FASTER

Farmers' Adaptation and Sustainability in Tunisia through Excellence in Research

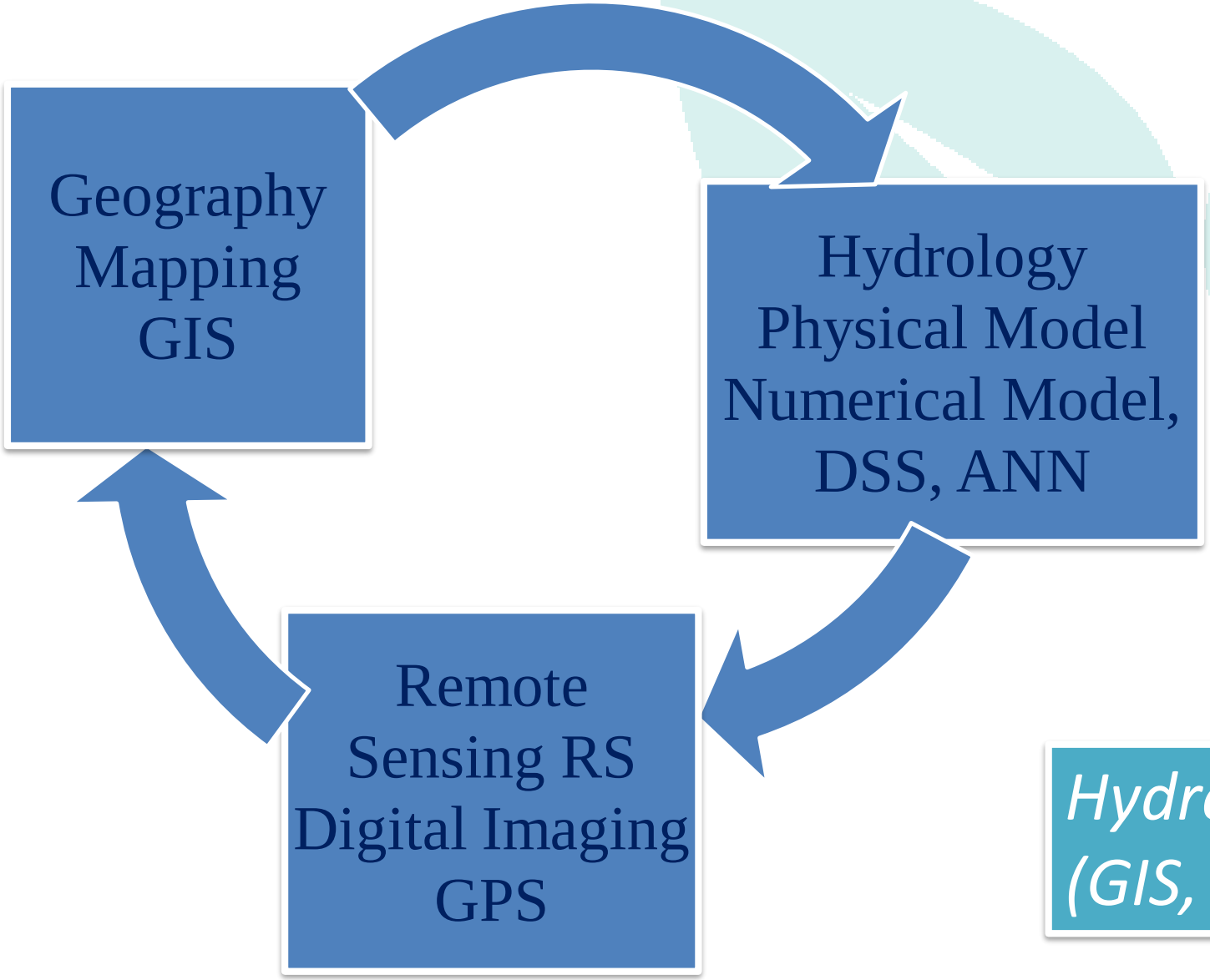
2nd FASTER SPECIALIZED TRAINING

on Climate change effects on water & land management in the Mediterranean

22-26 March 2021 (ONLINE)

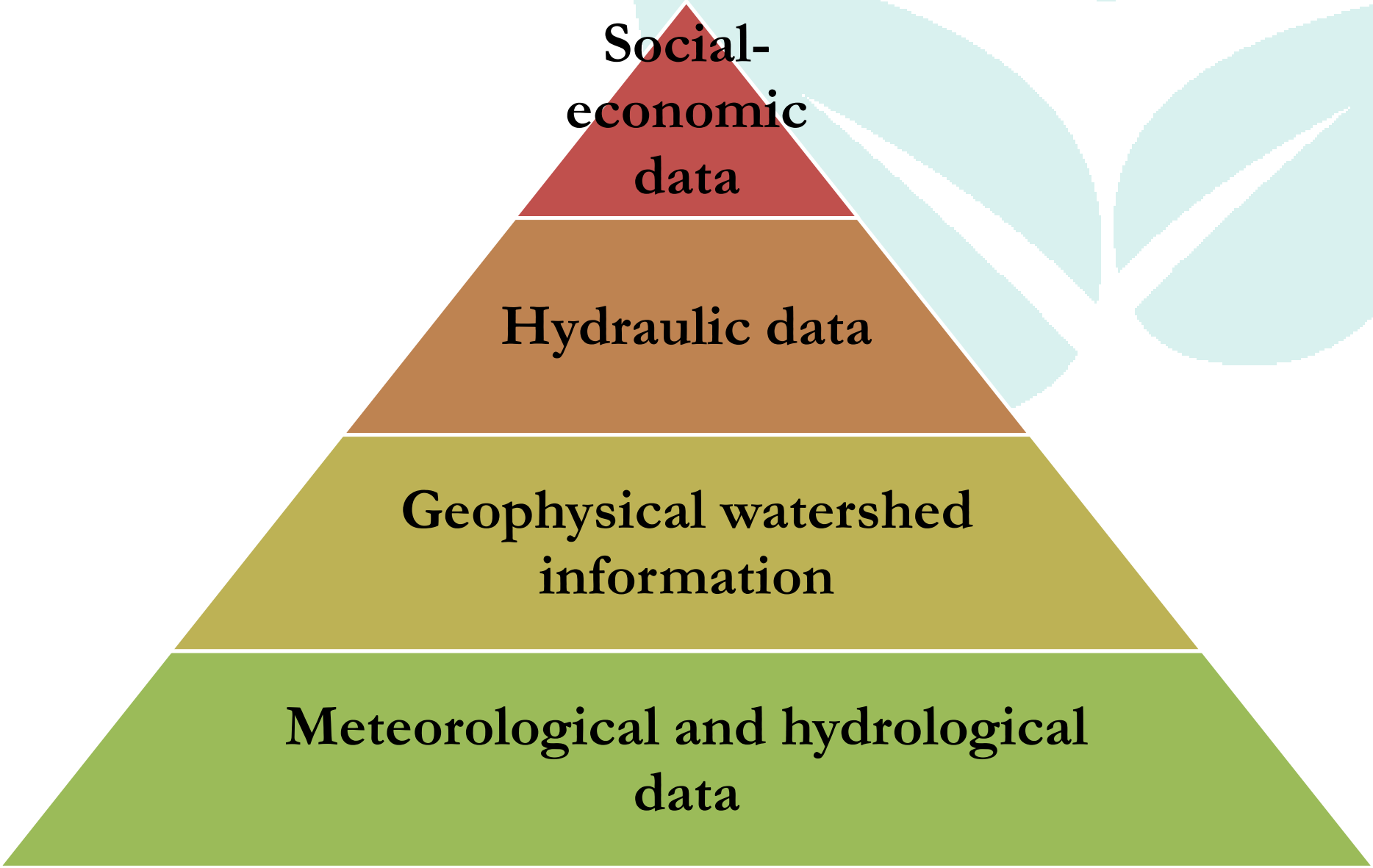
GIS/RS Practical aspects related to water management

Why GIS and/or RS?

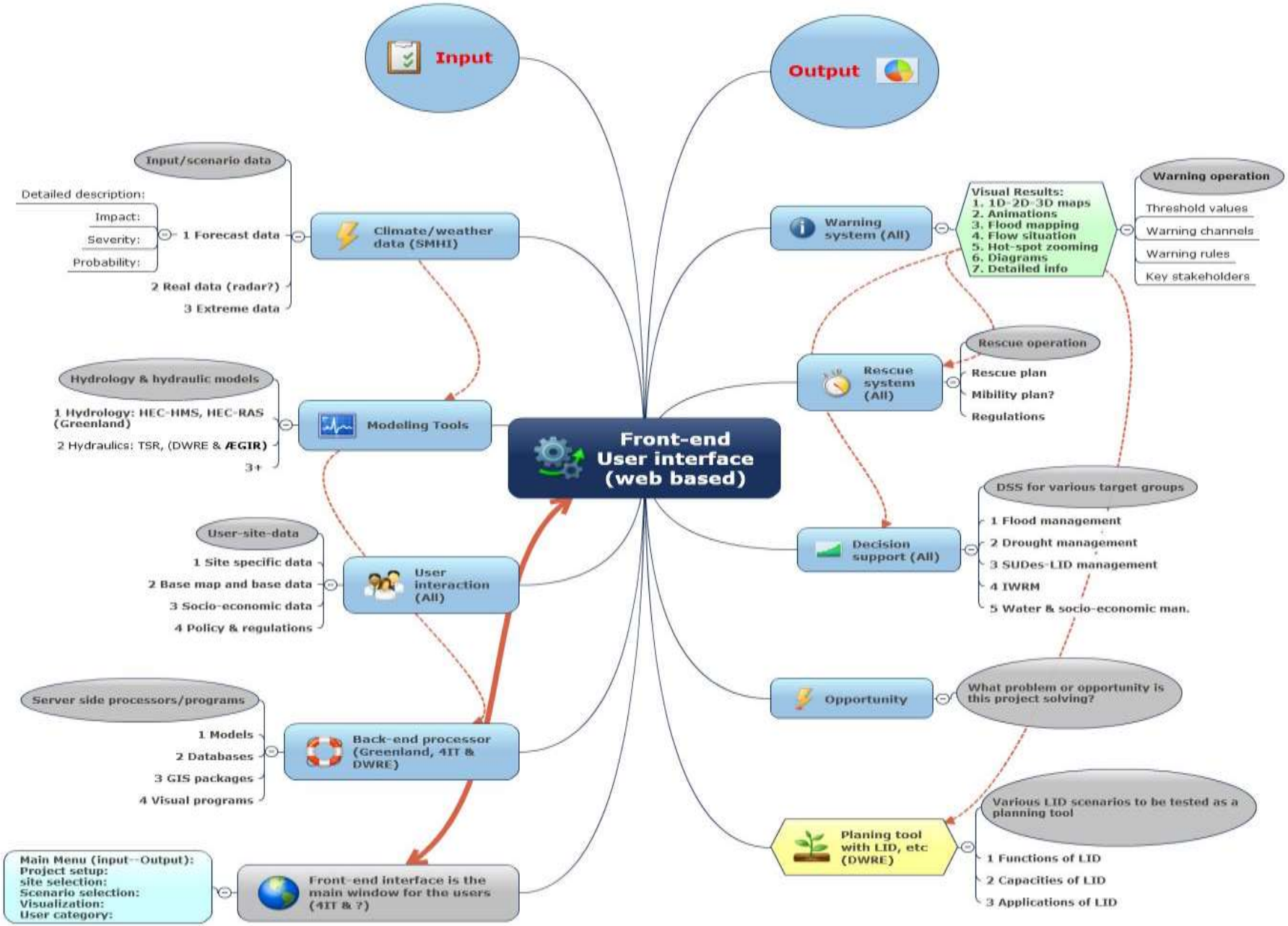


Hydrology+3S (GIS, RS, GPS)

Optimal Data Sets:



FloodView Product Concept



What's next?

Hydrology + 3S (GIS, RS, GPS)

1. *Data*
2. *GIS (software)*
3. *Goole Earth Engine (platform)*
4. *Python (script)*

Landsat 8-9 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) (USGS)

Bands	Wavelength (micrometers)	Resolution (meters)
Band 1 - Coastal aerosol	0.43-0.45	30
Band 2 - Blue	0.45-0.51	30
Band 3 - Green	0.53-0.59	30
Band 4 - Red	0.64-0.67	30
Band 5 - Near Infrared (NIR)	0.85-0.88	30
Band 6 - SWIR 1	1.57-1.65	30
Band 7 - SWIR 2	2.11-2.29	30
Band 8 - Panchromatic	0.50-0.68	15
Band 9 - Cirrus	1.36-1.38	30
Band 10 - Thermal Infrared (TIRS) 1	10.6-11.19	100
Band 11 - Thermal Infrared (TIRS) 2	11.50-12.51	100

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Some common band combinations applied to Landsat 8, displayed as a red, green, blue (RGB) (www.esri.com)

You want	Band combination
Natural Color	4 3 2
False Color (urban)	7 6 4
Color Infrared (vegetation)	5 4 3
Agriculture	6 5 2
Atmospheric Penetration	7 6 5
Healthy Vegetation	5 6 2
Land/Water	5 6 4
Natural With Atmospheric Removal	7 5 3
Shortwave Infrared	7 5 4
Vegetation Analysis	6 5 4

NDVI - Normalized Difference Vegetation Index (eos.com)

NDVI is calculated in accordance with the formula:

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

NIR – reflection in the near-infrared spectrum
RED – reflection in the red range of the spectrum

This index defines values from -1.0 to 1.0, basically representing greens, where negative values are mainly formed from clouds, water and snow, and values close to zero are primarily formed from rocks and bare soil. Very small values (0.1 or less) of the NDVI function correspond to empty areas of rocks, sand or snow. Moderate values (from 0.2 to 0.3) represent shrubs and meadows, while large values (from 0.6 to 0.8) indicate temperate and tropical forests. Crop Monitoring successfully utilizes this scale to show farmers which parts of their fields have dense, moderate, or sparse vegetation at any given moment.

NDWI - Normalized Difference Water Index (eos.com)

NDWI is calculated in accordance with the formula:

$$NDWI = \frac{NIR - SWIR}{NIR + SWIR}$$

NIR – near infrared range with wavelengths in the range of 0.841 – 0.876 nm
SWIR – a part of the range with wavelengths in the range of 1.628-1.652 nm

The NDWI product is dimensionless and varies from -1 to +1, depending on the hardwood content, as well as the type of vegetation and cover. The high NDWI values (in blue) correspond to high plant water content and coating of high plant fraction. Low NDWI values (in red) correspond to low vegetation content and cover with low vegetation. During periods of water stress the NDWI rate will decrease.

Let’s get started with actions

jupyter faster_demo (autosaved)

Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code Voilà

In [ ]: Edit Attachments

```
import os
import ee
import geemap
import ipywidgets as widgets
```

In [ ]: Edit Attachments

```
Map = geemap.Map(center=[40,10])
Map.add_basemap('HYBRID')
Map
```

In [ ]: Edit Attachments

Questions for discussion

- Can numerical models, GIS tools; remote sensing data <u>replace</u> the human power?
- Is reliable ground data necessary in the future?
- What is the main obstacle in using GIS/RS in your basin/area?

Tasks Day 3

- Choose one wet and one dry year between 1985 and the present, with at least 5 years gap in between, based on the precipitation data.
- Calculate NDVI, NDWI for your target basin in the selected years.
- Discuss the changes in vegetation cover (NDVI) and water bodies (NDWI) in the selected years. What has caused these changes, rainfall or other factors?
- Summarize in 1-2 A4 pages per group and add to your final report
- Submit 1 document in the end with all tasks to: ronny.berndtsson@tvrl.lth.se at latest 29th March.

Clarification on Task Day 3 and data

- You can use data from one rain-gauge station, and it can be daily, monthly, or yearly.
- dry and wet years can be years with minimum and maximum rainfall, respectively,
- Google Earth Engine is an online tool that you will learn how to derive the NDVI and NDWI
- You do NOT need to have ArcGIS or similar software installed in your computer
- You do NOT need to have shapefile of your basin necessarily. Instead, you do need to know the location of your selected basin/area on map and draw and estimated boundary.

Software and data source

- Google Earth Engine: https://earthengine.google.com/
- Earth Engine Data Catalog: https://developers.google.com/earth-engine/datasets/
- Python: https://www.python.org/
- GEE and python tutorials: https://github.com/giswqs/geemap
- ECMWF: https://cds.climate.copernicus.eu/cdsapp#!/search?type=dataset
- Copernicus.eu https://cds.climate.copernicus.eu/cdsapp#!/home
- USGS Data: https://dds.cr.usgs.gov
- Earth Engine Data Catalog: https://developers.google.com/earth-engine/datasets/catalog

That´s all for now!

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