

Satellite Data Access and Analysis Using Open Data Cube and Euro Data Cube

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Background

- Deimos Space UK is investigating how to access and analyse satellite imagery in a way that's straightforward.
- Currently, satellite data is accessed by downloading the images to the network storage, applying custom atmospheric corrections, then conducting analysis using software, such as QGIS or applying machine learning using Python libraries. This is time-consuming and uses a lot of computational resources
- Deimos Space UK are interested in two potential tools to solve this problem – Open Data Cube and Euro Data Cube.
- This internship was focused on exploring both of these software.

Open Data Cube

- The Open Data Cube (ODC) is an open source geospatial data management and analysis tool. It is a set of python libraries which depends on Python 3.5+, GDAL and PostgreSQL.
- The ODC is a data architecture solution, so to implement your own independent Open Data Cube, you need to load and index the data first
- The ODC has already been implemented by several countries, but the specific implementation investigated in this project was Digital Earth Australia (DEA).
- This is because they already indexed Landsat and Sentinel-2 data of the Australian continent in Analysis Ready Format, and they provided free access via the DEA Sandbox environment.

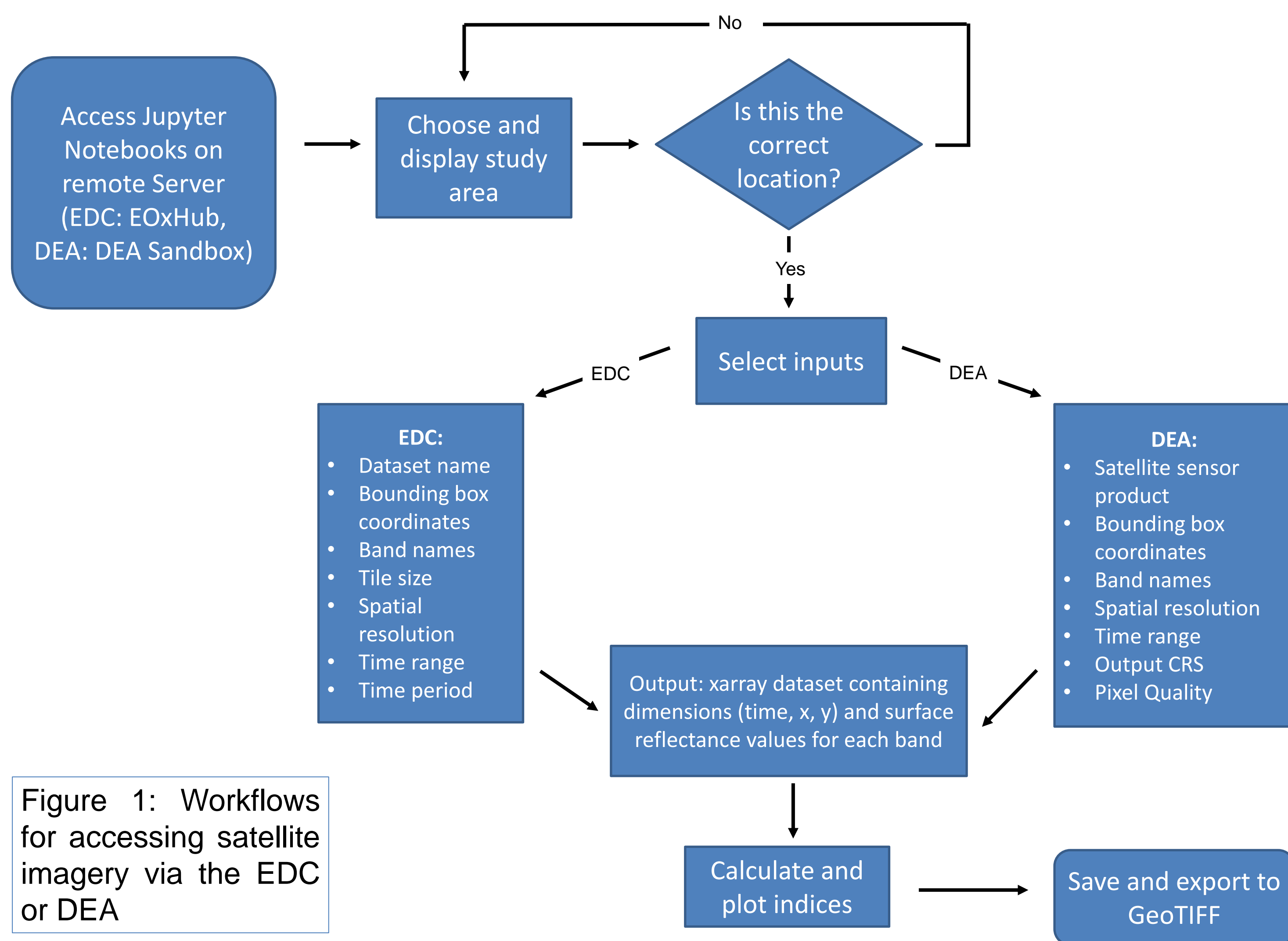


Figure 1: Workflows for accessing satellite imagery via the EDC or DEA

ODC - Digital Earth Australia

- The DEA have utilised the ODC to create a platform where users can access and analyse satellite imagery of Australia.
- Following a simple workflow (Figure 1), users can access satellite imagery for a specific location, time period and amount of cloud cover by setting input parameters.
- These parameters are used to load data from the DEA datacube database
- Users can then conduct time-series analysis, such as using the band surface reflectance values to calculate indices (Figure 2).
- The DEA have a range of useful data handling and plotting functions already available.

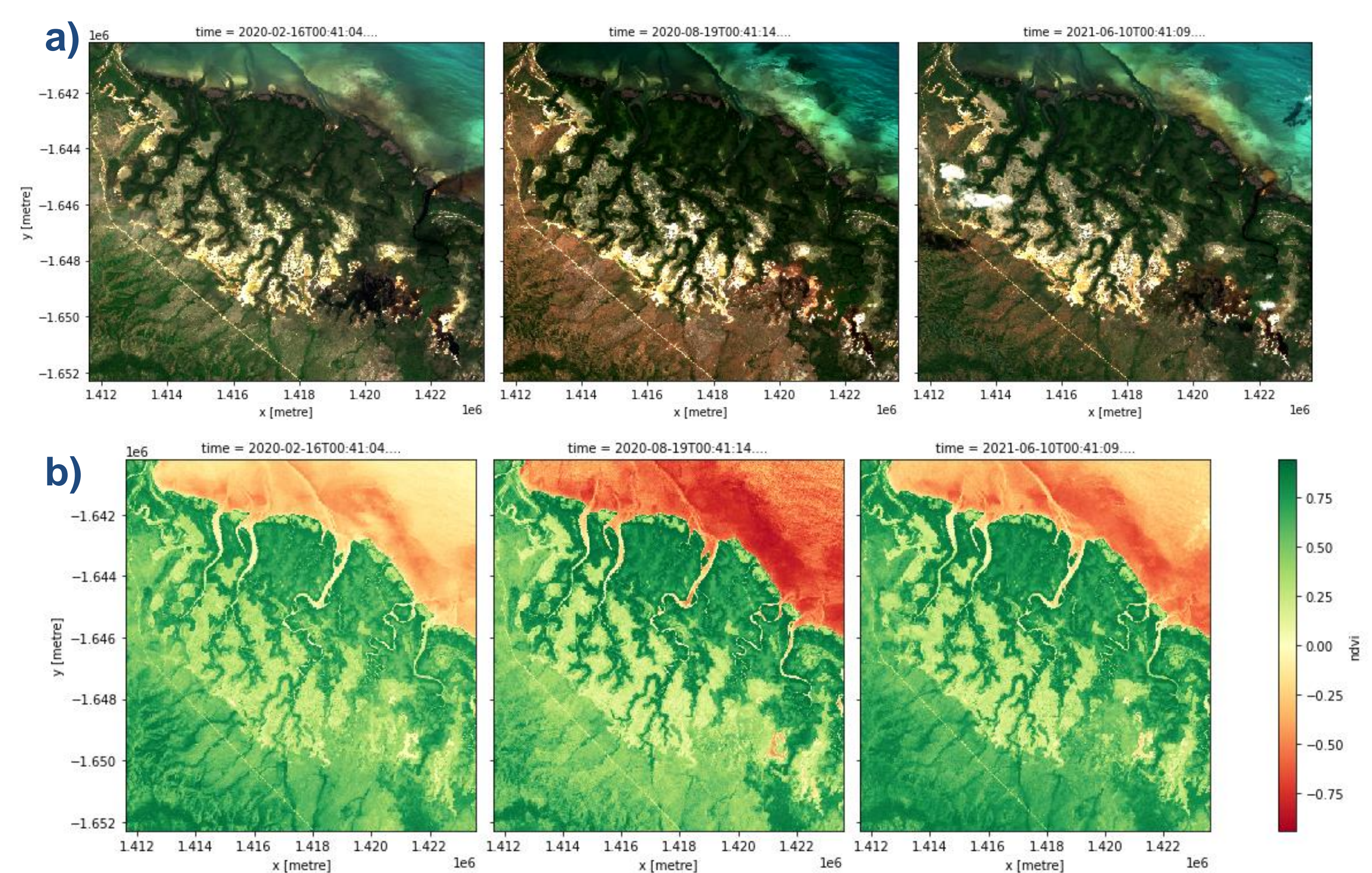


Figure 2: Example DEA Output. A) RGB plotted cloud-free images for three time steps of study area (the Australian coast) from 2020-21. b) NDVI calculated for these images

Euro Data Cube

- The Euro Data Cube (EDC) a combination of subscription-based services and processing tools brought together in one platform.
- The EDC allows users to access global archives of Analysis Ready Data (including Sentinel and Landsat) and easily set up processing workflows without installing software packages.
- Services utilised for on-the-fly data cube access and analysis:
 - EDC's EOxHub Workspace (which is a managed Jupyter Lab instance)
 - EDC Sentinel Hub API
 - xcube python library
- The satellite data is accessed by the Sentinel Hub API, and a datacube based on your specified parameters is created with xcube
- The output (an xarray dataset) can then be analysed in a similar way to the DEA's output; remote sensing indices can be calculated using the band surface reflectance values (e.g. Figure 3)

EDC Advantages

- Quick to set-up and get started
- On-the-fly satellite data access
- Analysis Ready Data (ARD) provided, so the burden of pre-processing and data preparation is reduced
- No need to download images directly to your local storage
- Can access only the sections of the image you are interested in
- Can analyse multiple images over a specified time period
- Working on a managed JupyterLab instance, which saves the user computational resources

Future Work

Due to the high availability of ARD data within its platform, the Euro Data Cube should be focussed on moving forwards and future work should further explore its capabilities. For example, there is the potential to do machine learning using the platform – this should be further investigated and tested.

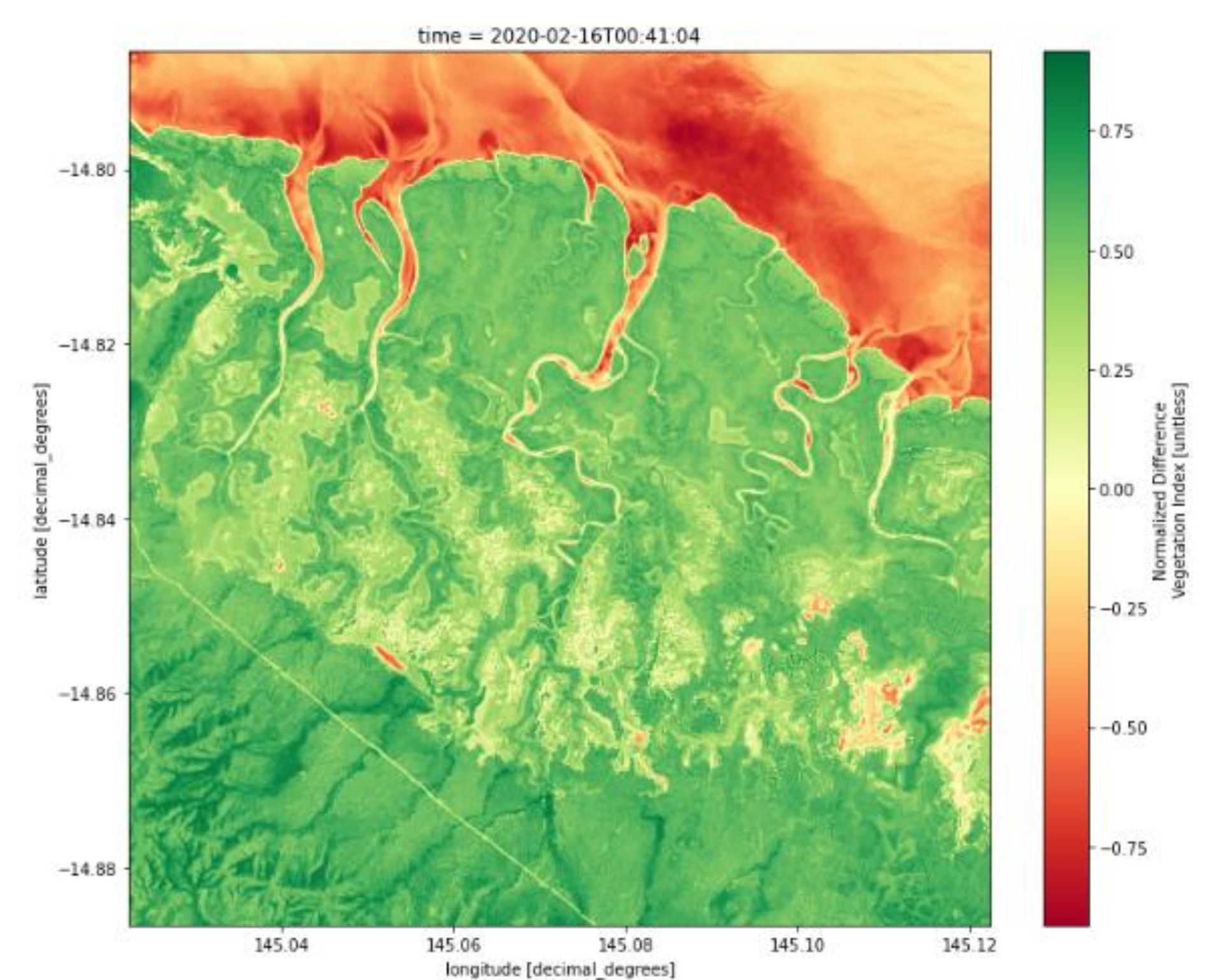


Figure 3: Example EDC Output. NDVI calculate for same geographical area as DEA example

Conclusions

- Both the Open Data Cube and Euro Data Cube have great potential as key tools for accessing and analysing satellite imagery in a hassle-free way.
- By specifying input parameters within Jupyter Notebooks, users can retrieve and plot satellite data over their desired location and time period. Users can also calculate and plot remote sensing indices..
- For Deimos Space, it seems that the Euro Data Cube is the better option to keep exploring, as there are many satellite datasets already available

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