WRF Ensemble Runs

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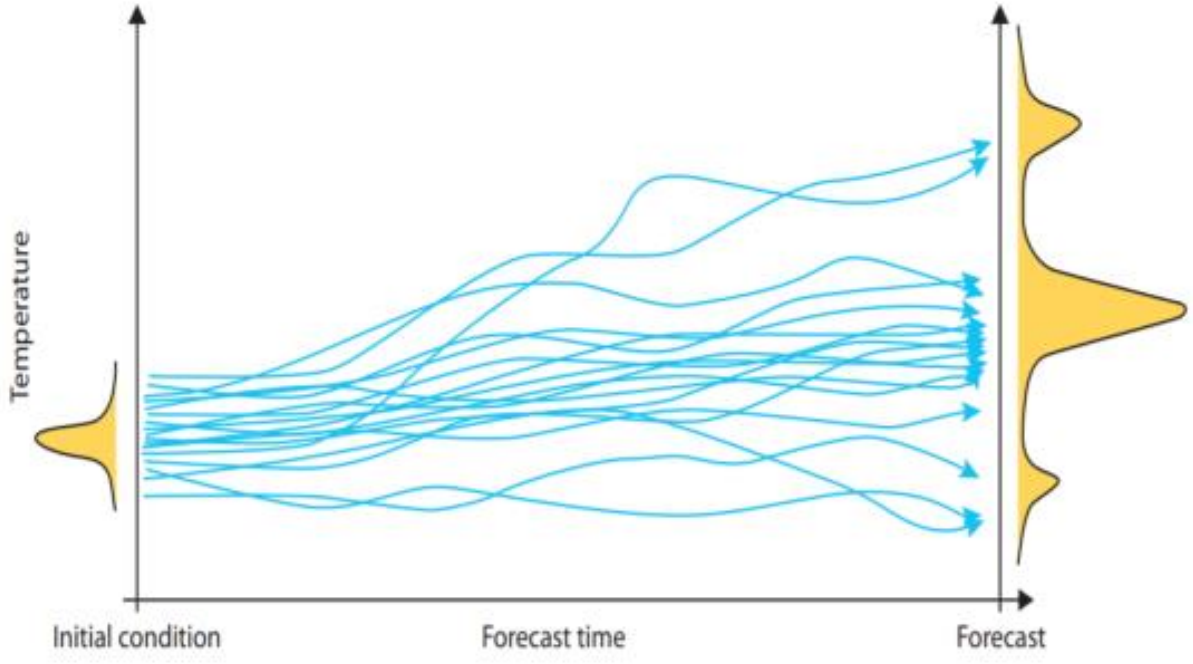
About

- Ensemble Forecasting (EF) is a method of forecasting that takes into account the uncertainties associated with the initial conditions and/or the forecast model.
- This means that an ensemble forecast is a collection of many forecasts that all verify at the same time.
- Ensemble members represent possibilities given the uncertainties associated with the forecasting.
- These possibilities can be used to estimate probabilities of various events as well as an average forecast (ensemble mean).

The basic principle of Ensemble Forecast

- The Ensemble Forecast reflects uncertainty in the initial conditions by generating a series of predictions starting from slightly different sta tes which are similar, but not identical, to our best approximation of t he initial atmosphere.

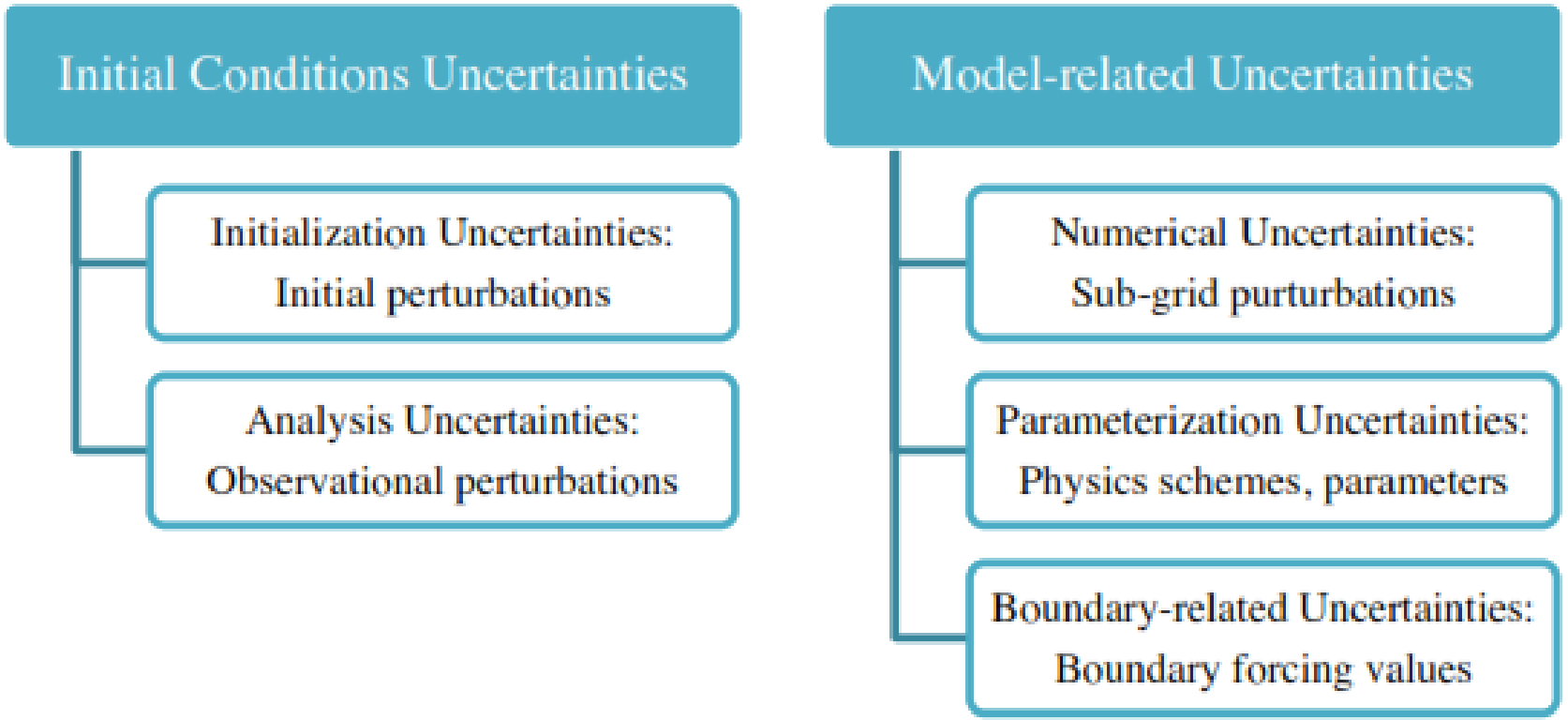


Advantages

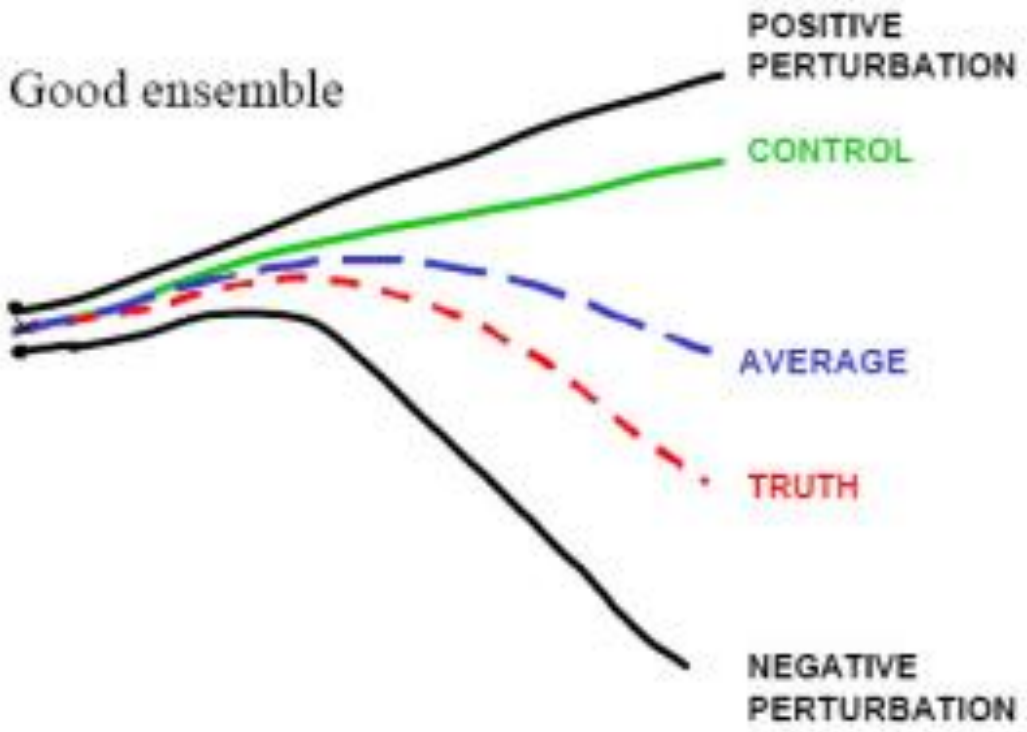
- WRF ensembles yielded better skill than single WRF forecasts for the events analyzed
- WRF ensembles also allow estimating the predictability through the dispersion of the forecasts providing relevant information for decision-making

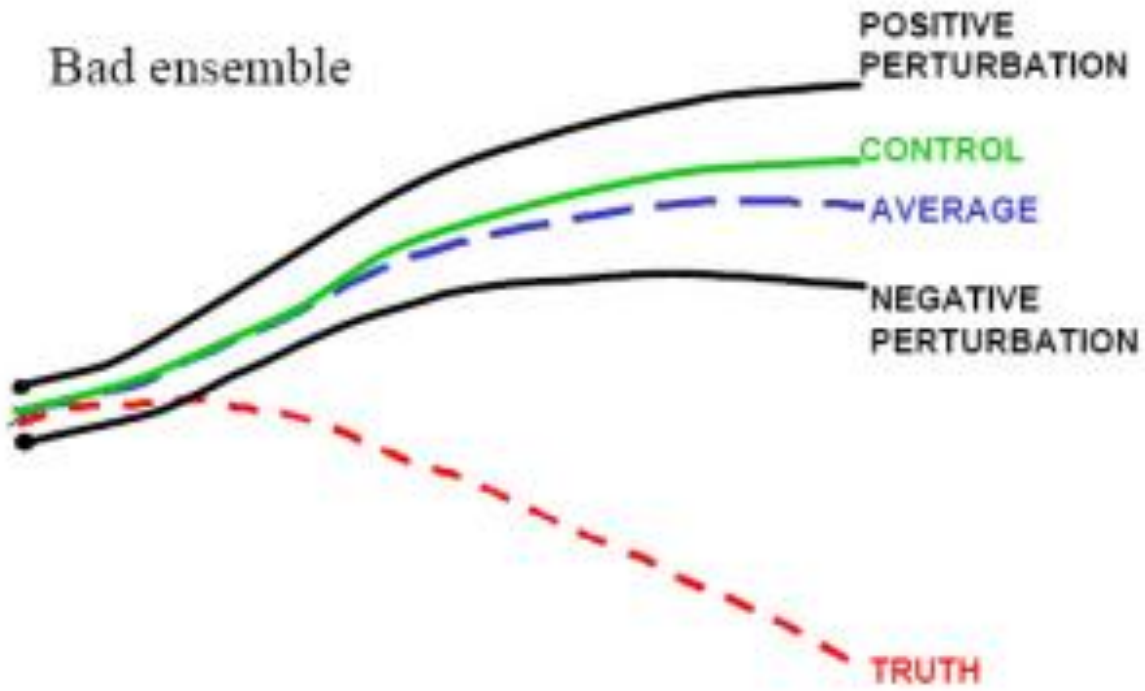
Construction of an Ensemble

- Ensemble Forecasting (EF) may take into account all known sources of uncertainty in NWP



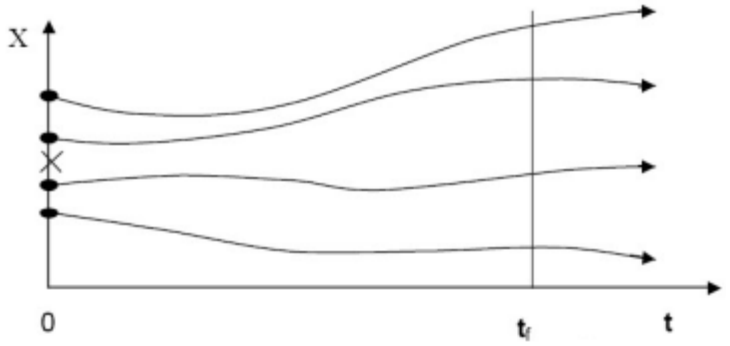
Schematic of the essential components of an ensemble of forecasts



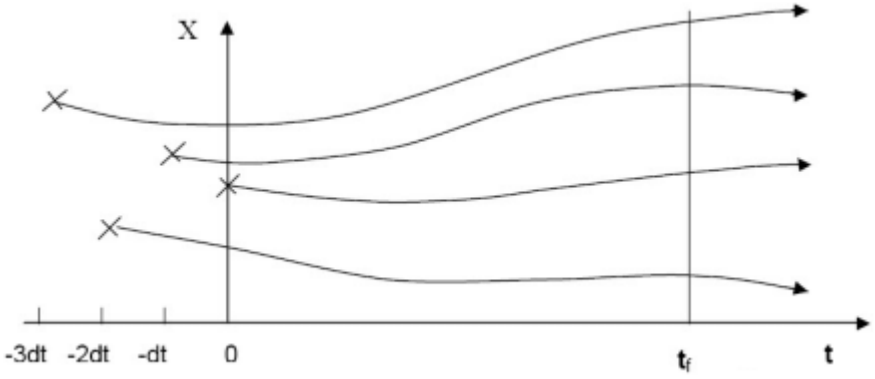


How to ensemble

- Monte Carlo Forecasting



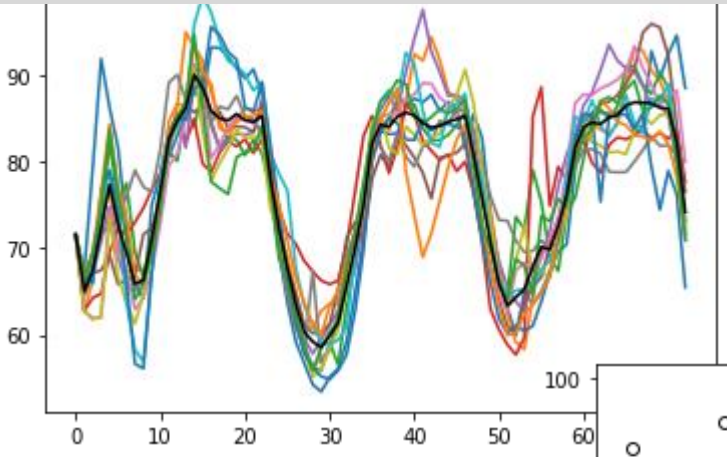
- Lagged Average Forecasting

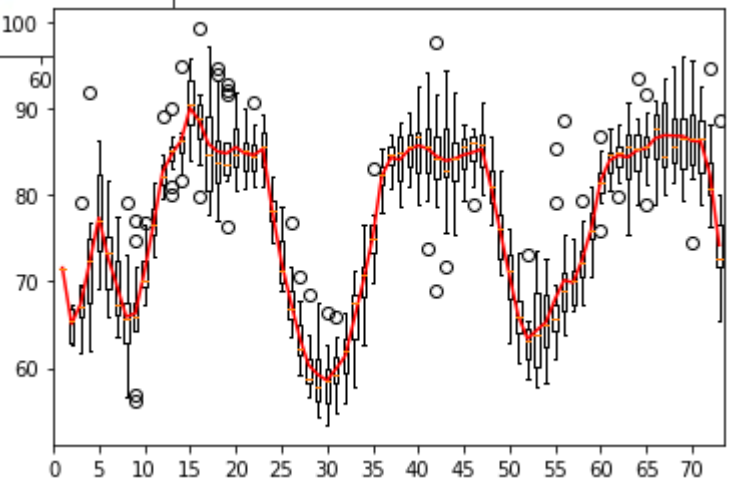


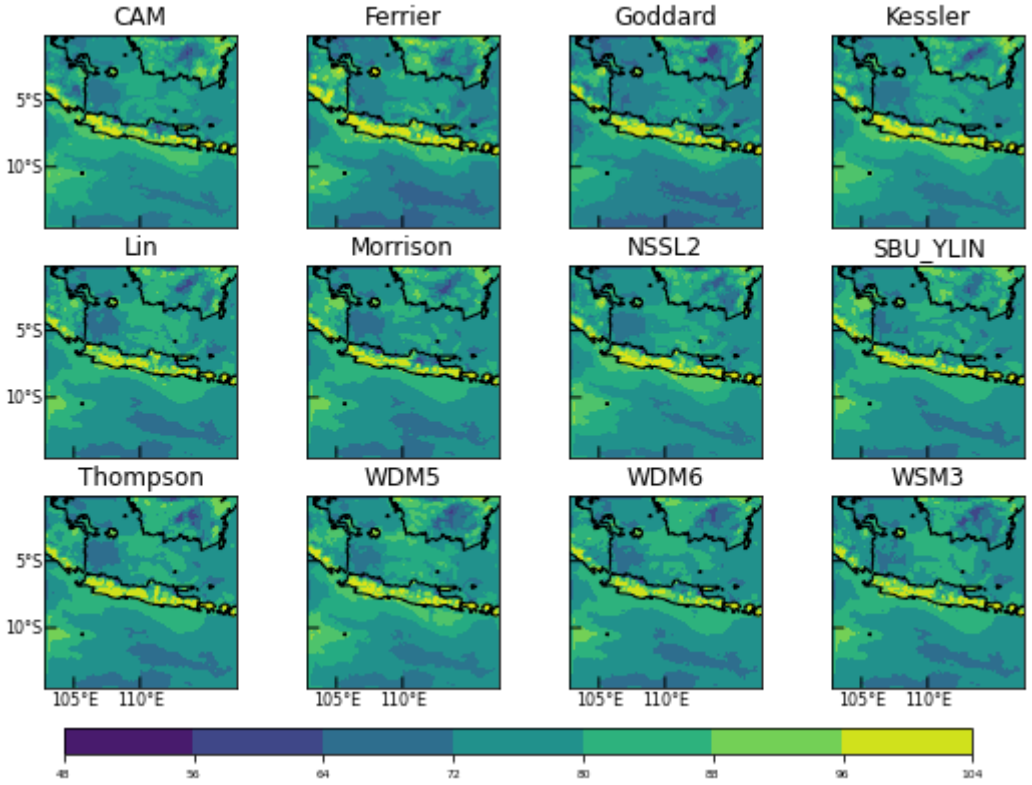
- Operational Methods
  - ensembles of data assimilations,
  - operational systems from different centers,
  - Combining different models and data assimilation systems.

Technique

- Ensemble mean
- Site Specific Meteograms
- Postage
- Etc.

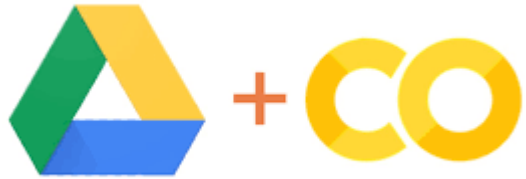






Google Colab

Google Collaboratory or **Google Colab** is a free and cloud-based tool for research purposes. Google colab is built with the jupyter environment and supports almost all the libraries needed in an Artificial Intelligence (AI) development environment



Google Colab is a jupyter notebook that runs online and is free.

What are the advantages of Google Colab

1 *Free Access*

The use of google colab is intended for researchers who are developing research and require high computer specifications. Just keep in mind that google colab requires an internet connection.

2 *Good Spesification*

When we first install Google Colab, we will be given computer cloud access with specificationsi:
GPU Nvidia
RAM 12 GB
Disk 34 GB

3 *Zero Configuration*

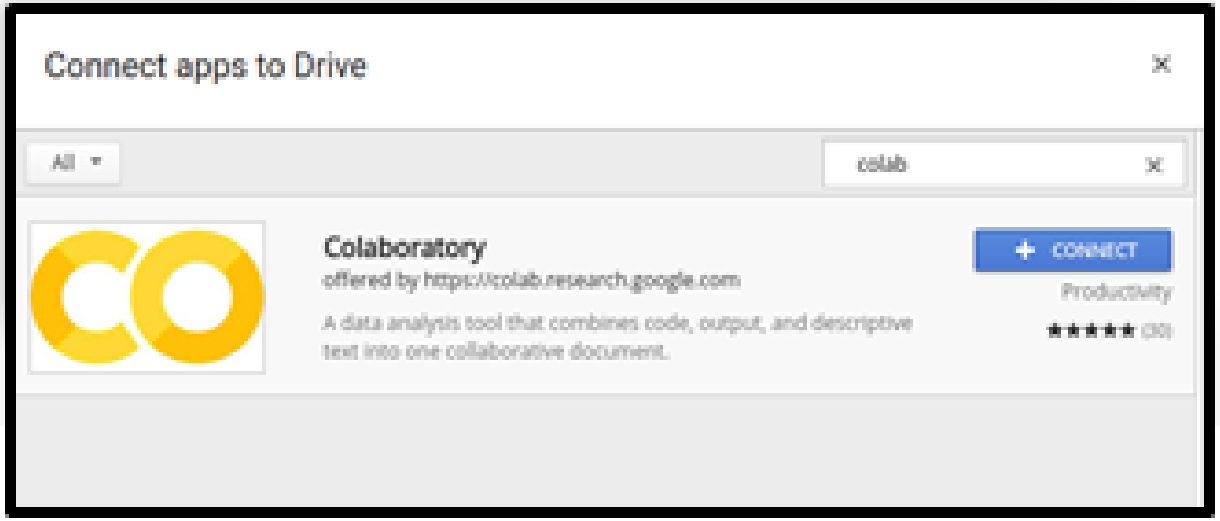
In using google colab we don't need any configuration, but when we want to add a new library, then we need to install the library package.

4 *Easy Sharing*

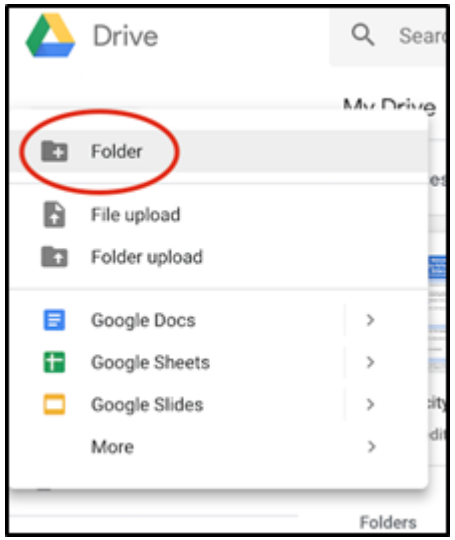
We can integrate with our own google drive and then save the script into the github project. Or share the link with others.

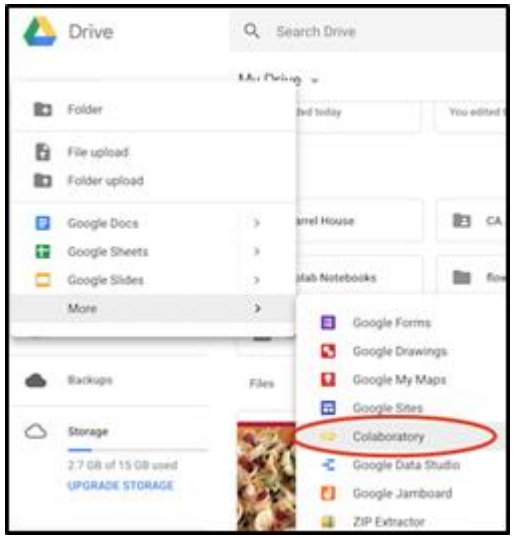
Using Colab

1. Go to Google Drive then in the upper left corner click **New** > **More** > **Connect more apps**. Then in the search field type "colab" after it appears click connect.



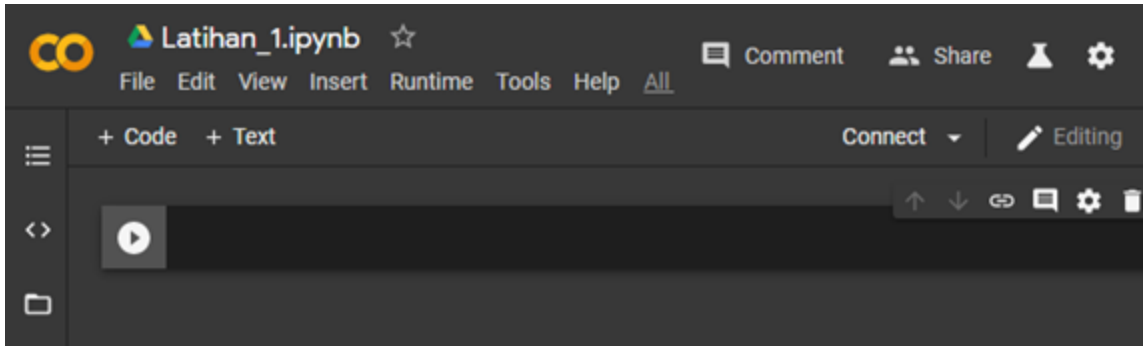
2. After a successful installation, create a new folder on the drive then enter that folder. Then right click **> More > Collaboratory**.





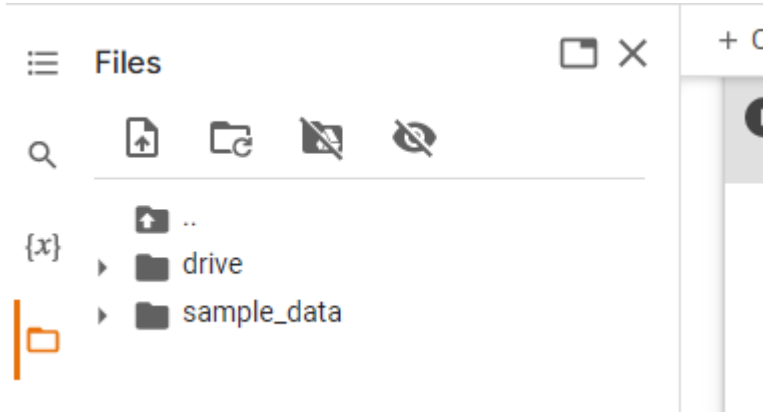
Colab display

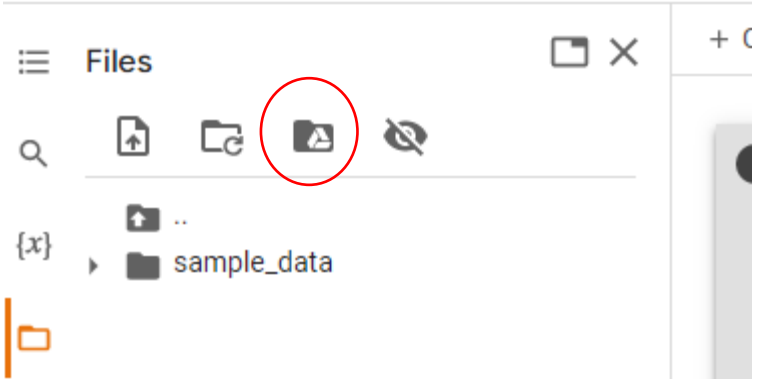
Then a collab display will appear, change the project name by clicking on the project name above. Then we can also set the appearance or theme according to what we want. Select **tools** > **settings** > **Site**. Then set the theme and save.

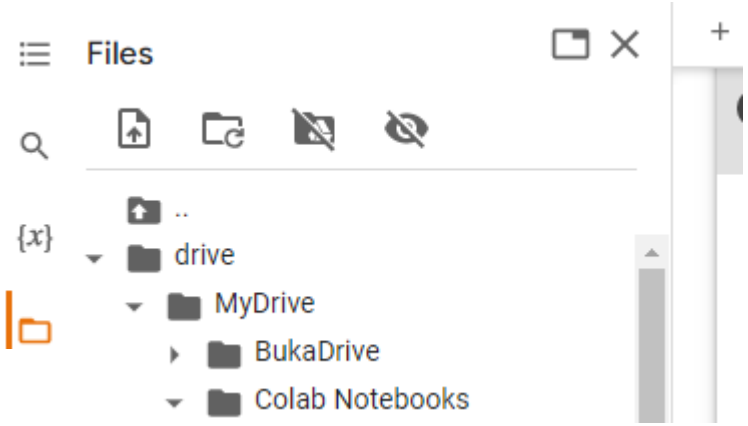


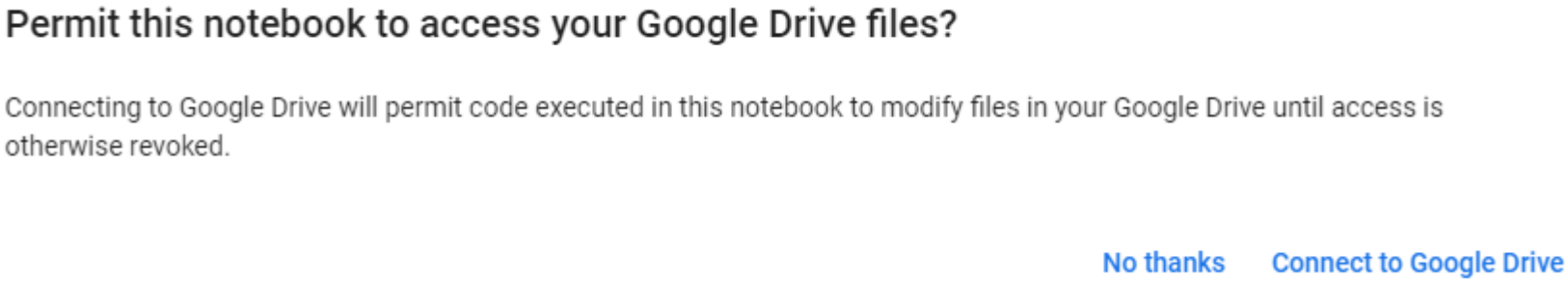
Connecting to google drive

- Click Files in the left side
- Mount Drive
- Follow the instruction



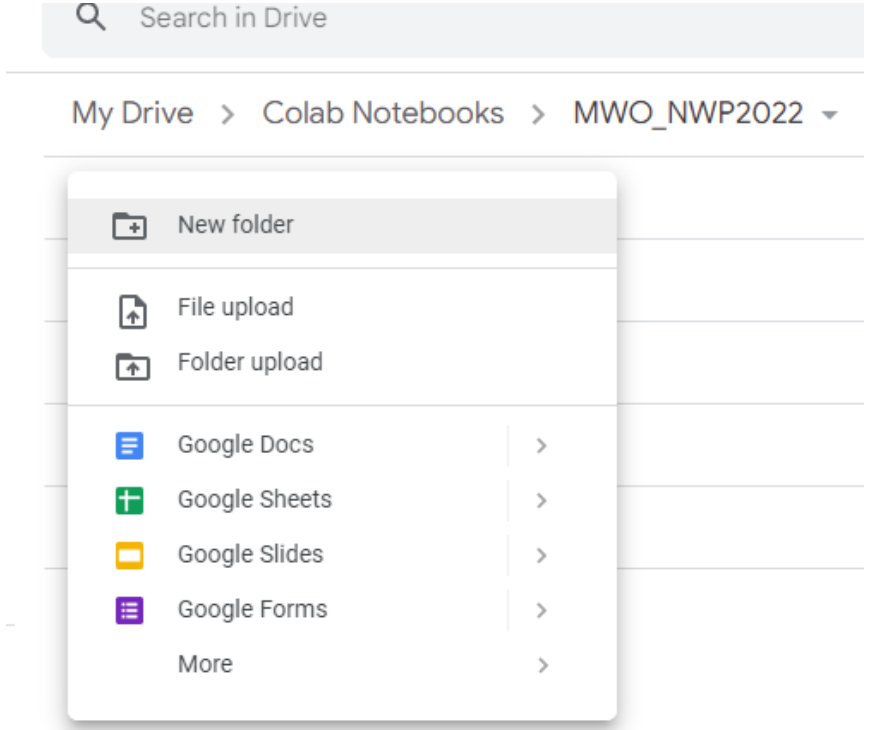






Copy the data to google drive

- Right click
- Choose folder to upload



Example:

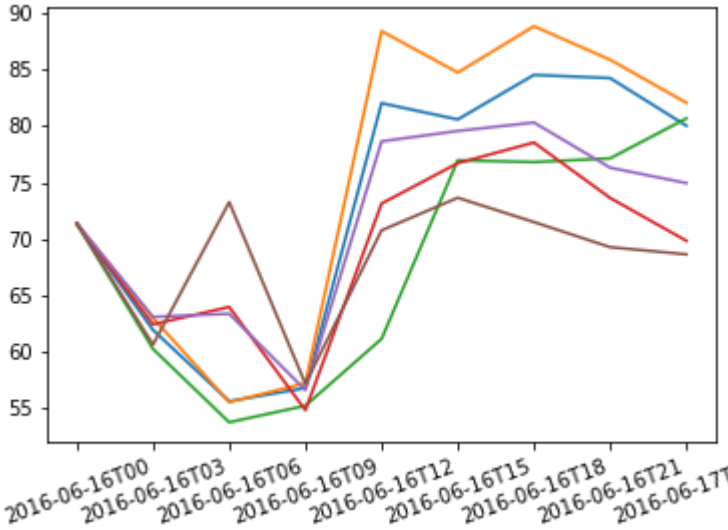
- Read data output WRF

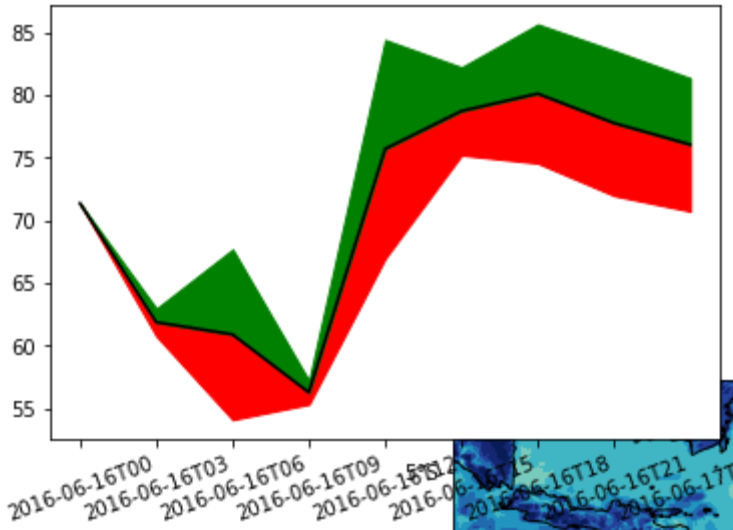
```
import netCDF4 as nc
fh=nc.Dataset('/content/drive/MyDrive/Colab Notebooks/MWO_NWP2022/wmo_nwp_testdata/7021/wrfout_d01_2016-06-16_00_00_00')
print(fh)
```

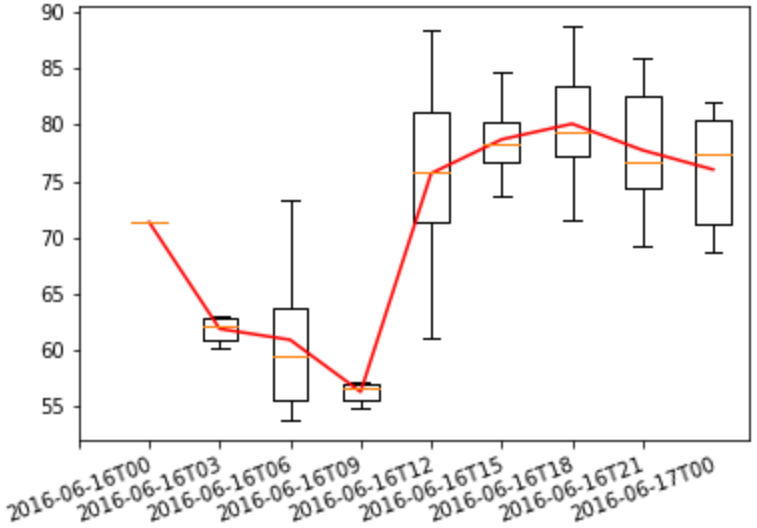
- Wrf-python modules
- !pip install wrf-python

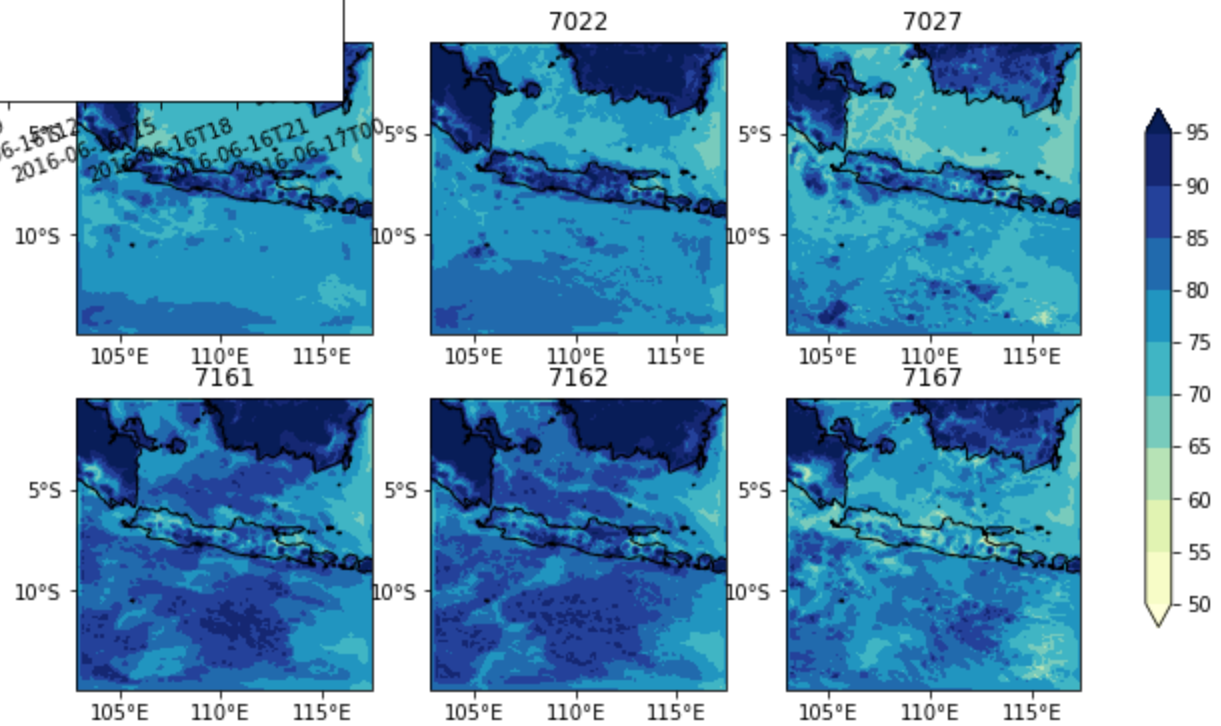
```
from wrf import getvar
rh = getvar(fh, "rh", timeidx=ALL_TIMES, method="cat")
lats, lons = latlon_coords(rh)
```

Example: Script_mwo_nwp_training.ipynb









Exercise

- Please make a WRF enaemble plot in your respective area. You can choose parameters Temperature and Wind. Please make:
  - Ensemble mean
  - Site Specific Meteograms
  - Postage

Thank you

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