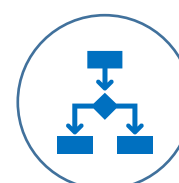
Contact

Picture
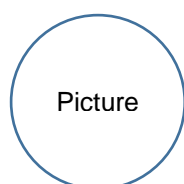
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Topics

- Residential heating
- Insulation
- Satellite Data

Methods

- Data Analysis
- Thermal remote sensing