e-shape

EuroGEO Showcases: Applications Powered by Europe

S6P5C1
Challenge 1
July 2022

FRIEND User Interface User's Guide

Flood **R**isk & **I**mpact ass**E**ssment through automatic cha**N**ge **D**etection of S-1+S-2 images

MEEO
Meteorological Environmental Earth Observation

The e-shape project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement 820852

Landing page

https://friend.adamplatform.eu/

This pilot aims at assessing the flood risk in selected areas, its impact on urban areas and the associated risk for population. It uses Sentinel-1 and Sentinel-2 change detection data and relevant processing chains to generate time-series of imagery and automatically detect changes on flood events dates, in the following areas: 1) Char-Piya region, an island used also as validation area (Bangladesh), 2) the eastern part of Australia between Queensland and New South Wales, an area relevant for Climate security issues and for its correlation with flood events caused by both hydro-meteorological factors and sea level anomalies (as for case 1), 3) the west Darfur, as additional example of inland area.

The main output will be exposed through the FRIEND platform public GUI based on MEEO data cube technology, to provide citizens and non-expert users with a Flood Risk & Impact Assessment dashboard based on maps and time-series charts.

The FRIEND platform also addresses expert users through the Jupyter Notebook web-based interactive development environment, thus allowing to configure and run customized pipelines and workflow.

Access the public version (free login)

friend
FRIEND Platform
(Public)

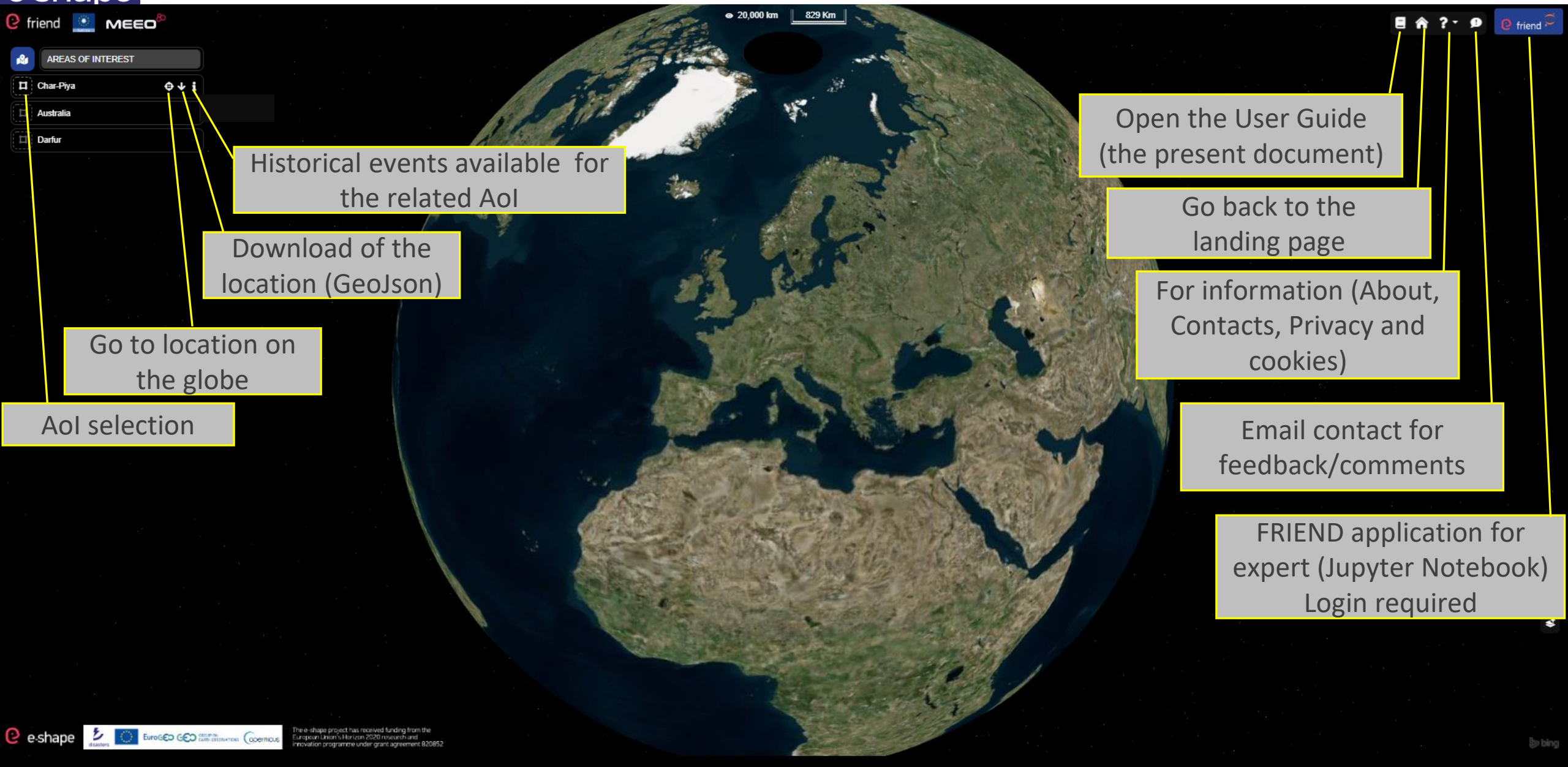
friend
FRIEND Jupyter Notebook
(Expert)

Most of the data are ingested and provided in near-real-time mode, thus covering the last recent days.

The Flood Impact Assessment products, based on Sentinel-1 and Sentinel-2, are produced in the frame of SatCen RTDI activities, in particular they are processed by the GEO-DAMP pipelines.

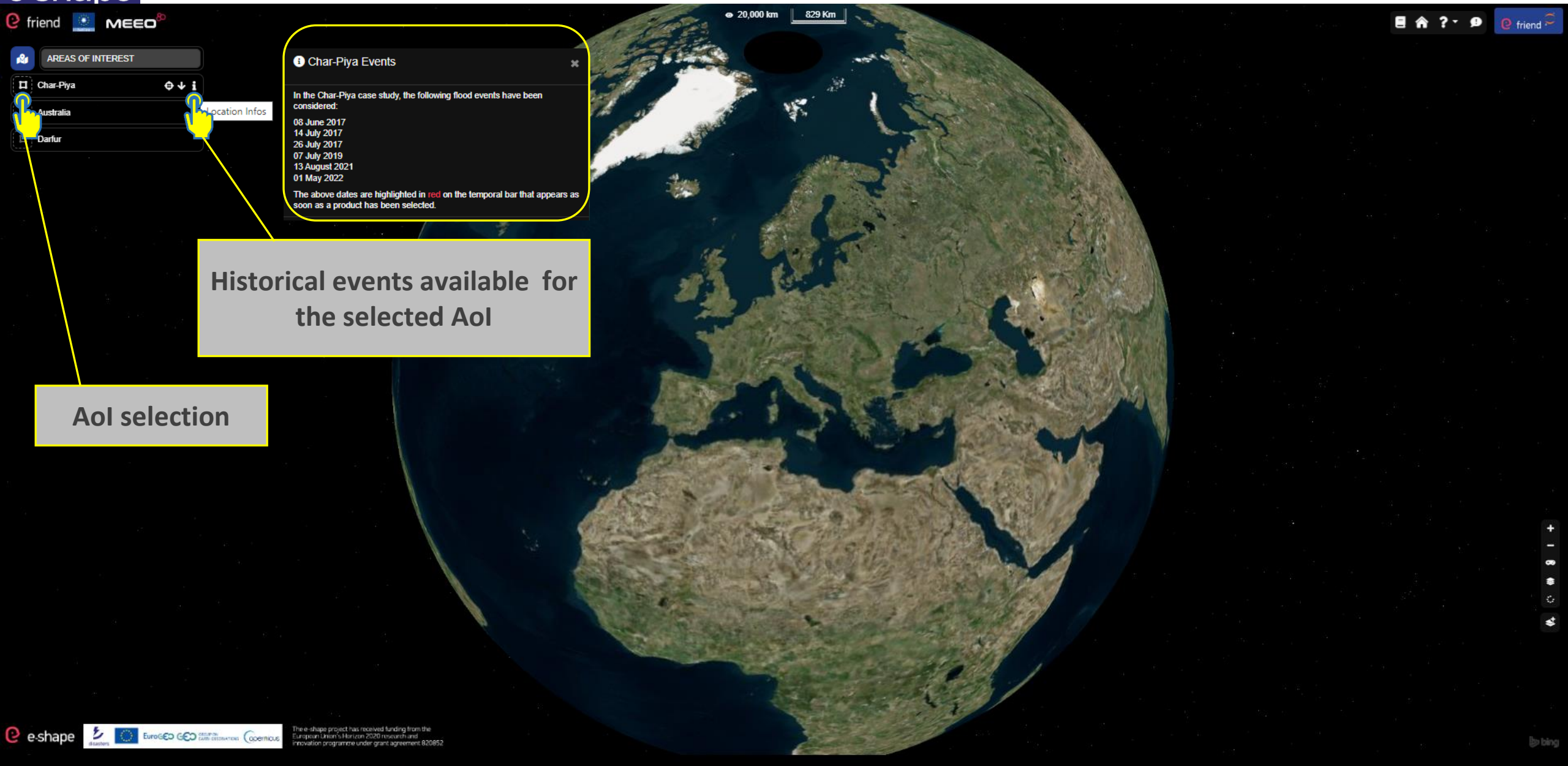
The inland GloFAS products are provided by the Copernicus Emergency Management Service – Global Flood Awareness System (GloFAS). GloFAS Terms & conditions

Main options
(buttons on the GUI)

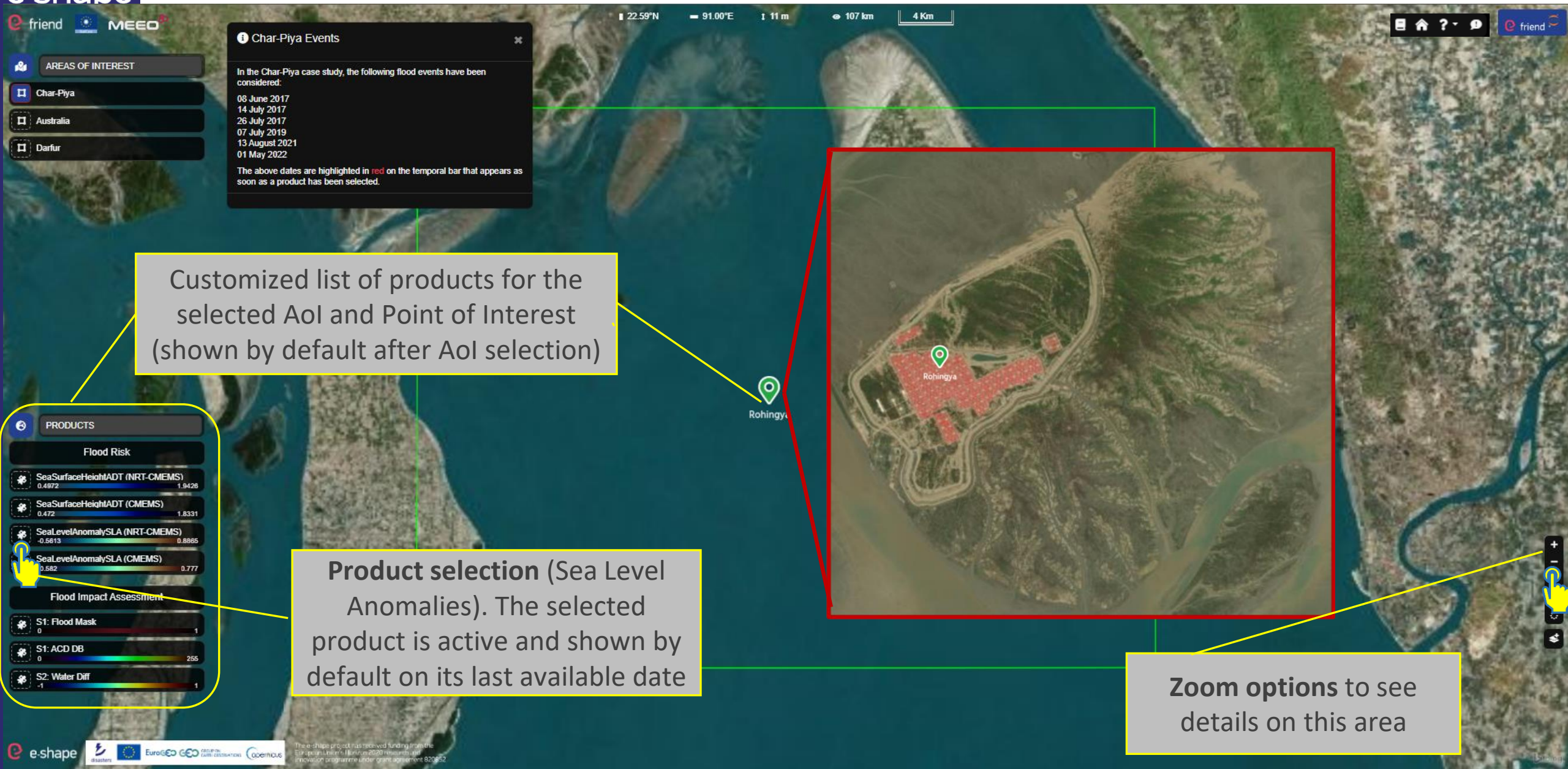


AoI (Area of Interest) selection

Three available areas and information on events for each AoI



Product selection
(Sea Level Anomalies, by CMEMS)

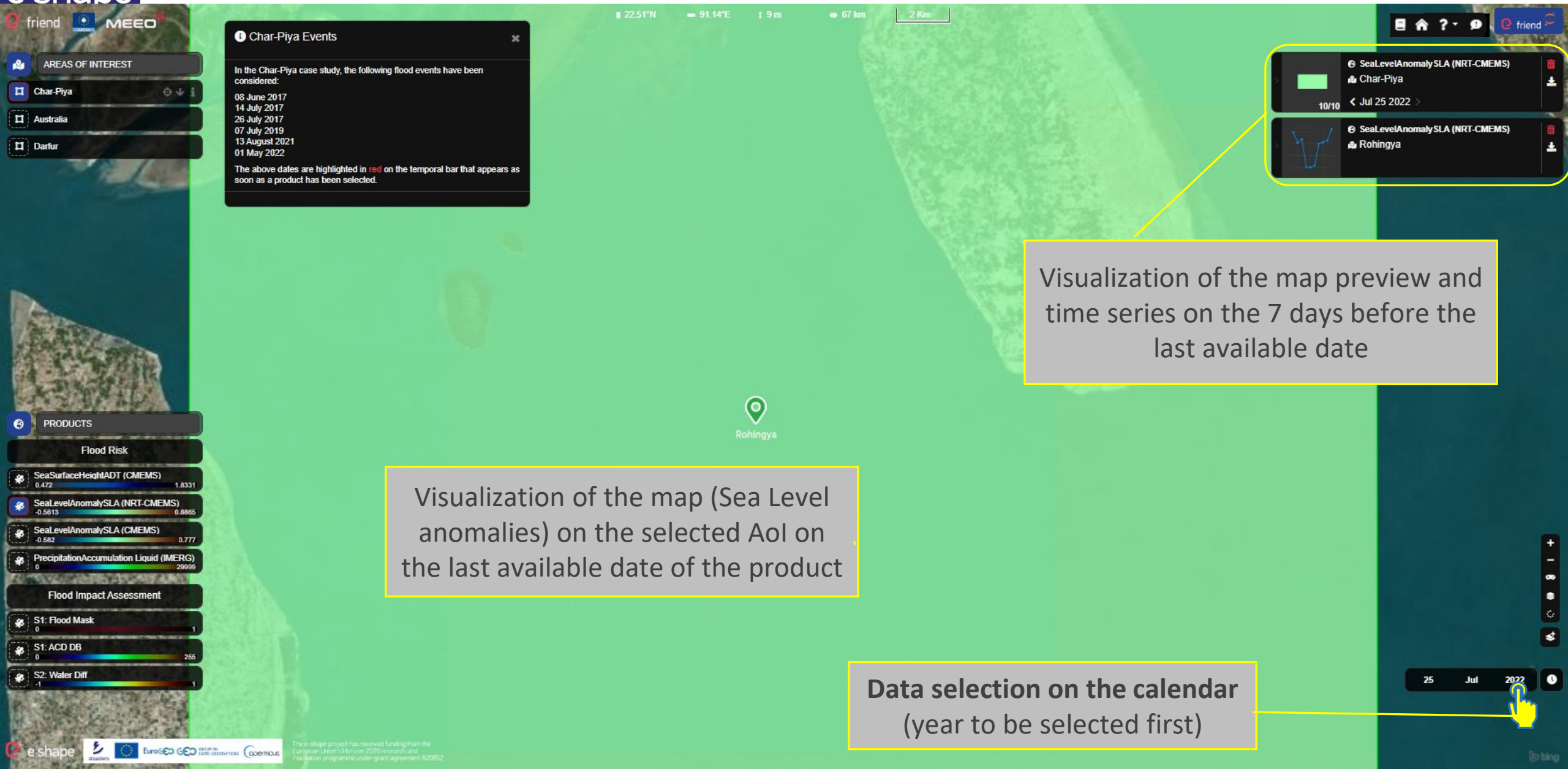


Customized list of products for the selected AoI and Point of Interest (shown by default after AoI selection)

Product selection (Sea Level Anomalies). The selected product is active and shown by default on its last available date

Zoom options to see details on this area

Map and time series
(by default after product selection)

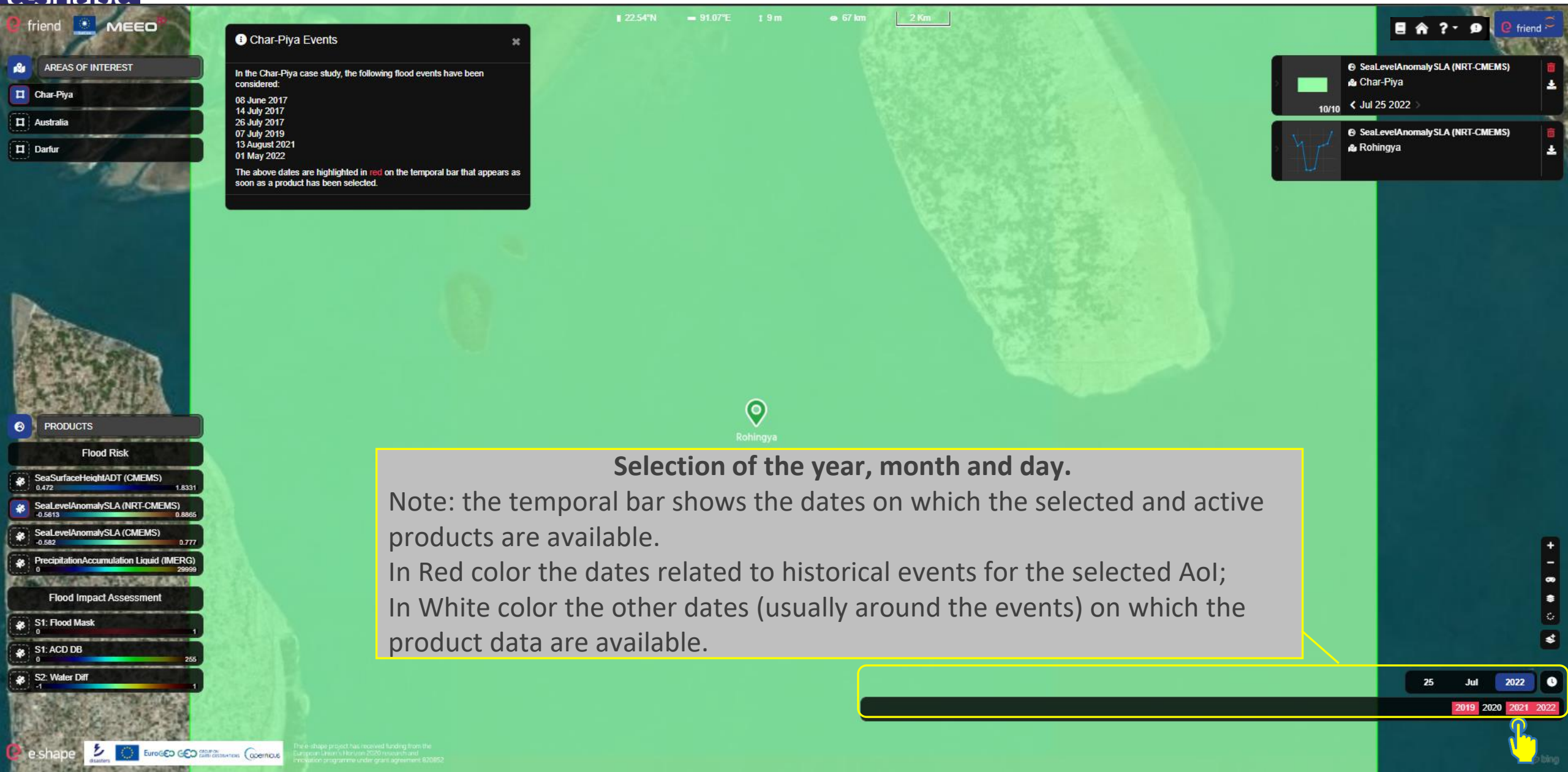


Visualization of the map preview and time series on the 7 days before the last available date

Visualization of the map (Sea Level anomalies) on the selected AoI on the last available date of the product

Data selection on the calendar
(year to be selected first)

Date selection on the Calendar
(to select an historical event date)



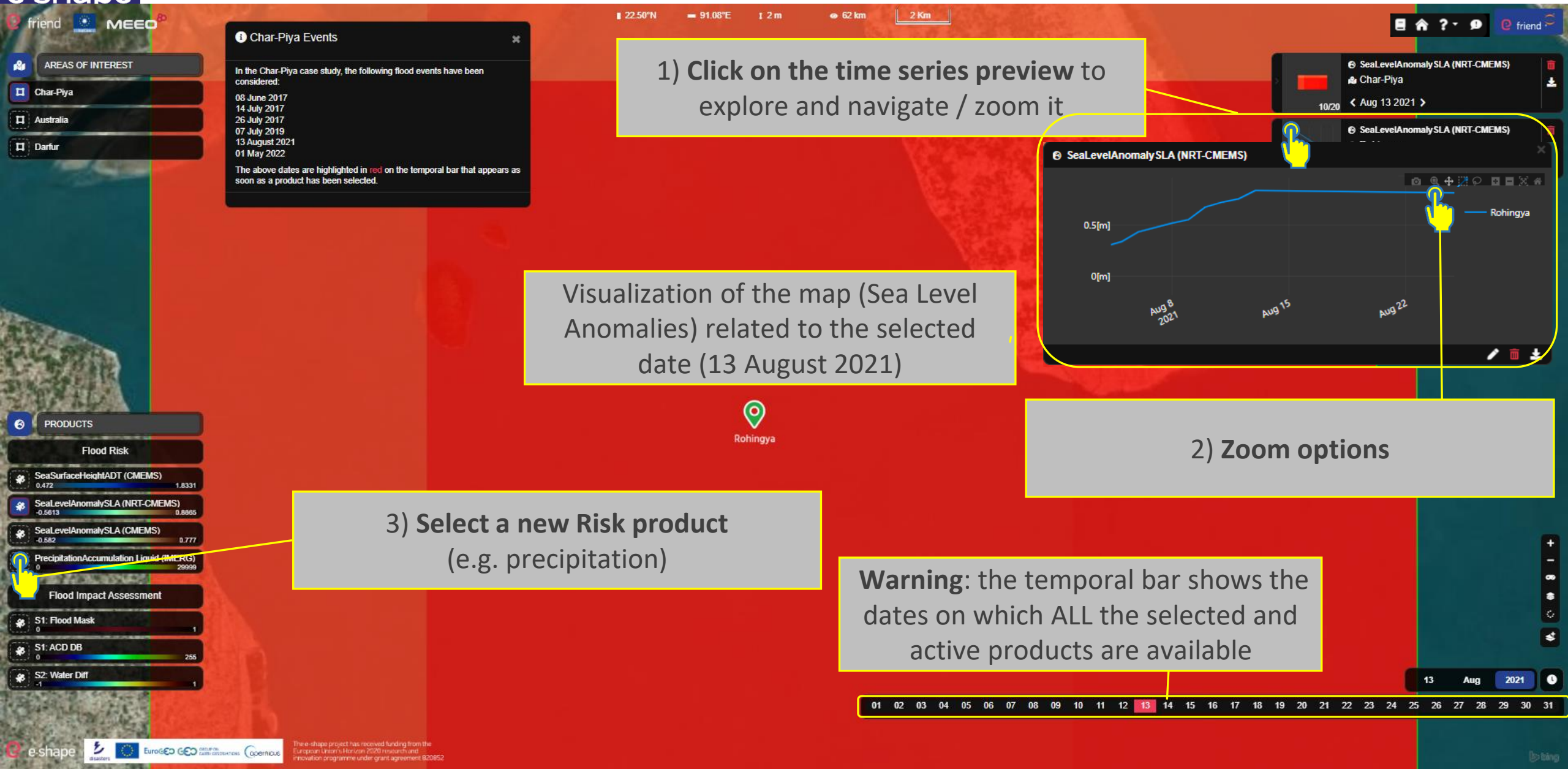
Selection of the year, month and day.

Note: the temporal bar shows the dates on which the selected and active products are available.

In Red color the dates related to historical events for the selected AoI;

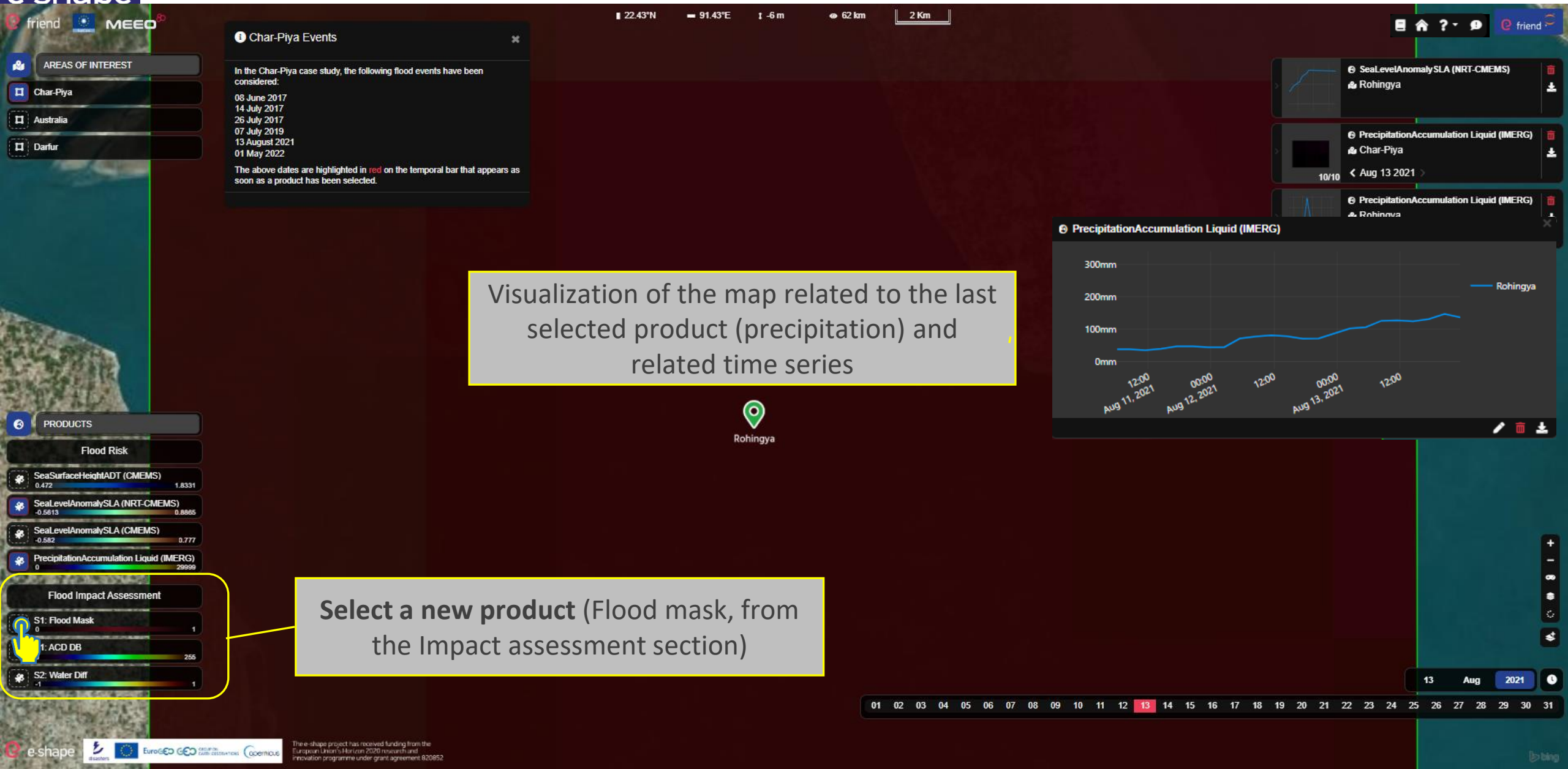
In White color the other dates (usually around the events) on which the product data are available.

Time series analysis and selection of a new product (the example of the IMERG precipitation accumulation)

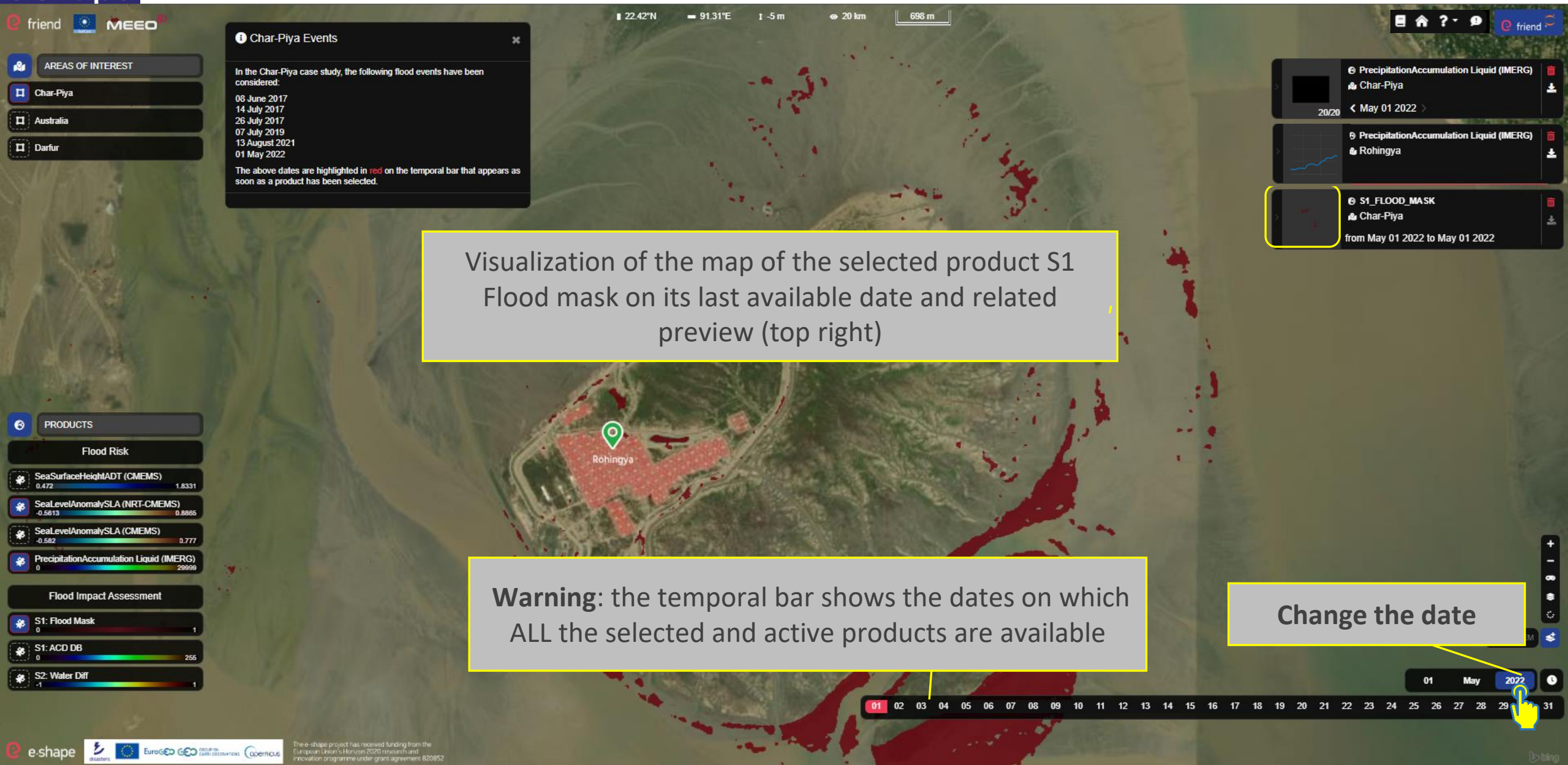


This e-shape project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement 820852

Impact assessment products
(S1 Flood mask)



Impact assessment products
(map visualization, time series not available)

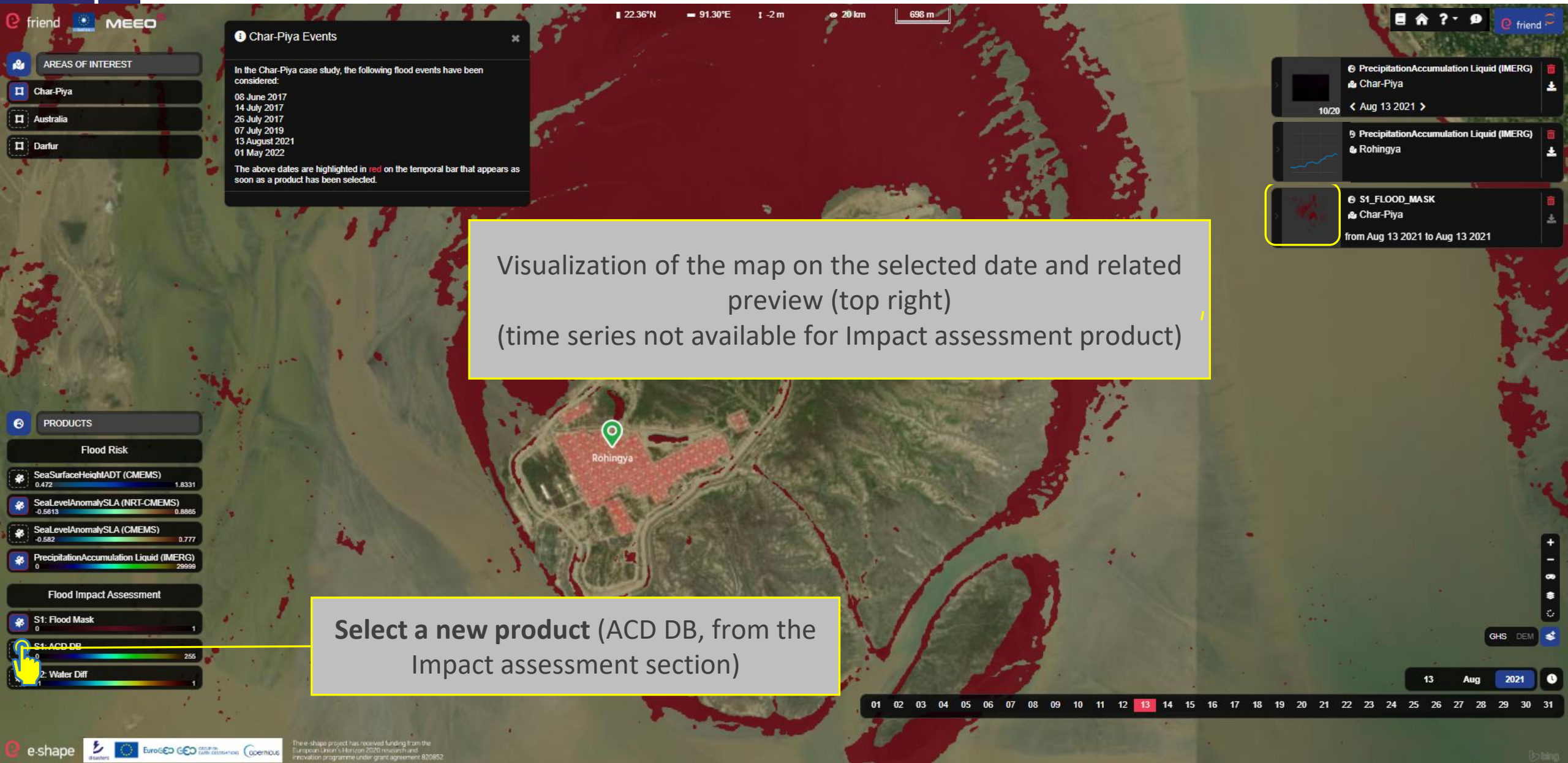


Visualization of the map of the selected product S1 Flood mask on its last available date and related preview (top right)

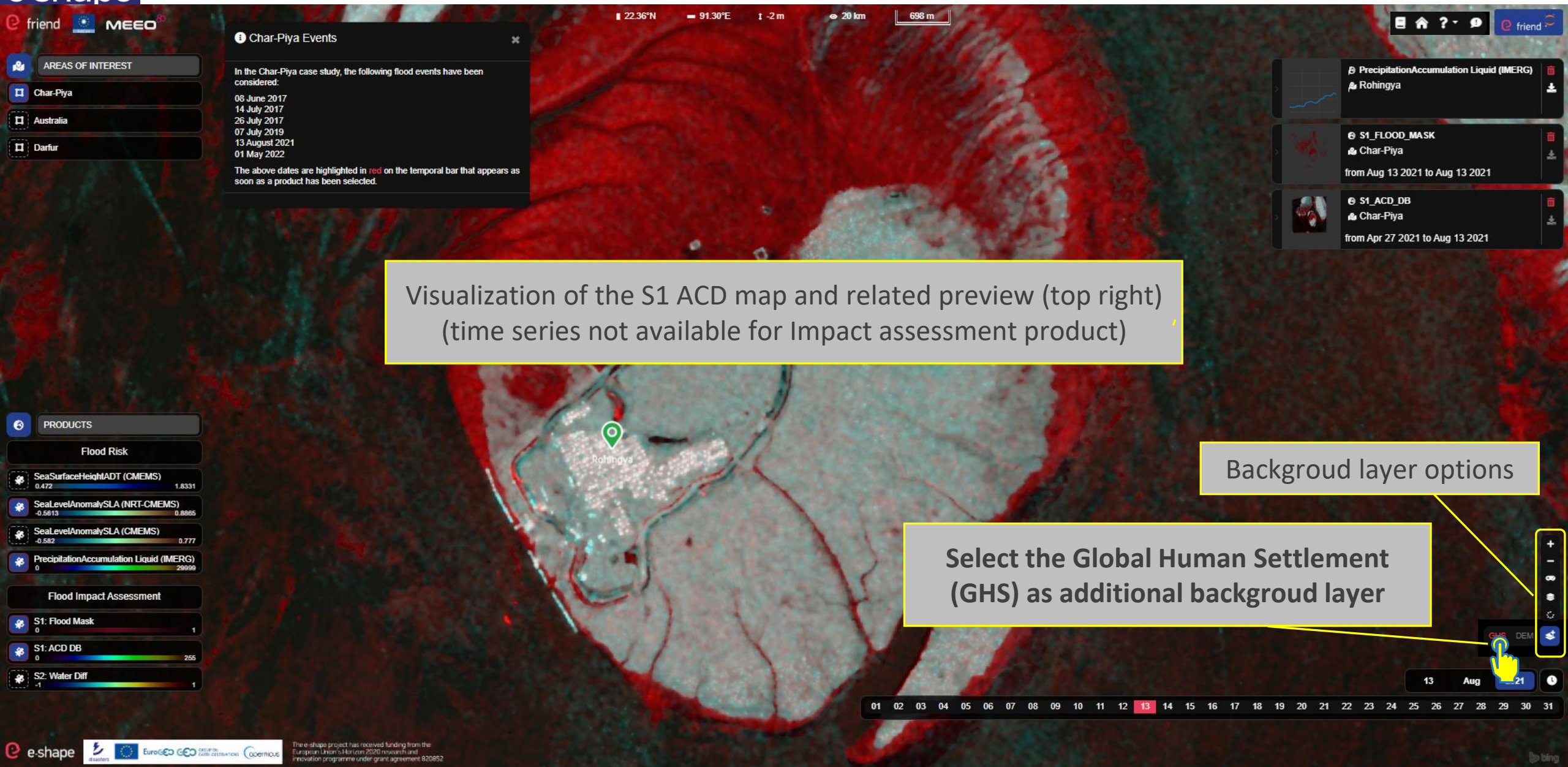
Warning: the temporal bar shows the dates on which ALL the selected and active products are available

Change the date

Impact assessment products
(S1 Change detection - ACD DB)

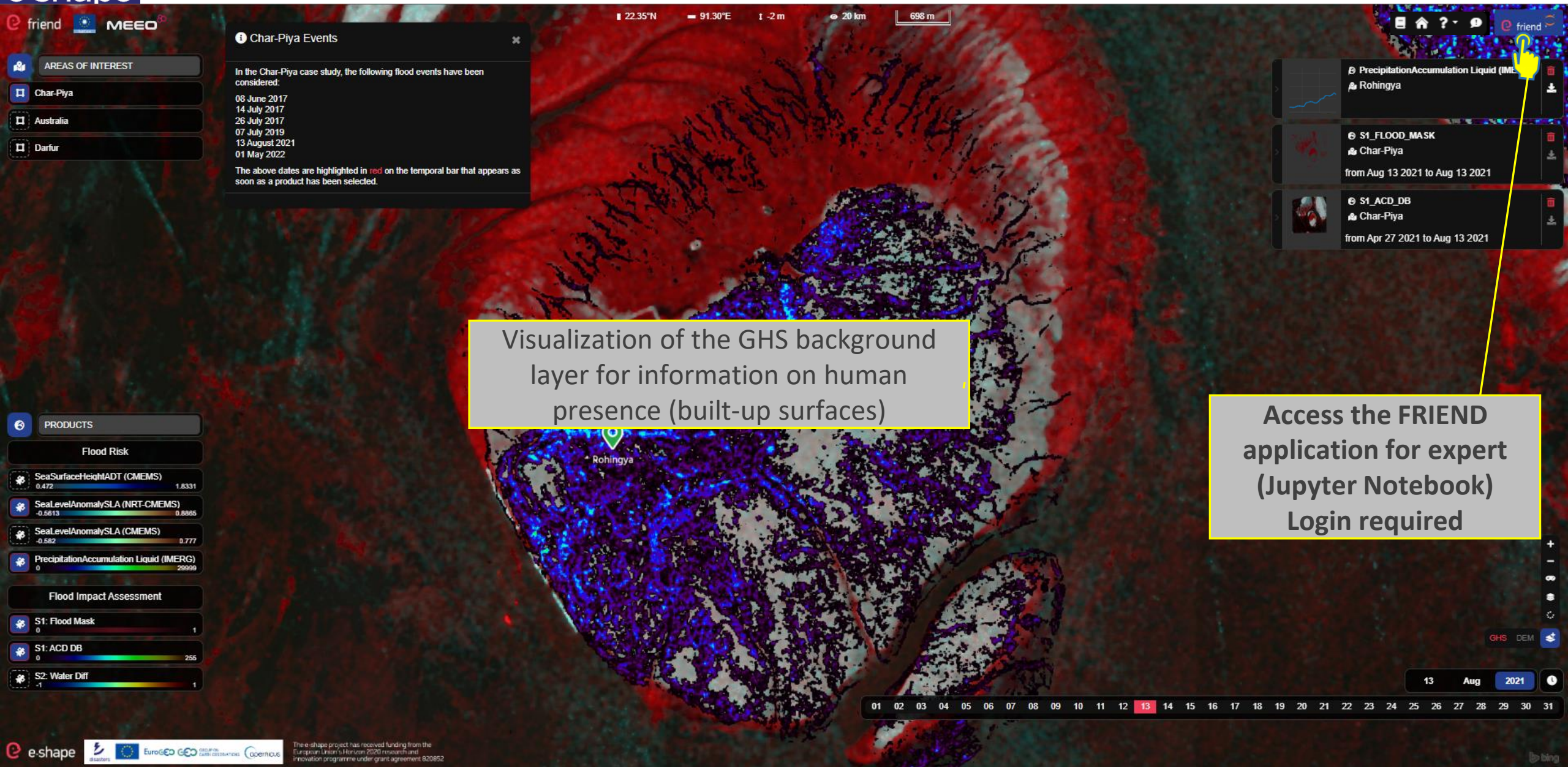


Additional Background layer (GHS)



e-shape
The e-shape project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement 820852

GHS layer and access the expert version
(access to the Jupyter Notebook)



(or in alternative from Landing page)

https://friend.adamplatform.eu/

This pilot aims at assessing the flood risk in selected areas, its impact on urban areas and the associated risk for population. It uses Sentinel-1 and Sentinel-2 change detection data and relevant processing chains to generate time-series of imagery and automatically detect changes on flood events dates, in the following areas: 1) Char-Piya region, an island used also as validation area (Bangladesh), 2) the eastern part of Australia between Queensland and New South Wales, an area relevant for Climate security issues and for its correlation with flood events caused by both hydro-meteorological factors and sea level anomalies (as for case 1), 3) the west Darfur, as additional example of inland area.

The main output will be exposed through the FRIEND platform public GUI based on MEEO data cube technology, to provide citizens and non-expert users with a Flood Risk & Impact Assessment dashboard based on maps and time-series charts.

The FRIEND platform also addresses expert users through the Jupyter Notebook web-based interactive development environment, thus allowing to configure and run customized pipelines and workflow.

friend
FRIEND Platform
(Public)

friend
FRIEND Jupyter Notebook
(Expert)

Access the version for expert (login required)

Most of the data are ingested and provided in near-real-time mode, thus covering the last recent days.

The Flood Impact Assessment products, based on Sentinel-1 and Sentinel-2, are produced in the frame of SatCen RTDI activities, in particular they are processed by the GEO-DAMP pipelines.

The inland GloFAS products are provided by the Copernicus Emergency Management Service – Global Flood Awareness System (GloFAS). GloFAS Terms & conditions

FRIEND application for expert users
(please read before logging in)

e-shape jupyterhub

friend

Back to FRIEND Platform for Public

friend

FRIEND Jupyter Notebook for Expert
Sign-in with FRIEND Login

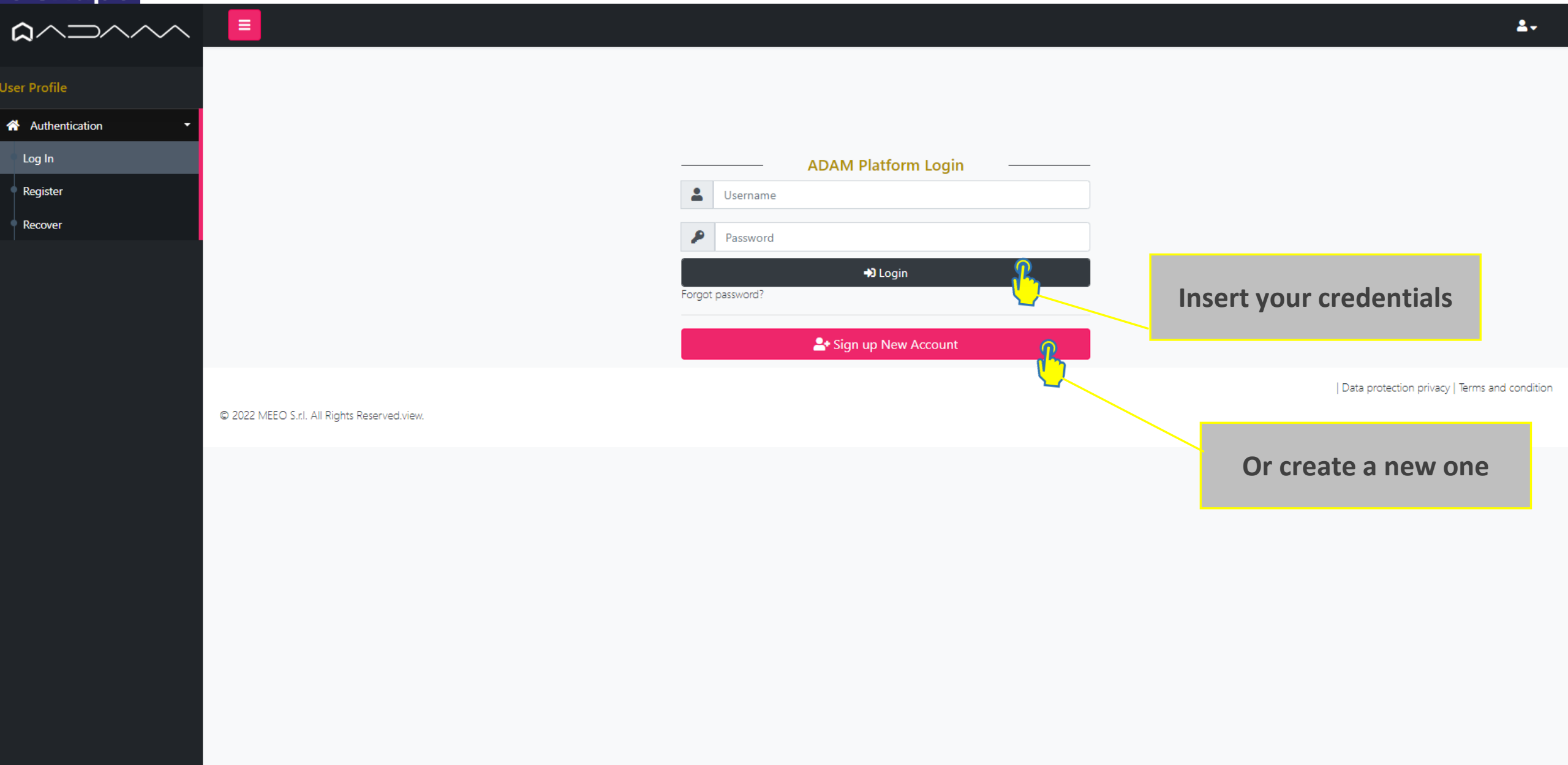
Access the version for expert (login required)

Dear user, welcome to the FRIEND interface for experts, which is based on Jupyterlab Version 3.4.2.
You will be able to work freely on the Base Image that you will find as default.
Keep in mind that your work environment will be cleaned up after 7 days of inactivity. We recommend to download your last version of the .ipynb file to avoid losing your changes.

friend MEEO

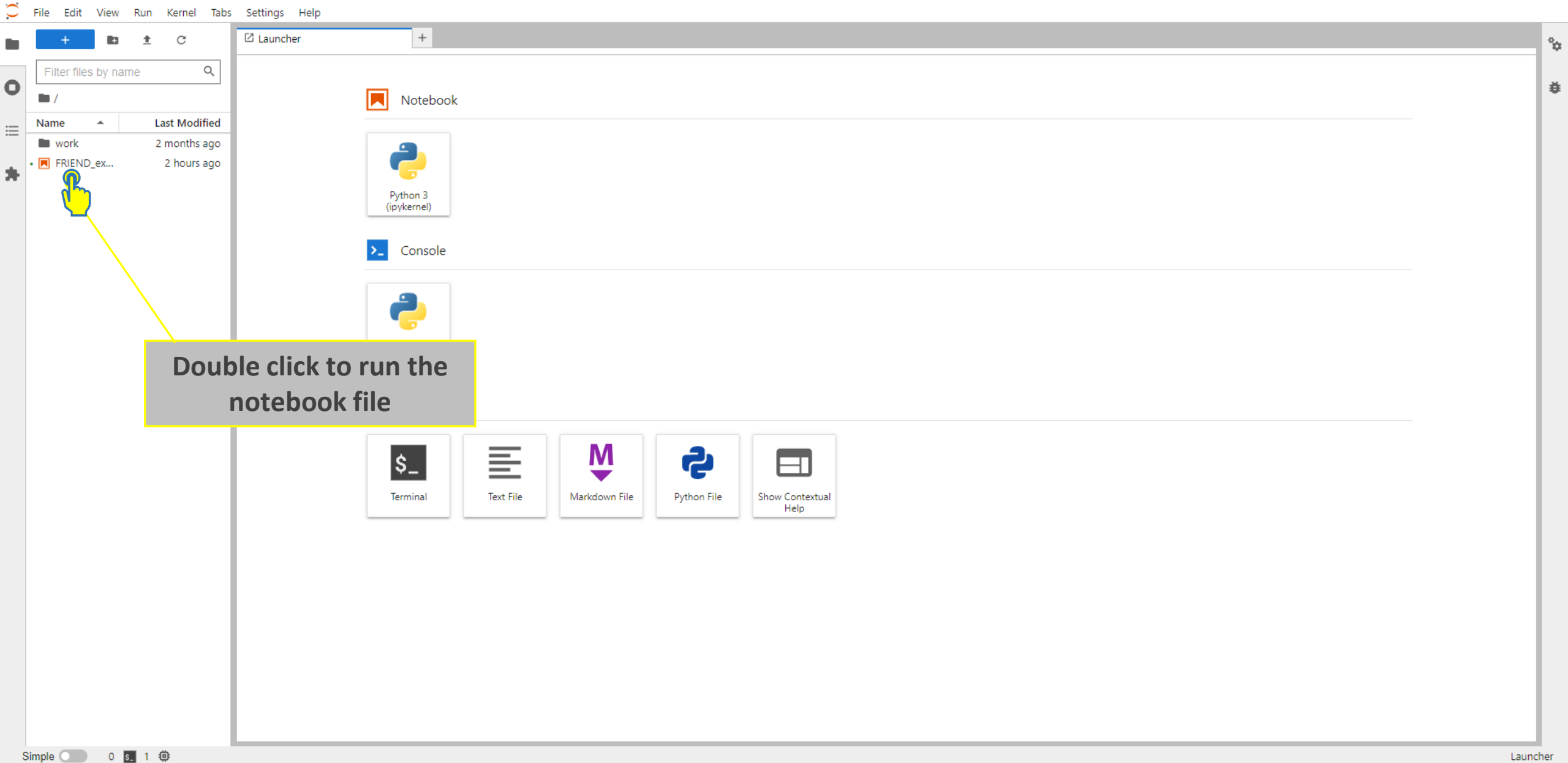
FRIEND application for expert users

(insert your credentials or self register for a new user)

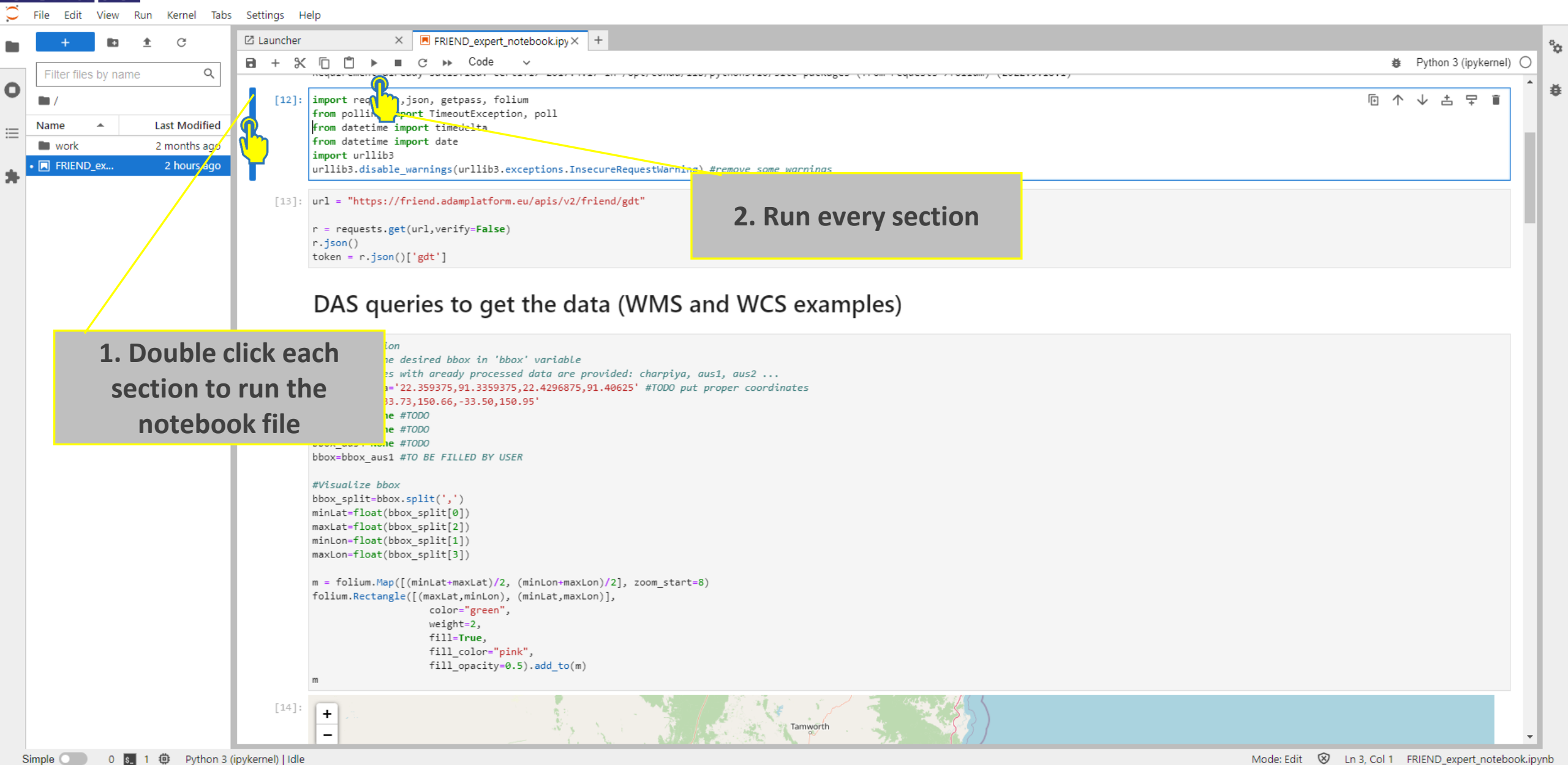


FRIEND application for expert users

(select the notebook file to run)



FRIEND application for expert users
(run the .ipynb notebook file)



FRIEND application for expert users
(and see the related results)

File Edit View Run Kernel Tabs Settings Help

Launcher | FRIEND_expert_notebook.ipy

Code | Python 3 (ipykernel)

Filter files by name

/

Name	Last Modified
work	2 months ago
FRIEND_ex...	a minute ago

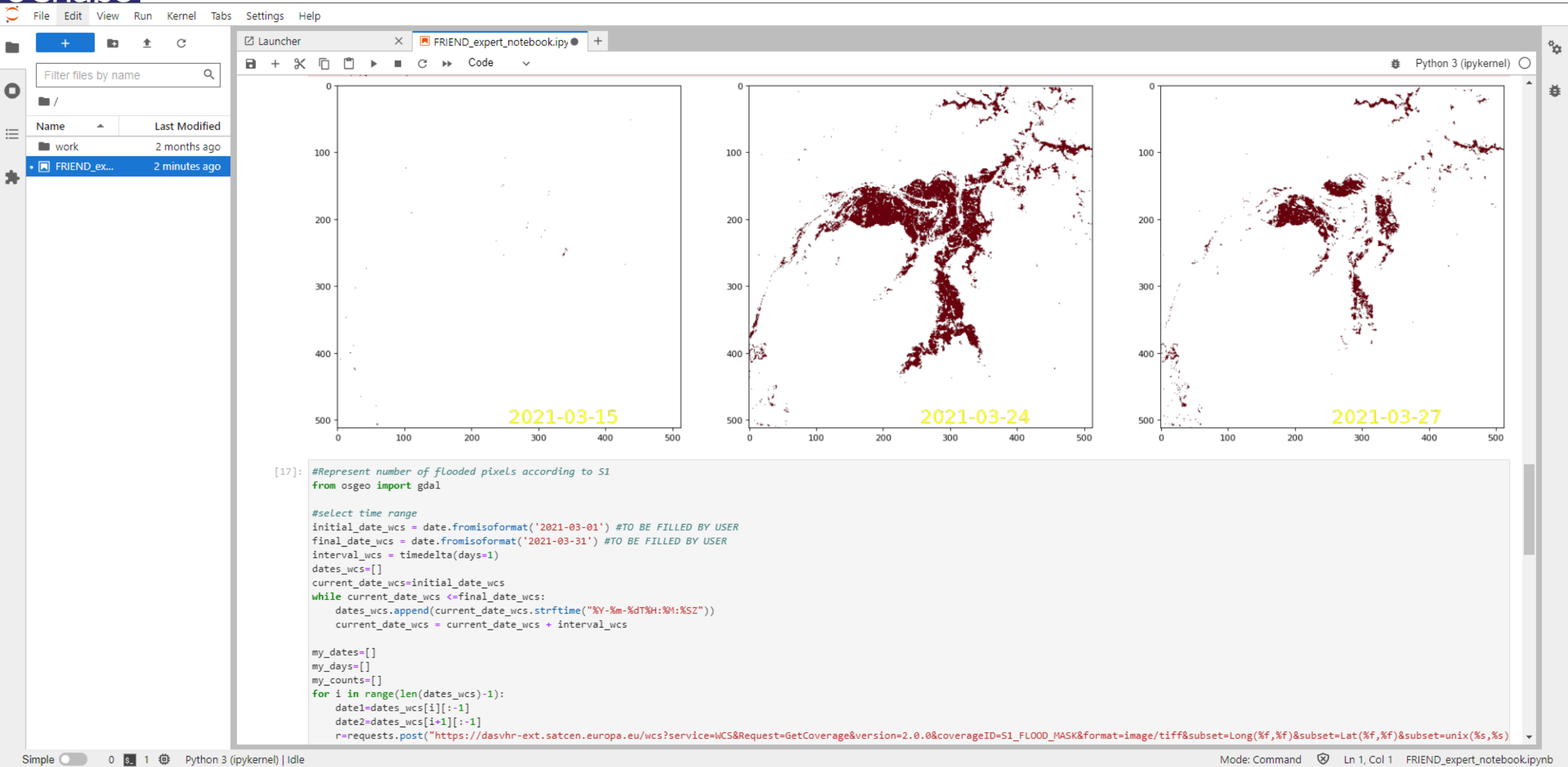
DAS queries to get the data (WMS and WCS examples)

[5]:
```
#Area selection
#Please define desired bbox in 'bbox' variable
#some examples with aready processed data are provided: charpiya, aus1, aus2 ...
bbox_charpiya='22.359375,91.3359375,22.4296875,91.40625' #TODO put proper coordinates
bbox_aus1='-33.73,150.66,-33.50,150.95'
bbox_aus2=None #TODO
bbox_aus3=None #TODO
bbox_aus4=None #TODO
bbox=bbox_aus1 #TO BE FILLED BY USER

#Visualize bbox
bbox_split=bbox.split(',')
minLat=float(bbox_split[0])
maxLat=float(bbox_split[2])
minLon=float(bbox_split[1])
maxLon=float(bbox_split[3])

m = folium.Map([(minLat+maxLat)/2, (minLon+maxLon)/2], zoom_start=8)
folium.Rectangle([(maxLat,minLon), (minLat,maxLon)],
                 color="green",
                 weight=2,
                 fill=True,
                 fill_color="pink",
                 fill_opacity=0.5).add_to(m)
m
```

[5]:

Simple | 0 | 1 | Python 3 (ipykernel) | Idle | Mode: Command | Ln 1, Col 1 | FRIEND_expert_notebook.ipynb

FRIEND application for expert users
(and see the related results)



FRIEND application for expert users
(and see the related results)

File Edit View Run Kernel Tabs Settings Help

Launcher | FRIEND_expert_notebook.ipy

Code | Python 3 (ipykernel)

Filter files by name

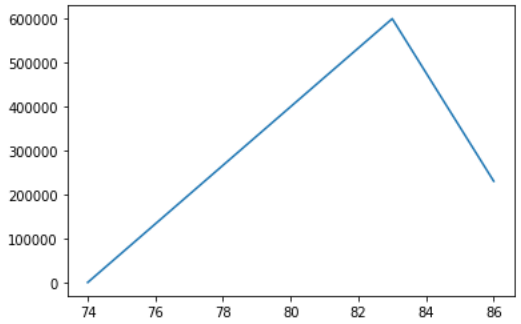
/

Name	Last Modified
work	2 months ago
FRIEND_ex...	seconds ago

```
my_days=[]
my_counts=[]
for i in range(len(dates_wcs)-1):
    date1=dates_wcs[i][:-1]
    date2=dates_wcs[i+1][:-1]
    r=requests.post("https://dasvhr-ext.satcen.europa.eu/wcs?service=WCS&Request=GetCoverage&version=2.0.0&coverageID=S1_FLOOD_MASK&format=image/tiff&subset=Long(%f,%f)&subset=Lat(%f,%f)&subset=unix(%s,%s)
    if (r.status_code==200):

        out = open('WCSrequestdasvhr.tif', 'wb')
        out.write(r.content)
        out.close()
        dataset = gdal.Open('WCSrequestdasvhr.tif', gdal.GA_ReadOnly)
        band = dataset.GetRasterBand(1)
        array = band.ReadAsArray()
        count=0
        for i1 in array:
            for j1 in i1:
                if (j1>0):
                    count = count + 1
        my_dates.append(dates_wcs[i])
        date_time_obj = datetime.datetime.strptime(dates_wcs[i], '%Y-%m-%dT%H:%M:%SZ')
        day_of_year=int(date_time_obj.strftime('%j'))
        my_days.append(day_of_year)
        my_counts.append(count)
        print(dates_wcs[i] + ' --> Day ' + str(day_of_year))

plt.plot(my_days, my_counts)
```

```
2021-03-15T00:00:00Z --> Day 74
2021-03-24T00:00:00Z --> Day 83
2021-03-27T00:00:00Z --> Day 86
```

[17]: [<matplotlib.lines.Line2D at 0x7fbb182328f0>]



Simple 0 1 Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 FRIEND_expert_notebook.ipynb

FRIEND application for expert users

(save the file locally if you have modified it)

File Edit View Run Kernel Tabs Settings Help

Launcher | FRIEND_expert_notebook.ipy

Code | Python 3 (ipykernel)

Filter files by name

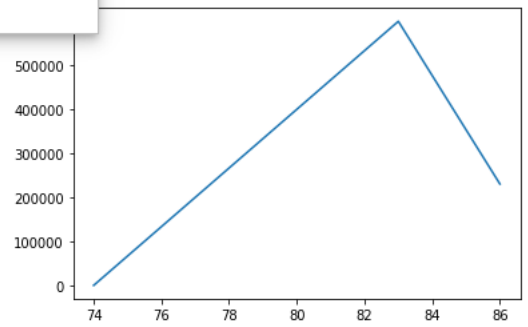
/

Name	Last Modified
work	2 months ago
FRIEND_ex...	30 minutes ago

Open
Open With
Open in New Browser Tab
Rename F2
Delete Del
Cut Ctrl+X
Copy Ctrl+C
Paste Ctrl+V
Duplicate Ctrl+D
Download
Shut Down
Copy Download Link
Copy Path
Copy Shareable Link
New File
New Notebook
New Folder
Shift+Right Click for Browser Menu

```
my_days=[]
my_counts=[]
for i in range(len(dates_wcs)-1):
    date1=dates_wcs[i][:-1]
    date2=dates_wcs[i+1][:-1]
    r=requests.post("https://dasvhr-ext.satcen.europa.eu/wcs?service=WCS&Request=GetCoverage&version=2.0.0&coverageID=S1_FLOOD_MASK&format=image/tiff&subset=Long(%f,%f)&subset=Lat(%f,%f)&subset=unix(%s,%s)
    if (r.status_code==200):

ut = open('WCSrequestdasvhr.tif', 'wb')
ut.write(r.content)
ut.close()
ataset = gdal.Open('WCSrequestdasvhr.tif', gdal.GA_ReadOnly)
and = dataset.GetRasterBand(1)
rray = band.ReadAsArray()
ount=0
or i1 in array:
   for j1 in i1:
       if (j1>0):
           count = count + 1
y_dates.append(dates_wcs[i])
ate_time_obj = datetime.datetime.strptime(dates_wcs[i], '%Y-%m-%dT%H:%M:%SZ')
ay_of_year=int(date_time_obj.strftime('%j'))
y_days.append(day_of_year)
y_counts.append(count)
rint(dates_wcs[i] + ' --> Day ' + str(day_of_year))

my_days, my_counts)
```

```
5T00:00:00Z --> Day 74
4T00:00:00Z --> Day 83
7T00:00:00Z --> Day 86
lib.lines.Line2D at 0x7fbb182328f0>]
```



Simple 0 1 Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 FRIEND_expert_notebook.ipynb

FRIEND application for expert users
(log out)

File Edit View Run Kernel Tabs Settings Help

New
New Launcher Ctrl+Shift+L
Open from Path...
Open from URL...
New View for Notebook
New Console for Notebook
Close Tab Alt+W
Close and Shutdown Notebook Ctrl+Shift+Q
Close All Tabs
Save Notebook Ctrl+S
Save Notebook As... Ctrl+Shift+S
Save All
Reload Notebook from Disk
Revert Notebook to Checkpoint
Rename Notebook...
Download
Save and Export Notebook As...
Save Current Workspace As...
Save Current Workspace
Print... Ctrl+P
Hub Control Panel
Log Out

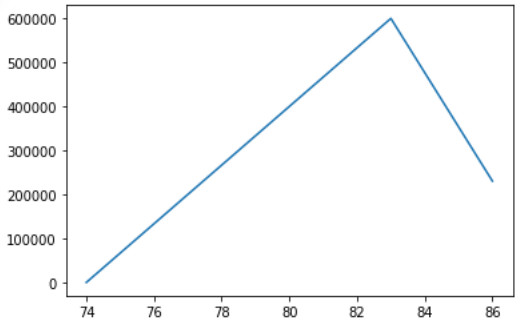
FRIEND_expert_notebook.ipy

Code

Python 3 (ipykernel)

```
my_days=[]
my_counts=[]
for i in range(len(dates_wcs)-1):
    date1=dates_wcs[i][:-1]
    date2=dates_wcs[i+1][:-1]
    r=requests.post("https://dasvhr-ext.satcen.europa.eu/wcs?service=WCS&Request=GetCoverage&version=2.0.0&coverageID=S1_FLOOD_MASK&format=image/tiff&subset=Long(%f,%f)&subset=Lat(%f,%f)&subset=unix(%s,%s)
    if (r.status_code==200):

        out = open('WCSrequestdasvhr.tif', 'wb')
        out.write(r.content)
        out.close()
        dataset = gdal.Open('WCSrequestdasvhr.tif', gdal.GA_ReadOnly)
        band = dataset.GetRasterBand(1)
        array = band.ReadAsArray()
        count=0
        for i1 in array:
            for j1 in i1:
                if (j1>0):
                    count = count + 1
        my_dates.append(dates_wcs[i])
        date_time_obj = datetime.datetime.strptime(dates_wcs[i], '%Y-%m-%dT%H:%M:%SZ')
        day_of_year=int(date_time_obj.strftime('%j'))
        my_days.append(day_of_year)
        my_counts.append(count)
        print(dates_wcs[i] + ' --> Day ' + str(day_of_year))

plt.plot(my_days, my_counts)
```

```
2021-03-15T00:00:00Z --> Day 74
2021-03-24T00:00:00Z --> Day 83
2021-03-27T00:00:00Z --> Day 86
[<matplotlib.lines.Line2D at 0x7fbb182328f0>]
```



Simple 0 1 Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 FRIEND_expert_notebook.ipynb

e-shape

Thank you!

www.e-shape.eu