GENHACK CHALLENGE: URBAN HEAT ISLAND (UHI) ANALYSIS

Project Goal
The goal of this period is to explore the provided data sources (ERA5, NDVI and ground stations).

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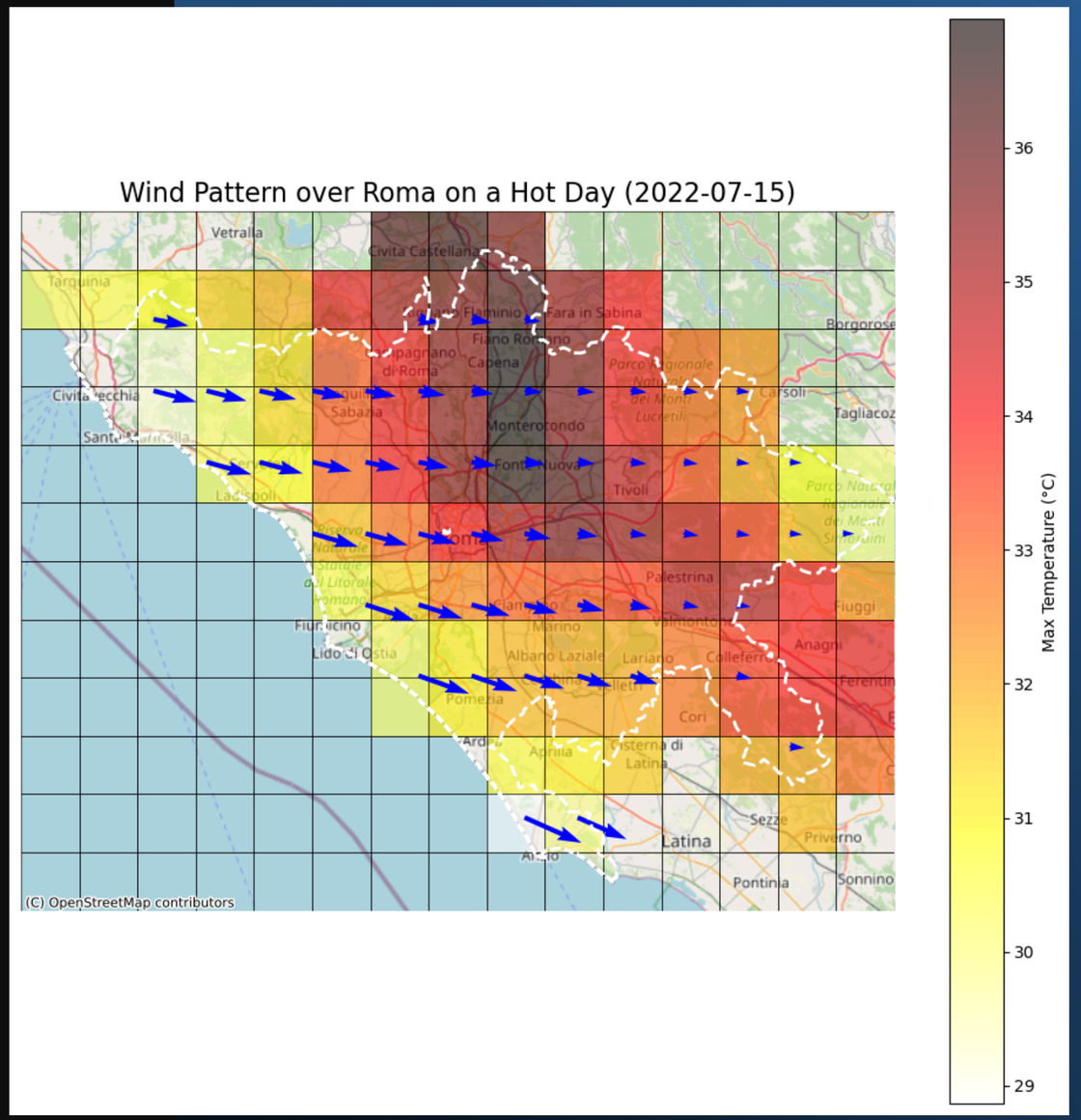
METHEOROLIGICAL DATA

Source: ERA5-Land
Format: NetCDF(.nc) with 1 file per year
Spatial Resolution: 9km x 9km grid
Temporal Resolution: Daily data

Four Key Variables:

- Daily maximum air temperature at 2m above ground (Kelvin).
- Average daily precipitation (m).
- Daily mean of the U-component of wind (East-West) at 10m (m/s).
- Daily mean of the V-component of wind (North-South) at 10m (m/s).



ADMINISTRATIVE BOUNDARIES (GADM)

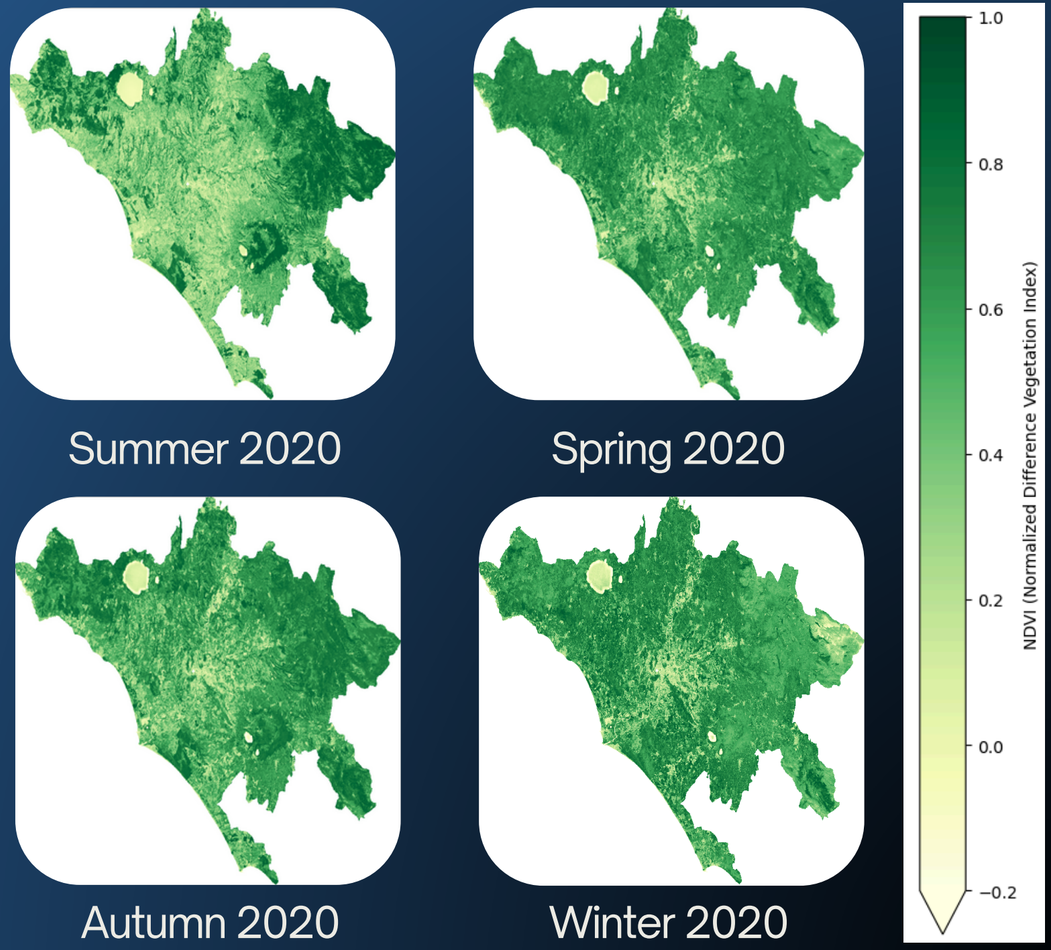
Geographical shapes (polygons) of administrative regions across the European continent. Define the boundaries of countries and their internal division (state, provinces, regions and counties)

Format: GeoPackage (.gpkg)
Type: Vector Data (Polygons)

Level 0: country (*Italy*), tot. 54.
Level 1: Region/State (*Lazio)*, tot. 805.
Level 2: Province (*Rome*), tot. 10168
Level 3: Municipality (*Rome*), tot. 29553.
Level 4: Borough (*Municipio 1*), tot. 38343.
Level 5: Urban Zone (*Colosseo*), tot. 34086.

VEGETATION (SENTINEL-2 NDVI)

- Format: GeoTIFF (.tif)
- Spatial Resolution: 80m x 80m grid
- Temporal Resolution: Quarterly
- Normalized Difference Vegetation Index (NDVI) where NDVI = (NIR - Red) / (NIR + Red)



NDVI range from +1 to -1

- Close to +1: healthy vegetation, dense forest (highest density of green leaves)
- Around 0.2 to 0.4: sparse vegetation or crops in early growth stages.
- Around -0.1 to 0.1: barren areas of rock, sand, or artificial urban surfaces.
- Around -1: water bodies like lakes or oceans or clouds.

SENTINEL-3 & ECAD- WEATHER STATION

We combine two datasets to correlate seasonal vegetation with daily temperature.

Dataset 1: Sentinel-3 NDVI (The "Where")

What it is: Gridded satellite data that quantifies green vegetation density across Europe.

Strengths: Provides complete, "wall-to-wall" spatial coverage, giving us the broad environmental context.

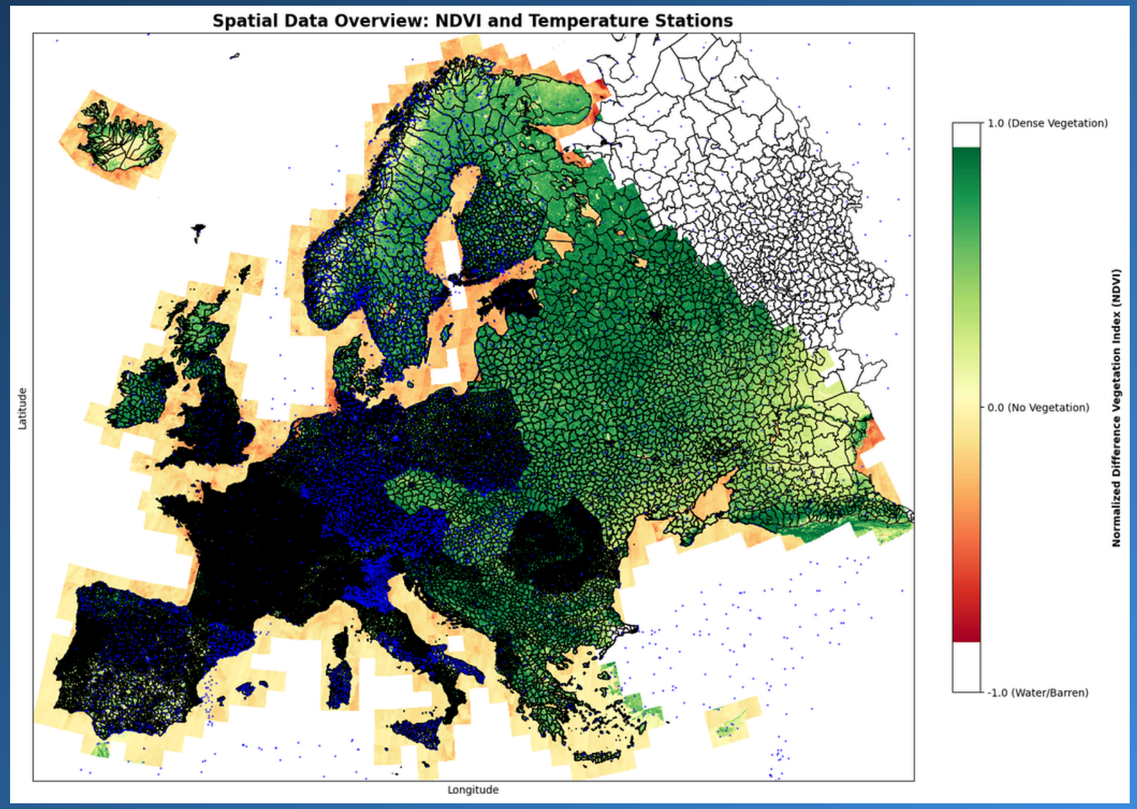
Limitations: Lower temporal resolution (one data file per quarter).

Dataset 2: ECA&D Temperature (The "When")

What it is: Daily maximum temperature records from 8,568 in-situ weather stations.

Strengths: Provides highly accurate, high-frequency (daily) measurements at specific locations.

Limitations: Spatially sparse; only tells us what's happening at the point of measurement.



Source: ECA_blend_tx
Format: .txt
Temporal Resolution: Daily data