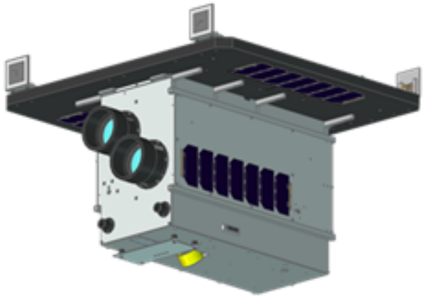
GOVERNMENT OF DUBAI

مركز محمد بن راشد للفضاء
MOHAMMED BIN RASHID SPACE CENTRE



The DMSAT-1 mission: primary instrument - Polarimeter characteristics and its earth observation applications

Alya AlMaazmi – Remote Sensing Applications Engineer

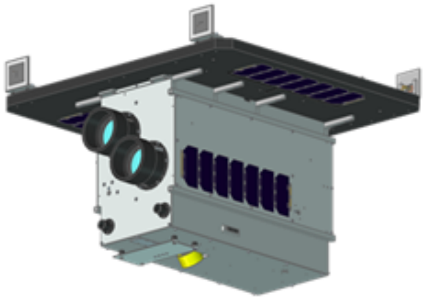
Mohammed Bin Rashid Space Center (MBRSC)

MOTIVATION

UAE DUSTY ATMOSPHERE

- Dust storms occur frequently in UAE, they most often hit during the summer and times of turbulent weather.
- Sandstorms typically contain silica crystals as well as viruses, bacteria, dust mites, fungi and even plant.
- Can cause vital problems linked to health, economy and environment.
- Space-based monitoring can supplement ground-based weather stations that are currently used for dust storm research.
- Map atmospheric aerosols, including their sources and transport, and study their influence within UAE.

DMSAT-1



Dubai Municipality Satellite

- Is a high-performance small microsatellite designed to perform multi-spectral multi-polarization observations in visual and near-infrared bands, in addition to shortwave spectrum, for aerosol and greenhouse gas monitoring.

01

Mission Objectives

End-users tells us of what they want and need.

02

Investigations

Set of Constituents to be retrieved and studied

03

Instruments

Instrument design to aid the investigation and fulfill mission objectives

Mission Objectives

Map the distribution of atmospheric aerosols concentration (PM2.5, PM10) in the troposphere over Dubai land surface.

Map greenhouse gases (CO_2, CH_4, H_2O) concentration (ppm) over Dubai

Investigations

Determine 2-D total column Aerosol Optical Depth (AOD) over Dubai urbanized areas at local noon.

Determine total column Aerosol Effective Radius (AER) of PM2.5 and PM10 over Dubai urbanized areas at local noon.

Determine total column abundance and radiances of CO_2, CH_4, H_2O over Dubai urbanized areas at local noon.

Instruments

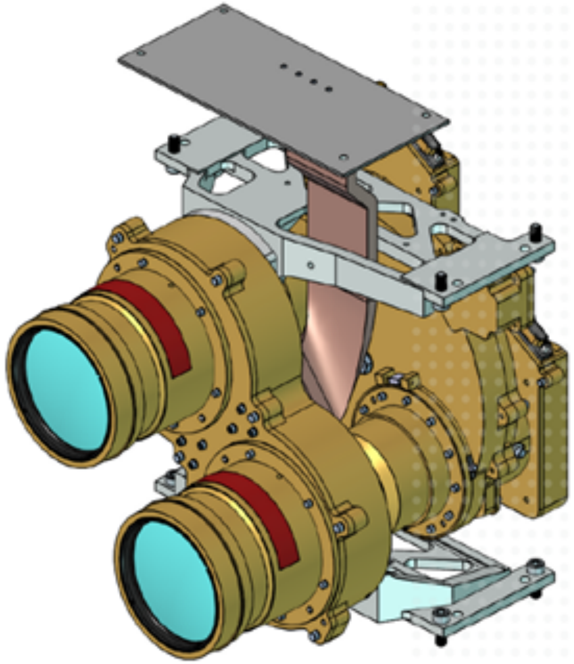
Multi Spectral – Multi polarized Imager (Polarimeter)

Shortwave spectrometer 1 (1215 – 2000nm)

Shortwave spectrometer 2 (1730 – 2400nm)

Instrument Design

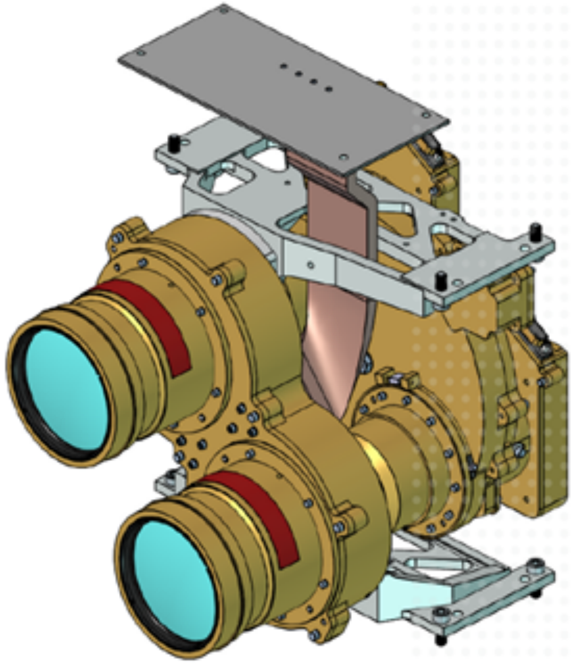
Polarimeter instrument



- High transitivity telescope with a focal length of 150 mm and focal-length-to-aperture ratio of 2.8.
- Filter wheel used to divide the incoming light into three bands: 480-500 nm, 660-680 nm, and 860-880 nm.
- A “p-s” polarizing beam splitter, generates two identical images at two different polarizations 0° and 90°
- Kodak CCD detector at the focal plane.

Instrument Design

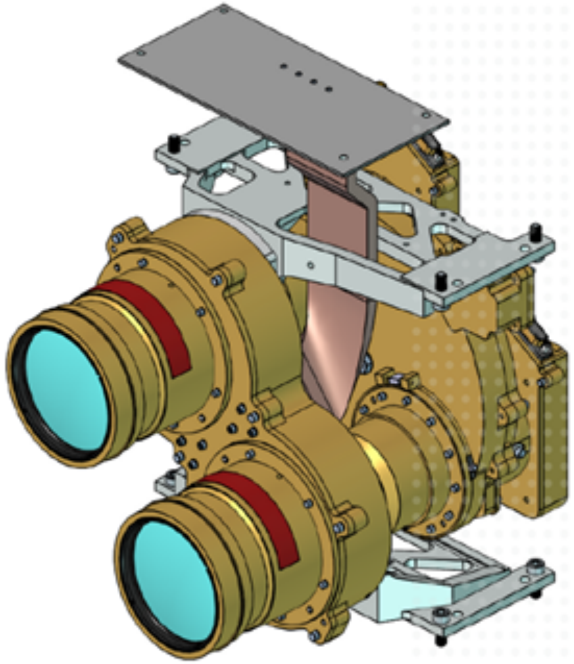
Spectral Bands and Polarization Measurements



- Chosen based on the mission's scientific requirement of retrieving aerosols properties.
- 3 polarized bands with central wavelengths 490, 670 and 870 nm.
- Each band has a polarization of 0° and 90°.
- The DMSAT-1 Polarimeter instrument is designed to measure the linearly polarized Earth-reflected radiance only.

Instrument Design

Geometry and spatial resolution

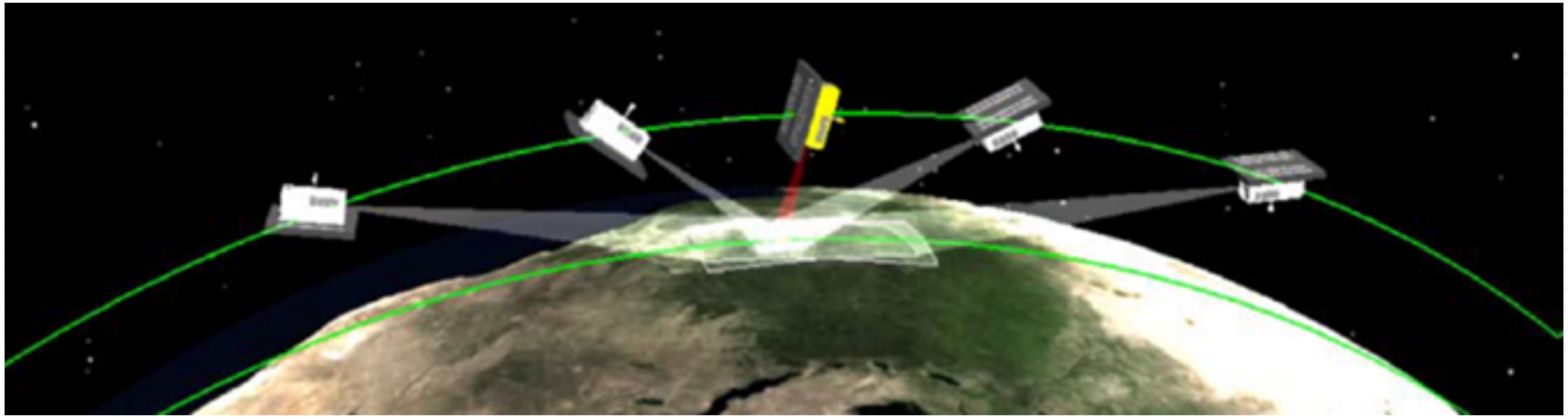


- Spatial resolution of the Polarimeter image is 43.8 m.
- Swath width of 107x38 km.
- Field of View (FOV) is 4.46 deg half diagonal, with an in-track look capability of less than 90° and an off-track look capability of 30°.

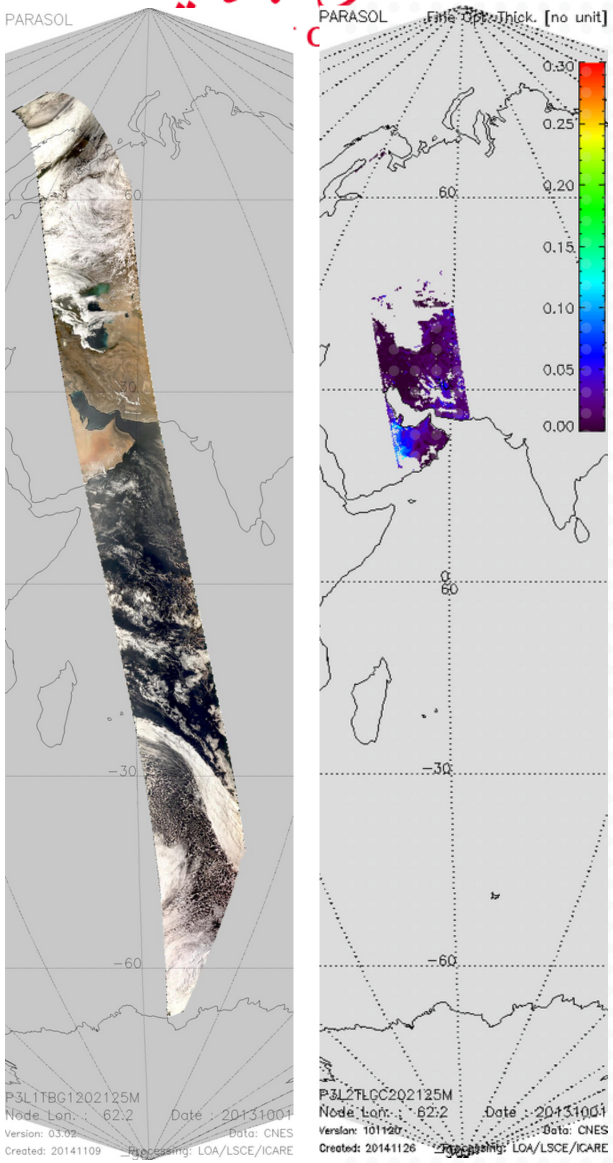
Operational Scenario

730 km Altitude, SSO 12:00 LTDN

- Slewing maneuver at 7 different angles.
- Target observation at different reluctance and scattering angles.



Polarimeter Applications



Credit : ICARE PARASOL Browse Products 01/OCt/2013

Primary Polarimeter Instrument Applications

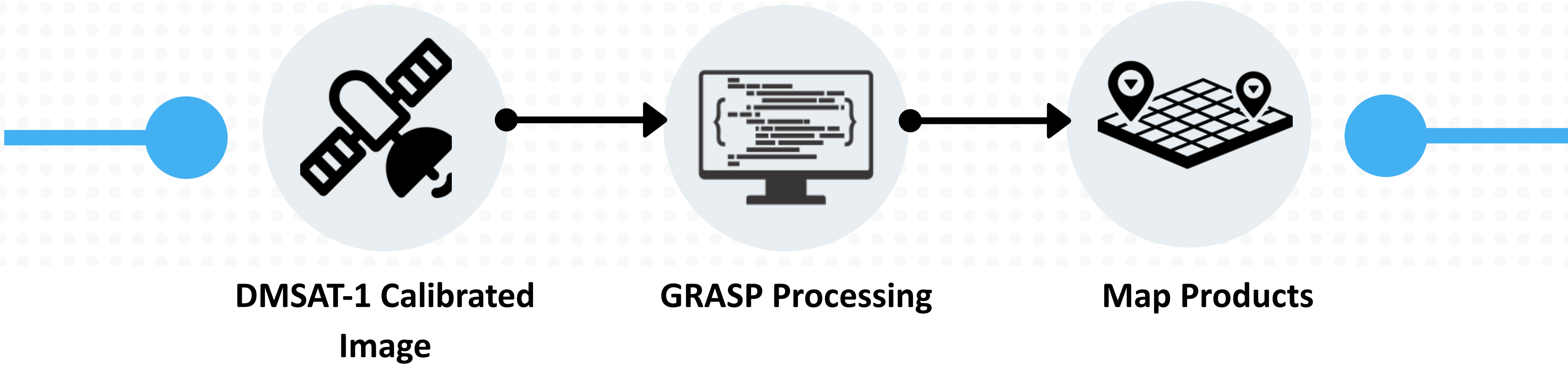
- Aerosol Optical Depth.
- Aerosol effective radius.
- Aerosol type PM 2.5.
- Aerosol type PM 10.

Secondary Polarimeter Instrument Applications

- Surface ALBEDO.
- Normalized Difference Vegetation Index (NDVI).
- Aerosol mass mixing ratio.

Polarimeter Applications

GRASP Algorithm for DMSAT-1 retrievals



Polarimeter Applications

GRASP Algorithm for DMSAT-1 retrievals

GRASP OPEN

GRASP

INPUT	ALGORITHM	OUTPUT
WEB APP	**GRASP PROCESSING**	**KEPLER VIEWER**
User Input DMSAT-1 Image from processing	DMSAT-1 YAML and SDATA files, processing in Ubuntu using Python	Output format .CSV files, viewed in MBRSC Kepler Viewer.

ubuntu

GOVERNMENT OF DUBAI

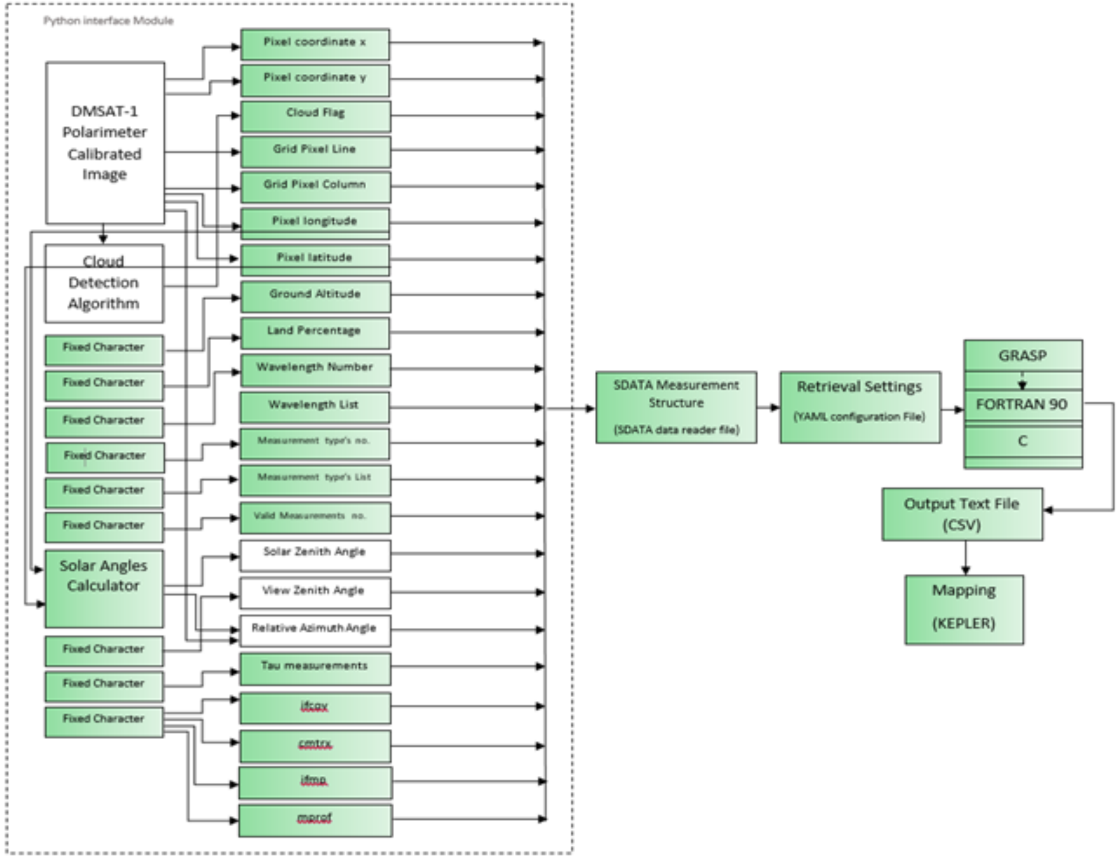
مــــــركز محمد بن راشد للـــــــــــــــفضـــــــاء
MOHAMMED BIN RASHID SPACE CENTRE

Polarimeter Applications

GRASP Algorithm for DMSAT-1 retrievals

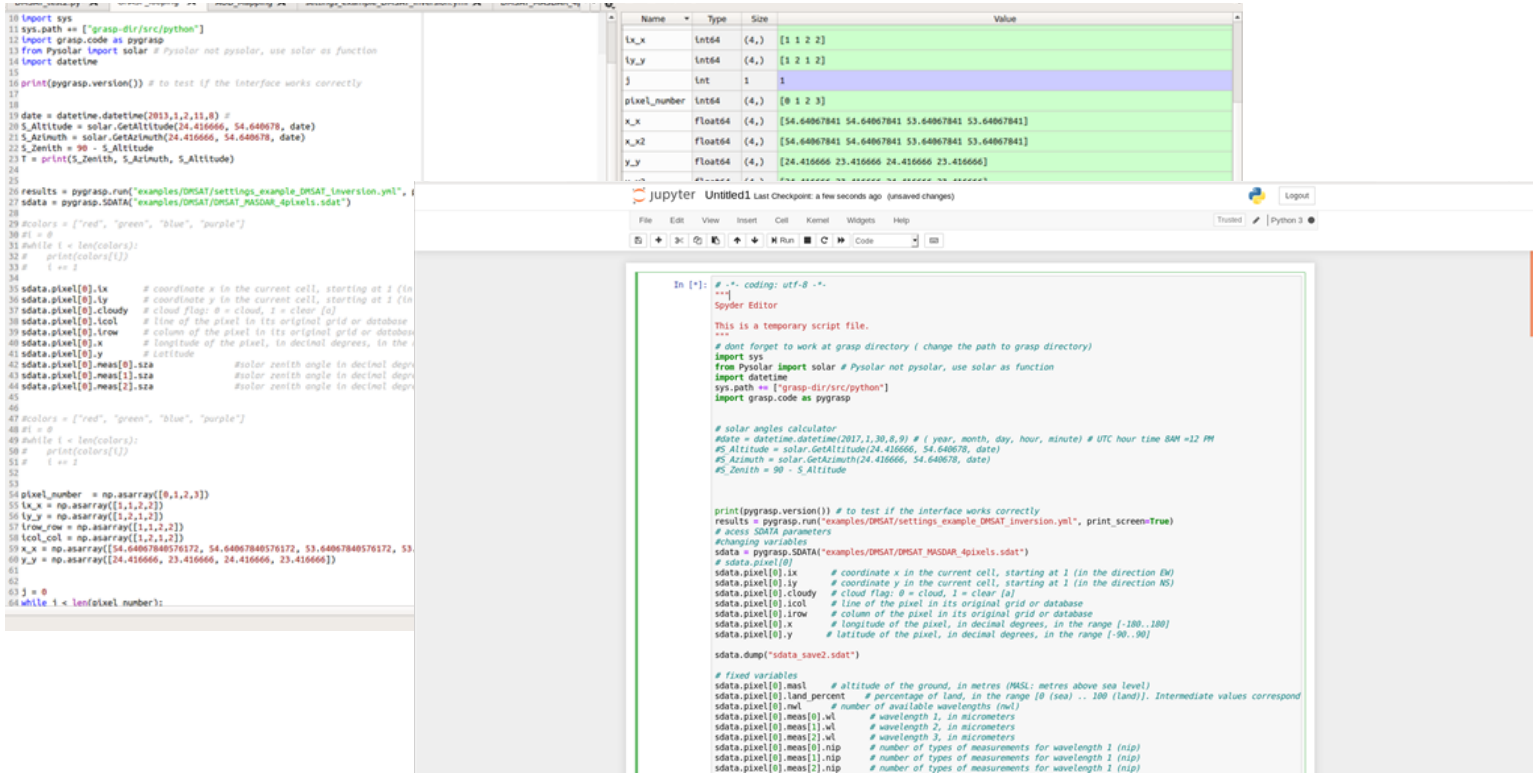
GRASP OPEN

GRASP



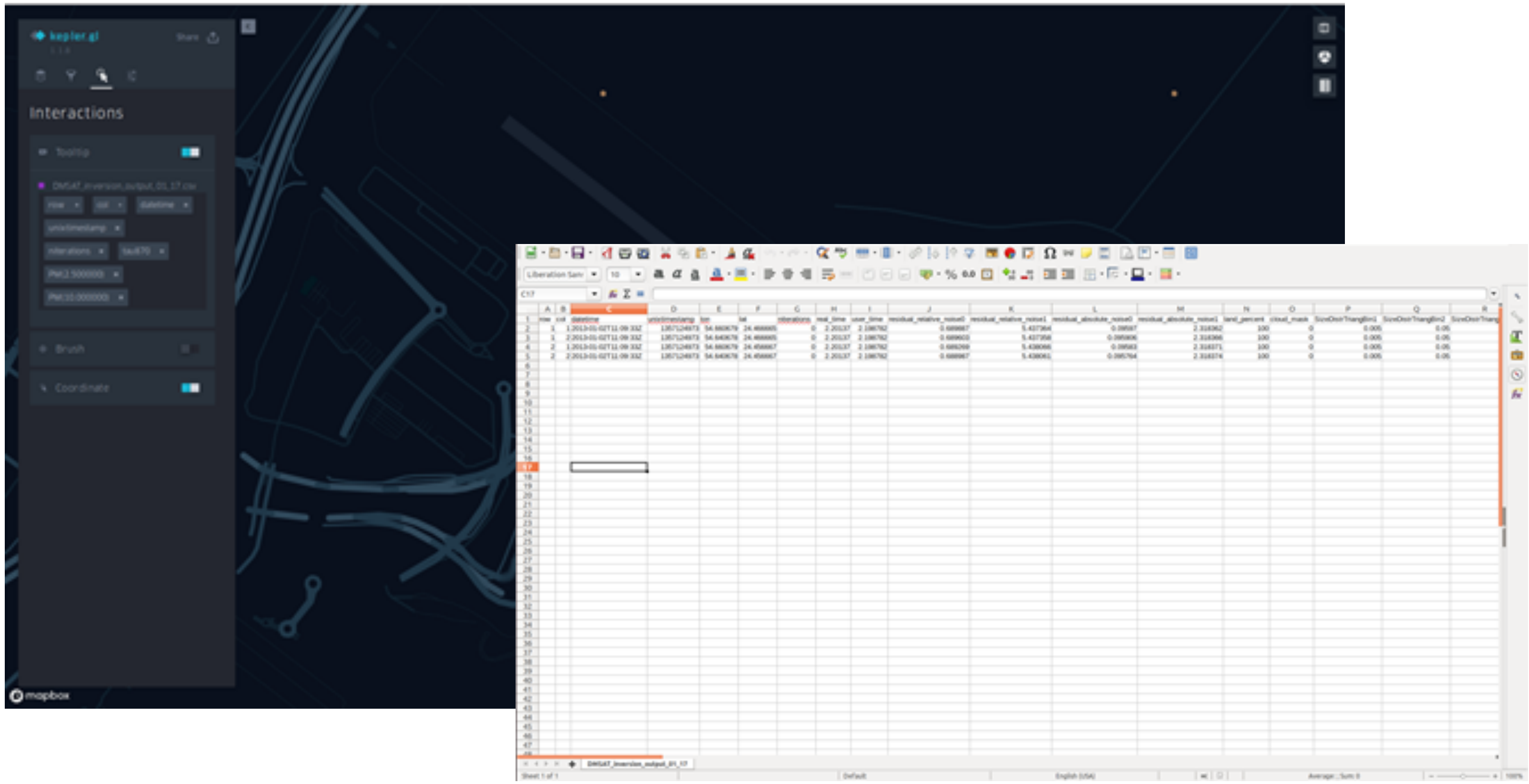
Polarimeter Applications

GRASP Algorithm for DMSAT-1 retrievals



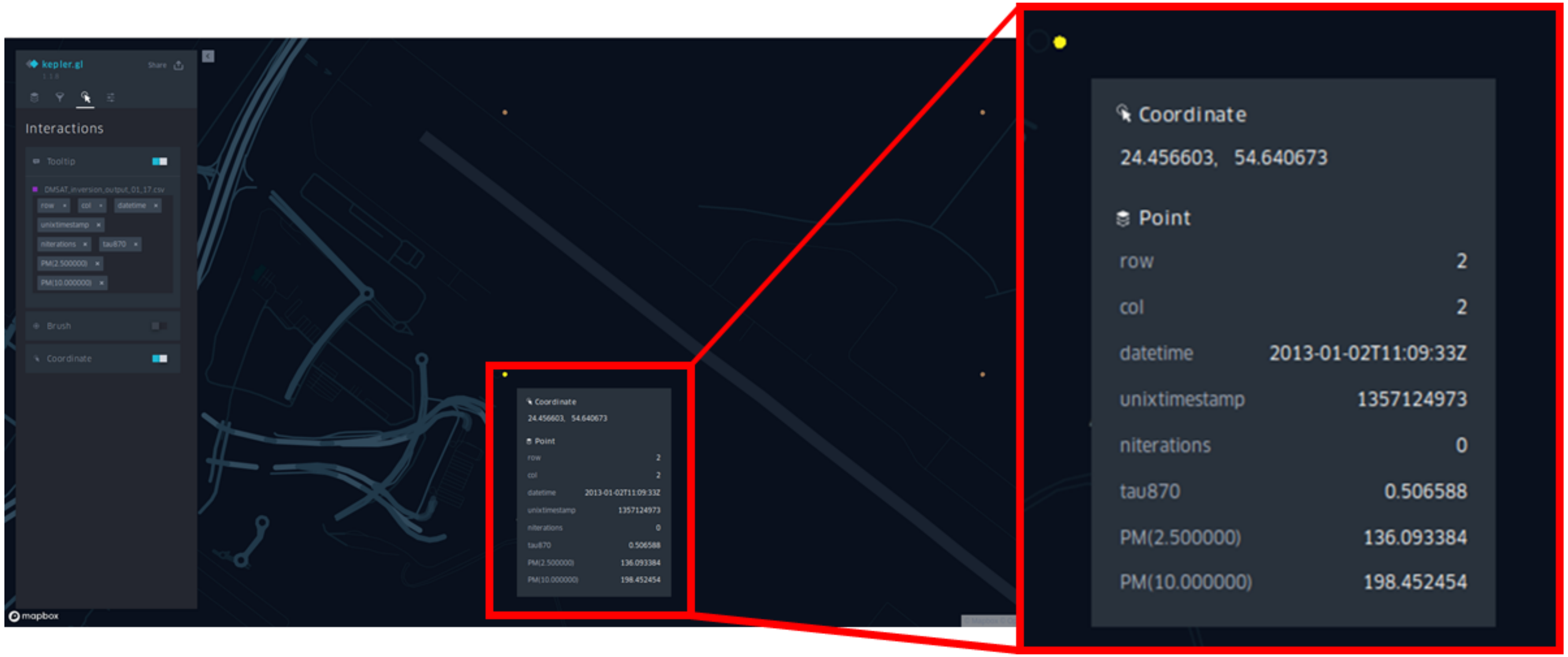
Polarimeter Applications

GRASP Algorithm for DMSAT-1 retrievals



Polarimeter Applications

GRASP Algorithm for DMSAT-1 retrievals

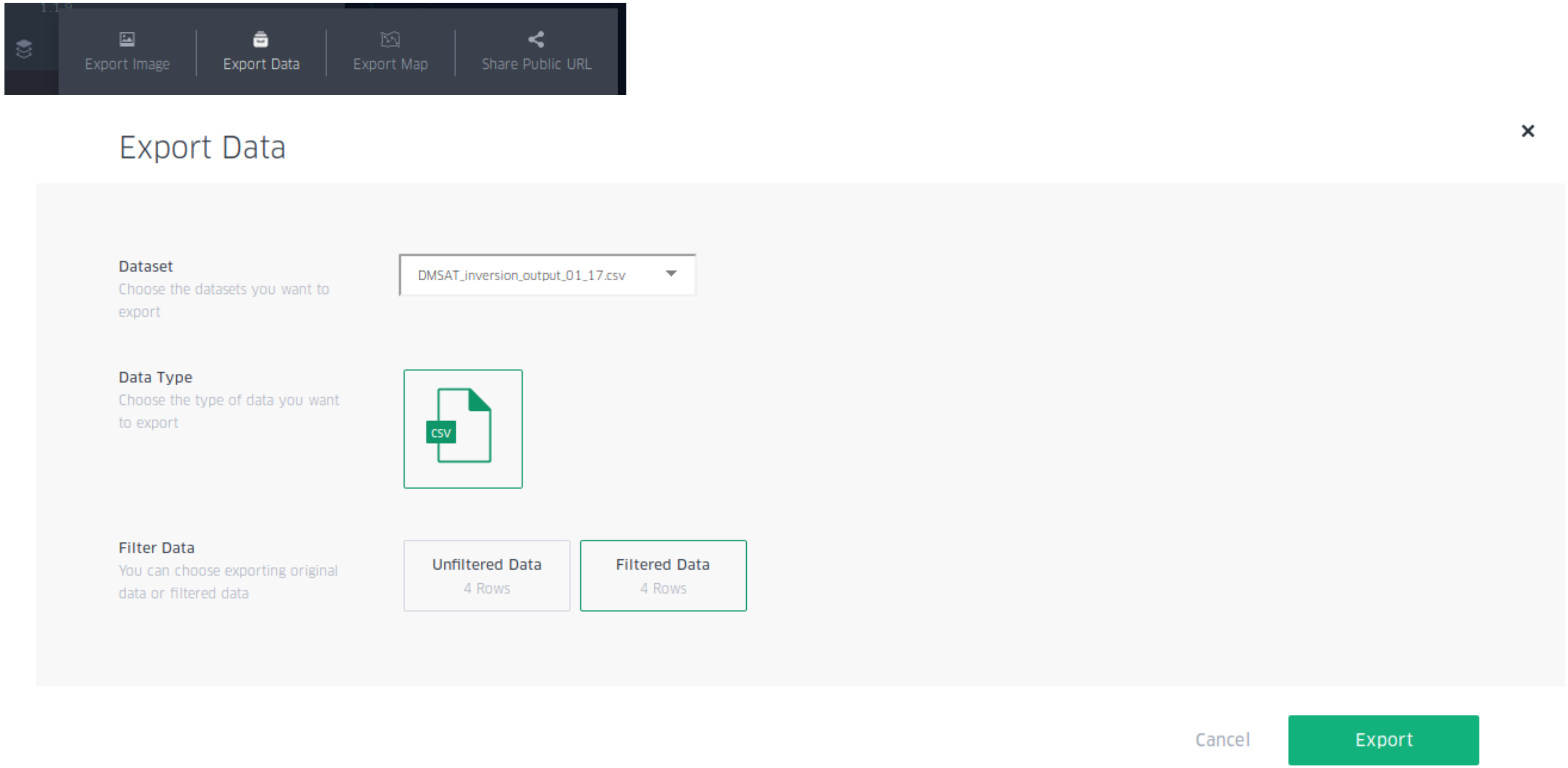


GOVERNMENT OF DUBAI

MOHAMMED BIN RASHID SPACE CENTRE

Polarimeter Applications

GRASP Algorithm for DMSAT-1 retrievals



حكومة دبي
GOVERNMENT OF DUBAI

مركز محمد بن راشد للفضاء
MOHAMMED BIN RASHID SPACE CENTRE

Polarimeter Applications

GRASP Algorithm for DMSAT-1 retrievals

GRASP OPEN

GRASP

حكومة دبي
GOVERNMENT OF DUBAI

مركز محمد بن راشد للفضاء
MOHAMMED BIN RASHID SPACE CENTRE

Thank You

alya.almaazmi@mbrsc.ae