→ EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT

Climate Resilience

Webinar: How can EO data support climate resilient development?

climate resilience
eo4sd

11 June 2019

Webinar agenda

- Introduction & webinar aims (5 min)
- Part 1: Case studies (20 min)
  - Monrovia Integrated Development & Greater Monrovia Urban Review projects (World Bank)
  - World Bank Climate Change Knowledge Portal (CCKP)
- Part 2: Demo of EO4SD online platform (20 min)
- Q&A and closing (15 min)

Housekeeping:
- The webinar will be recorded
- Please keep yourself on mute
- If you have a question please type it in the chat box (visible to everyone)
- The moderation team will select questions to answer during the last 15 minutes. We will try to answer as many as we can!

Speakers

Alastair Baglee is a Technical Director at Acclimatise with over 25 years of experience as an earth scientist and international environmental and climate change consultant.

Dr. Carlos Domenech is Project Manager at GMV with over 9 years' experience in coordination of Earth Observation projects.

Dr. Amanda Hall is a Principal Earth Observation Engineer at Telespazio VEGA UK. She is involved in projects with ESA, EO4SD and the Copernicus Climate Change Service.

Stefano Natali is managing director and space business manager at SISTEMA GmbH with over 20 years' experience in the analysis of satellite data for atmospheric and biophysical parameters retrieval.

Live poll question

Please answer the poll question that appears in your webex session:

1. Do you have experience using Earth Observation products and services in your work? Yes/No

EO4SD Climate Resilience cluster

Main aim: Demonstrate the potential for EO data to support climate resilient decision making at regional and national scales, in collaboration with key International Financial Institutions (IFIs)/ Multi-lateral Development Banks (MDBs) and their client states.

Highly experienced team with skills in **geospatial analysis, EO data, climate resilience and capacity building**

Phase 1: Strategic planning and stakeholder engagement (2018-2019)

Provision of customised climate services through:

- *EO-based service portfolio*: enhancing climate resilience in IFI/ MDB projects/programmes (Webinar Part 1)
- *EO-based climate information platform*: with specific applications for climate resilience (Webinar Part 2)

Phase 2: Service demonstration & transfer preparation (2019-2021)

How can EO-based information help foster climate resilience?

- Information plays a **crucial role in sustainable development and climate resilience**
- Proven its value across many sectors of society (e.g. agriculture, forestry, urban planning)

Monitoring climate-induced changes

Complement existing data

Consistent data streams

Targeting specific challenges

Hazard & Exposure information

Supplementing data gaps

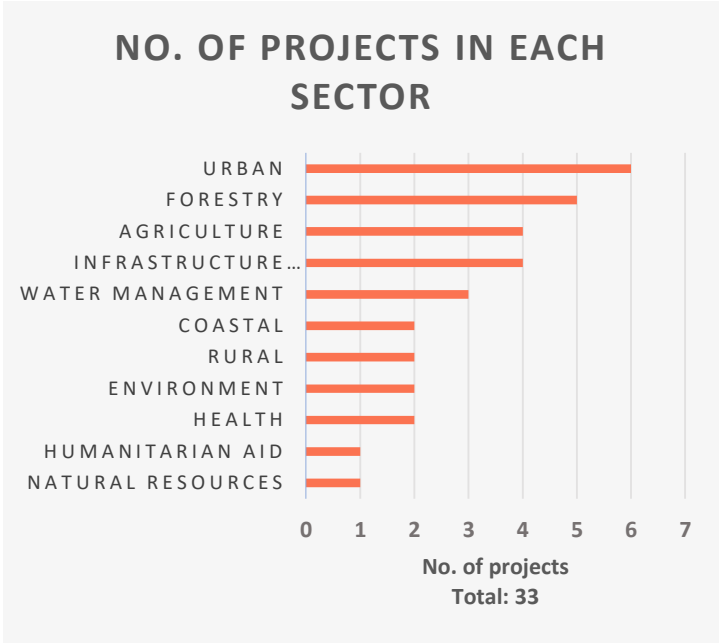
Evidence-based climate resilience decision making

Countries and regions of interest

After initial engagement with IFI/ MDBs, **33 development projects were proposed as candidates** for EO4SD CR, across 5 regions

Currently working with: World Bank, International Finance Corporation (IFC), Asian Development Bank (ADB), Inter-American Development Bank (IADB), African Risk Capacity (ARC)

10 projects taken forward in Phase 1 based in technical feasibility, relevance to CR, timing, etc.



Part 1: Case Studies

Case 1: Monrovia

Collaboration with the World Bank: Monrovia Integrated Development Project & Greater Monrovia Urban Review Project

Case 1: Monrovia
What are the climate-related challenges?

Climate risk analysis conducted for Monrovia in support to World Bank projects: Monrovia Integrated Development Project & Greater Monrovia Urban Review Project

1. **Analysis of socioeconomic challenges**
2. **Analysis of climate hazards and impacts** based on Climate Projections (CMIP5)
3. **Identification of climate adaptation solutions**

World Bank project objectives:

- Identify pragmatic spatially integrated, and location specific interventions that contribute to service delivery, improved welfare, and the creation of jobs.
- Identify policies that can help Monrovia be better prepared to absorb urban growth in a context of extreme poverty/informality, fragility and increasing risks from climate change

Climate risks in Monrovia (I)

Socioeconomic challenges include extreme poverty, high population density, informal settlements, under-developed infrastructure & limited access to basic services

Projections due to climate change:

- Sea level rise (SLR) of 0.13-0.56 m by the 2090s.
- Average daily max temperatures likely to increase by +1.1°C (by 2035).
- Average daily rainfall: -14.6% (April) to +59.2% (December) (by 2035).
- Water stress projected to increase by 2.8x or greater (by 2035).

Source: OpenDRI.org

Climate risks in Monrovia (II)

Socioeconomic challenges combined with climate change pose risks to Monrovia:

- Since 2013 sea level rise and coastal erosion displaced 6,500+ people & destroyed 800 houses (in West Point)
- Estimated additional 30,000 families at risk of coastal erosion

Employing a mix of EO, climate projections and socioeconomic data can help integrate climate resilience into investments under the Greater Monrovia Urban Review project

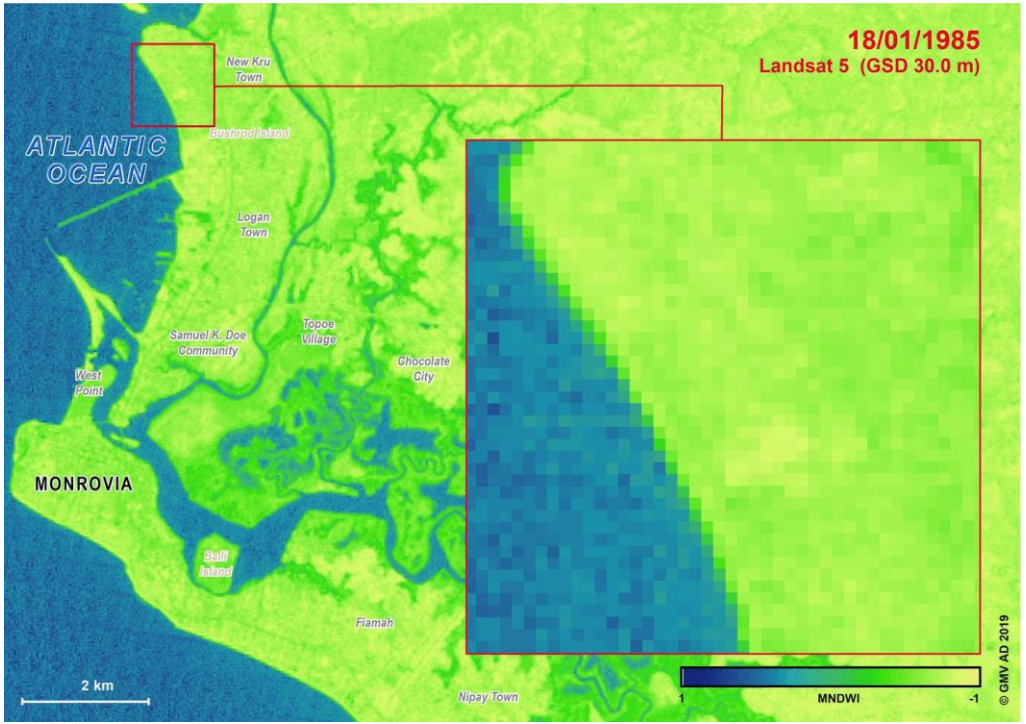
Section of Doe Community flooded year round

Source: OpenDRI.org

EO-based climate adaptation solutions

Identification of climate adaptation solutions for Greater Monrovia

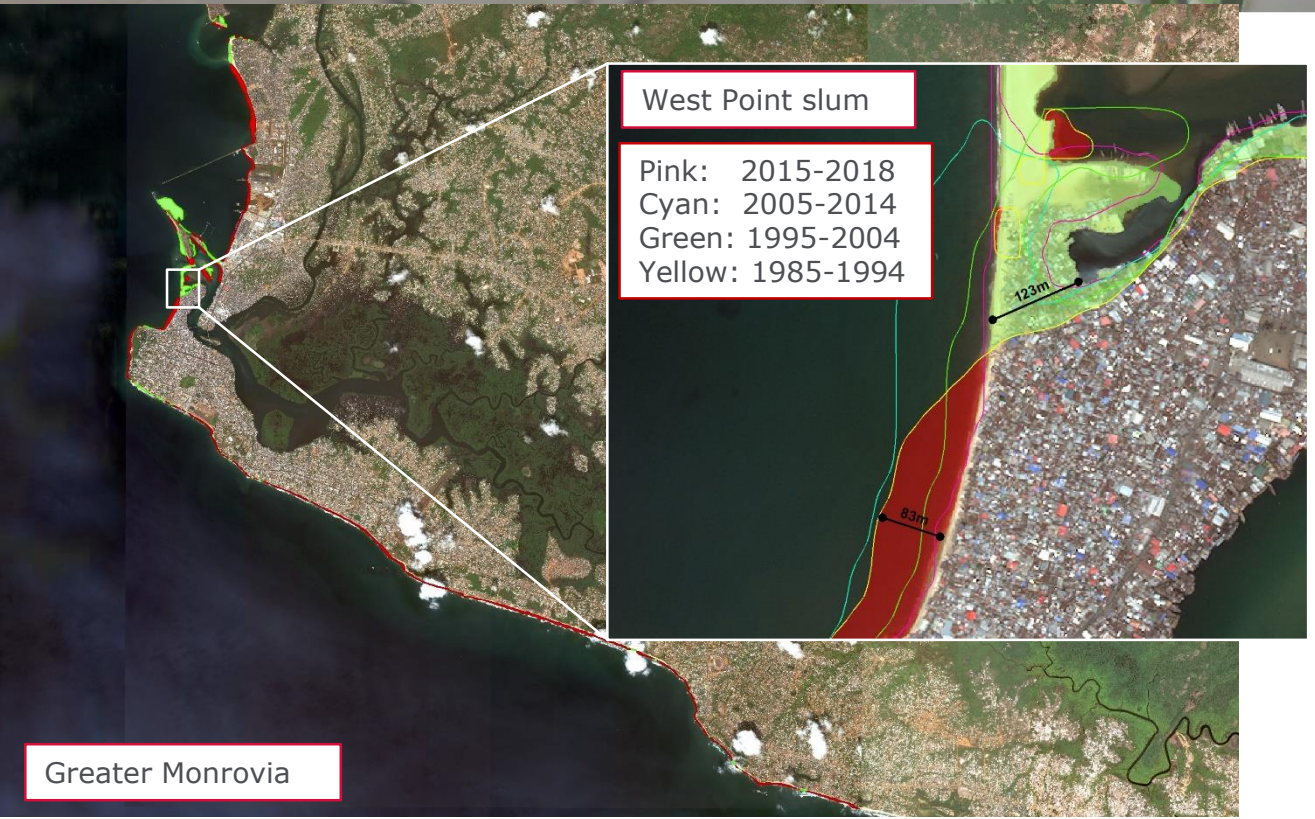
- Model and map the impact of sea level rise along the coastline
- Model and map the impact of coastal and inland flooding
- Monitor and map the impact of historical and future coastal erosion
- Model, map and monitor saltwater intrusion in coastal areas



Shoreline monitoring and change detection

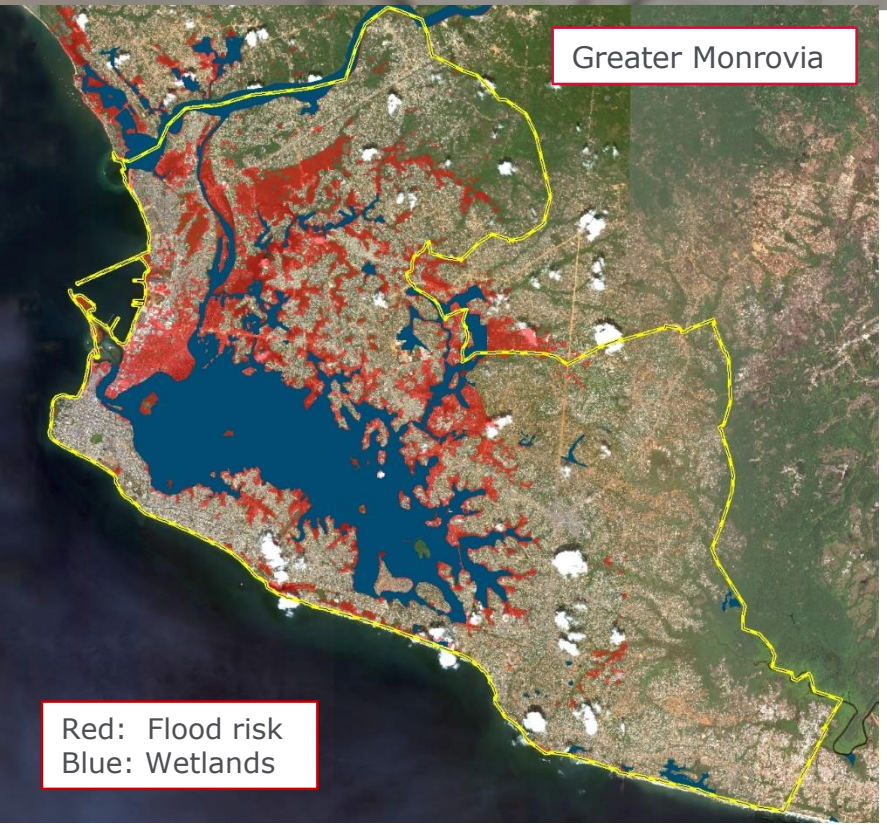
- 41km shoreline evolution monitored through a 34 year satellite series, co-registering and analysing Landsat, Sentinel-2 and Worlview-3 scenes
- Natural water flow (waves, heavy swell, tides) considered by comparing water/land pixels in images from short time periods
- Land loss area estimated from 1984 to 2019 is 0.8 km^2

Shoreline monitoring and change detection

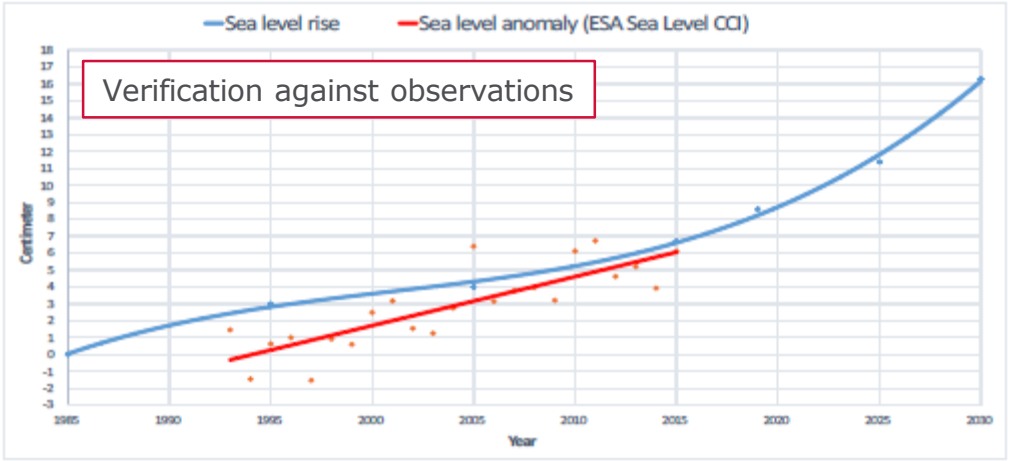


- Dwellings built in 2010, favoured by land gains due to the shoreline and river dynamics
- Mapping of the shoreline is dependent on availability of imagery. The low revisit time (16 days) of first Landsat satellites and the persistent cloud decks over Monrovia makes the time period used to estimate the shoreline in 80's and 90's of 10 years

Inland and coastal flood risk analysis



- Sea level rise generally leads to erosion and causes the shoreline to retreat landwards
- This analysis estimates sea level increase from the shoreline retreat of the last 34 years
- Sea level rise trend projected to 2030 and mapped against a DTM to identify regions at risk of being flooded



Inland and coastal flood risk analysis

- Potential of flood events in Clara Town is combined with the population exposure obtained from the population density (census 2007) to estimate the flood risk
- Risk severity is depicted by red gradient
- DTM used might be too coarse for estimations over coastal-flat-low-lying sites
- Knowledge of hydrological processes of the catchment areas is necessary to ascertain the extent of floods more accurately

Outlook

Flood risk analysis conducted for Monrovia can be better assessed by considering

- To include analysis of **critical infrastructures and buildings** to assess vulnerability
- To include projection of **coastal erosion**
- To include projection of **land subsidence**
- To analyse **hydrologic** information
- To include **high resolution DTM**
- To include **bathymetry** map

Sea-level rise and shoreline retreat are threats for worldwide coastal regions

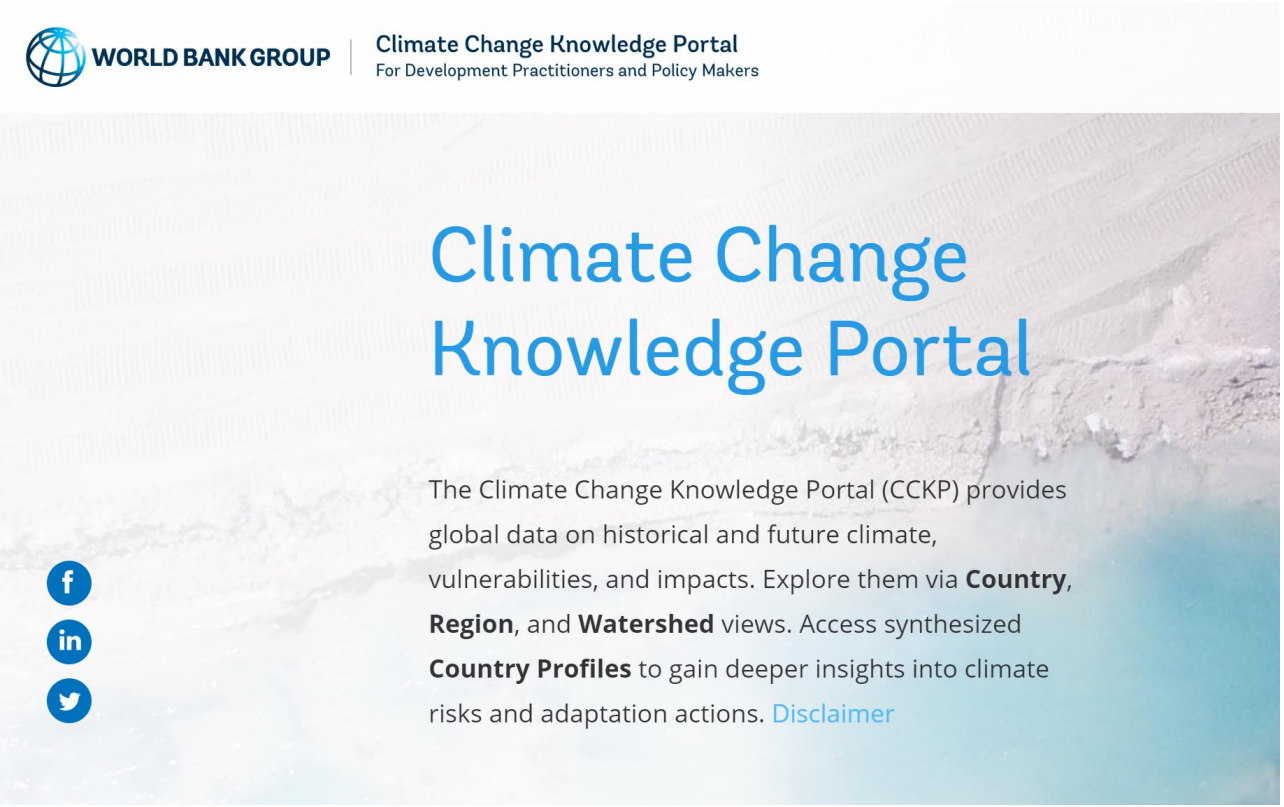
But not only! Cluster is currently also analyzing shoreline changes in hotspot areas of Lake Victoria for a World Bank project.

EO can support the implementation of **climate adaptation solutions** for regions affected by a large variety of **climate hazards**

Case 2: Climate Change Knowledge Portal

Collaboration with the World Bank's
Climate Change Knowledge Portal (CCKP)

Case 2: Climate Change Knowledge Portal (CCKP)
What does CCKP do to support climate resilience?



Highlights

Scope: Improve integration of scientific data into decision making processes

How: through a web-based platform

Data: **environmental**, disaster risk, and socio-economic datasets, as well as **synthesis products**

Example of service provision via API

EO-based climate data being provided automatically from EO4SD CR cluster to the **World Bank's Climate Change Knowledge Portal**

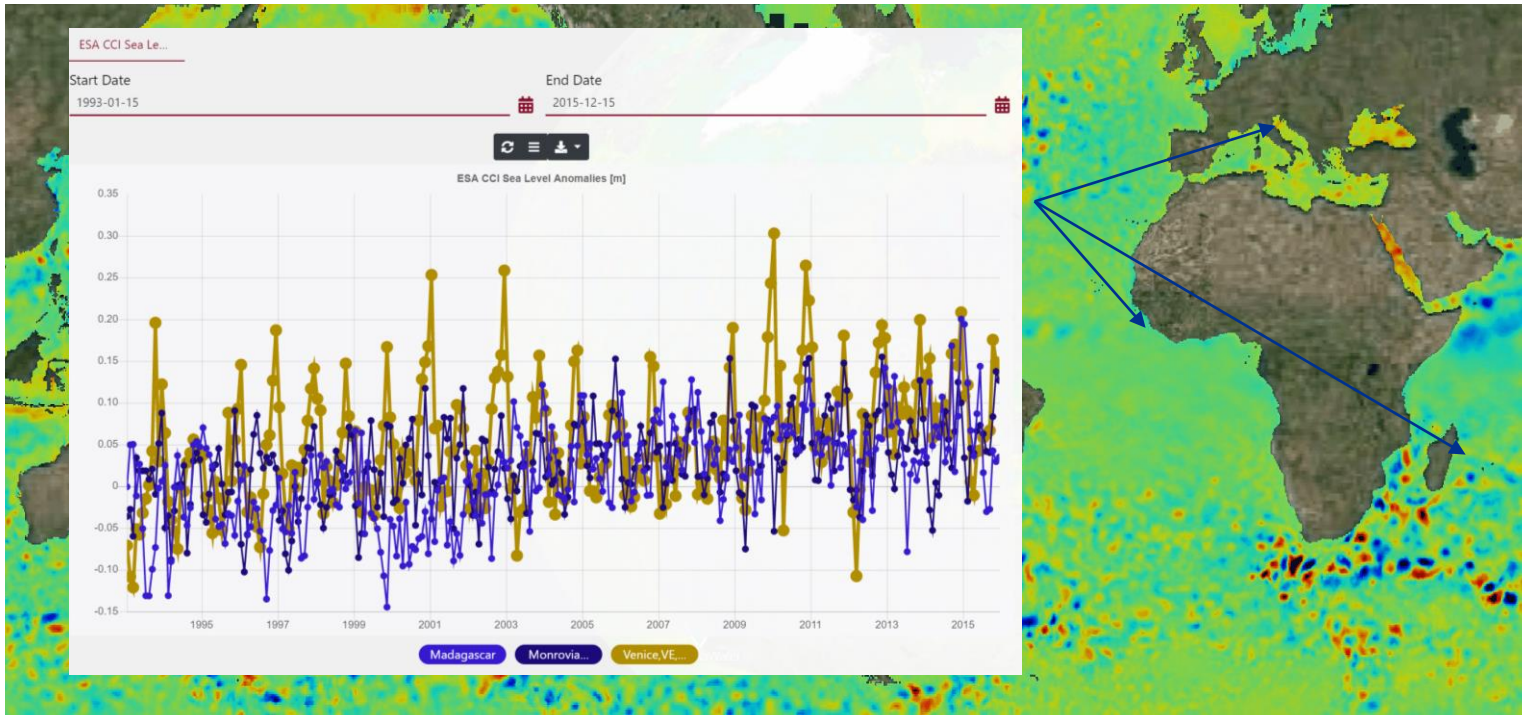
- Data maps for the CCKP Screening tool via Python API (WCS parsing) and WPS
- The function returns either raster data (geoTIFF) or time series data (JSON). Python API to download all the data in PNG format also developed
- Data provision will continue into Phase 2 (Jun 2019 – Jun 2021, expanding to more products as requested
- Products currently provided:

  (more agreed for Phase 2)

Products	Spatial coverage	Time coverage
2 m Temperature (Copernicus ERA5)	Global	1979-2018
Sea Surface Temperature (ESA CCI)	Global	1991-2010
Sea Level Anomaly (ESA CCI)	Global	1993-2015

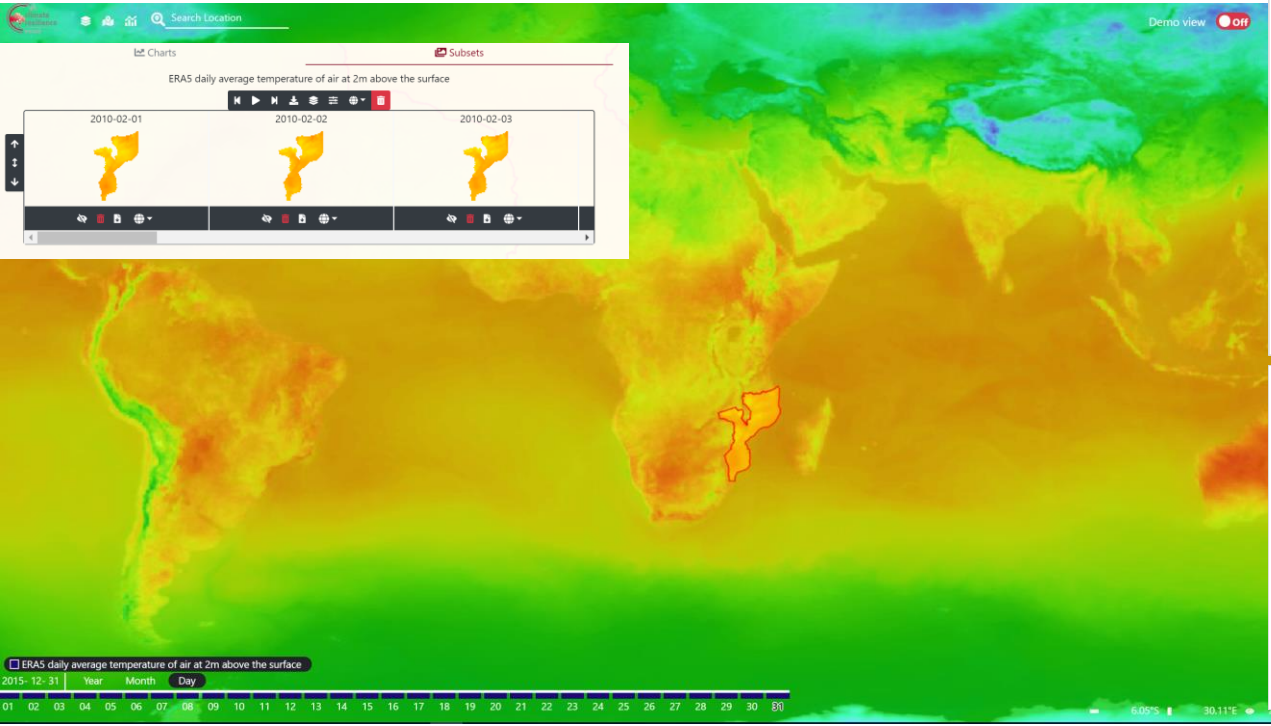
Climate Change Knowledge Portal

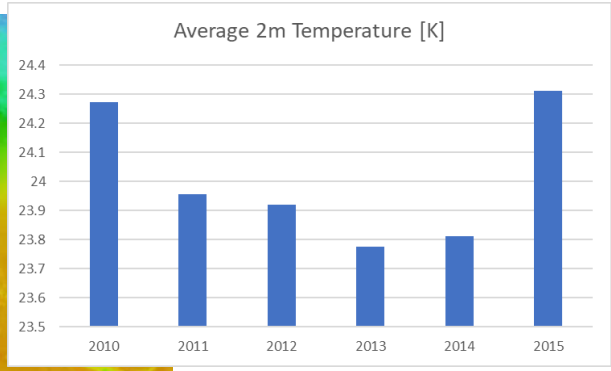
- Example retrieved product: Sea Level Anomaly (1997 - 1998)

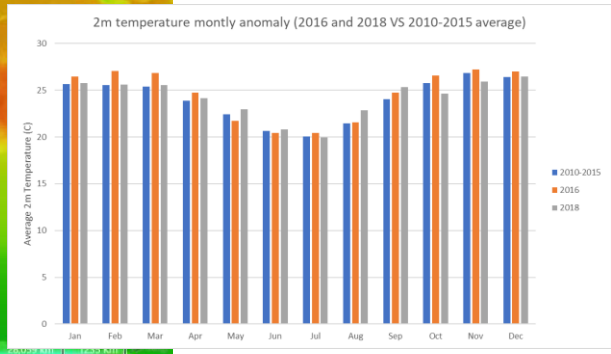


Climate Change Knowledge Portal

Example retrieved product: 2m Temperature (2016 and 2018 VS 2010 - 2015)







Other on-going prototype developments based on APIs

Provision to **International Finance Corporation's (IFC) Risk tool**

Product	Spatial coverage	Time coverage
1-day maximum precipitation	Global	20-year return level

Provision to **Africa Risk Capacity's (ARC) Africa Risk View (ARV)**

Product	Spatial coverage	Time coverage
Soil moisture monitoring (SMOS)	Sub-Saharan Africa	2010-present
Daily precipitation (IMERG & Hydro-Estimator)	Sub-Saharan Africa	2006-present
Drought monitoring	AOI	2018-present

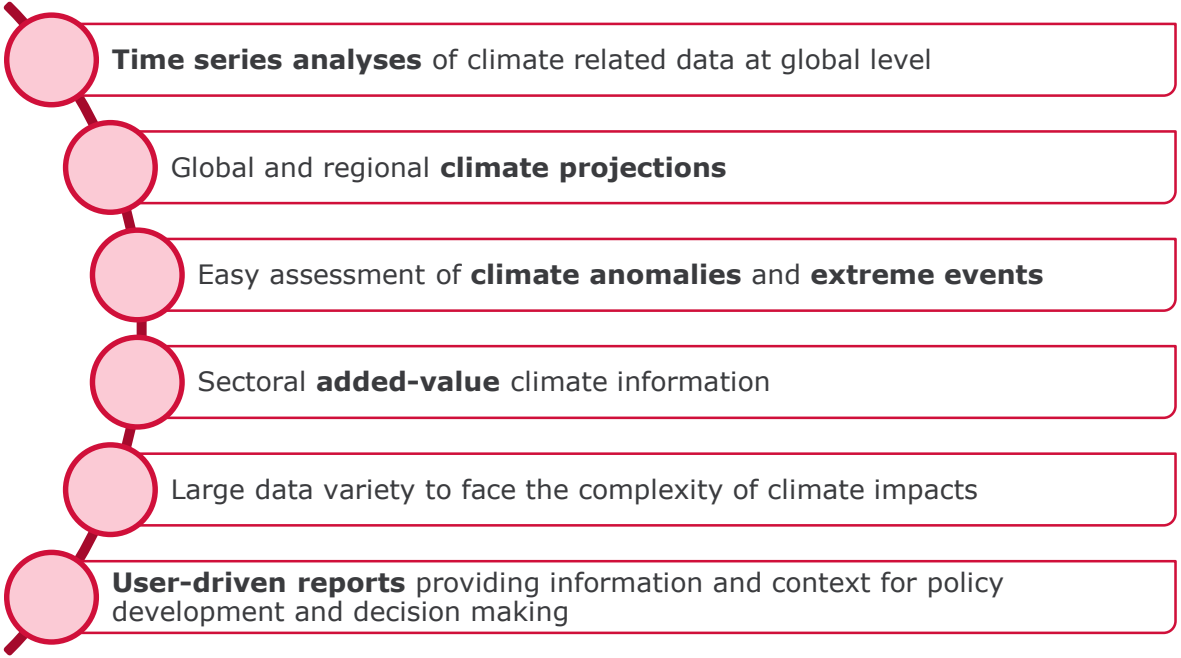
Provision to **Inter-American Development Bank's (IDB) HydroBID**

Product	Spatial coverage	Time coverage
Algal Pigment Concentration (Chlorophyll-a)	Ypacarai Lake (Paraguay), Titicaca Lake (Bolivia/Peru), and Panama Bay (Panama)	1997-2015
Wetland and Water inventory - status product	Part of Pantanal, Brazil	2017 - 2018

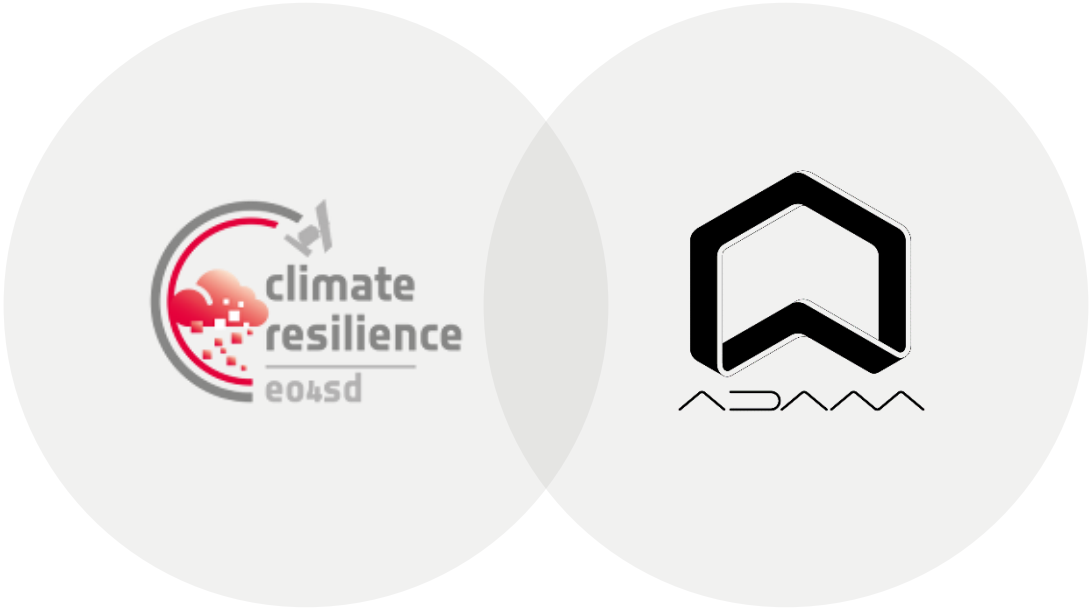
Part 2: Demo of EO4SD CR online platform

EO-based climate information platform

The project aims to develop an **EO-based integrated platform** for the **provision of climate services**, including the screening of **climate indicators** and **assessment of climate change risks**.



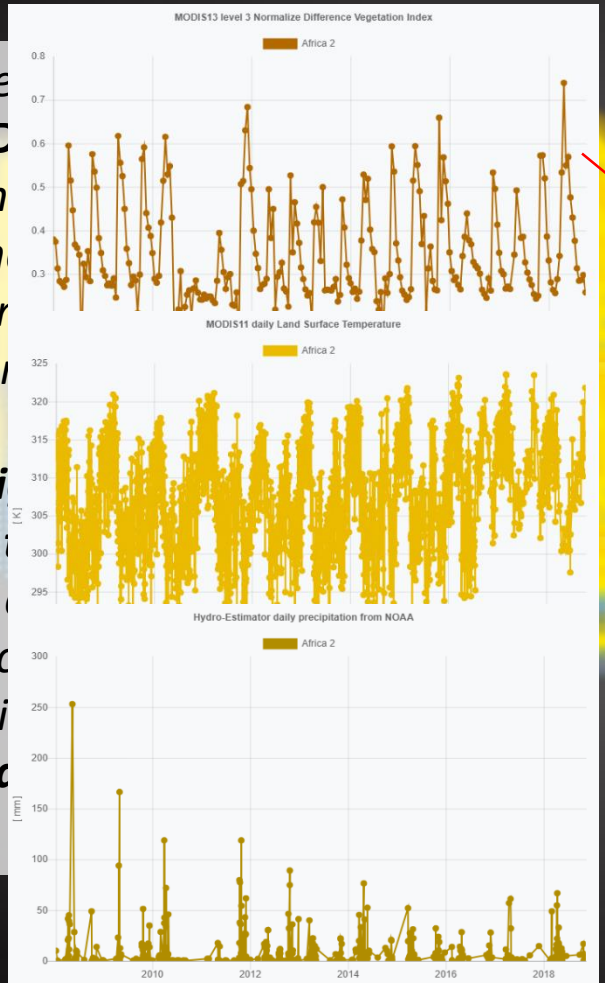
EO4SD Climate Resilience Platform

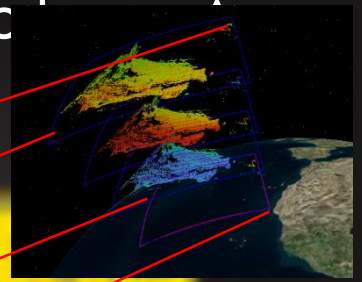


If you want to protect our planet you have first to

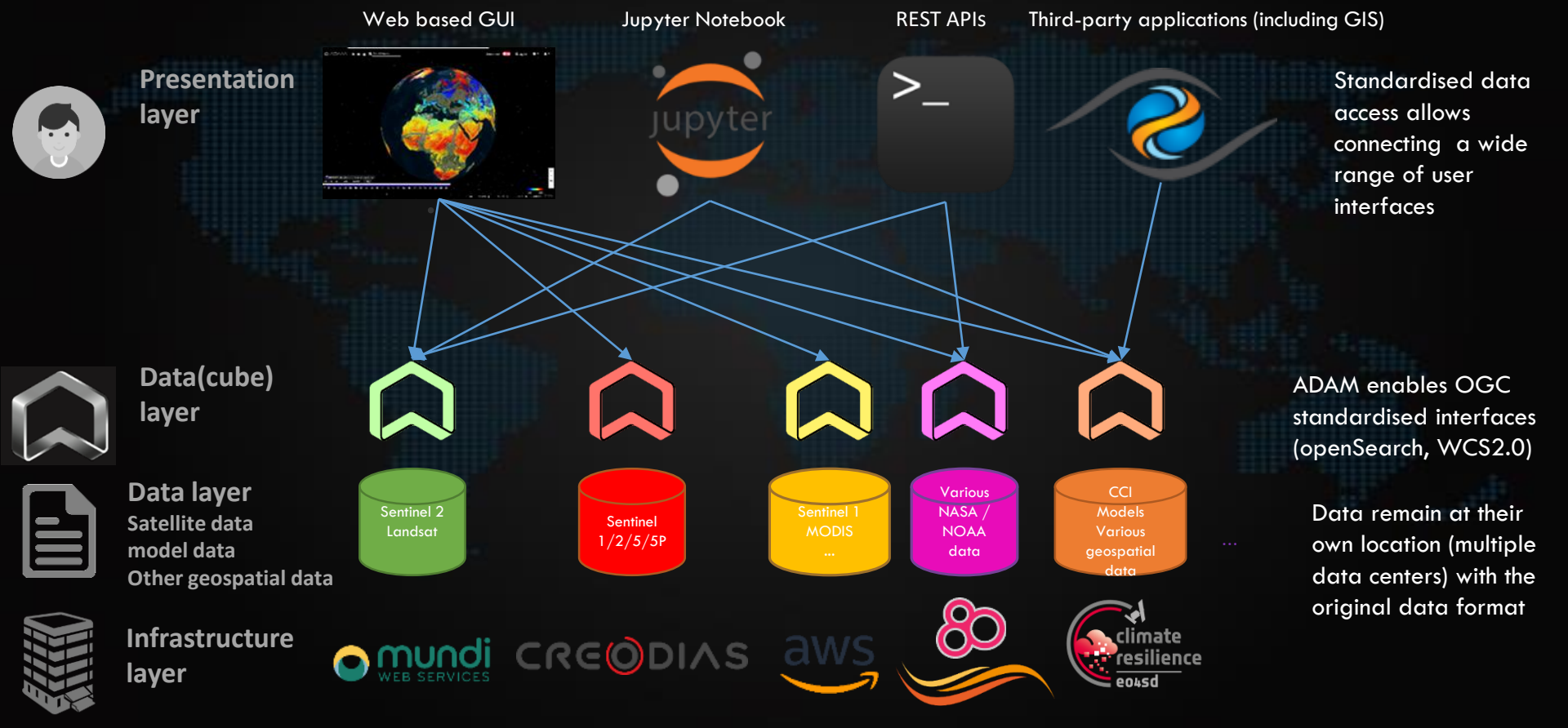
'Digital Earth' *(Gore*
multi-resolution, 3D
representation of th
→ ***find***, ***visualise*** *an*
sense *of vast amour*
geo-referenced infor

Allows users to ***navi***
through space and
accessing historical
well as future predic
and would support i
scientists, ***policy-ma***
and ***children*** *alike*





ADAM in one slide



Baseline Data Offer

SATELLITE-BASED PRODUCTS

ESA CLIMATE CHANGE INITIATIVE

- CHLOROPHYLL CONCENTRATION (1997–2018)
- SEA LEVEL ANOMALY CONCENTRATION (1993–2015)
- SEA SURFACE TEMPERATURE (1992–2010)
- SOIL MOISTURE (1978–2018)

REAL TIME DATA

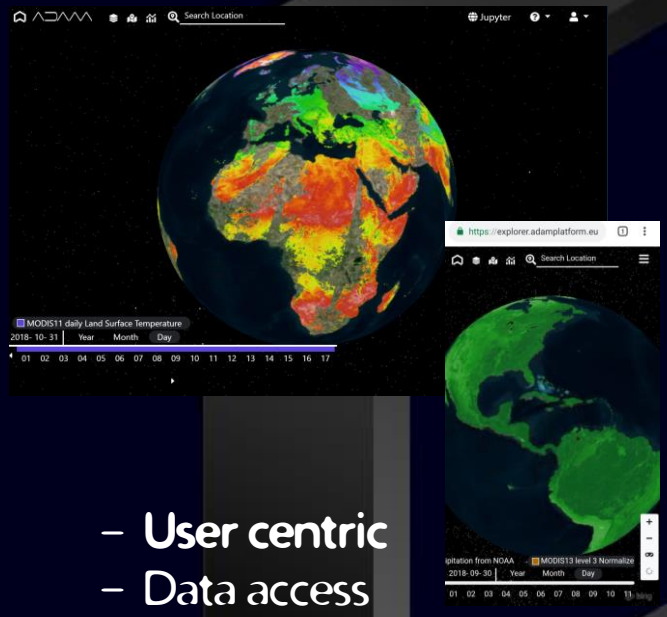
- PRECIPITATION (GPCP, HYDRO ESTIMATOR, GPM) (1996–)
- VEGETATION INDEX (MODIS, SENTINEL 2) (2000–)
- SOIL MOISTURE – SMOS (2010–)
- HIGH RESOLUTION IMAGING – SENTINEL 2 (2015–)

MODELS – ANALYSIS AND PROJECTIONS

- ERA5 2M TEMPERATURE AND PRECIPITATION (1979–2019)
- NEX-GDDP TEMPERATURE AND PRECIPITATION (1950 – 2100)

askADAM

EXPLORER



- **User centric**
- Data access
- **E-collaboration**

JUPYTER

jupyter

For scientist

- **Coding** environment
- **Processing** resources
- **Results publication** and / or download

APIs

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stefano@eoservice:~$
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For developers

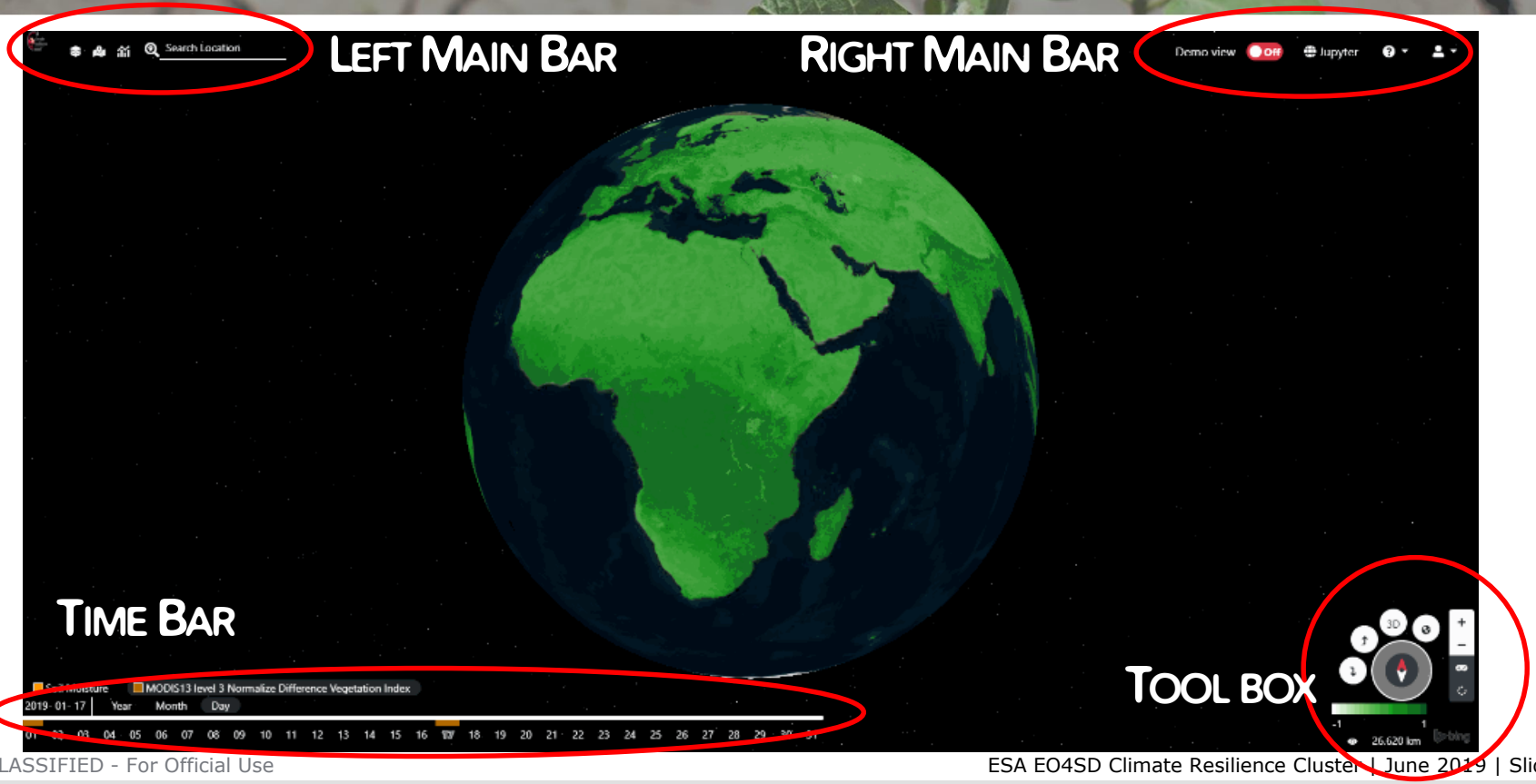
- **OGC** interfaces
- **APP** connection
- ...

Platform usage prerequisites

- Laptop / computer / smartphone
- user registered on the platform

https://explorer-eo4sdcr.adamplatform.eu/

The EO4SD FCV Platform – Overview



Philippines case - requirements

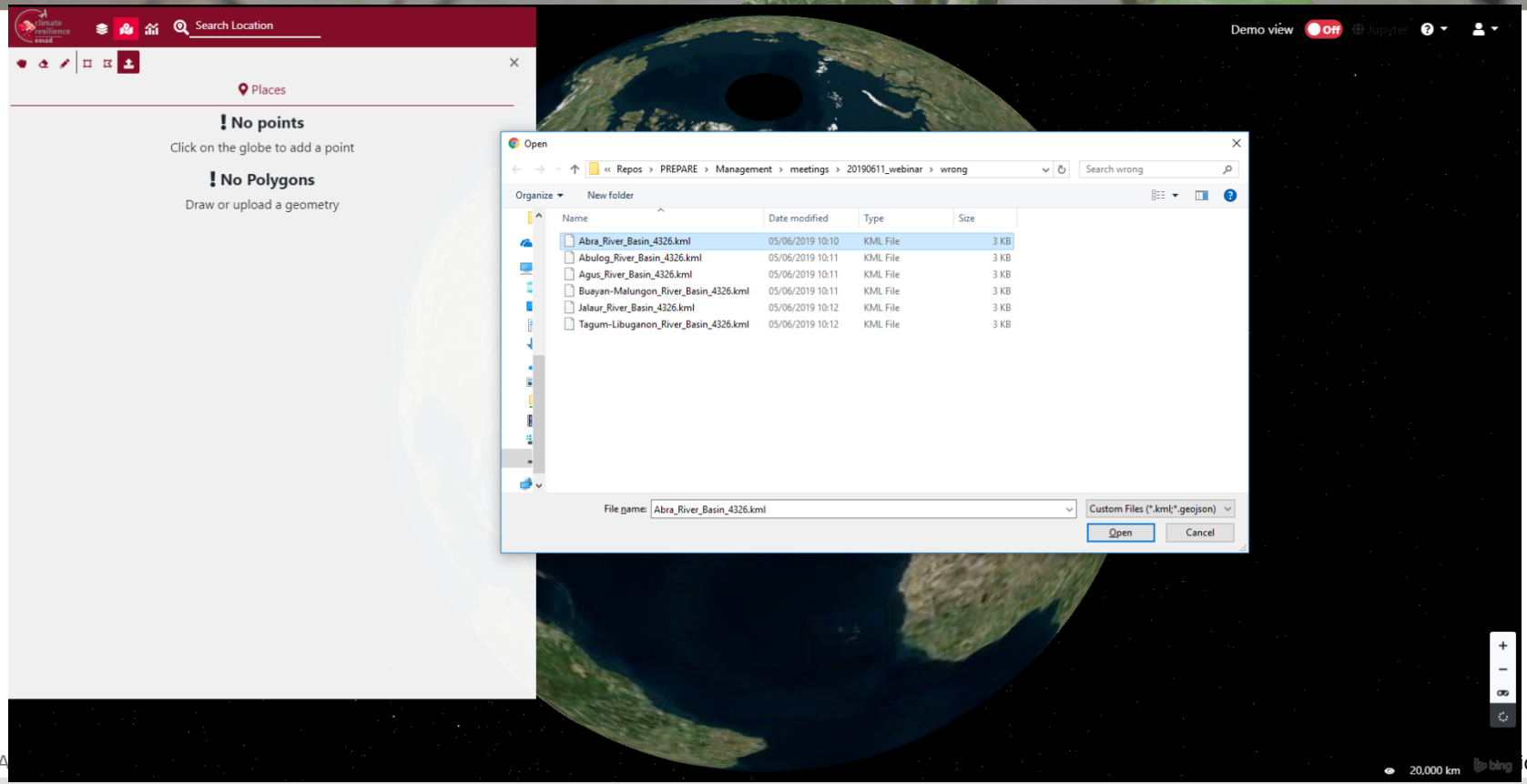
Areas of interest:
- Six river basins

Fields to be provided:
- Precipitation (2006-present)
- Sea level anomalies (1993-2015)
- Soil moisture content (2000-2016)

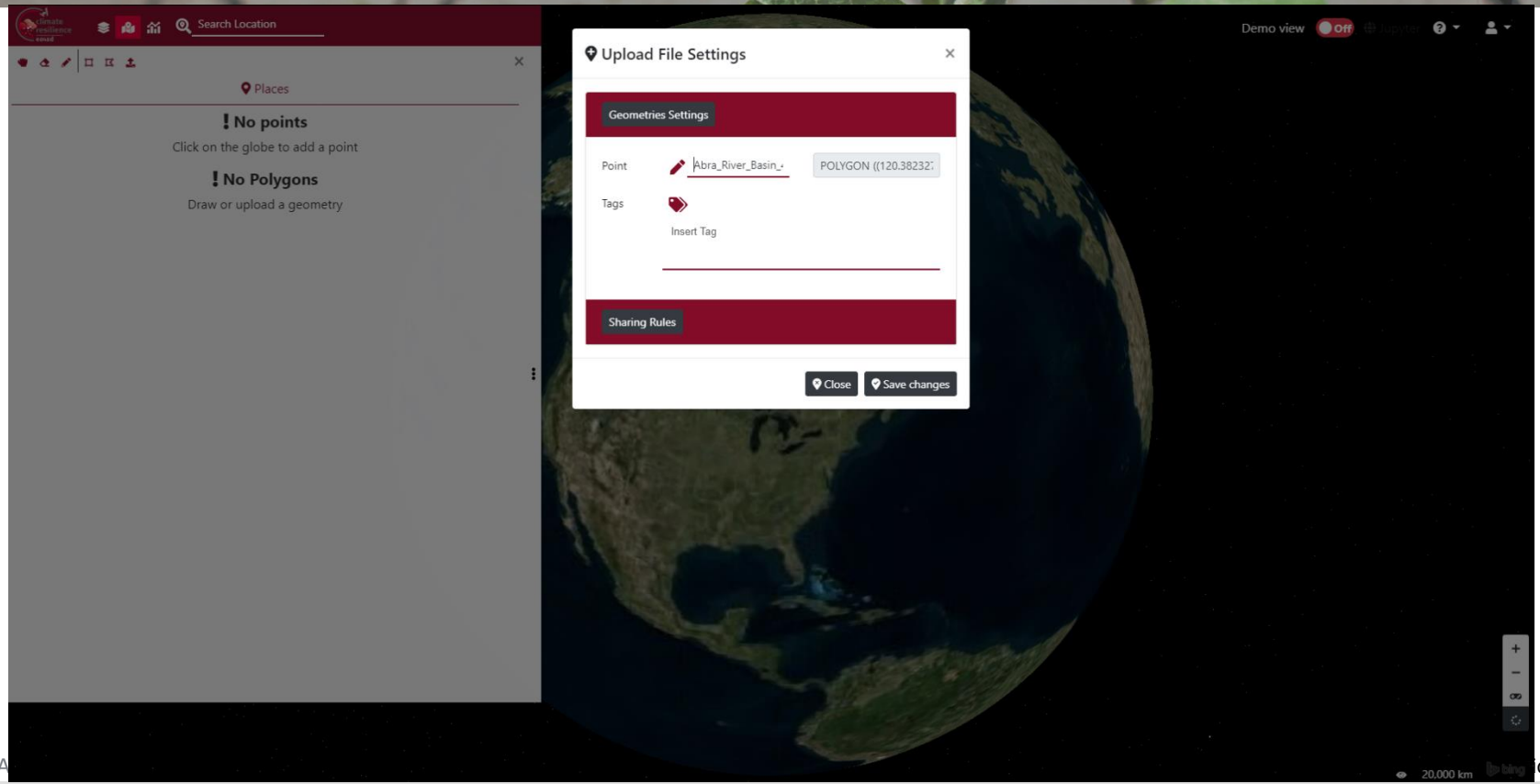
Precipitation
- maps aggregated and daily precipitation data for a grid covering the full domain would be expected
- Preferably, the format used should be NetCDF.

For Sea level
- preferably both full time series at monthly basis and 'decadal' aggregation
- Time series should be as long as possible.

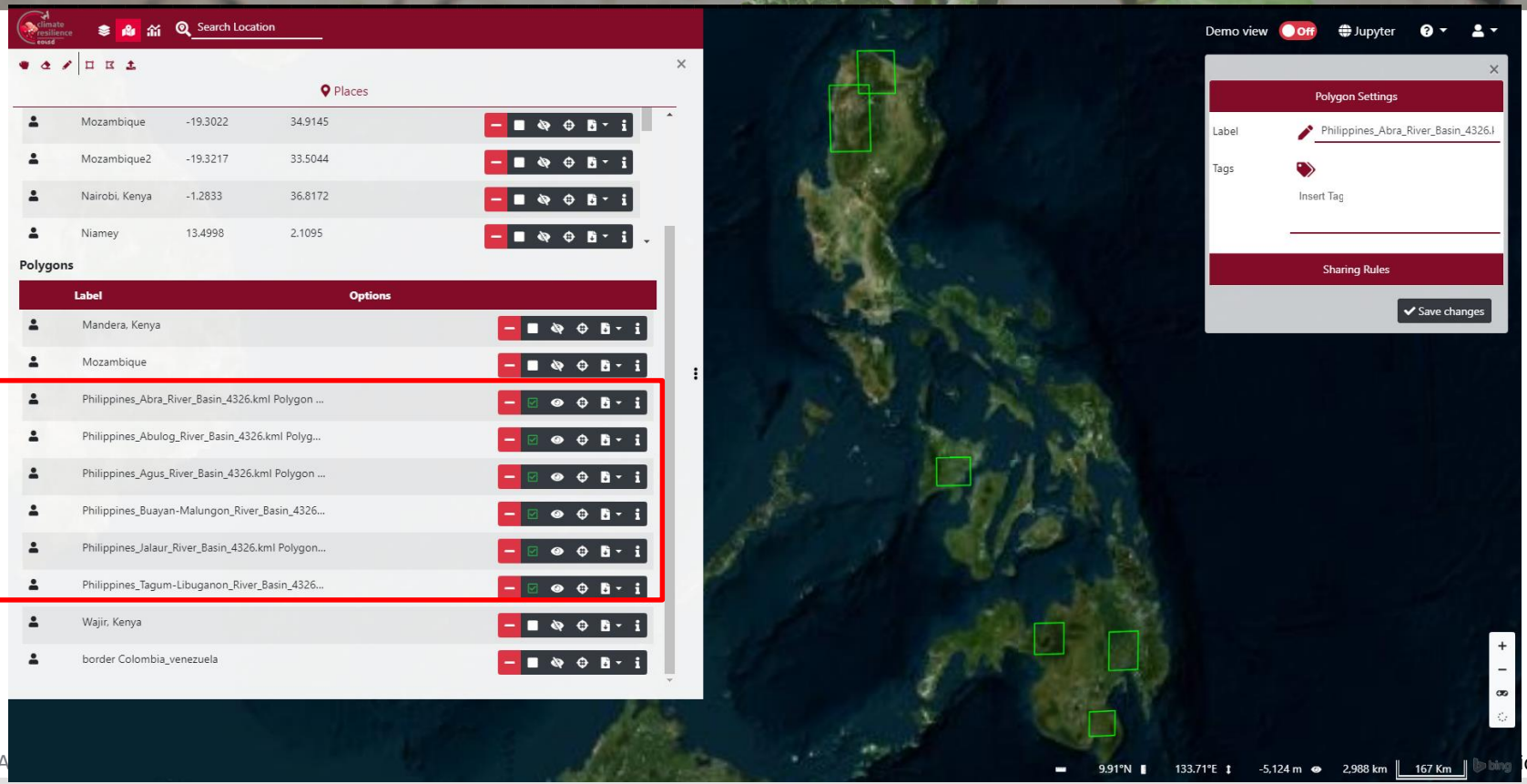
Philippines case – polygons upload



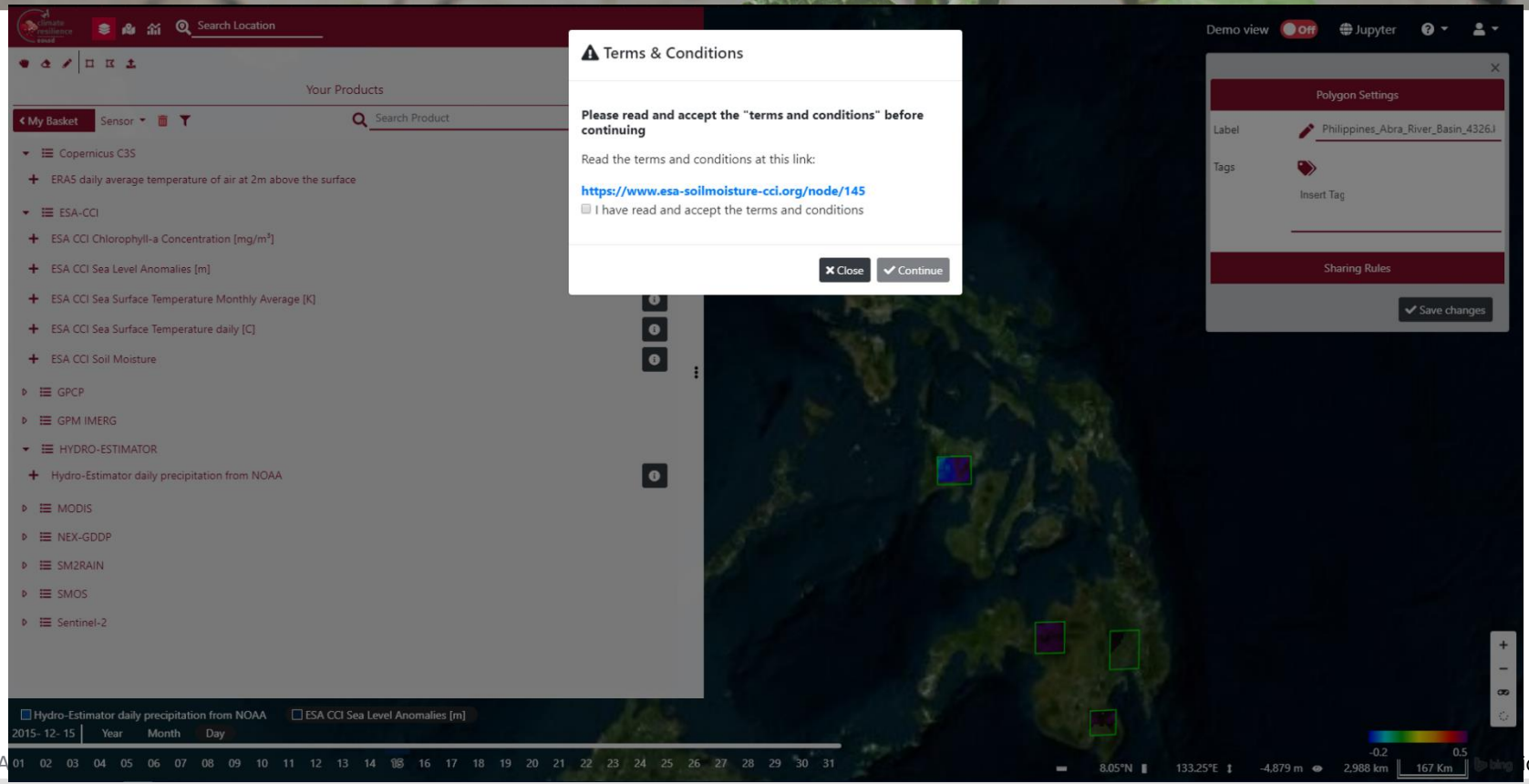
Philippines case – polygons upload



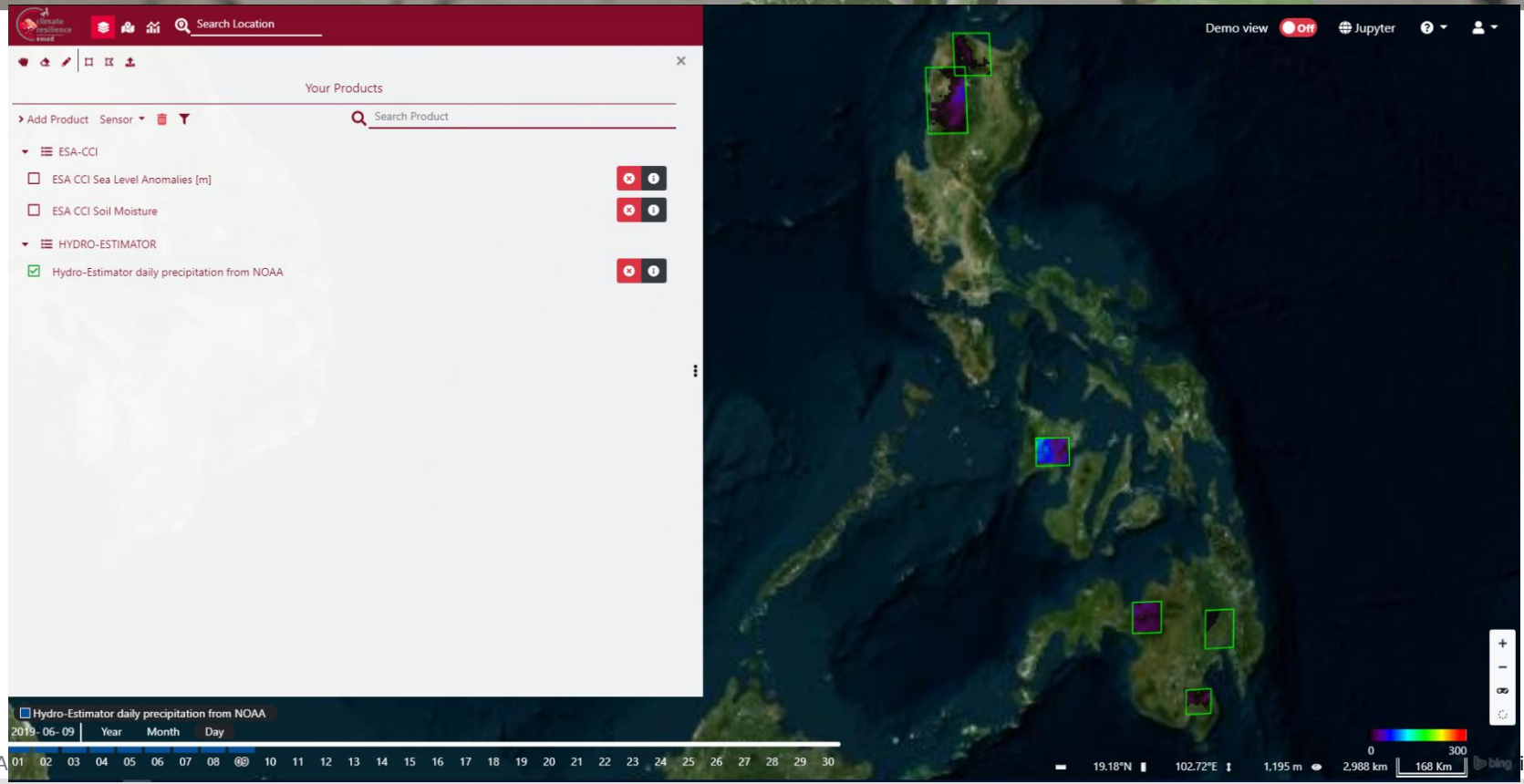
Philippines case – uploaded areas of interest



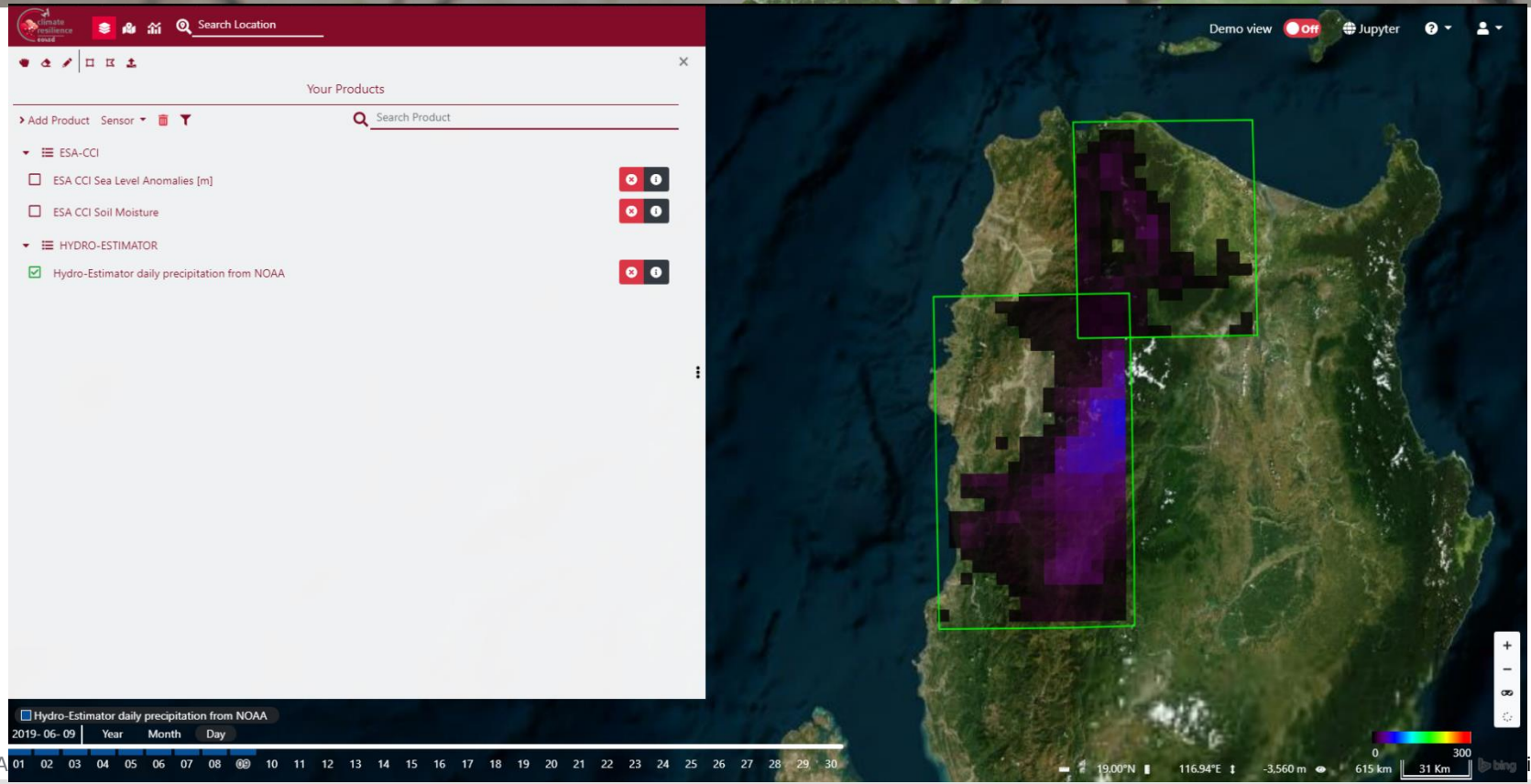
Philippines case - datasets



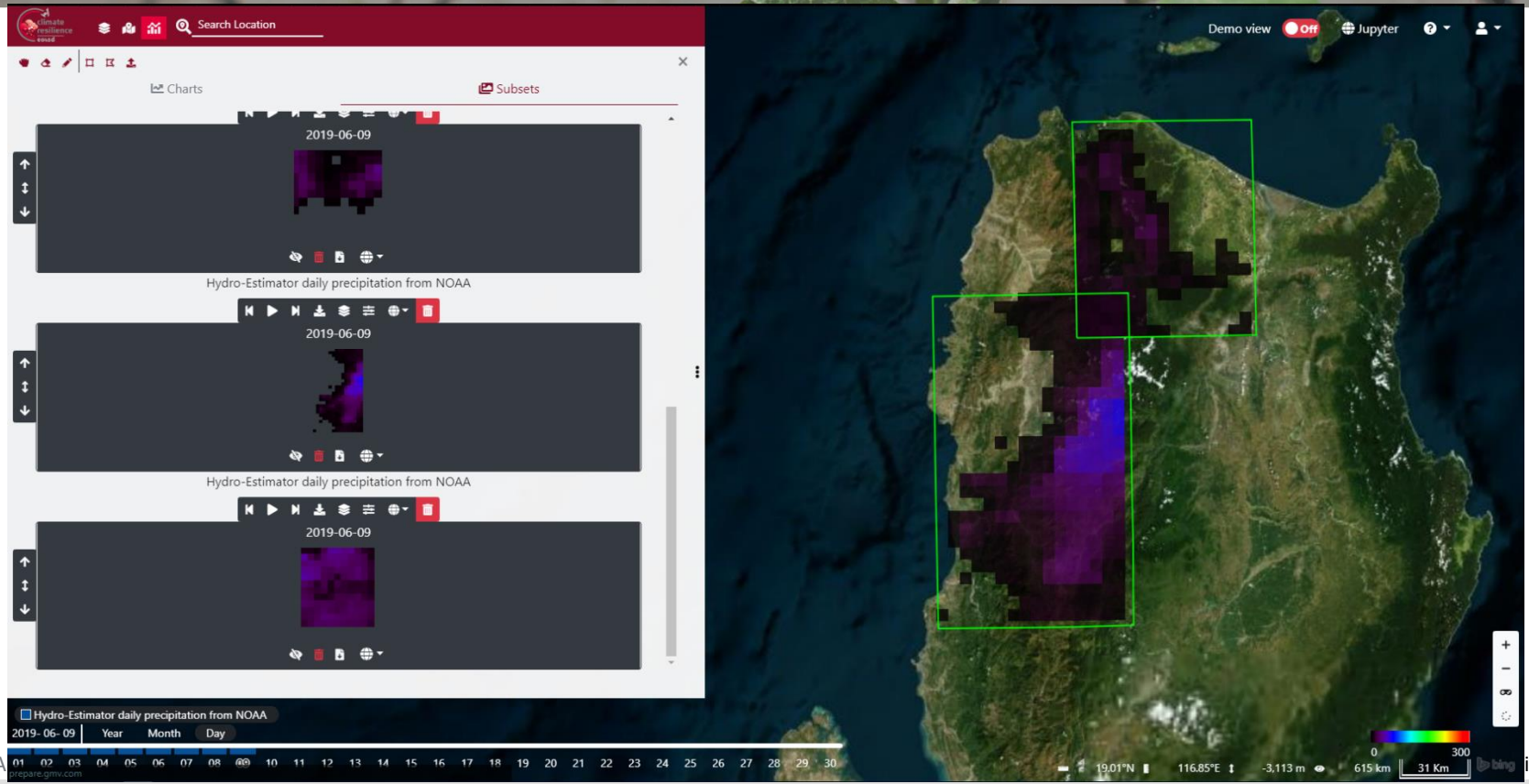
Philippines case - datasets



Philippines case - datasets



Philippines case – time series extraction



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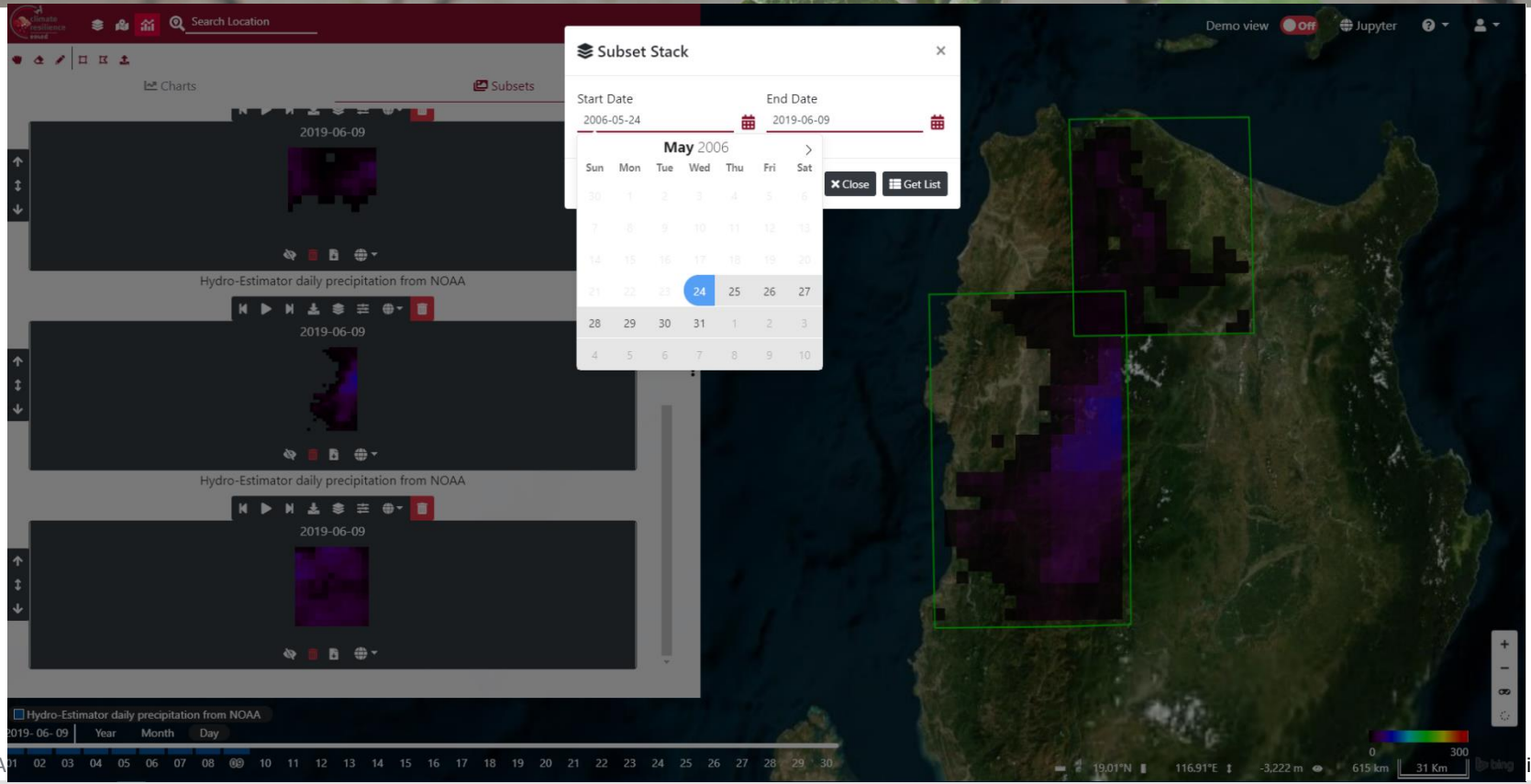

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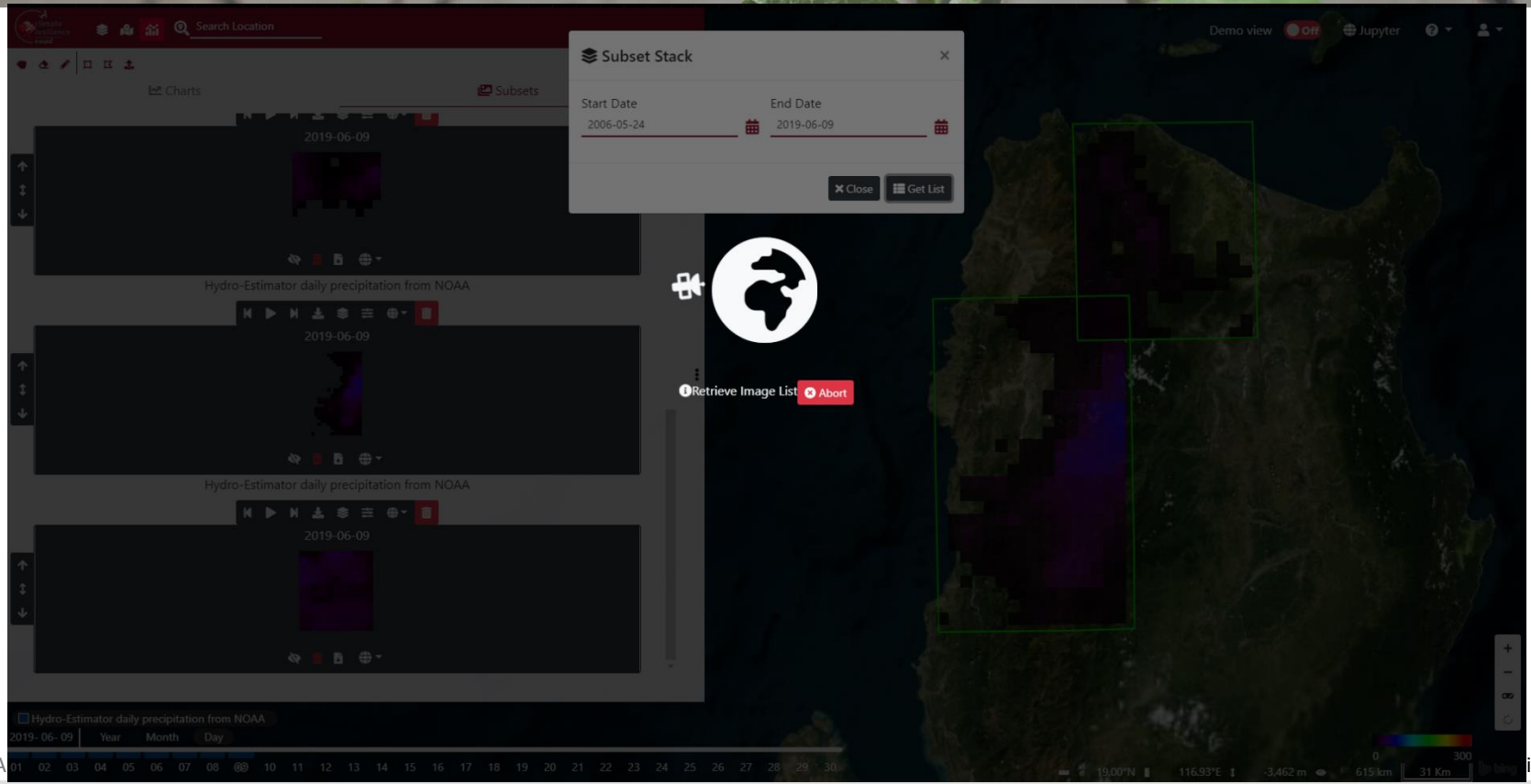

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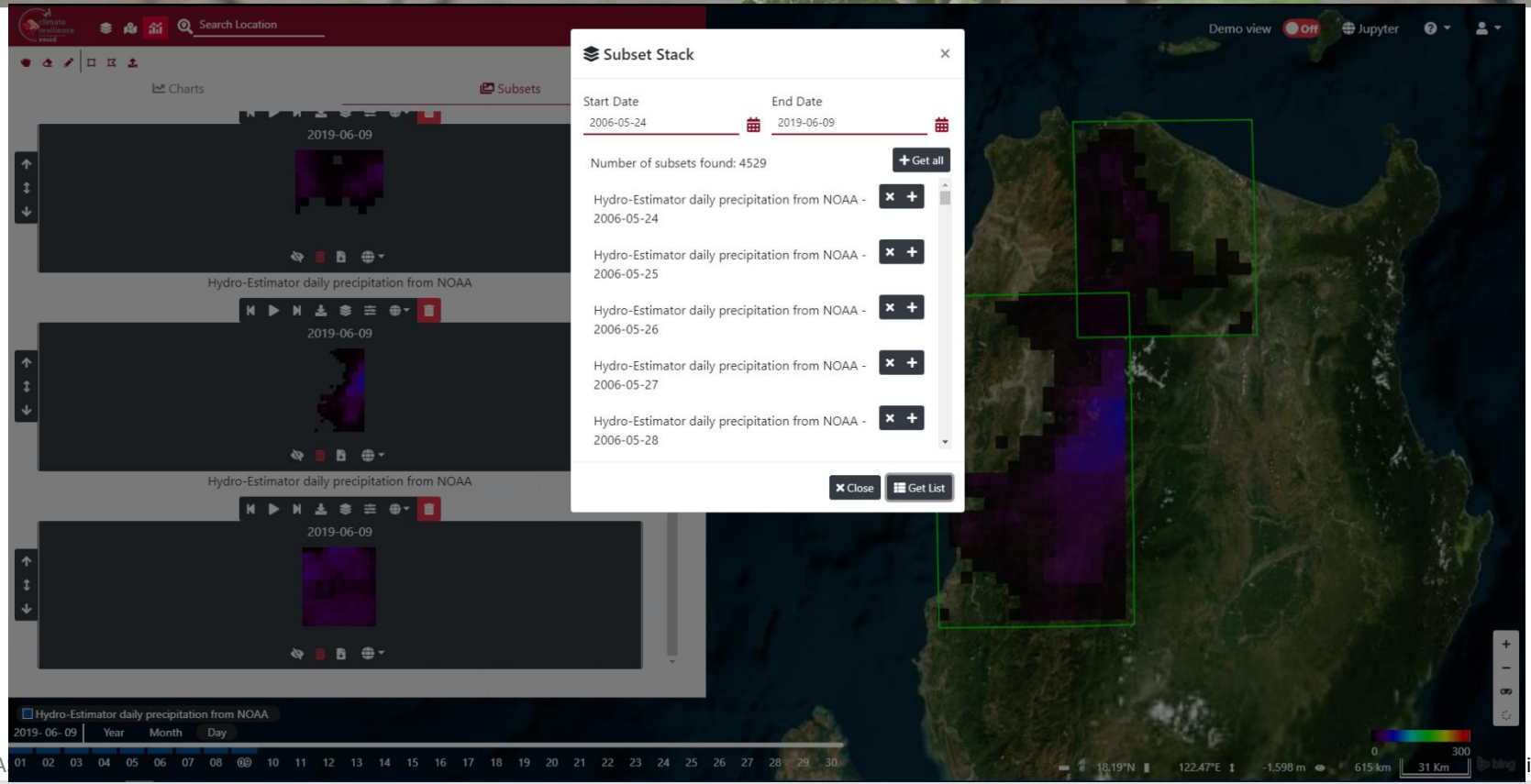

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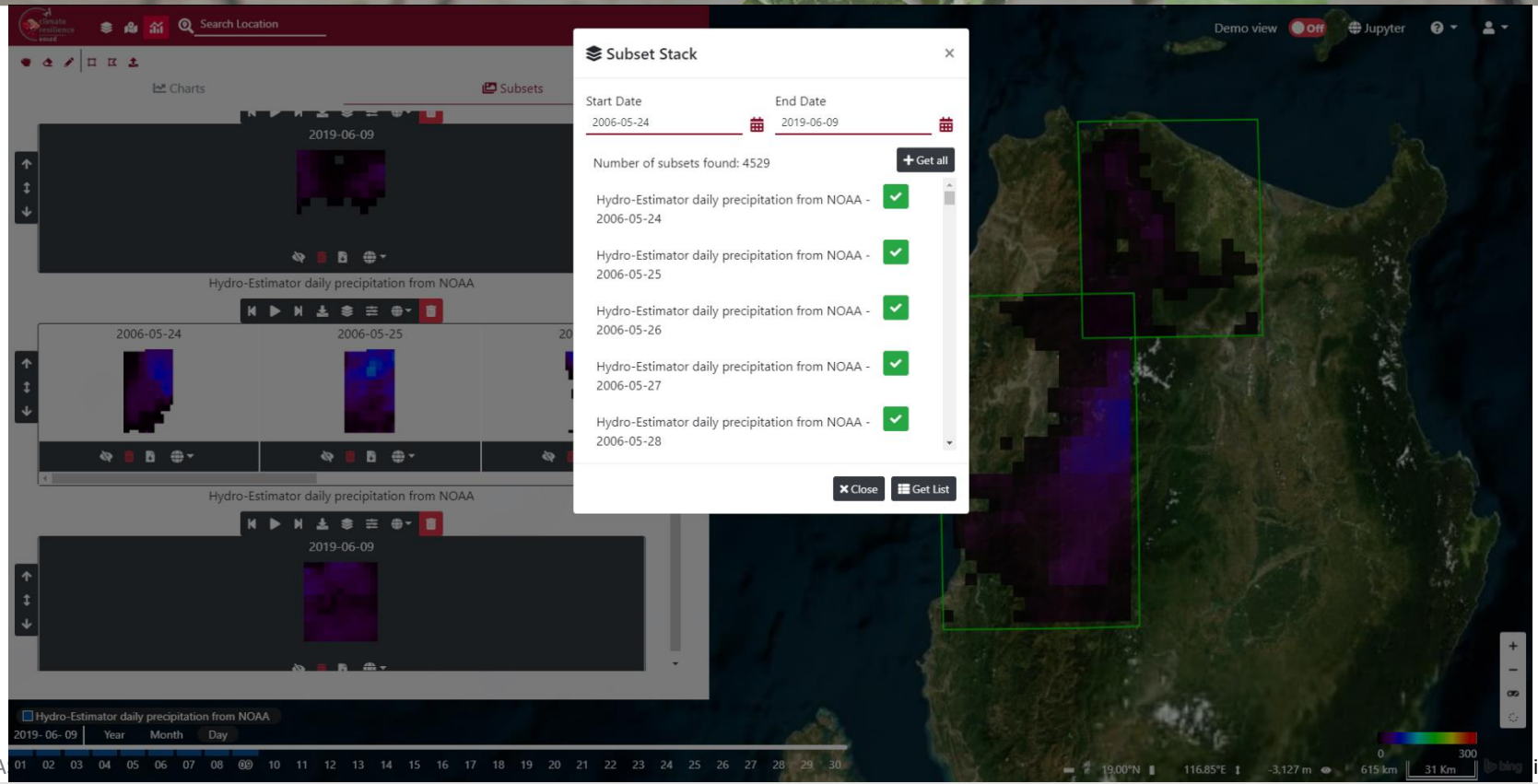

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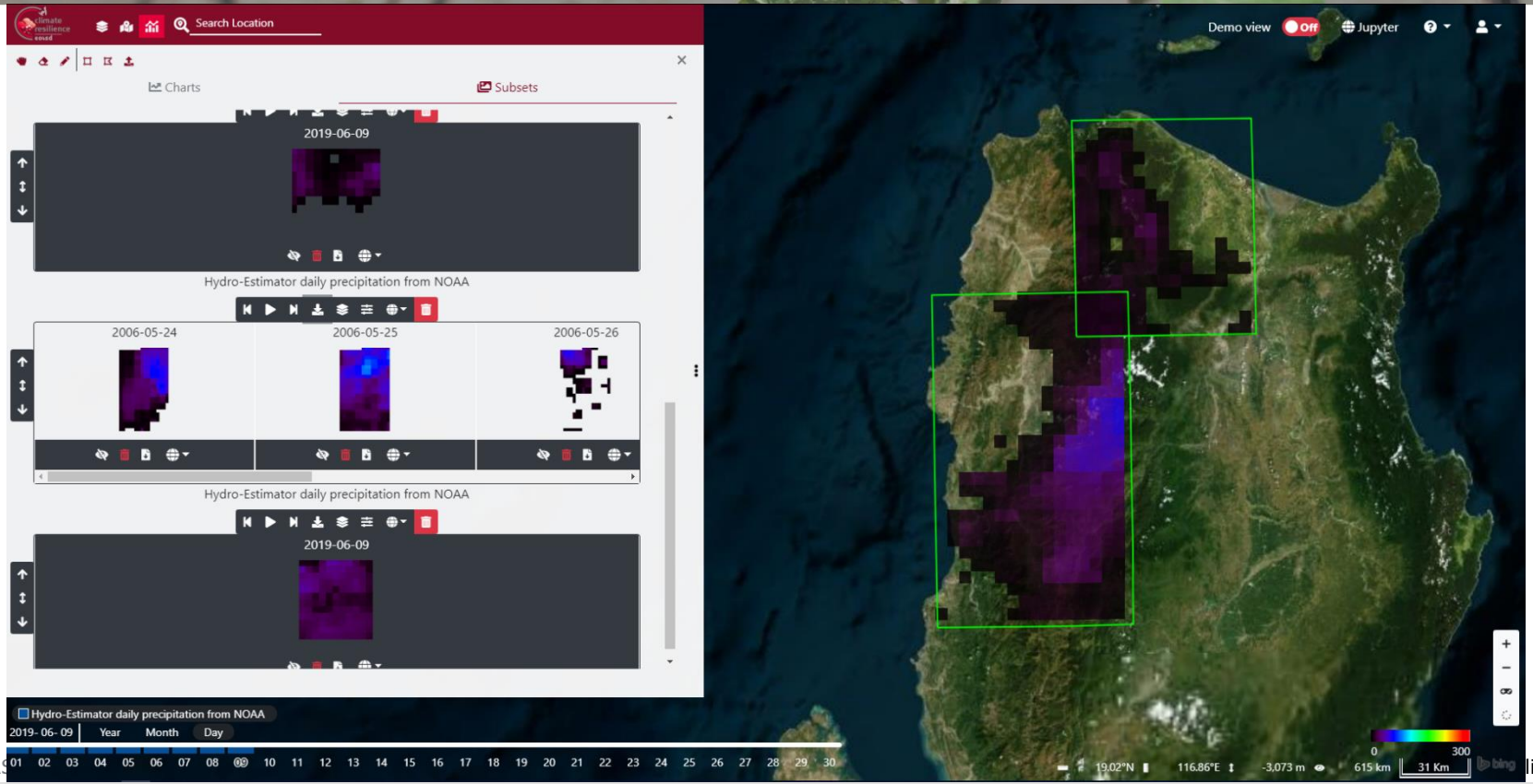
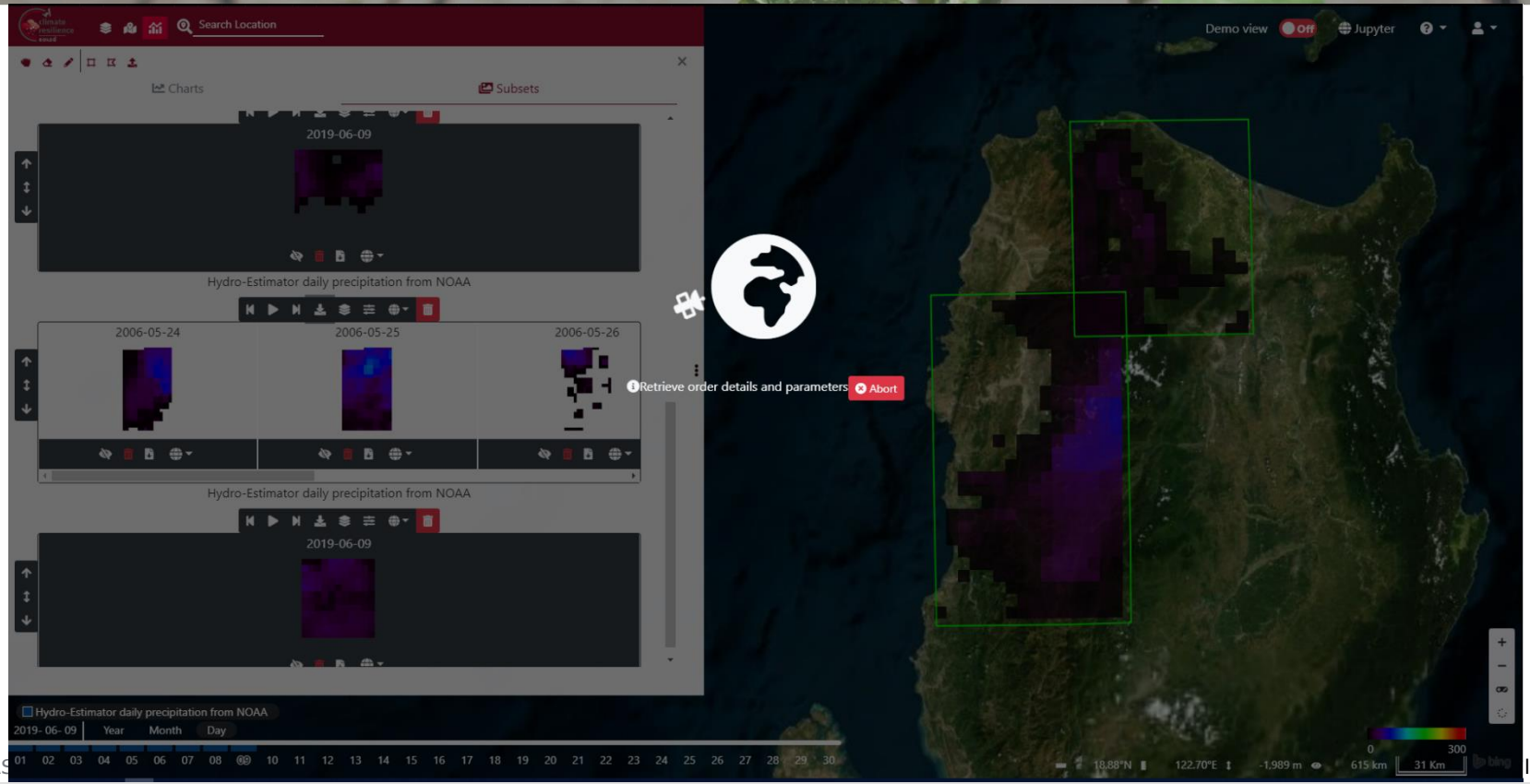


Philippines case – time series download



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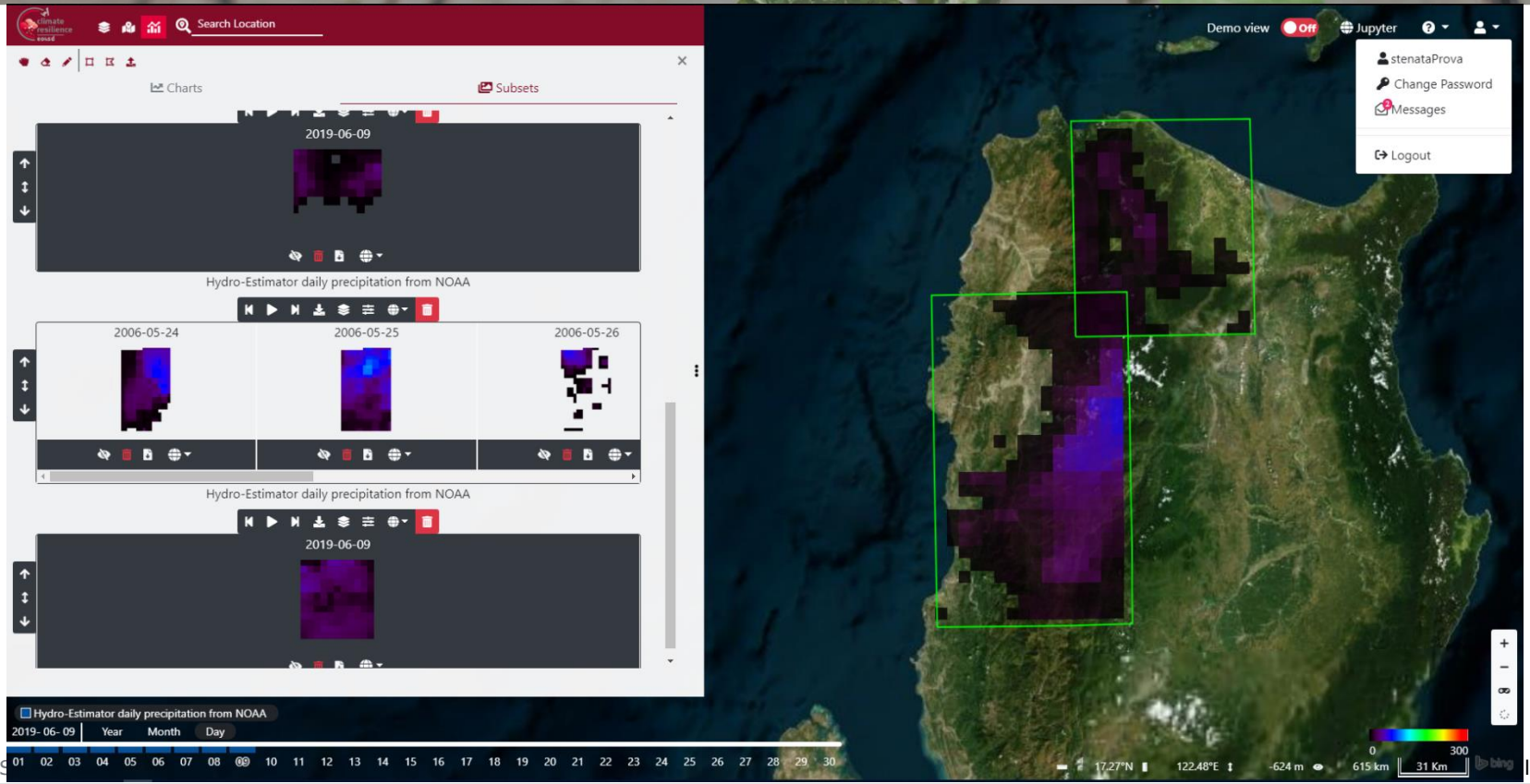

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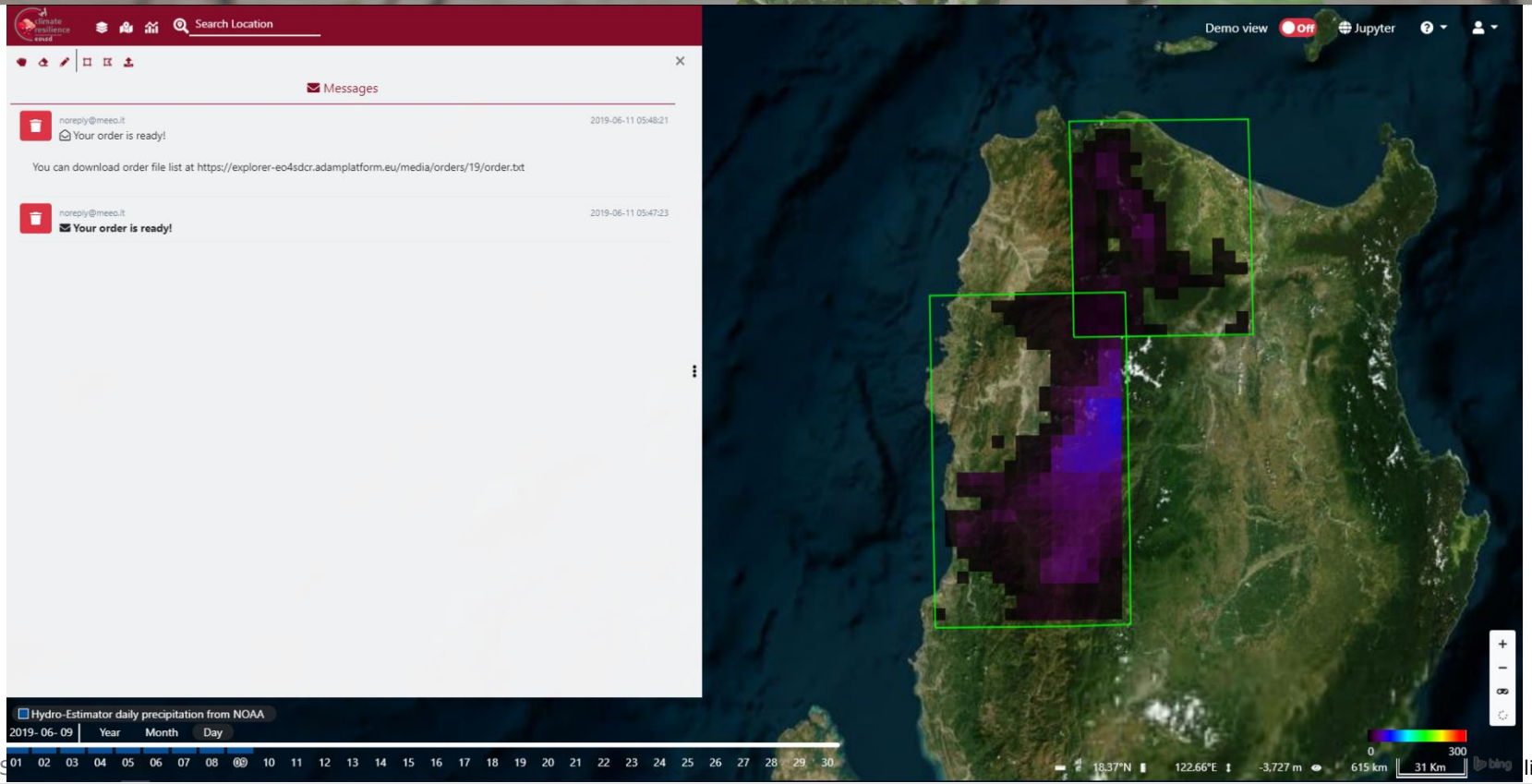

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Philippines case – other options

Jupyter notebook
- Single notebook for data download

APIs / libraries

```
import adampy_devel as adam
import numpy as np
from datetime import timedelta, date
import rasterio
from rasterio.mask import mask
import geopandas as gpd

def daterange(start_date, end_date):
    for n in range(int ((end_date - start_date).days)):
        yield start_date + timedelta(n)

start_date = date(1993, 1, 15)
end_date = date(2015, 12, 15)

df = gpd.read_file('Philippines.geojson')

for single_date in daterange(start_date, end_date):
    date_in = single_date.strftime("%Y-%m-%d")

    time_t= '{}T00:00:00,{}T23:59:59'.format(date_in,date_in)
    collection = 'ESACCI-SEALEVEL-L4-MSLA-MERGED_4326_025'
    try:
        image, crs = adam.getImage('wcs-eo4sdcr.adamplatform.eu', collection ,time_t,df.geometry[0].bounds[1], df.geometry[0].bounds[3],
        df.geometry[0].bounds[0], df.geometry[0].bounds[2], fname = 'phil_sla/{}_{}-{}.tif'.
        format(collection, time_t.split(',')[0],time_t.split(',')[1])).get_data()
```

Live poll questions

Please answer the poll questions that appear in your webex session:

2. Has this webinar helped you better understand how EO data can support climate resilient development? Yes/Somewhat/No

3. Do you feel a webinar was a useful mechanism to deliver this kind of information? Yes/No

Thank you for your attention!

For more information:

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Website: http://eo4sd-climate.gmv.com/

Webinar slidepack and recording will be shared with all participants

" ***Earth Observation*** *provides […] an unbiased, consistent and timely perspective that can inform* ***data-driven decision-making****. It therefore helps us to achieve our core mission at the World Bank […], and to* ***better serve our clients****."*

Laura Tuck, VP, World Bank