

Developing Synergies in EO/AI

Nektarios Chrysoulakis

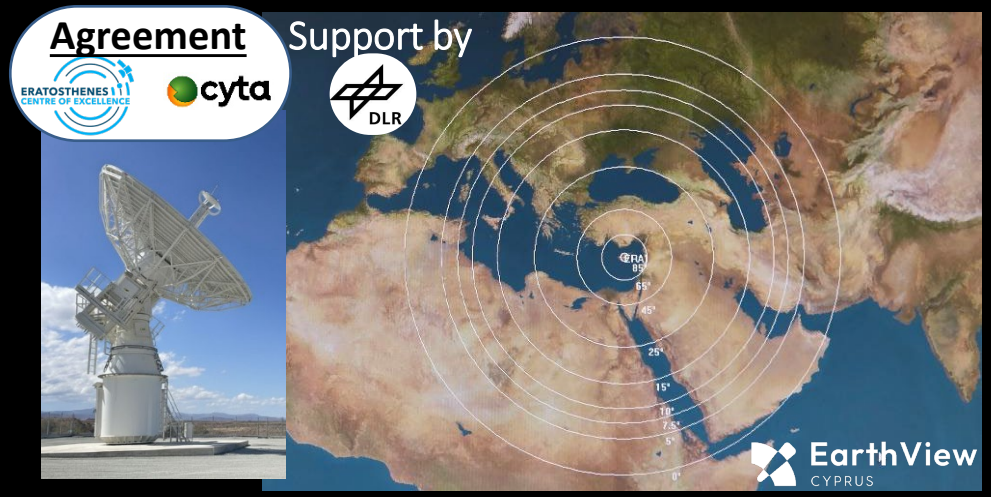
Remote Sensing Lab | IACM

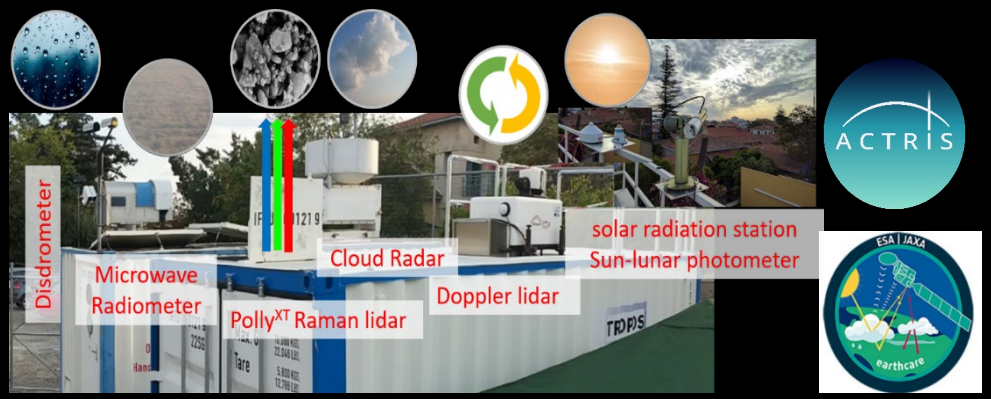
http://rslab.gr

Space-Crete Info Day, Heraklion, 2 October 2026

Chairman of the Board of Directors of ECoE

ERATOSTHENES CENTRE OF EXCELLENCE





- Established through the **Teaming Project EXCELSIOR**, funded by the **EU** with **15 M€**, the **Ministry of Finance** with **15 M€** and by **CUT** with **7 M€**.
- **6 years** of life
- **> 130 employees**
- **2 critical infrastructures**
- **> 500 publications** in journal and conferences
- **> 100 R&I projects** (**25** as Coordinator)
- **> 21 M€** from research projects & services
- Collaborations with **> 1000 Organizations**
- Member in **> 15 European and International networks**

Earth Observation at IACM

RSLab



Nektarios Chrysoulakis
Director of Research - Head of RSLab



Zina Mitraka
Principal Researcher
Earth Observation for Urban Climate



David Parastatidis
Research Assistant
Cloud Computing - GIS Analysis & Applications



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Research Assistant
Machine Learning - Algorithm Development



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Research Assistant
Urban Environment & Climate Monitoring



Konstantinos Politakos
Research Assistant
Urban CO_2 Emissions Monitoring



Manolis Panagiotakis
Research Assistant
Urban Environment & Climate Modelling



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Research Assistant
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Vasileios Geladaris
Research Assistant
Computer Science - Geospatial Applications



Agathi Bantisouli
Research Assistant
Image Processing - Machine Learning



George Stavrakakis
Research Assistant
Machine Learning - Algorithm Development



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Research Assistant
CO_2 Monitoring in Urban Environment



Christina Katsoura
Research Assistant
Urban Climate - Atmospheric Observations



Argyro Gati
Research Assistant
Thermal Remote Sensing & Environmental Data Analysis



Nektarios Spyridakis
Collaborating Technician
Scientific Equipment Management



George Kochilakis
Collaborating Research Assistant
Spatial Data Analysis & Management



Michael Foumelis
Collaborating Researcher
Imaging Geodesy - Geohazards Monitoring



HySpex Hyperspectral Camera



Flux Towers



Field Spectroradiometer



PhenoCams



Optris Infrared Camera



Unmanned Aerial Systems



Meteorological Stations



AERONET System



VHR Satellite Imagery



Surface Thermometers



QUESTemp Heat Stress Monitors



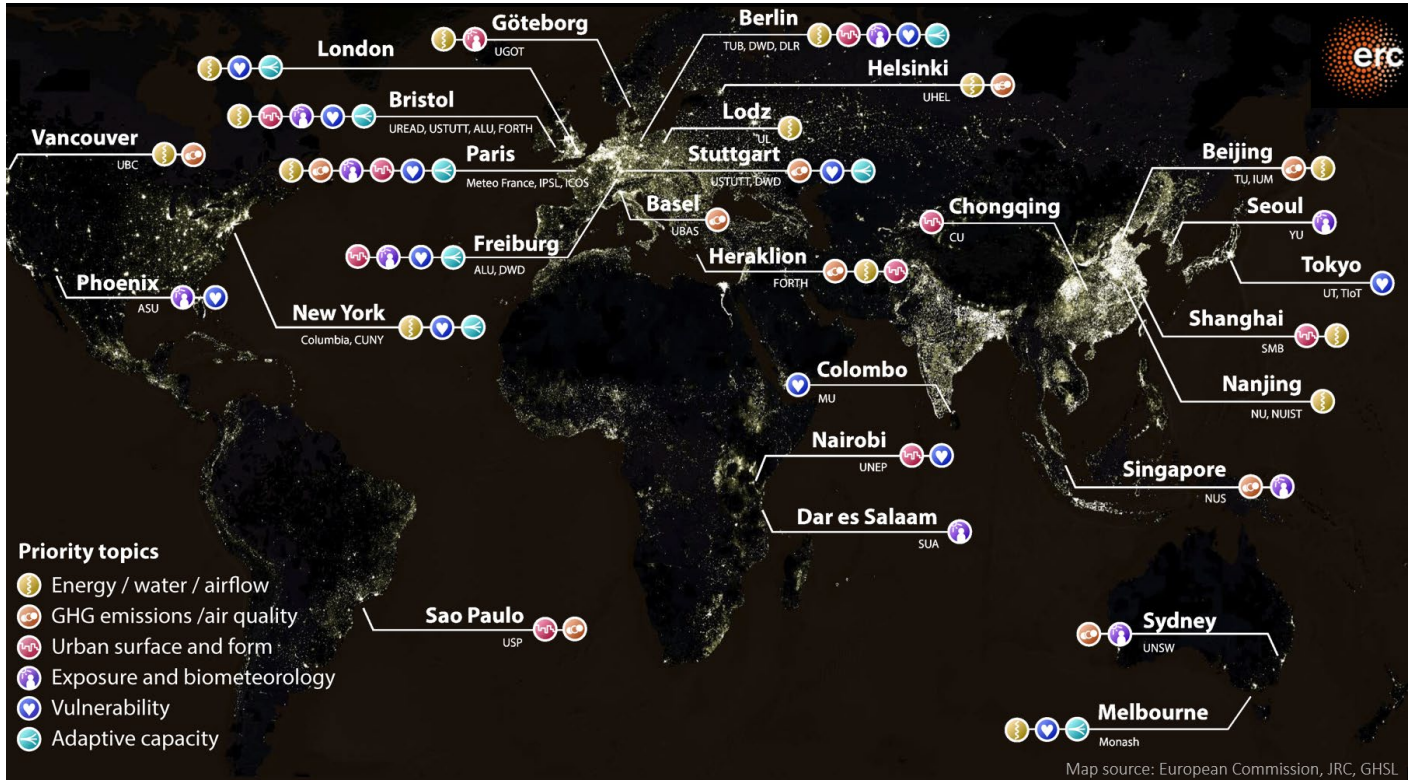
Telraam S2

Coupling Dynamic Cities and Climate

urbisphere

coupling dynamic cities and climate

erc

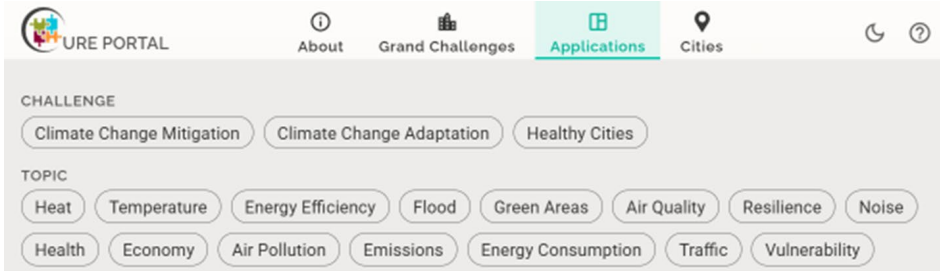


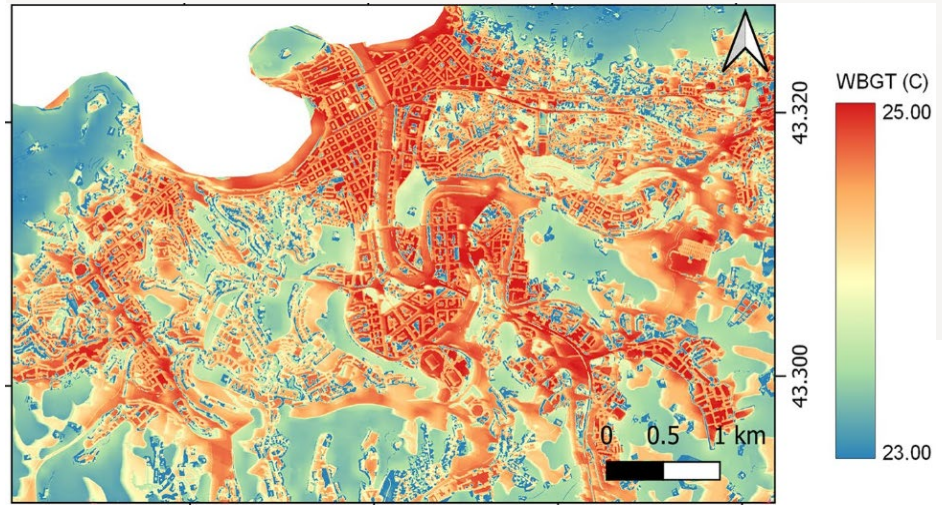
- How are the **urban** and the **atmospheric** processes **interlinked** across spatial scales?
- To what extent is the interplay between **urban form** and **function** understood?
- What are the **feedbacks** between the process of **urbanization** and **climate**?
- What are the cumulative effects of **emerging technologies** for climate **neutrality** and **resilience**?

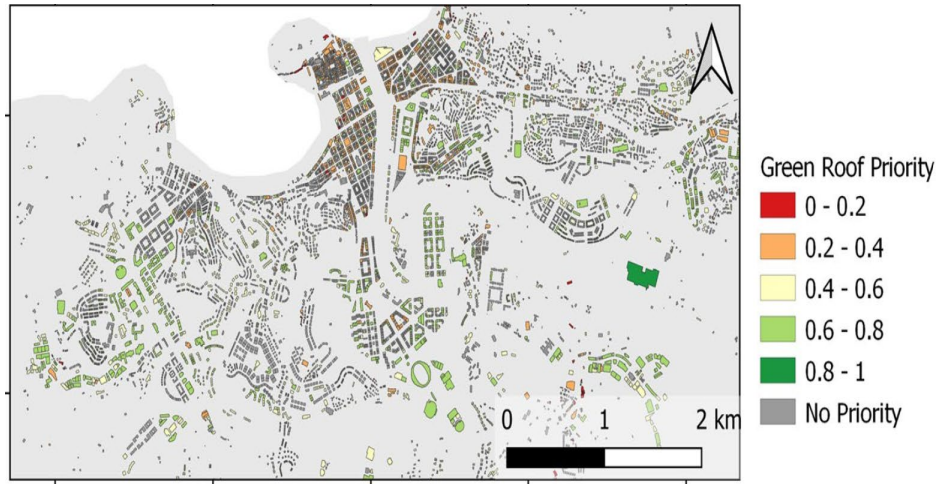
Chrysoulakis, N., et al. 2026. Environmental Research Letters, 21, 151002

Services Development

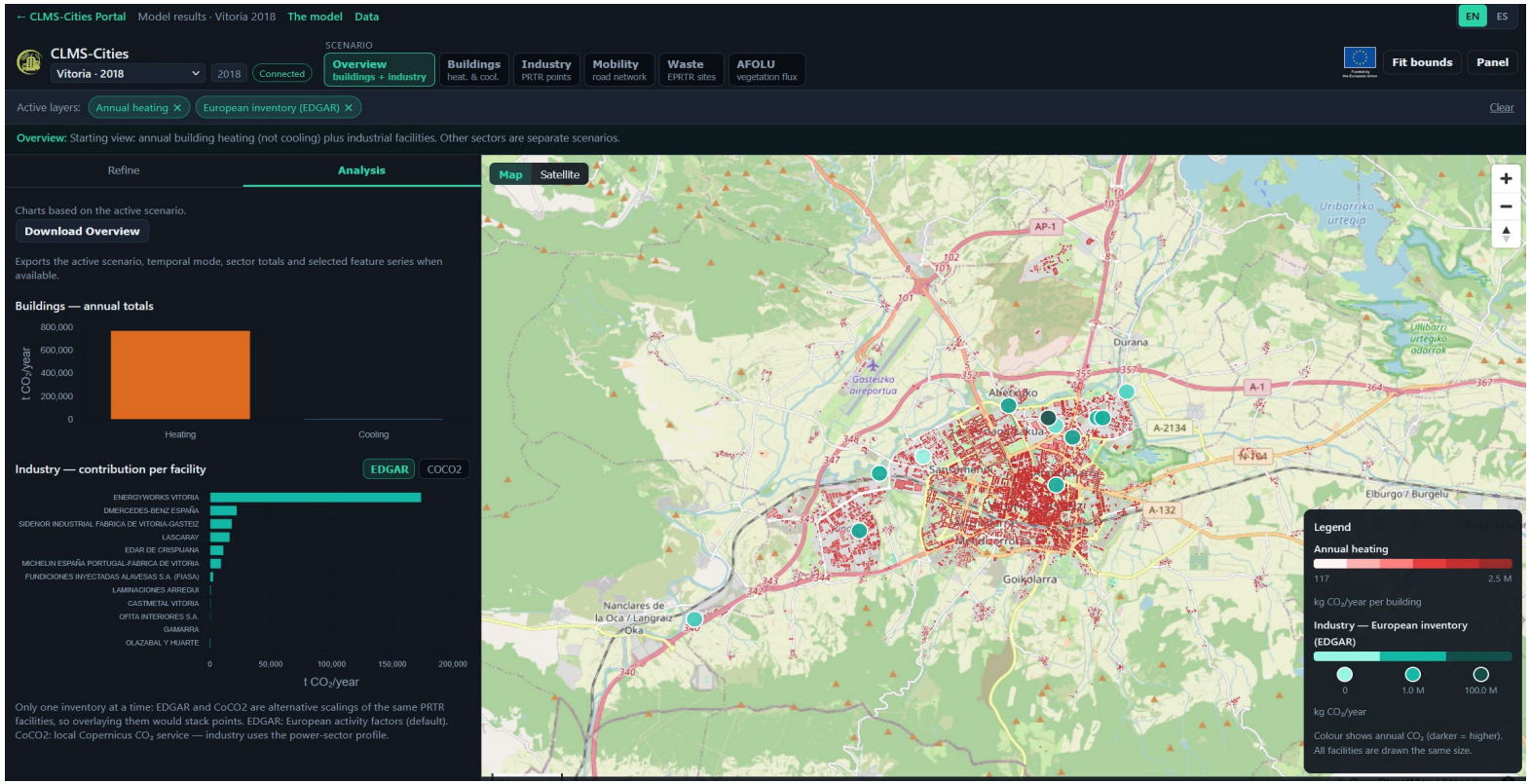
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Chrysoulakis, N., et al. 2023. Scientific Reports, 13, 16251



EUSPA

#EUSpace

Infrastructure heat stress

Urban development

Extreme heat is no longer a distant risk. Global warming has already crossed the 1.5 °C threshold, pushing infrastructure systems beyond the conditions they were designed to withstand.

Across Europe, prolonged high surface temperatures are already degrading transport networks and urban assets. During heatwaves, asphalt can soften and expand, while steel rails may deform or buckle under thermal stress, disrupting transport systems. At 2 °C of warming, extreme heat could raise annual operation and maintenance costs by €1.3 billion in the EU and the UK (Mulholland & Feyen, 2021).

For infrastructure managers, understanding where heat stress accumulates over time is critical for prioritising inspections and interventions.

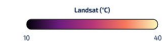
From regional patterns to street-level detail: High resolution missions

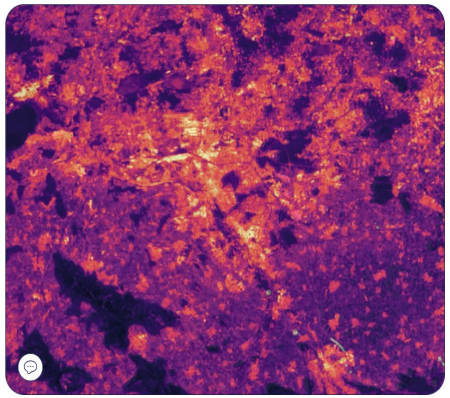
Copernicus Contributing Missions, like Landsat, complement Sentinel-3 by providing land-surface temperature at 100 m native resolution, provided resampled at 30-metre resolution, though not as frequently (approx. once every 2 weeks).

These LST images might not capture the maximum LST during the day, but still reveal detailed temperature patterns across streets, industrial zones, transport corridors, and built-up areas, vital information for identifying thermally vulnerable infrastructure and prioritising maintenance and adaptation measures.

When interpreted together, coarse-resolution frequent observations and less frequent high-resolution imagery support a more comprehensive understanding of where heat stress related degradation to infrastructure is likely to occur.

Even better news with future the upcoming Sentinel expansion mission LSTM, set to join the Copernicus in 2028. It will provide LST at 50 m resolution every 2 days, supporting systematic monitoring of heat exposure across infrastructure assets.



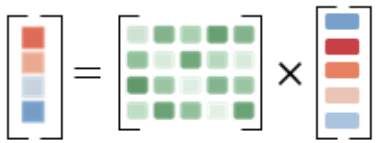


Potential Collaborations with Space-Crete: AI for TIR downscaling

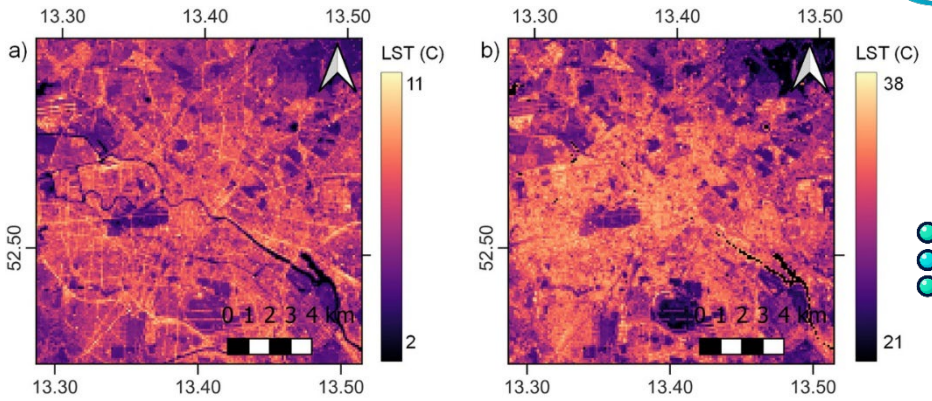
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$$\underbrace{\mathbf{S}^{(L)}}_{w\times 1} = \underbrace{\mathbf{A}^{(L)}}_{w\times n} \cdot \underbrace{\boldsymbol{E}}_{n\times 1} + er \qquad \min_{\boldsymbol{E}} \left\| \boldsymbol{S}^{(L)} - \boldsymbol{A}^{(L)} \cdot \boldsymbol{E} + b\frac{w^2}{n}\left(\boldsymbol{E} - \boldsymbol{S}'^{(L)}\right) \right\|_2^2$$

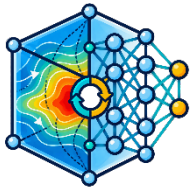
$$\underbrace{\mathbf{S}^{(H)}}_{P\times 1} = \underbrace{\mathbf{A}^{(H)}}_{P\times n} \cdot \underbrace{\boldsymbol{E}}_{n\times 1}$$

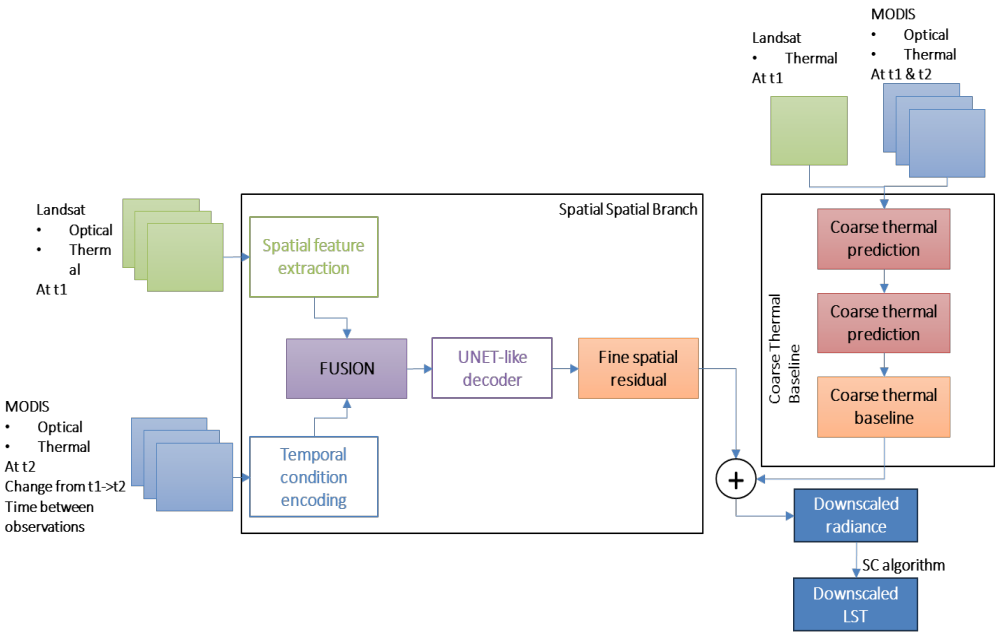


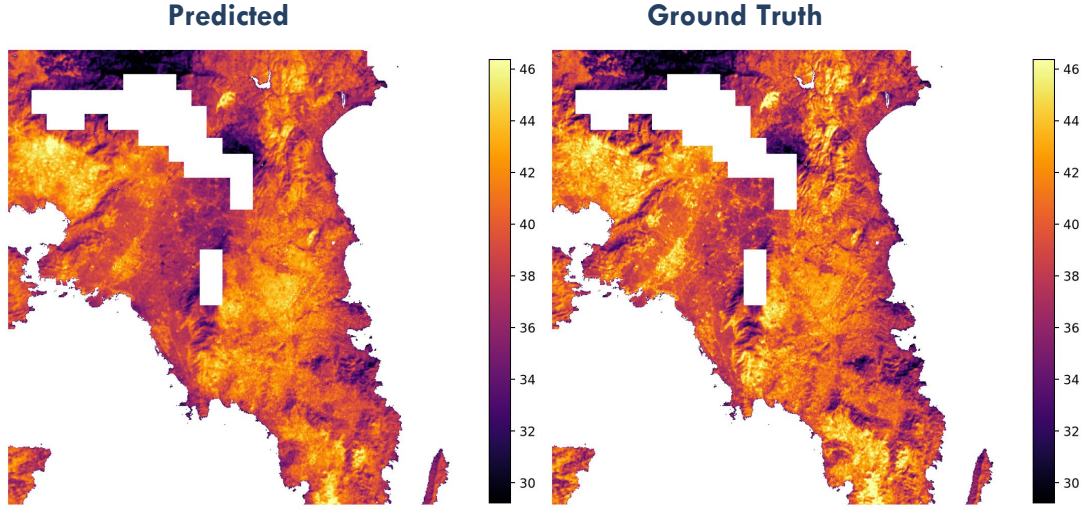












Validation sample – Athens (RMSE: 0.8 °C)



Zina Mitraka

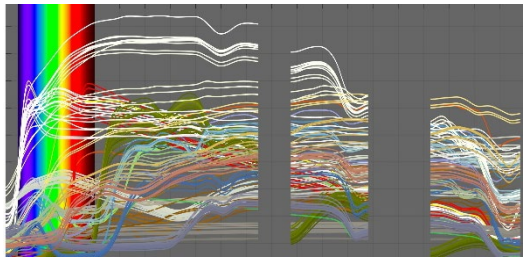
Mitraka, Z., et al. 2026. Remote Sensing of Environment (in review)

Potential Collaborations with Space-Crete: AI for mapping urban fabric

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In-situ campaigns → Data Processing → *urbisphere* Library → ML Training → Trained Model → Satellite Images





> 30.000 Spectra organized in > 700 clusters















Giannis Lantzanakis

WV-3 Image



Urban Material Mapping

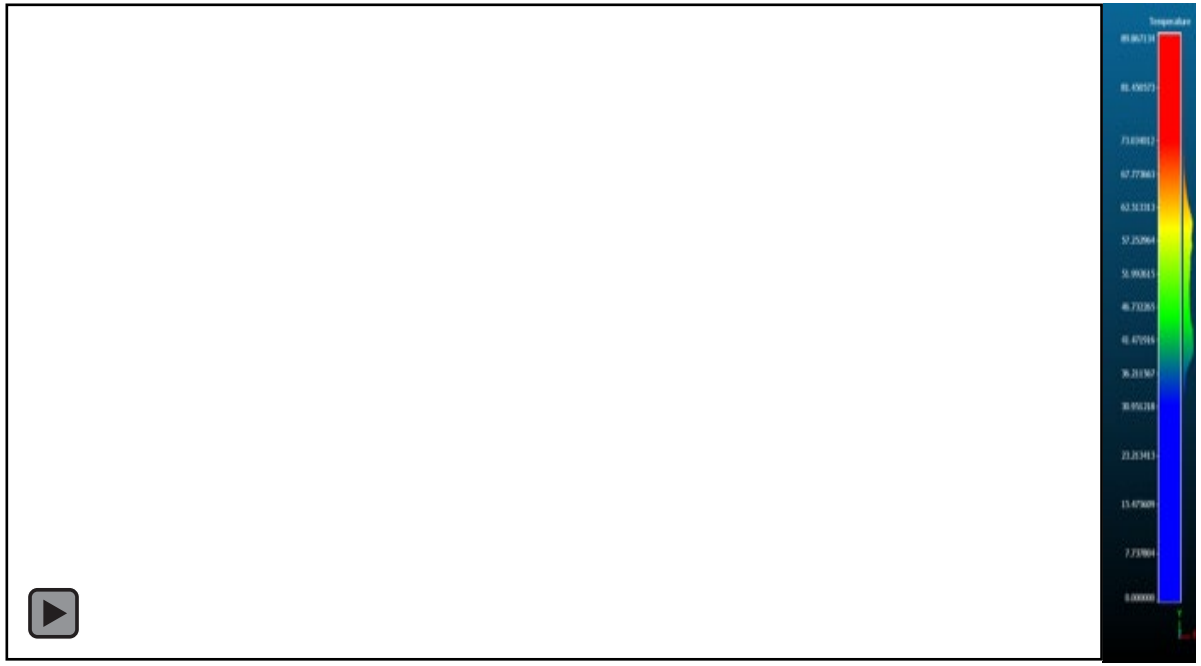


Lantzanakis, G., et al., 2026. ISPRS Journal of Photogrammetry and Remote Sensing (accepted)

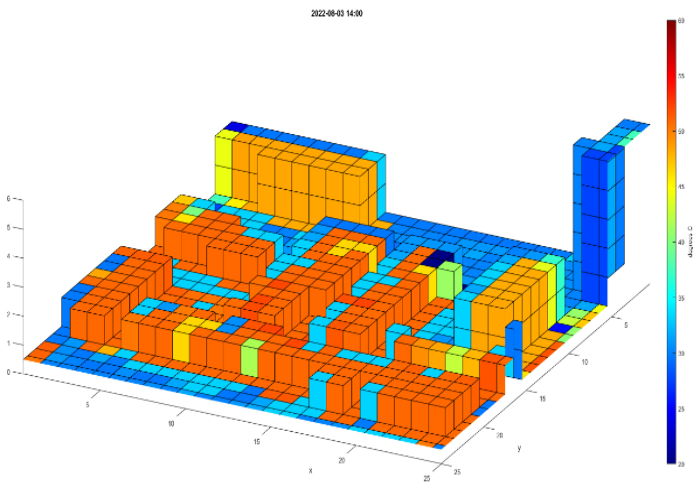
Potential Collaborations with Space-Crete: AI for 3D TIR modelling

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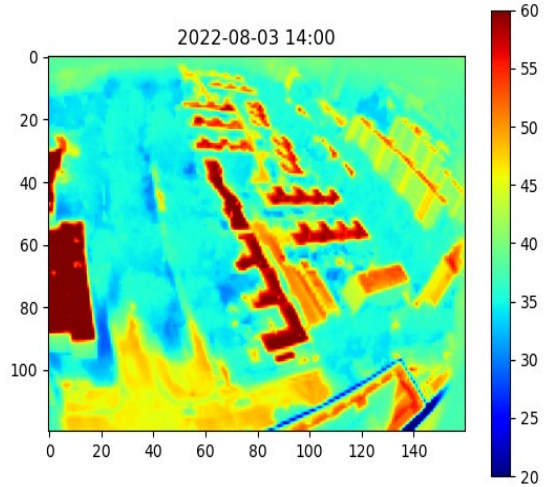
3D TIR reconstruction - FORTH



Model Simulations – Berlin



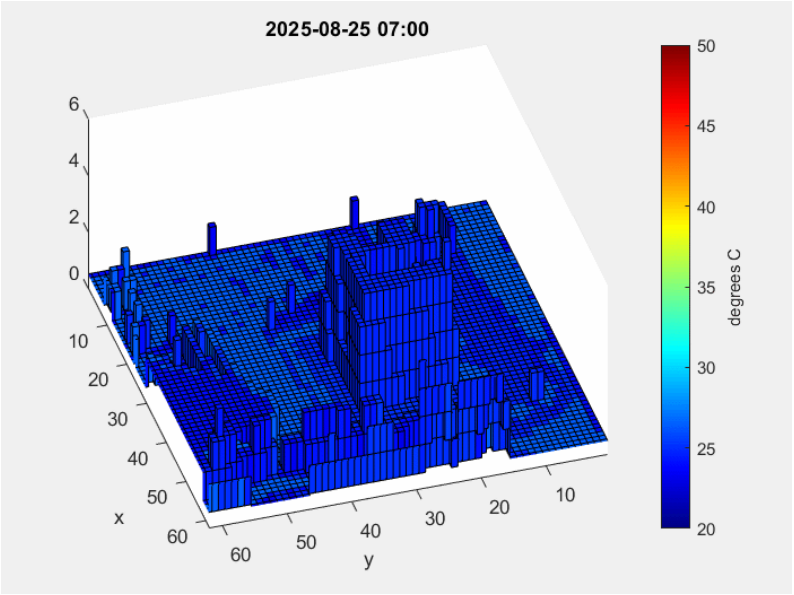
Simulated 3D surface temperature

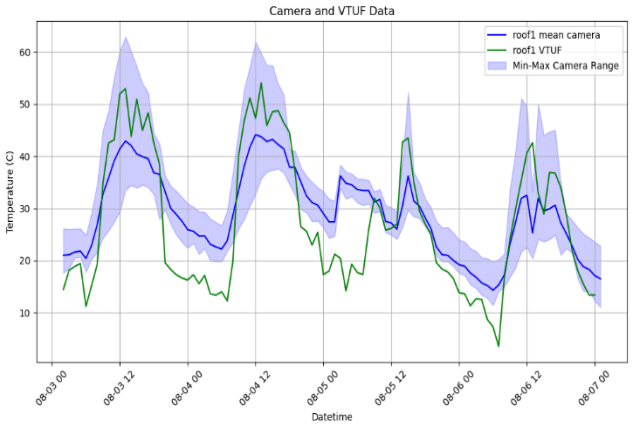


Surface temperature from TIR camera

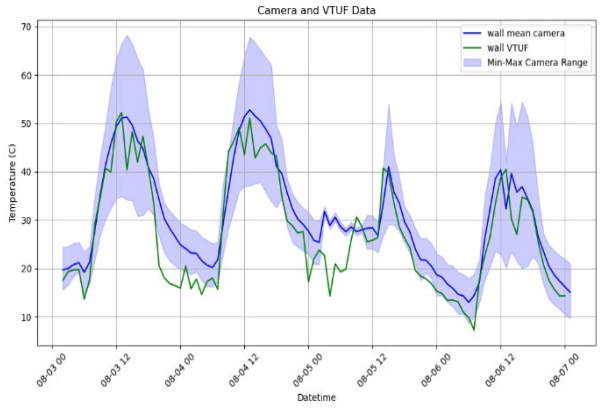


Maria Gkolemi





Simulated and Camera surface temperature timeseries (Roof)



Simulated and Camera surface temperature timeseries (Wall)

Potential Collaborations with Space-Crete: GR satellites – AI for Urban Services

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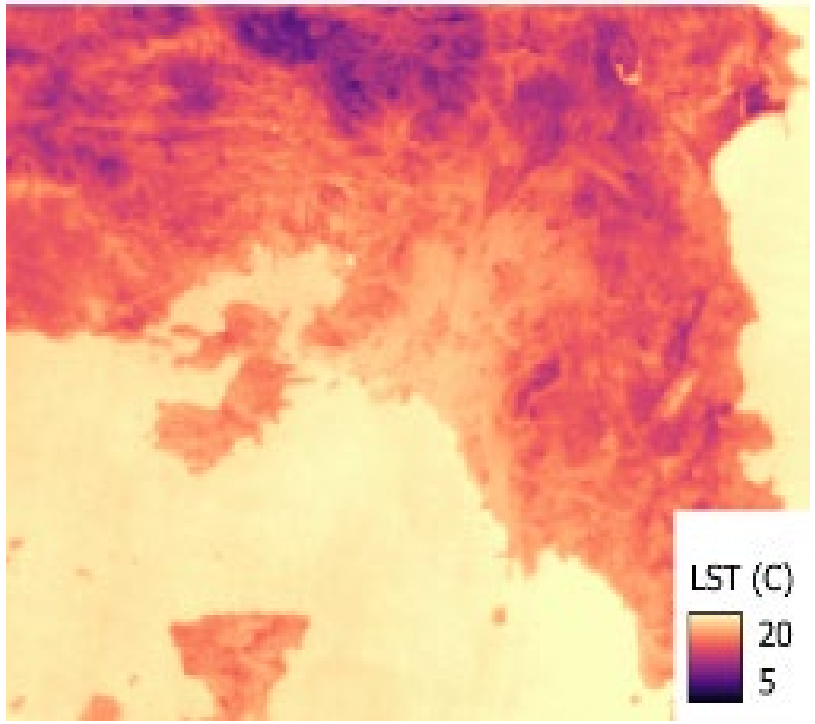
GREEK NATIONAL SMALLSAT PROGRAMME

- **UHI**
  - LST
  - Air Temperature
  - UHI/SUHI
- **Urban Air Quality**
- **Urban Public Health Index**

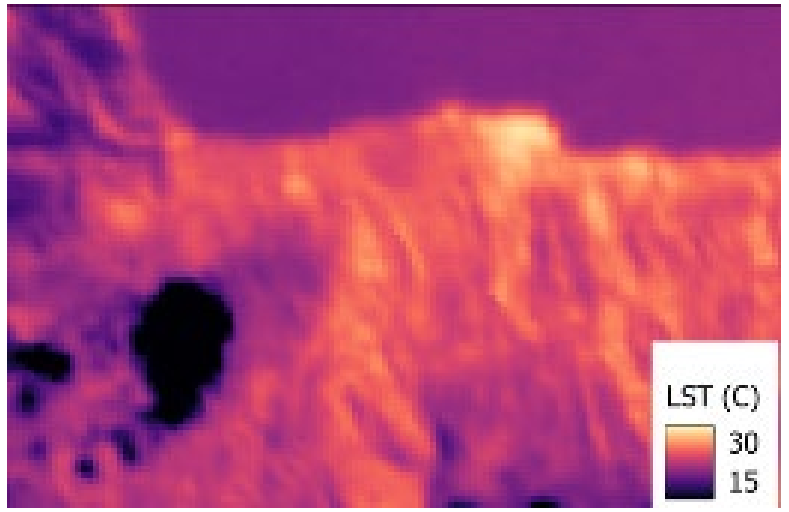
- Planned **Cross Country LST** product to cover the whole Greek territory



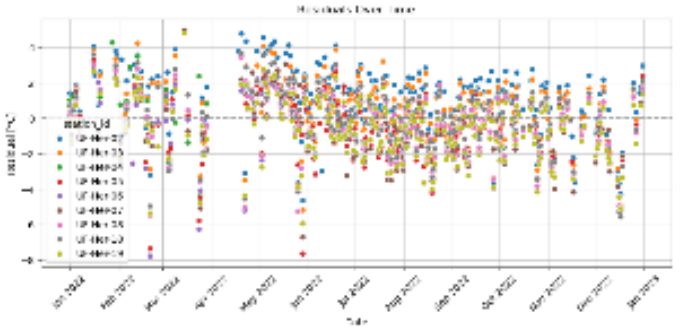
David Parastatidis

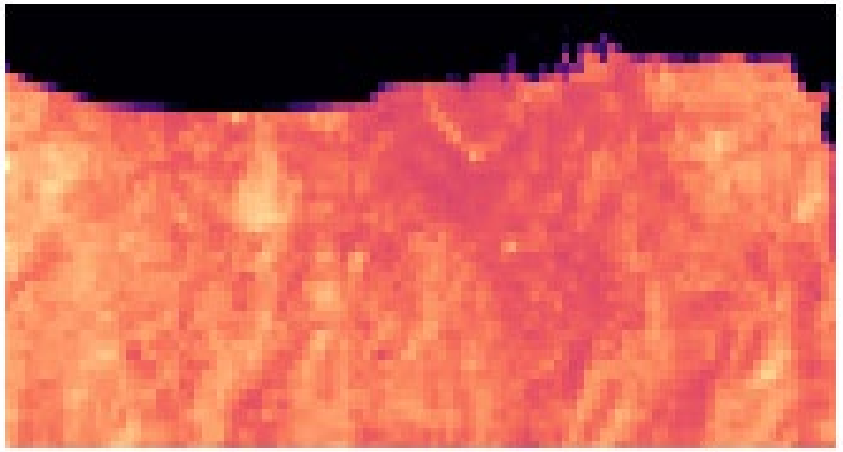


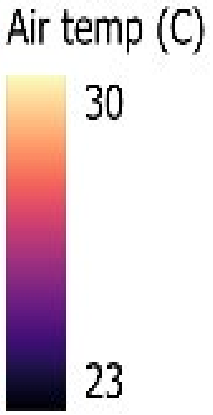
Athens, 18/8/2025 23:44

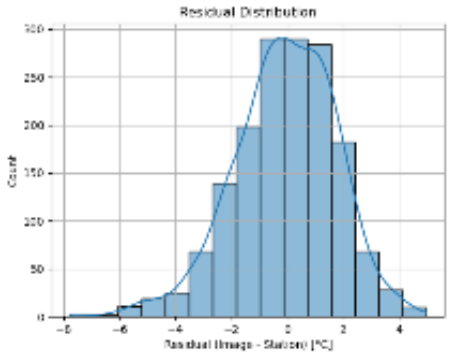


Heraklion, 9/10/2025 12:57









Potential Collaborations with Space-Crete: Combine AI with Physical Modelling

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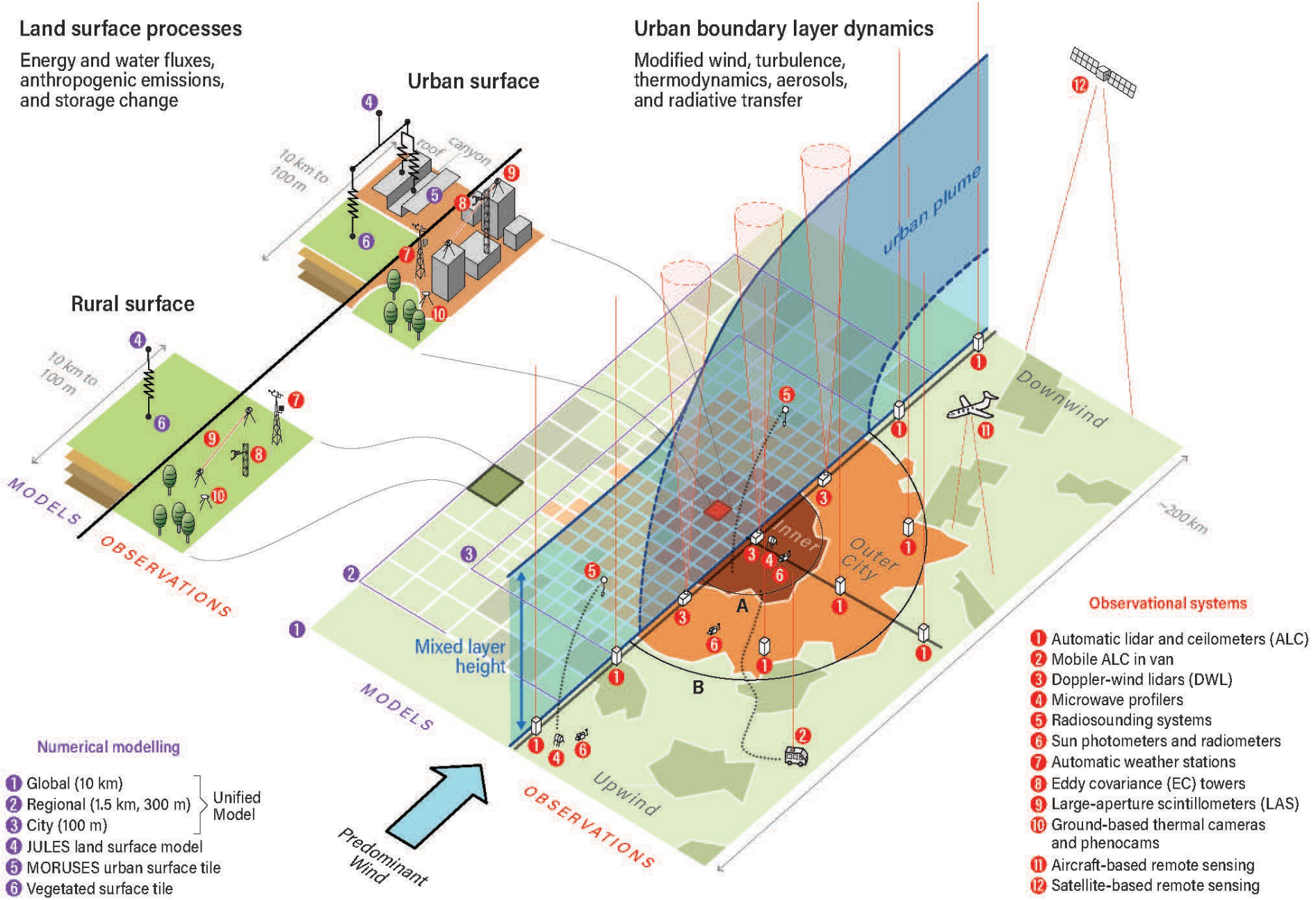
Dimitris Tsirantonakis



Manolis Panagiotakis



Konstantinos Politakos

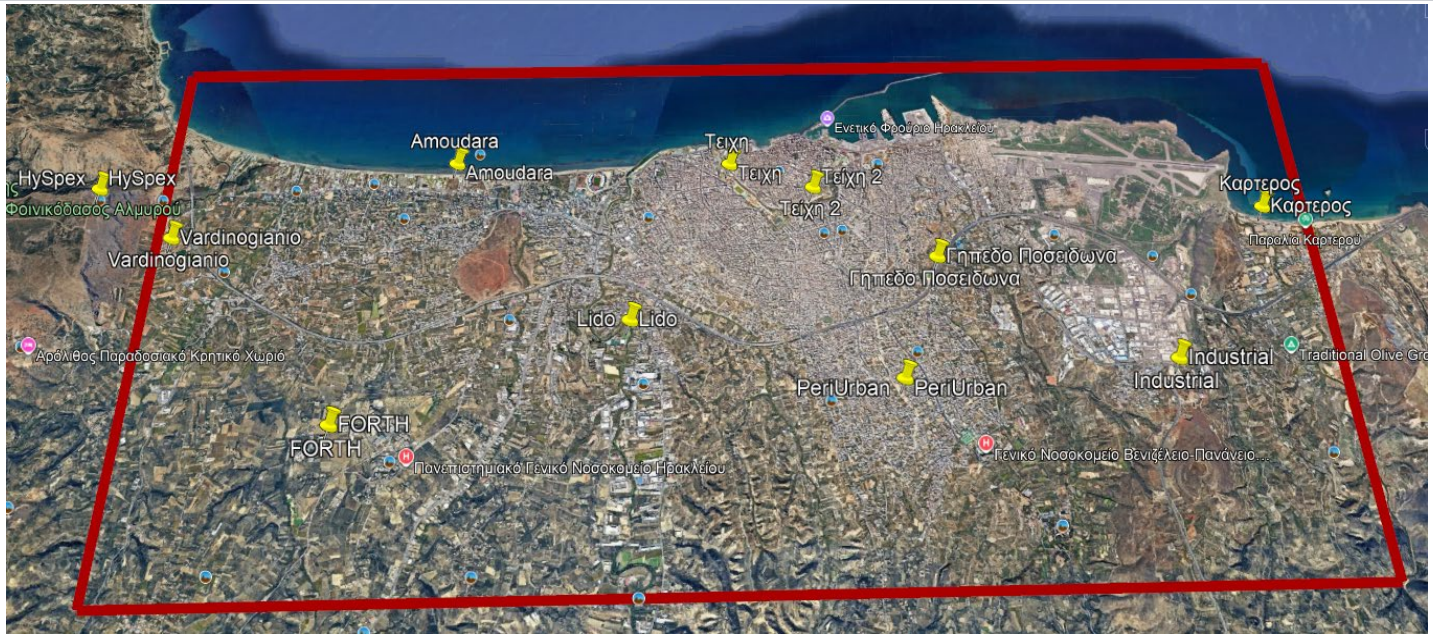


Fenner, D., et al. 2024. Bulletin of the American Meteorological Society, 105, E1929–E1961

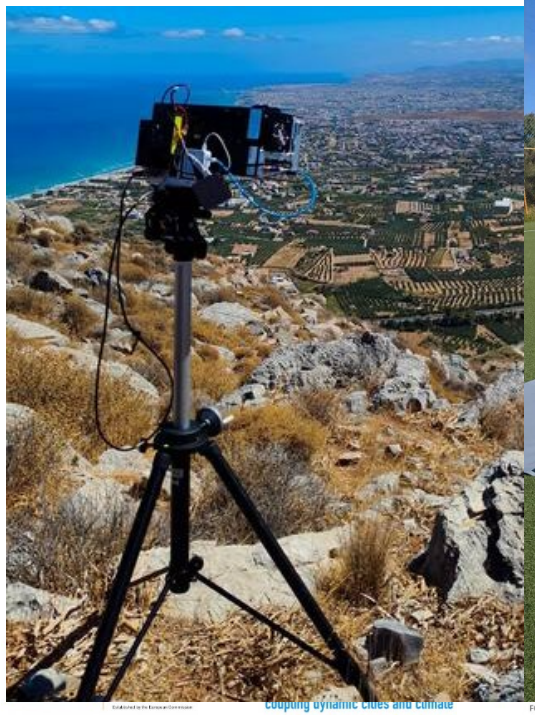
Heraklion Supersite: 2026 - 2027 *urbisphere* campaign

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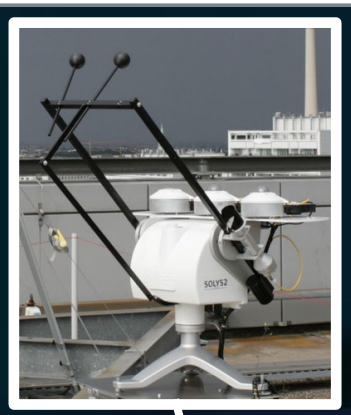


Heraklion Supersite: 2026 - 2027 *urbisphere* campaign

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DWL

ALC

ALC

ALC

0 2 4 6 km

Heraklion Supersite: 2026 - 2027 *urbisphere* campaign

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Port

Historic Center

Airport

Asklipeion

Venetian Walls

Industrial Area

Fire Staion

FORTH

UoC Physics





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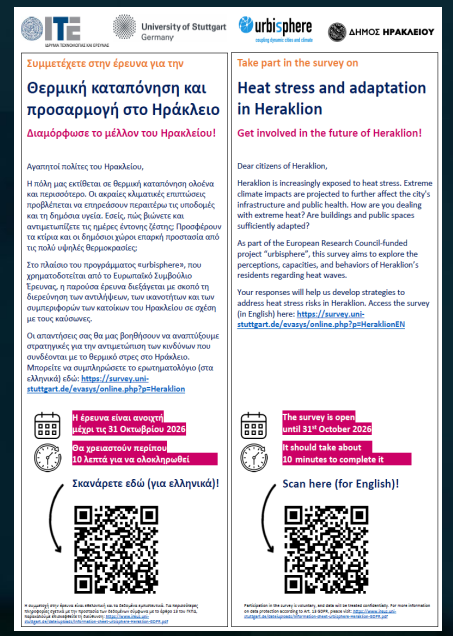
Heraklion Supersite: 2026 - 2027 *urbisphere* campaign

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HELAKK
HEMPEN
HEBIOM
HEGAZI
HEKOMA
HEMESA
HEMAFO
HEFORT
HEKALL
HEAMFI
HEKNOS
HEGOUR
HEMARA
HESKAL
HEAGIR
HEVASI
HEVOUT
HEGIOU

0





Thank you!

Nektarios Chrysoulakis

FORTH

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http://rslab.gr