EO4GEO Intelligent Earth Observation Summer School Report

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Introduction:

EO4GEO summer school was organized by the University of Salzburg and UNEP/GRID-Warsaw Centre from 08 June to 07 July 2021. The central idea of the summer school was to educate about the advancements in artificial intelligence in EO*GI sector. The summer school addressed the recent advancements in artificial intelligence in EO*GI comprising topics such as analysis-ready data, data assimilation, machine learning, hybrid AI, data quality and reproducibility.

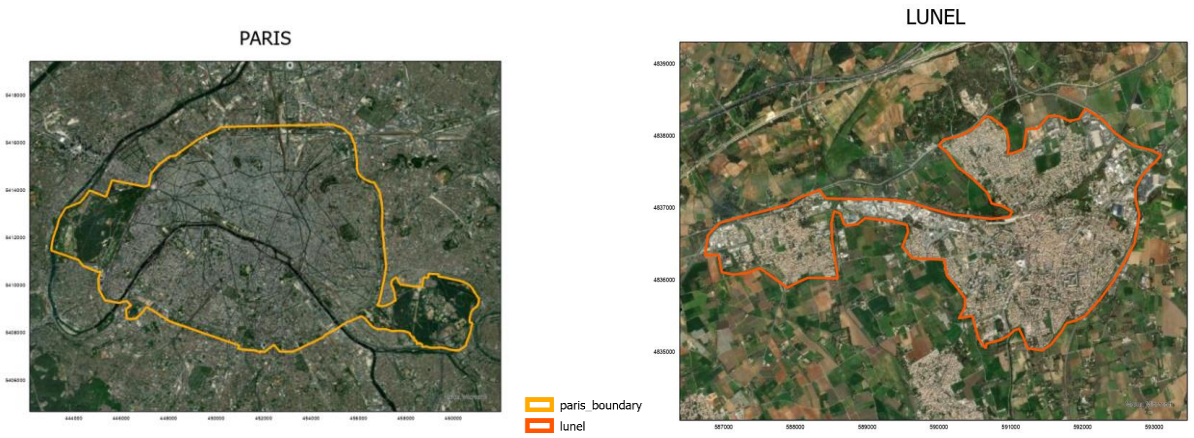
Conceptual Design and Learning outcomes:

The summer school was distributed into three phases in Phase 1 we were taught about different application cases of EO*GI, we made groups and choose a use case for the group projects. During Phase2 concepts and tools like Terrascope, Jupyter notebooks to create solutions for use cases. In Phase3 solutions to the use cases were developed and presented. The following were the learning outcomes of the summer school:

- We learnt the Project development cycle of EO*GI project from data acquisition to developing solution.
- Introduction to new tools Terrascope
- Key concepts of the artificial intelligence applications for earth observation
- Distributed group work , defining objectives and working towards a common goal

Final Project: Assessing Urban Heat Islands-2019 France

In late June and late July 2019 there were two temporally distinct European heat waves, which set all-time high temperature records in Belgium, France, Germany, Luxembourg, the Netherlands, and the United Kingdom. An urban heat island (UHI) is a city or metropolitan area that is much warmer than its surrounding rural areas. This is mostly attributed to urban areas consisting man-made surfaces such as paving and building material, causing a warming effect. For our project we decided to map urban heat islands utilizing satellite imagery and tools like Terrascope and Google earth engine. The objective of the project was to calculate and compare land surface temperature of Lune and Paris from Landsat8 using three different tools ArcGIS Pro, GEE and Terrascope.



EO Technique to investigate UHI

Urban Heat Island are majorly mapped and investigated using Earth Observation technique majorly Land Surface Temperature data from Landsat | Sentinel 3| MODIS or Impervious surface data from satellite imagery or both.

Methodology

Three different tools were used to calculate LST and their results and efficiency was compared.

ArcGIS Pro

Calculating LST in ArcGIS pro require different steps, a model was created to perform the steps in one run:

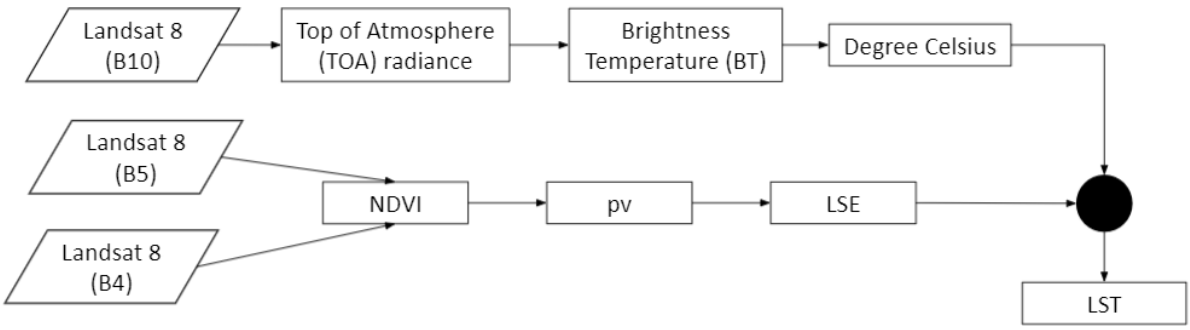
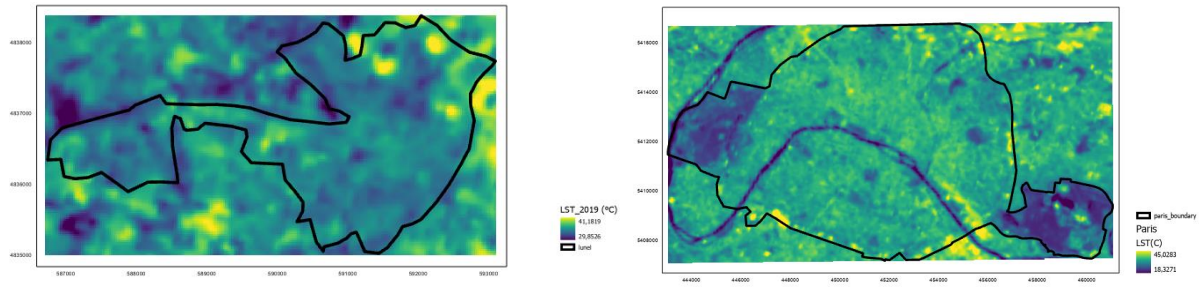


Figure 1 ArcGIS Pro LST calculation workflow

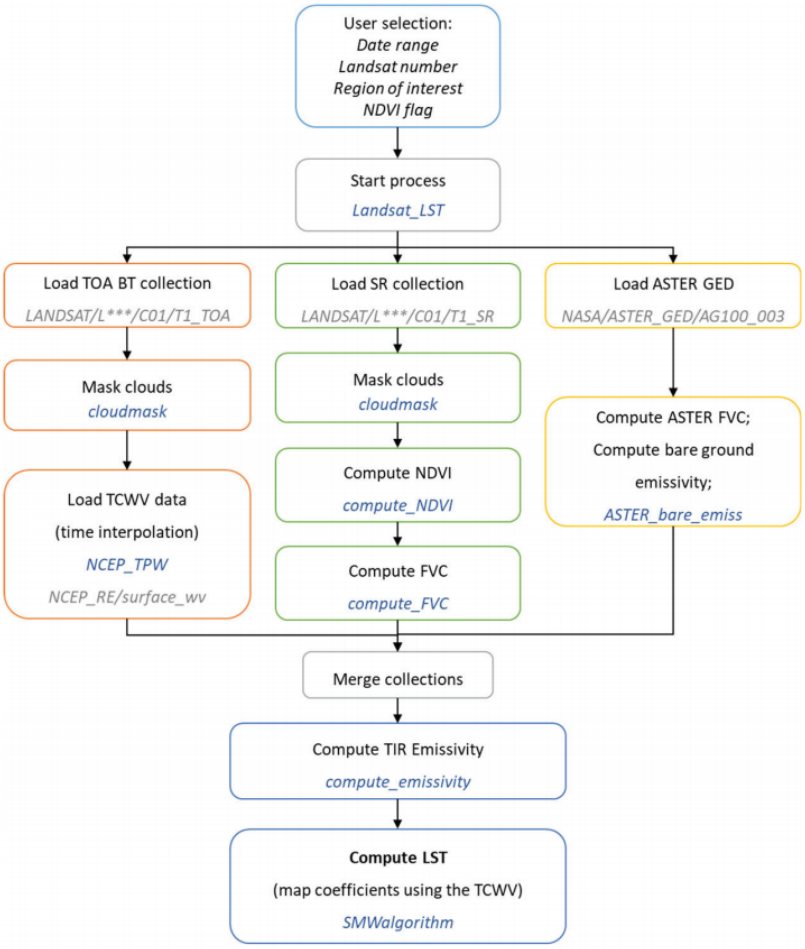


Lune and Paris LST output

The maximum temperature observed in Paris was more than Lune this is because > 80% of the land surface is covered by impermeable features like buildings, roads and artificially surfaced areas. Non-linear areas of vegetation and bare soil are exceptional.

Google Earth Engine

Calculating LST with Google earth engine is fairly easy as it doesn't requires you to download images and you can play with the time series of images.



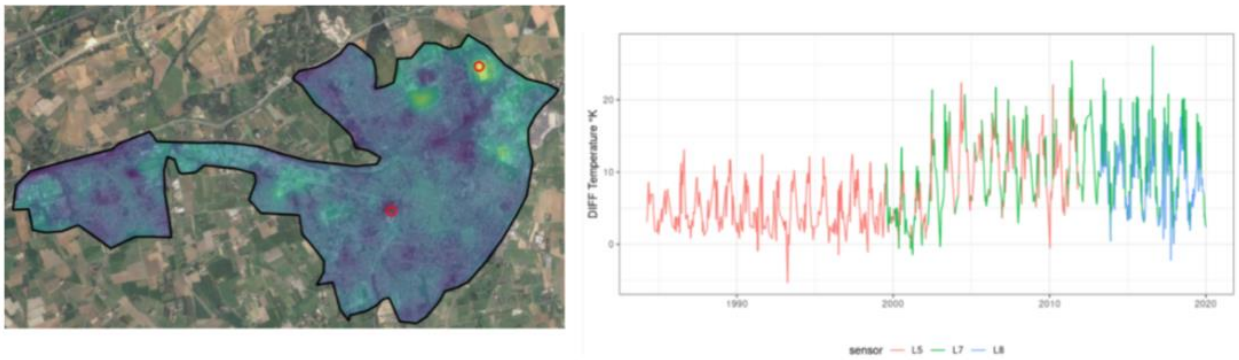


Figure 2 LST Time Series, Lune France

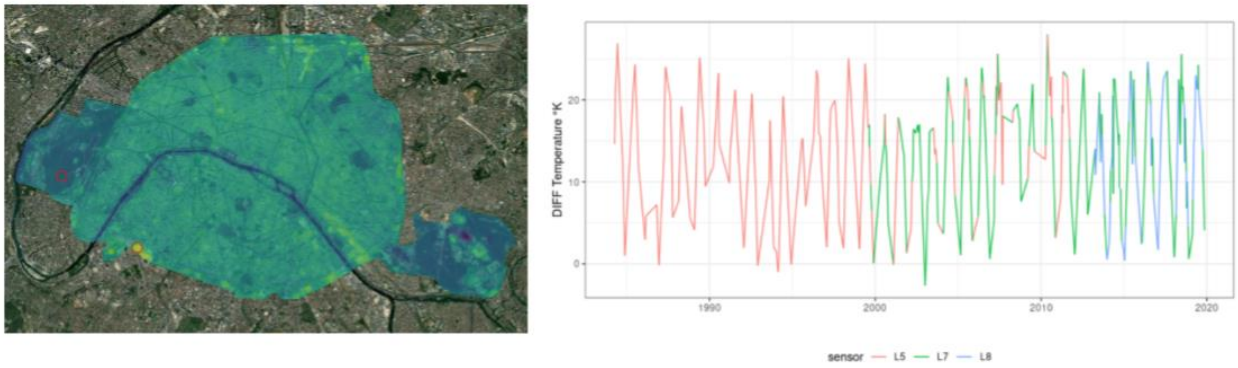
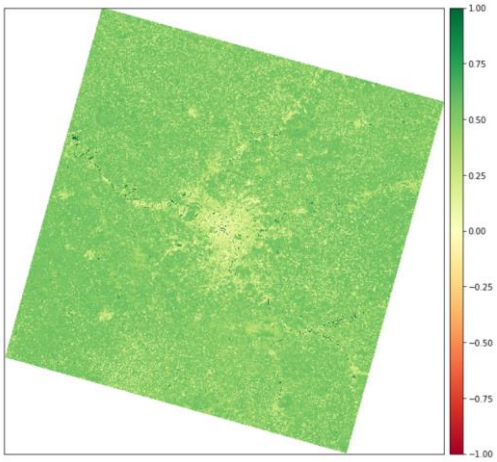


Figure 3 LST Time series Paris, France

Terrascope:

Terrascope is a platform like GEE, the difference lies in the programming language used by the two platforms the former uses JavaScript and the later uses Python. As it was a new platform, so we only managed to calculate NDVI in this platform.

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S_l8tirs_bands
```

```
['Public/LC08_L1TP_199026_20190602_20200828_02_T1_B10.TIF',
 'Public/LC08_L1TP_199026_20190602_20200828_02_T1_B4.TIF',
 'Public/LC08_L1TP_199026_20190602_20200828_02_T1_B5.TIF']
```

```
ndvi = es.normalized_diff(arr_st[2], arr_st[1])
ep.plot_bands(ndvi, cmap="RdYlGn", cols=1, vmin=-1, vmax=1, figsize=(10, 14))
plt.show()
```

Pros and cons of virtual mode

Pros:

- Virtual mode provides opportunity to get together from different corners of the world irrespective of distance
- No traveling and you can gain knowledge from the comfort of your home.
- You get to know ideas and challenges different countries are facing in the field of EO*GI

Cons

- Connectivity issues.
- It’s difficult to stay attentive for a longer period of time.
- The sessions are not that interactive, as people hesitate to ask questions
- I think the summer school should have included more practical, hands-on sessions.

Key challenges of group work

Main challenge of the group work was that most of the people were in different time-zones so it was difficult to get together at one time and this leads to less team engagement and conflicts.

Personal Technical achievement

Working on a EO*GI project from problem to the solution, defining the objectives, dividing them among the team and achieving them using new techniques , that I wasn’t familiar with before was the learning outcome and achievement for me.