Team Name: TheHappy.Pi

Chosen theme: Life on Earth

Team members' names: Dominik Lau, Jakub Dąbrowski

Organisation name: I Liceum Ogólnokształcące w Słupsku

Country: Poland

Introduction

The principal goal of our project was to analyse the amount of photosynthesis going on in various places all around the world. Aside from that, we wanted to see if underwater life is observable from altitude of 408 kilometers, because if so, that would be really useful. From the data we would get we'd expected to speculate why for example on picture A let's say in Kongo there is more photosynthesis going on than on Sahara, what causes that. We find it really interesting how many factors make an impact on the life that surrounds us and being able to observe that from space is all the more fascinating.

Method

Our python programme took photos with IR camera + blue filter. Over a half of these photos were pitch black and useless - they were taken during a "nighttime" that happened every 40 minutes. The rest of the photos we got back were quite good. After we got the photos we put them in infragram ndvi image processing so we'd be able to observe the chlorophyll concentration in leaves. Our assumption was based on the fact that green plants' cells re-emit solar radiation in near IR spectrum(they do so to maintain bigger efficiency of the entire photosynthesis process), that's why they appear really bright in our photos. It seems that the brighter the spots on the photos appear, the more photosynthesis going on here. Aside from the photos, we thought that the latitude and longitude would come in handy, so that we'd be even able to locate the places we took the photos of on the google maps/earth. We saved it along with the timestamps in the csv file, and labeled the photos with the same timestamps. Matching timestamps from photos to the ones in sheet was quite tedious, so next time we could put the coordinates on the photo.

Results

Here are some of our most important discoveries:

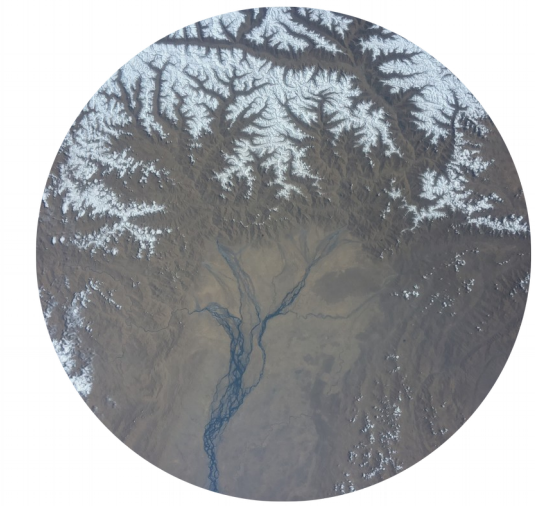
Figure 1 & 2:

- We are able to observe where the semi-evergreen forest is located - that

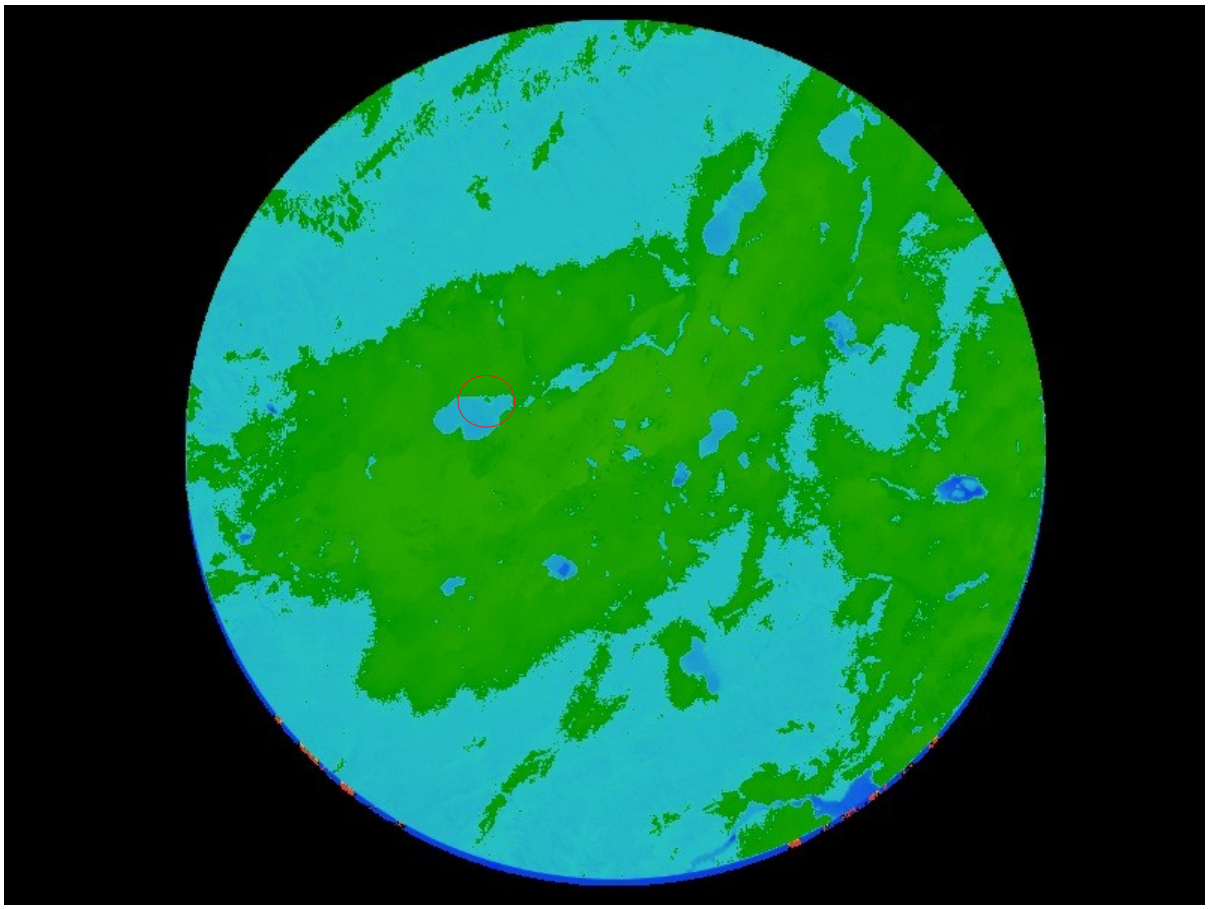
F 1: river Brahmaputra, eastern India

suits our expectations, the slightly greener parts, the stronger photosynthesis = more leafs, other types of plants.

- The amount of flora decreases with a really rapid growth in elevation(between the marked area there is almost 4 km difference in high).
- Water like the one in the river Brahmaputra has rather low reflectance ratio(albedo) in IR spectrum - it busts our initial theory.
- Simillarly to water, the snow located on the summits of mountains also has low albedo - it's blue after we put it through our filter.



F 2: before the filter

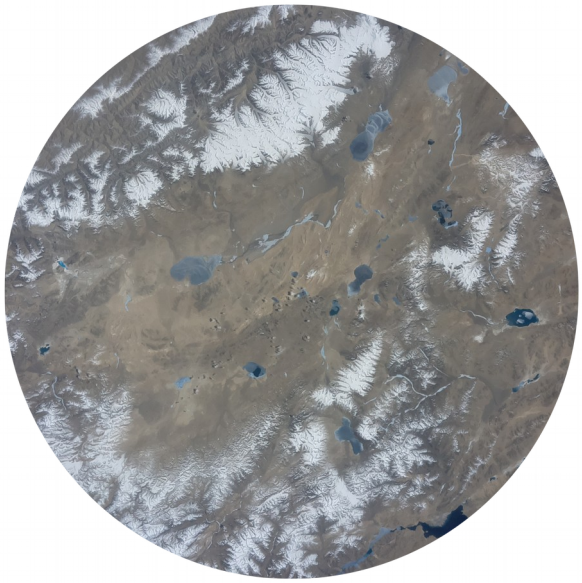


F 3: Aksai Chin - west of Tibetan Highlands

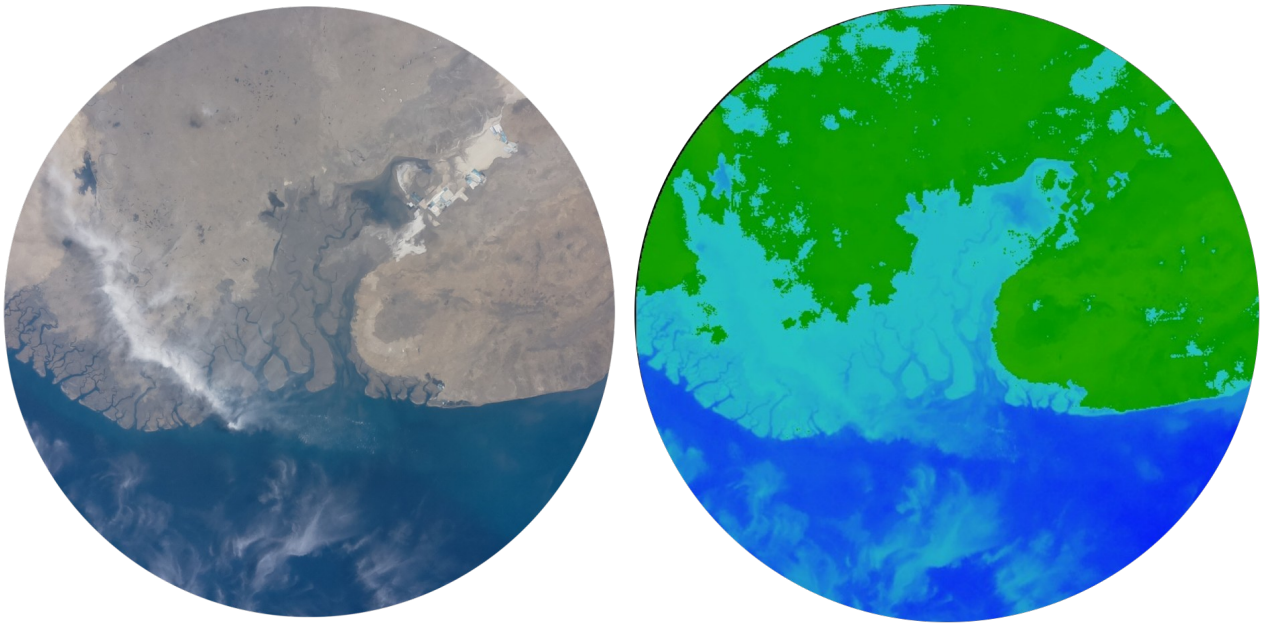
Figure 3 & 4:

- In place where lake is there are some spots of green by shore(marked red), it might be foam or sediment floating above the water that reflects light.

- The darker the blue on lake, the clearer the water is - the lighter parts of water might contain some sort of sand, floating chlorophyll or something that increases the albedo.
- Flat area of Tibetan Highlands, though it's located almost entirely above 5 km, is home to vast areas of green.



F 4: previous photo without NDVI filter

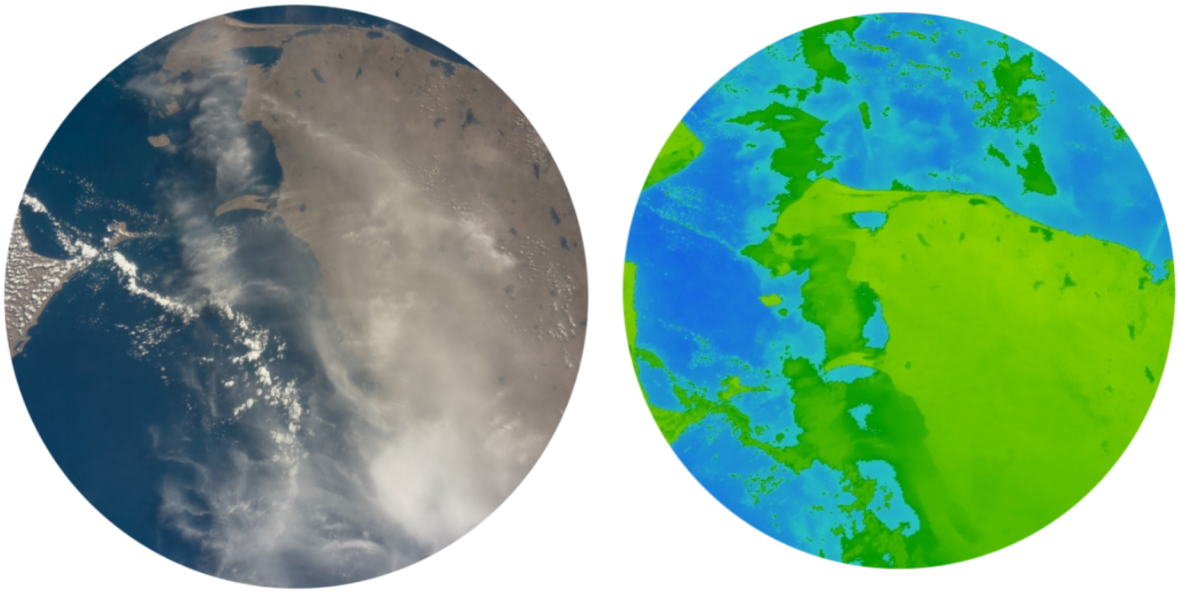


F 5: delta of river Indus, before and after

Figure 5:

- On these photos we captured sediments by the estuary. It's a swampy area with humid soil, hence the absence of flora.

- We can speculate, that whatever that sediment might be, it has rather low albedo (appears blue on filter), but it isn't as low as water's thats why we can easily distinguish where delta, where ocean and where regular land starts



$$F\ 6$$

- **Figure 6**: bigger clouds cause the filter to glitch out - in visible lights clouds appear to be transparent, but apparently they have high albedo, and for IR aren't.

Conclusion

The results were quite shocking for us - we didn't think that so much facts can be extracted about Earth from a camera located over 400 km above it's surface. We found out that with these types of photos (IR + nvdi) you can tell for example the value of albedo of things captured in IR. That fact we found particularly interesting, we concluded that reflactance of water, as well as snow's is really low in this spectrum. We have also seen that clouds completely demolish the value of photos - they reflect quite a lot of light in that spectrum. Clear water actually has no reflectance in that spectrum, so following this trail we can tell the clear water from the muddy one. Knowing the greener parts of the forrests, we also know where different type of plants or the luxuriant flora is located. In conclusion, with a mere few photos done with near ir camera we could acquire a ton of useful informations and learned a lot. The methods of analysing life on our planet aren't limited to the ground level. The factors that affect it's shape can be concluded hundreds of kilometers above everything that they concern.