

Technical Background of CityCLIM UltraHD

Technical Details

Advanced City weather model



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

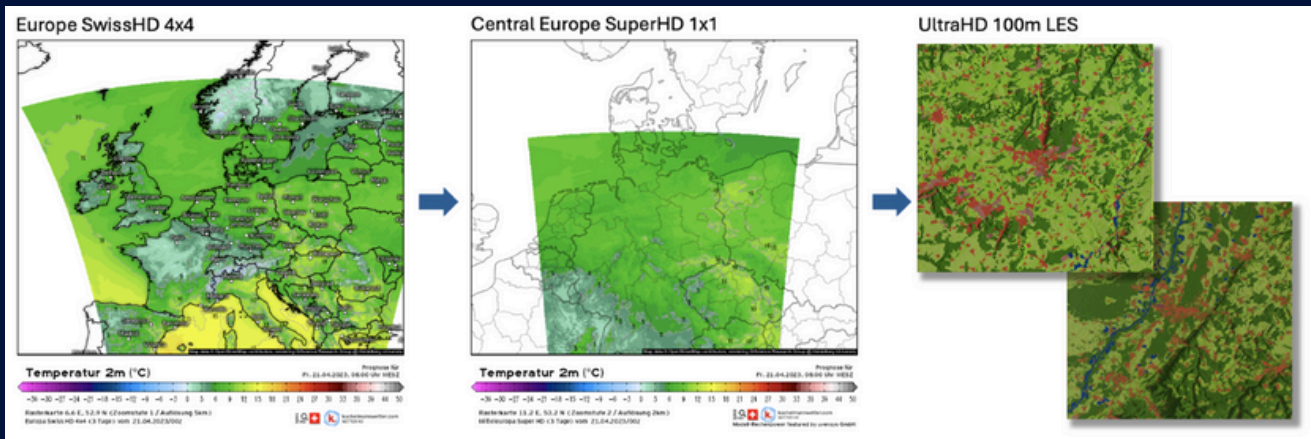
ADVANCED URBAN
WEATHER MODEL

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WEATHER MODEL



UltraHD - Advanced Urban Weather Model

The purpose of the Advanced Weather Model Processor is to provide short range weather forecasts with very high resolution on a daily operational basis and on demand. Therefore, it uses the UltraHD model developed at Meteologix AG (MTL) which is driven with three-dimensional boundary data from the operational SuperHD model. Since the used UltraHD model is a fully compressible large eddy simulation model, it is computationally very demanding and the envisioned operational weather forecasts are only possible using the latest GPU technology.



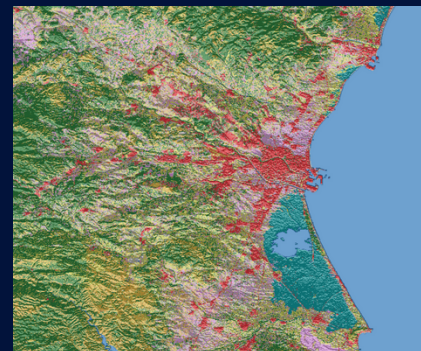
Operational forecast modelchain: Europe SwissHD 4x4 > Central Europe SuperHD 1x1 > UltraHD 100m LES

Daily maps for SwissHD 4x4 and SuperHD 1x1 are publicly available online at: meteologix.com

UltraHD Model will provide daily LES simulations at 100m resolution using boundary data from SuperHD and additional data (in-situ, EO) from CityCLIM Cloud platform

Key features:

- Fully compressible Large Eddy Simulation model driven by an operation model chain on daily basis at a resolution of 100m with output every five minutes
- Using GPUs for computational performance and efficiency
- Three-dimensional radiative transfer model with raytracing
- Soil model for heat and moisture transport and energy balance at surface layer
- Including microphysical processes for water and ice clouds and precipitation
- Suite of chemical equations for pollution transport and processing
- The Model uses Earth Observation data as input and In-Situ measurements during assimilation phase



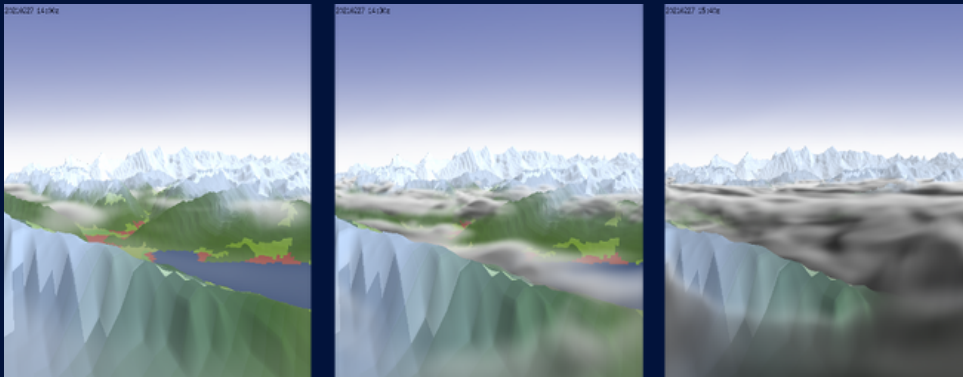
Modelling area and land use for City of Valencia.



Hardware setup: UltraHD is run on GPUs (faster, more efficient and greener)

UltraHD - Analysis Engines

The UltraHD forecast engines are essential for delivering advanced climate and air quality services. The City Climate Forecast Engine processes weather model outputs for real-time forecasting and early warnings. The City Climate Simulation Engine enables scenario-based analysis by modifying urban characteristics and environmental conditions. The City Climate Diagnostics Engine performs statistical analyses to detect trends in heat, pollution, and airflow, supporting identification and decision-making services. Together, these engines provide accurate data and simulations, helping cities plan sustainable, climate-resilient strategies and improve urban living conditions.



UltraHD 3D visualization of terrain and clouds.

Check out UltraHD



Key features of the UltraHD Engines

City Climate Forecast Engine

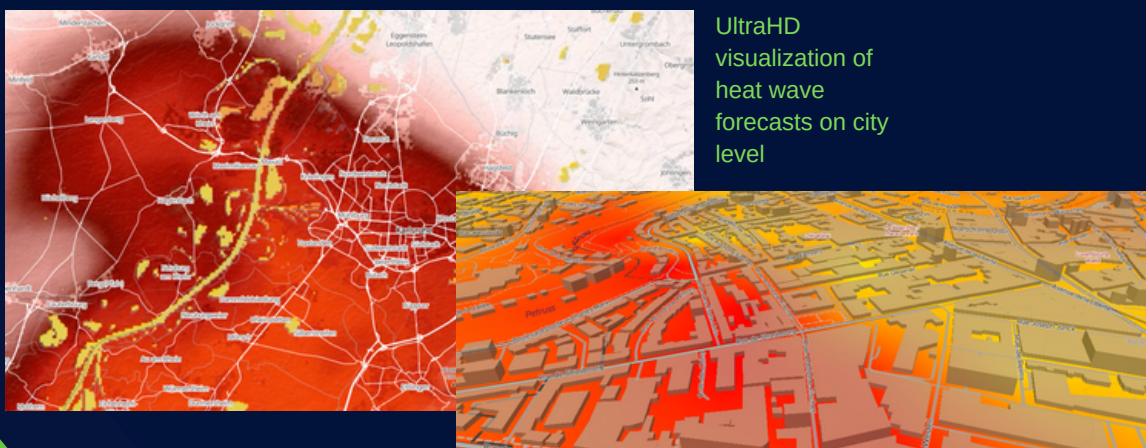
- Manages weather model outputs for operational forecasts, simulation services, and MOS-based warnings.
- Handles postprocessing tasks like coordinate transformation, data storage, and video generation.
- Uses scalable Azure functions for cost-effective processing and efficient response to forecast requests.

City Climate Simulation Engine

- Manages user-requested simulations, modifying EO data and urban characteristics for analysis.
- Enables comparison between original and simulated model runs for impact assessment.
- Integrated with GCCP middleware for efficient data management.

City Climate Diagnostics Engine

- Performs statistical analysis of UltraHD model runs, focusing on heat, airflow, and pollution.
- Supports Identification Services by generating on-demand visual and numerical results.
- Extends capabilities with MOS model warnings, new parameter calculations, and optimized data access.



UltraHD visualization of heat wave forecasts on city level