# REQUEST FOR A SPECIAL PROJECT 2026–2028


**MEMBER STATE:** Italy

**Principal Investigator[1]:** Andrea Zonato (NKAZ)

**Affiliation:** CIMA Research Foundation

**Address:** Via Magliotto 2, 17100, Savona

**Other researchers:** Massimo Milelli (MCY), Luca Monaco (ITA3494)


**Project Title:** GLIDE-SOL: Scalable urban thermal comfort assessment for Italian and European cities

To make changes to an existing project please submit an amended version of the original form.)

| | | |
|---|---|---|
| If this is a continuation of an existing project, please state the computer project account assigned previously. | **SP** ………….. | |
| Starting year: (A project can have a duration of up to 3 years, agreed at the beginning of the project.) | 2026 | |
| Would you accept support for 1 year only, if necessary? | YES X | NO ☐ |

| **Computer resources required for project year:** | | **2026** | **2027** | **2028** |
|---|---|---|---|---|
| High Performance Computing Facility | [SBU] | | | |
| Accumulated data storage (total archive volume)[2] | [GB] | | | |

| **EWC resources required for project year:** | | **2026** | **2027** | **2028** |
|---|---|---|---|---|
| Number of vCPUs | [#] | 16 | 16 | 16 |
| Total memory | [GB] | 256 | 256 | 256 |

[1] The Principal Investigator will act as contact person for this Special Project and, in particular, will be asked to register the project, provide annual progress reports of the project's activities, etc.
[2] These figures refer to data archived in ECFS and MARS. If e.g. you archive x GB in year one and y GB in year two and don't delete anything you need to request x + y GB for the second project year etc.
[3]The number of vGPU is referred to the equivalent number of virtualized vGPUs with 8GB memory.

| | | | | |
|---|---|---|---|---|
| Storage | [GB] | 100 | 100 | 100 |
| Number of vGPUs[3] | [#] | 4 | 4 | 4 |

*Continue overleaf.*

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## Extended abstract

*All Special Project requests should provide an abstract/project description including a scientific plan, a justification of the computer resources requested and the technical characteristics of the code to be used. The completed form should be submitted/uploaded at https://www.ecmwf.int/en/research/special-projects/special-project-application/special-project-request-submission.*

*Following submission by the relevant Member State the Special Project requests will be published on the ECMWF website and evaluated by ECMWF and its Scientific Advisory Committee. The requests are evaluated based on their scientific and technical quality, and the justification of the resources requested. Previous Special Project reports and the use of ECMWF software and data infrastructure will also be considered in the evaluation process.*

*Requests exceeding 10,000,000 SBU should be more detailed (3-5 pages).*

This Special Project aims to deploy and further develop the GLIDE-SOL framework to estimate outdoor thermal comfort across Italian and European cities in a consistent, scalable, and reproducible manner. GLIDE-SOL is a GPU-accelerated, fully scripted workflow that operationalizes the SOLWEIG radiative model to compute mean radiant temperature (Tmrt) and derived bioclimatic indices such as UTCI. The project targets both retrospective climatological analyses and near-operational applications, supporting climate adaptation planning, heat-risk assessment, and inter-city comparison.
The scientific objective is to quantify spatial and temporal patterns of human thermal comfort at meter-scale resolution across diverse urban morphologies and climates, focusing on Italian metropolitan areas and selected European cities. By relying on globally available datasets for urban morphology, vegetation, land cover, terrain, and meteorological forcing, the workflow ensures methodological consistency and transferability across regions.
GLIDE-SOL builds upon the SOLWEIG model (Lindberg et al., 2008) and integrates recent advances in urban climate modelling, including morphology-dependent wind attenuation and diagnostic representations of the urban heat island. GPU acceleration and explicit domain tiling enable simulations over entire cities at 1–5 m resolution and multi-year periods with computational costs compatible with operational HPC environments.

**Scientific Plan**
The project will conduct coordinated simulations for multiple cities, producing hourly fields of Tmrt, air temperature, wind speed, and UTCI. Analyses will address: (i) intra-urban variability of thermal stress; (ii) sensitivity to urban form and vegetation; (iii) comparison across climatic regions; and (iv) implications for heat-risk metrics and adaptation strategies.

**Technical Characteristics of the Codes**
The core of the workflow is based on the SOLWEIG radiative transfer and energy balance model, rewritten within a Python-based, GPU-enabled execution framework. Radiative geometry, shadow casting, and UTCI calculations are executed on GPUs, while preprocessing and I/O are handled on

CPUs. The code supports large domains through automatic tiling and is designed for reproducibility and portability.

**Computer Resources**

The project requires access to high-performance computing resources with GPU acceleration. Estimated annual usage is on the order of 500000 SBU, depending on the number of cities, simulation years, and spatial resolution. Data storage requirements remain moderate due to compressed outputs.

**References**

1. Lindberg, F., Holmer, B., & Thorsson, S. (2008). SOLWEIG 1.0 – Modelling spatial variations of 3D radiant fluxes and mean radiant temperature in complex urban settings. International Journal of Biometeorology.
2. Thorsson, S., Lindberg, F., & Grimmond, C. S. B. (2007). The influence of urban geometry on mean radiant temperature.
3. Jendritzky, G., et al. (2012). UTCI—Why another thermal index? International Journal of Biometeorology.
4. Theeuwes, N. E., et al. (2017). A diagnostic equation for the daily maximum urban heat island effect.