

Multi-decadal thermal remote sensing archives as a resource for global-scale mapping of permafrost change

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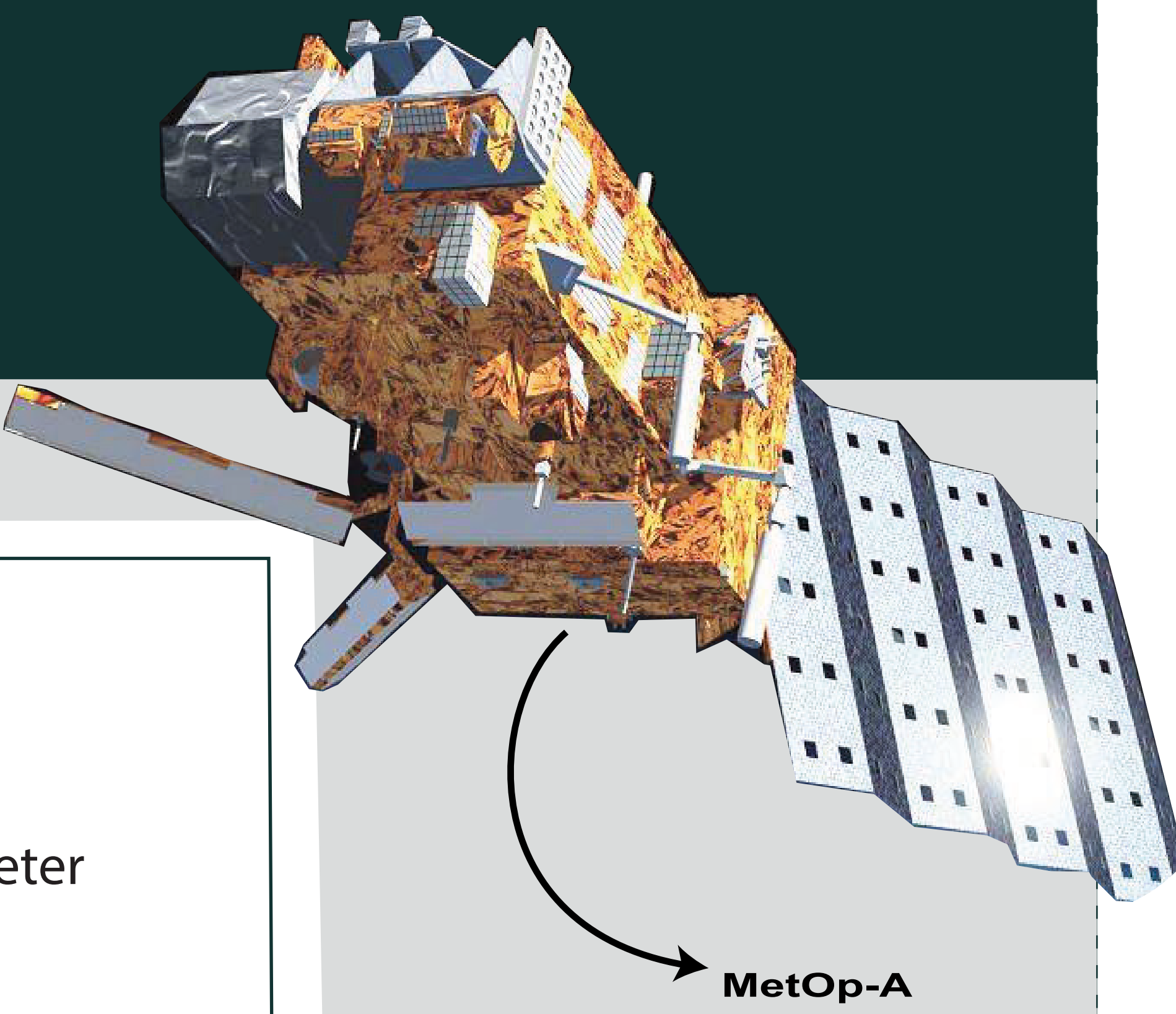
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MOTIVATION

- Land surface temperature (LST) is a key input for permafrost models [1].
- The most frequently used LST datasets are based on Moderate Resolution Imaging Spectro-radiometer (MODIS) at 1km spatial resolution. MODIS LST products are only available from 2000 onwards [2].
- A new LST dataset for the Pan-Arctic region has been generated from AVHRR GAC data (1981-2023). The native AVHRR LST product is spatially enhanced to reach a spatial resolution of 1km. To do so, guided anisotropic diffusion combined to a deep learning framework is applied to the Pan-Arctic LST dataset [3].



DATA AND METHODS

DATA

LST

Enhanced pan-Arctic AVHRR LST dataset [3]

- 1981-2023
- 0.01° (~1km spatial resolution) grid
- Twice-daily (day and night for each satellite)
- Including cloud mask, overpass time and angles

Auxiliary

- ESA CCI land cover 2015
- ERA5 air temperature (1977-2021)
- Ground stratigraphies
- Digital elevation model
- Heat flux anomalies

Permafrost modelling

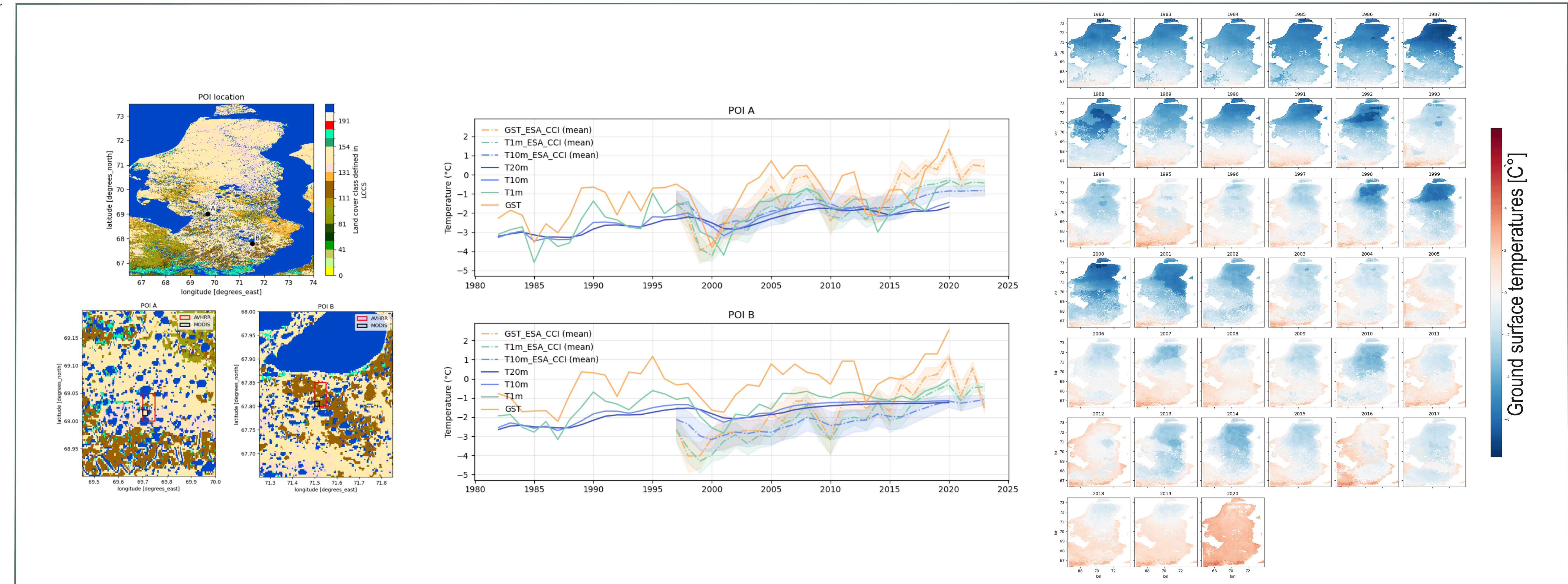
CryoGrid model [4]

1. Forcing data

2. Model outputs

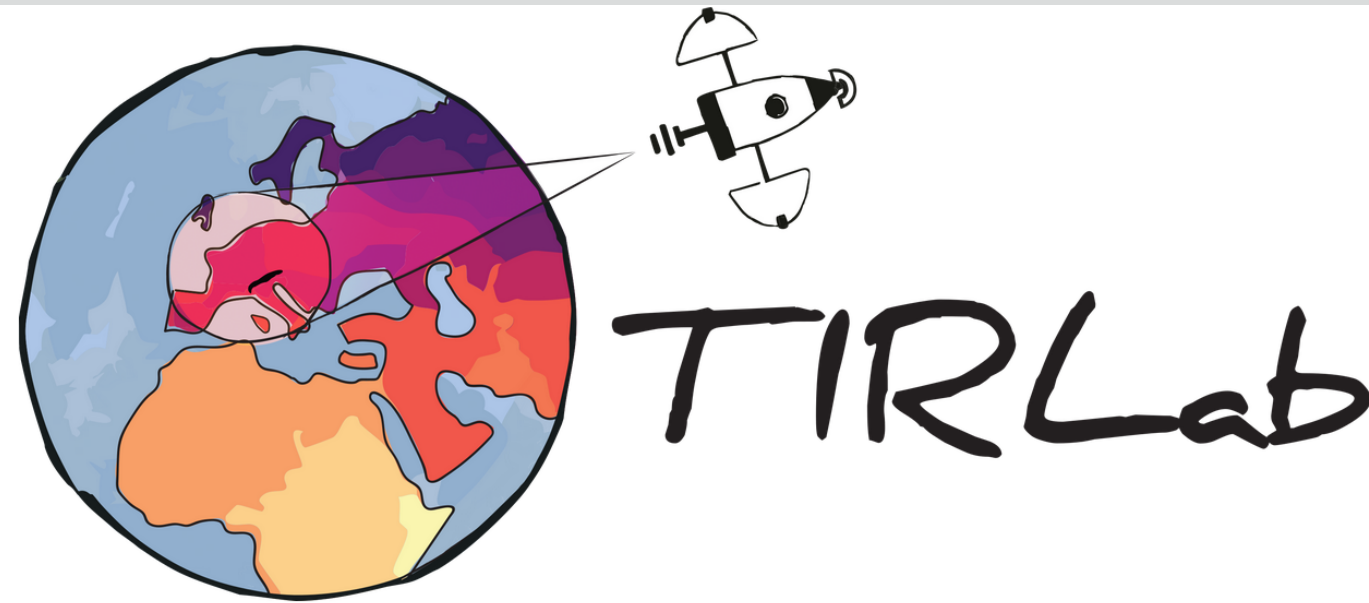
- Ground temperatures & Active layer thickness
- Permafrost extent

RESULTS



REFERENCES

[1] Obu, J. et al. (2019), doi:10.1016/j.earscirev.2019.04.023
[2] ESA CCI Permafrost, <https://climate.esa.int/en/projects/permafrost/>
[3] Dupuis, S. et al. (2025) [preprint], doi: <https://doi.org/10.48550/arXiv.2511.17134>
[4] Westermann, S. et al. (2023), <https://doi.org/10.5194/gmd-16-2607-2023>



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