Phase 4 Astro Pi Report

Name: **teamkvadda**

Chosen Theme: **Life on Earth**

Team members name: **Mats, Albert, Lasse, Pytor and Isak**

Organization name:

Country: **Norway**

Introduction

For our Astro Pi research project, we agreed to study the carbon dioxide emissions from where the ISS passes over the world. Initially, we wanted to search for more, but we figured that it would take a longer time than we had until phase 2 would start. For trying to figure out how we would begin to our project, some of us already started to visualize our data and answers. Seeing how to difference in temperature and oxygen can affect different landscapes, and how the plants can show us through NDVI just how much they work. Being able to see how much the plants and nature are to work to maintain a stable and consistent ecosphere-like of land is incredible.

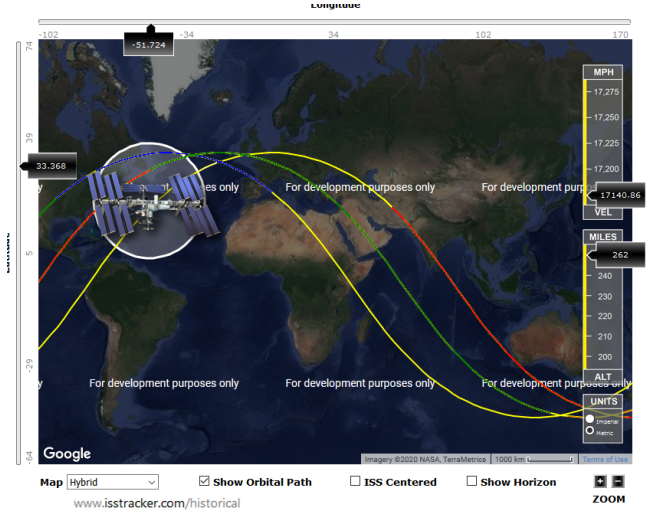
Method

The main code ho has run on the ISS, starts a loop and calls the functions in order and sends the data to the database. We calculate the NDVI value to use if the storage limit doesn't, then we would delete the images with the lowest score. After every loop run, we remove the old object, and we did this because we had a problem with RAM usage in the testing phase. We have multiple systems to handle errors in the code. For example, in the main python file, we run functions tree times if an error has happened.

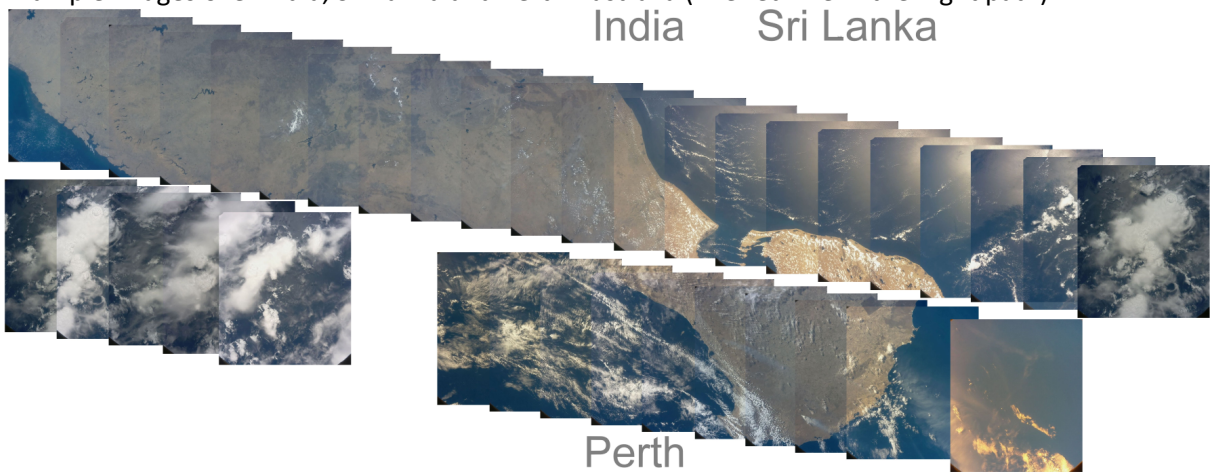
The post-processing code gets data from the web by using API and a web scraper. Some of the data we get are based on the information we have collected on the ISS. We collect the coordinate of where the images have been taken by using the time of the image and isstracker.com/historical after we have the coordinate we convert them to name of location, region and county. We also collect the co^2 value from a CSV file from globalcarbonatlas.org/en/CO2-emissions. All this information is stored in the SQLite database file, and the images are sorted in folders of what country they are. The python code is located on GitHub in this location https://github.com/MatsAndT/Astro-pi-kvadda

We created a discord server Team Kvadda Astro Pi to coordinate the team and there we shared all the links, images and discussions.

The ISS flight path



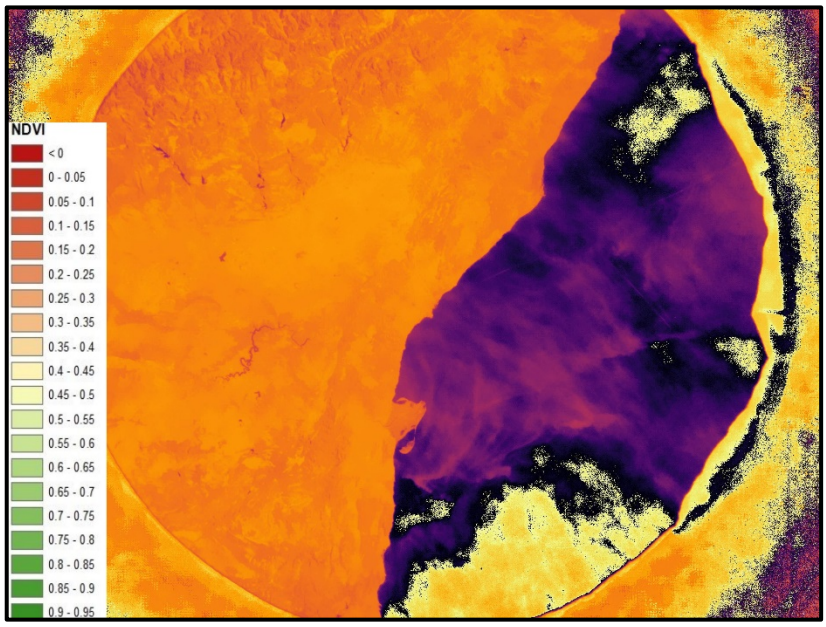
Example images over India, Sri Lanka and Perth Australia (The red line in the flight path)



Results

After the code had given us the visual images off the earth that we needed, our primary mission had started. By giving the photos an NDVI value, we could see the difference in the Vegetation the ISS had flown over.

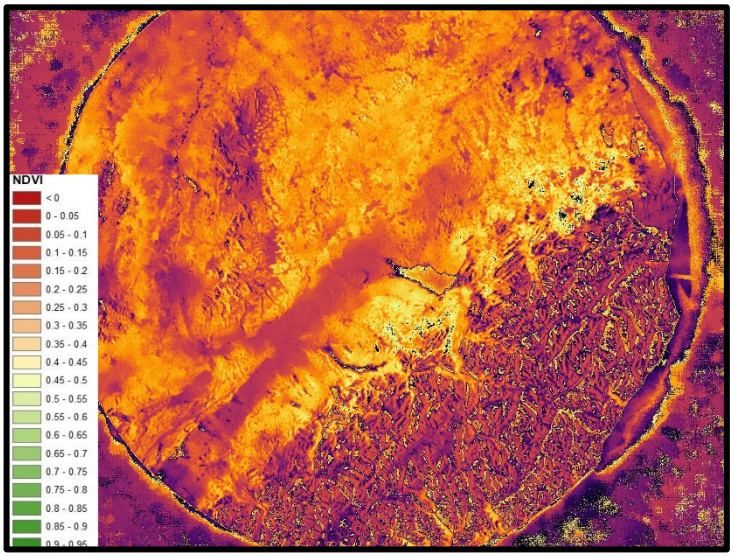
Here is an image of a part of Spain.



As you probably already noticed, is the intense orange-like colour.

We can tell that there is a considerable part of the land that has a value of under 0.2-0.15. That tells us that there is not much vegetation growing, quite the opposite. As you also see, is the sea. You can see how much of a difference the two parts make.

Now if we compare this to another country, say Germany



You clearly can spot a difference. It has more variation in the colour. The blue is snow for the mountains, but it seems that there is more of a lighter value, around 0.4 -> 0.35.

Unfortunately, there is not much vegetation in either of the images. Still, if you can visualize a grass field in Spain and then a grass field in Germany, you may understand that Germany will have a much greener and healthier grass field. Since Spain is much more to the south, the heat, the infrared and ultraviolet radiation is much higher, thus making the grass dry up faster, giving a more yellow/red-ish colour.

Even though Spain is more south than Germany, the red/yellow-ish colours have another reason to exist. The carbon dioxide emissions from the same region also are to blame for the lack of vegetation. Spain released around 268 Metric tons of carbon dioxide since the last check-in 2018. The added CO2 has helped the Infrared, and ultraviolet radiation to prolong much longer, thus heating the plants. Of course, the CO2 will spread around the world. You must take to mind that this was only Spain.

Conclusion

In conclusion, all the data and images we had received made our shoulder drop in relif by knowing the code had worked. But the data was still not quite as we had expected. The NDVI images did not quite make things easy, either. Considering that most of our NDVI images were of low plant life regions, with the rest being oceans, you could say that we did not quite have the best of luck at the timing. I suppose we had expected a more green/red images by looking at and comparing the other NDVI images from google with our own.

All in all, the python program worked like a charm, and the data received were at some point useful.

Sources

- http://www.globalcarbonatlas.org/en/CO2-emissions
- https://restcountries.eu/rest/v2/alpha/
- https://github.com/MatsAndT/Astro-pi-kvadda

Phase 2 report:

- https://docs.google.com/document/d/1HDaLV4qIq_1J3GtXyjIPPyLo7sYL50FGFFRwIJmSnII/edit

Image data from ISS

- https://esaeducation.wetransfer.com/downloads/3fd823bbcbf3af8415dc9c367e396b0820200513190229/422d22