EUROPEAN UNION

EU MISSIONS

ADAPTATION TO CLIMATE CHANGE

November 2025

Smart City Sensing Supporting Climate Change Adaptation

Reducing urban heat in Weiz, Austria, with drone-based analysis

Preparing the ground for local decision-makers to implement tailor-made heat adaptation measures in an urban context.

Key Learnings

- **Data enables smarter decisions**: A clear, data-driven foundation supports informed urban planning to improve the microclimate and reduce heat in the city. The SmaCiSe service provides high-resolution 3D data that allows for systematic evaluation, implementation and monitoring of the urban climate measures across four districts and public spaces in Weiz. Compared to existing methods, the service is more time-, energy and cost-effective.
- **Continuous monitoring supports adaptive planning**: Cost- and time-efficient data underpins a streamlined process that enables urban planners and local authorities to adopt innovative adaptation approaches and track their impact on the urban climate. Identifying areas heat accumulation and urban heat islands helps assess environmental quality and energy efficiency within urban communities.

About the region

The municipality of Weiz, Austria covers an area of about 17,5 km² and has about 12,900 inhabitants (2025). At 477 meters above sea level, hills with agricultural land, and forests characterise the landscape. The local climatic conditions contribute to a lush landscape with diverse plant and animal species, offering various outdoor activities across the seasons.

Climate Hazards

Extreme Temperatures

Sector

ICT, Urban, Land Use Planning

Key system

Land use and Food Systems

Local Economic System

Climate Threats

In Weiz, increasing temperatures combined with highly sealed surfaces in the city centre result in extreme temperatures in the city during the summer months. Higher temperatures in the city compared to its surroundings reduce the residents' well-being and can have serious health effects, especially on the elderly and children. Heat, which reduces outdoor life quality, also negatively impacts the local economic situation, with sales dropping and businesses leaving the area. In response, the municipality has launched a large-scale redesign and conversion of the main square, adapting it to rising temperatures while making it more attractive.

Drone-based analysis is preparing the ground for adaptation

Understanding the development of temperature hotspots and the factors influencing them is crucial for implementing effective adaptation measures. Following the suggestion of the Energy Region Weiz-Gleisdorf, and together with their support through the KLAR! programme – an initiative of the Austrian Climate and Energy Fund that supports regions and municipalities in adapting to climate change through local action, awareness-raising, and the practical application of research – the city of Weiz and AEE INTEC, an institute for sustainable technologies, launched the innovative Smart City Sensing process. This initiative represents an alternative approach to conventional technologies such as microclimatic simulation tools, based on thermographic mapping using high-flying aircraft in combination with on-site measurements.

Smart City Sensing applies an innovative methodology that is significantly more efficient than conventional, time-, energy-, and cost-intensive approaches, while providing reliable data and services. The method enables a precise three-dimensional representation of the urban thermal environment and its key influencing factors based on multispectral, infrared, and visible Red-Green-Blue image data. This enables modelling the effects of targeted measures preventing or reducing the development of heat islands,

meaning particularly hot areas in the city. Smart City Sensing evaluates, for example, the specific cooling effects of green measures such as green walls, newly planted trees, and lawns, as well as structural and engineering solutions, including shading elements, water installations, or lighter-colored road surfaces. In addition, the method identifies the locations where each measure achieves the greatest cooling effect.

Facilitating urban planning decisions

Smart City Sensing improves urban planning decisions and supports more informed decision-making processes in Weiz. The method provides the required scientifically sound data for targeted urban planning decisions aiming at climatically improving buildings and districts within the city. The understandable and data-driven analysis reduces the risk of ad-hoc decisions, which can result in inappropriate investments and cause maladaptation, meaning the implementation of well-intended adaptation measures with negative effects.

Implementation Steps

1. **Defining an analysis area**: City representatives and the SmaCiSe service providers define the analysis area, preferring densely populated and highly sealed areas.

2. **Data collection**: During a representative heat period, a drone collects thermal data as well as the solar radiation reflected from all surfaces within the defined area. For this purpose, special cameras are used that can capture up to 800 images per flight. In addition, on-site measurements record further relevant parameters for the precise determination of thermal comfort in the study area, including solar radiation, air temperature, humidity, airflow velocity, and radiant temperature.

3. **Creating the 3D and interactive city model**: The collected data enables creating an interactive three-dimensional city model that visualises thermal comfort, meaning how warm or cold people feel in the urban environment. A specialised spatial calculation model visualises the results in layered maps, providing information on local heat stress and its causes, such as overheated façades or limited vegetation (Figure 1). This forms the basis for the targeted planning of specific adaptation measures aimed at reducing urban heat stress.

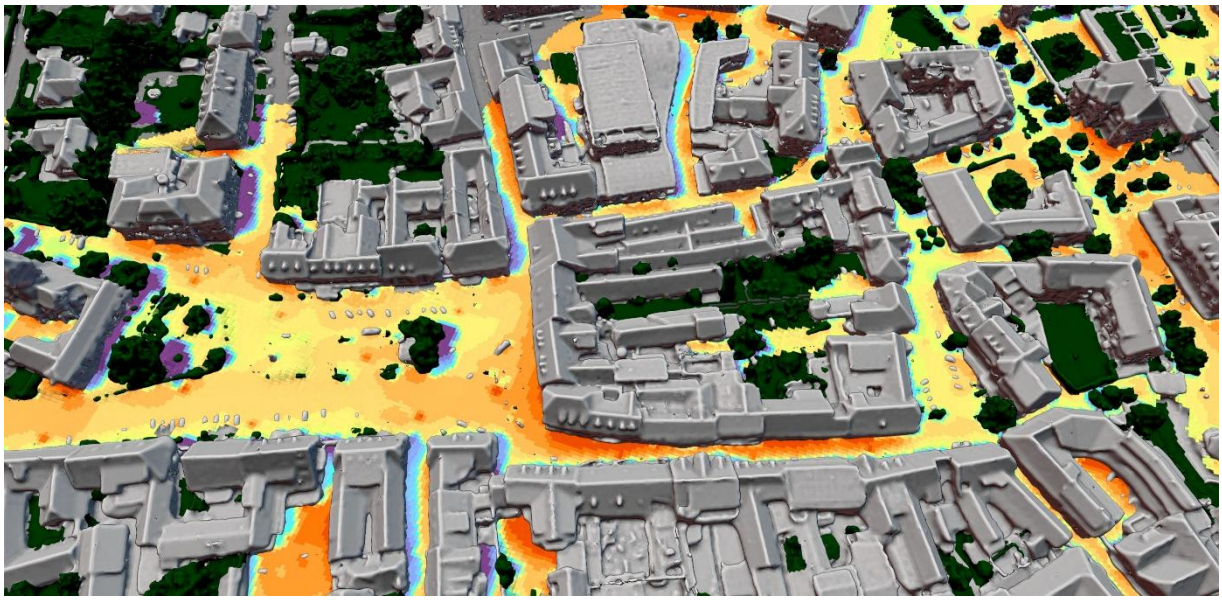

Figure 1: Three-dimensional city model, depicting local heat (red) and cool areas (purple). Image Credit: AEE INTEC, City of Weiz.

Smart City Sensing supports the prioritisation of interventions and the implementation of forward-looking urban planning strategies. Raising awareness about the impacts of urban heat and illustrating potential improvements through location-specific visualisations of the city structure based on Smart City Sensing data allows the development of tailored adaptation solutions. Building on this approach, concrete measures have already been implemented, such as the de-paving and greening of the Weiz-Zentrum train stop. Approximately 80 m² of paved surface was transformed into a climate-adapted green space featuring an elevated planting bed (Figure 2), resilient vegetation, and a smart irrigation system.

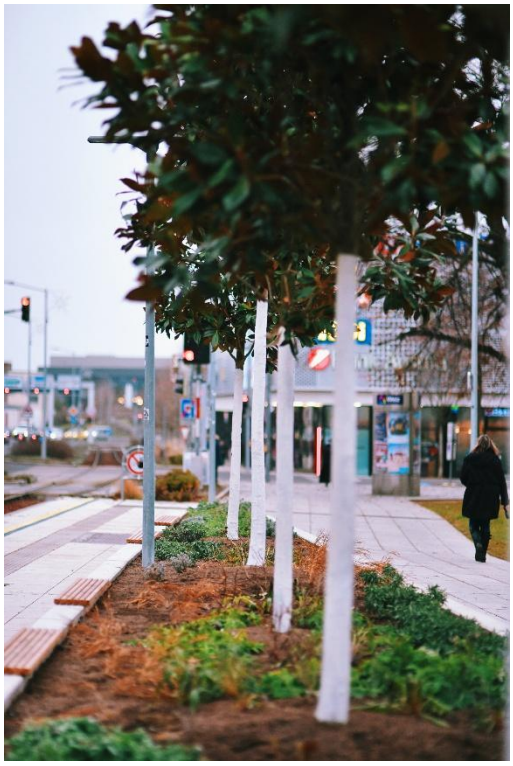

Figure 2: Elevated Plant bed at the Weiz-Zentrum train stop. Image Credit: City of Weiz (Measure as part of the KLAR! programme).

The innovative technology supports a deeper understanding of the interactions between buildings and their surroundings. For future planning, the data models and database are available, among others, to urban planners and city officials to promote sustainable urban development – attracting local investment and creating jobs through adaptation measures, while simultaneously improving the overall quality of life in the city.

“In Weiz, the microclimate and quality of life should be sustainably improved for the citizens. To ensure this, we need proper data and facts. This project should also serve as a reference project for other squares.”,

DI Gerd Holzer, Technical Director and 2nd Deputy of the City of Weiz

Summary

The innovative Smart City Sensing method brings a data-driven approach to urban planning in Weiz, helping to improve microclimatic conditions. This reliable, measurement-based planning tool supports informed decision-making and reduces the risk of ad-hoc measures or costly maladaptation investments. Building on a solid data foundation helps avoid interventions that could have significant economic or environmental consequences. While particularly effective in public spaces, Smart City Sensing can be applied wherever outdoor areas require thermal analysis for improvements. Enhancing microclimatic conditions not only increases comfort but also revitalises local businesses and supports the well-being of residents.

Further information

- https://www.weiz.at/Gruene_StadtOase_-_PK_Hitzeinsel-Ortung
- https://www.aee-intec.at/newsletter-stories/hitze-hotspots-in-weiz-drohnenflug-liefert-daten-fuer-begruenungsprojekt/
- https://www.energieregion.at/

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Funded by the European Union