

Technical Background of CityCLIM

Index Calculator

Technical Details

Index Calculator



What is CityClim?

CityCLIM is a European Union-funded project designed to develop an open platform for climate information and mitigation services. It integrates data from Earth observation sources, ground measurements, and urban weather prediction models to provide detailed weather forecasts for various European cities. The project acknowledges the significant impact of climate change on urban life, particularly the Urban Heat Island (UHI) effect, and addresses these challenges through mitigation and adaptation strategies.

Generic City Climate Platform (GCCP)

The Generic City Climate Platform (GCCP) is a Software-as-a-Service (SaaS) solution developed as part of the CityCLIM project to provide climate adaptation and mitigation services for cities. It **integrates diverse climate data sources, including ground measurements, airborne and satellite data, to offer an advanced urban weather model.** The platform serves as a one-stop shop for City Climate Services, helping both city administrations and citizens understand, predict, and respond to climate-related challenges.

- Services**
- **Citizen Climate Knowledge Services (CCKS):** A public service that informs, warns, and engages citizens on climate change and extreme weather events, encouraging awareness and adaptation.
 - **City Administration Services:** A decision-support tool for city planners and policymakers to analyze, simulate, and implement sustainable urban climate strategies.

INFORM CITIZENS ON CLIMATE CHANGE

WARN CITIZENS ON ARISING HAZARDS

ONE-STOP SHOP FOR CITY CLIMATE SERVICES

SUPPORT MITIGATION & ADAPTATION STRATEGIES

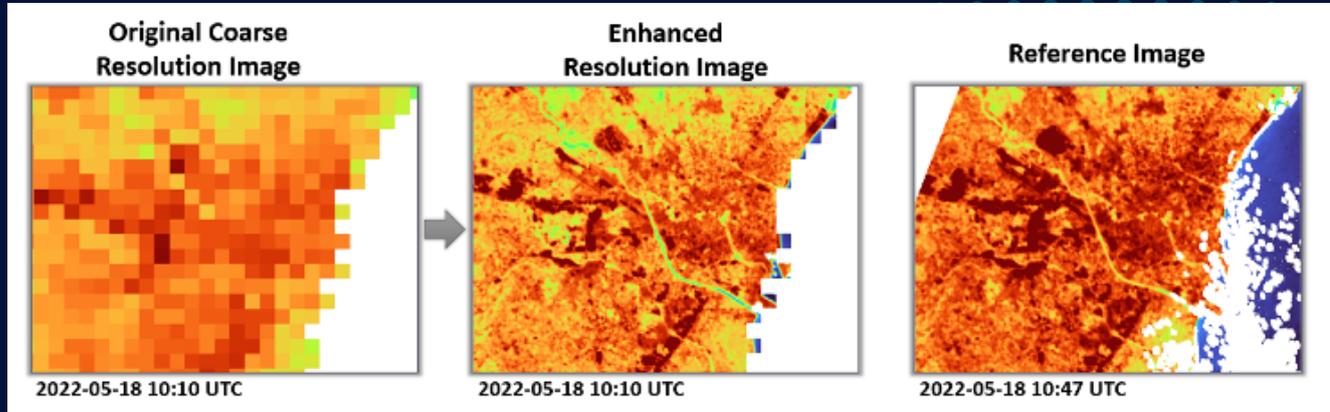
ADVANCED URBAN WEATHER MODEL

ADVANCED URBAN WEATHER MODEL



Index Calculator

The Thermal Sharpener developed in CityCLIMs is responsible for fusing satellite data to produce enhanced Land Surface Temperature (LST) products. It fuses coarse but frequent LST data from Sentinel-3 (1 km) with finer but less frequent data from Landsat 8 and 9 (30 m), yielding bi-daily LST outputs at a 30-meter resolution for detailed urban heat analysis.



Thermal sharpener comparison of results.

Data Sources

- **Sharpened LST:** Produced by the Thermal Sharpener at 30 m resolution, it serves as the core input for calculating heat-related indices.
- **Urban Areas:** Provided by users or calculated from WorldCover data, these define areas of interest for heat analysis.
- **Relative humidity:** Sourced from the ERA5 land reanalysis dataset, this is used in combination with LST to calculate the Discomfort Index.

Key Features

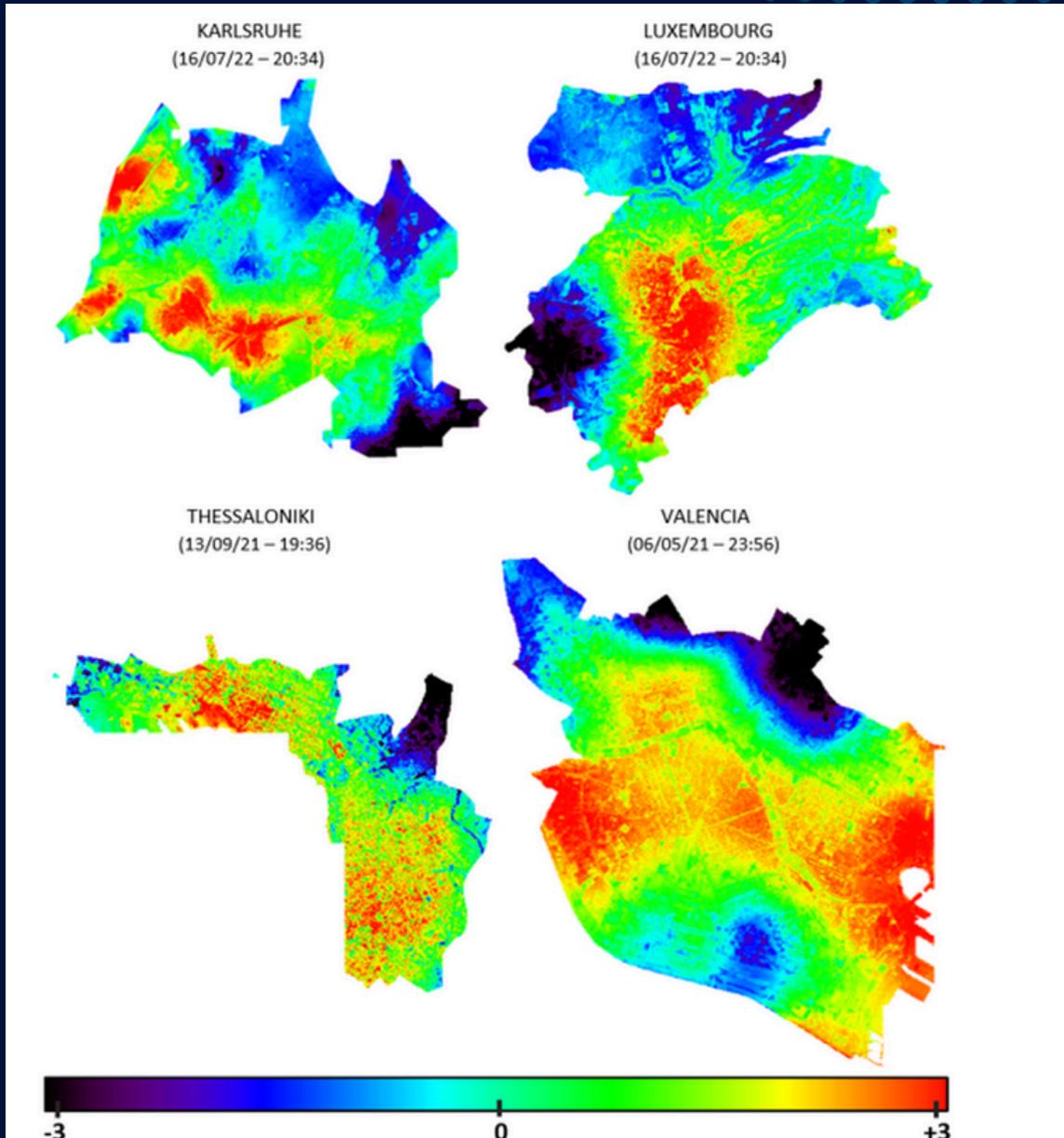
- **Multiple heat indices:** computes a range of indices addressing aspects of urban heat, including human discomfort, thermal heterogeneity, and the intensity of urban heat island.
- **Customizable analysis areas:** Users can input specific bounding boxes for tailored analysis
- **Integration with reanalysis data:** Incorporates relative humidity for comprehensive thermal comfort assessments.

Methodology

- **Discomfort Index (DI):** Combines surface temperature and relative humidity to quantify heat and humidity effects on comfort.
- **Surface Urban Heat Island (SUHI):** Measures temperature differences between urban and rural areas, showing urbanization impacts.
- **Urban Thermal Field Variance Index (UTFVI):** Assesses temperature variability within urban areas, indicating thermal heterogeneity.
- **Urban Heat Island Intensity Index (UHII):** Measures intensity of the urban heat island effect by comparing temperatures between urban cores and rural areas.
- **Urban Hot Spots (UHS):** Identifies areas with significantly higher temperatures linked to impervious surfaces and human activity.
- **Surface Temperature (LST):** Also provided as an output for a comprehensive view of thermal states.

Main achievements

Successful calculation of multiple heat-related indices from the sharpened LST data series provides essential insights for decision-makers and the public, enabling informed actions to manage urban heat and enhance livability.



Example SUHI map (K) for each pilot city (at night).

Validation & Key metrics

The Index Calculator is a valuable tool for urban planners, environmental agencies, and researchers:

- **Urban heat mitigation:** Identifies heat islands for targeted interventions like increasing vegetation.
- **Climate resilience:** Quantifies heat patterns to help cities cope with rising temperatures.
- **Public health:** The Discomfort Index identifies areas at risk during heatwaves.