GLOBAL LAKE RESPONSES TO CLIMATIC CHANGE

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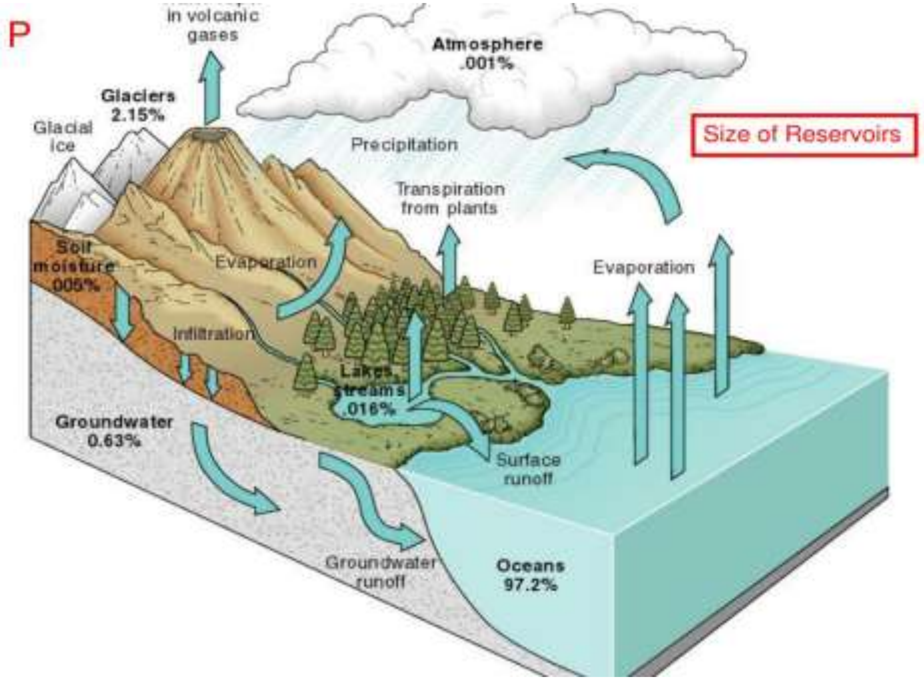
ACKNOWLEDGEMENT



INTRODUCTION

With water, the essential natural resource for sustaining life, coming under threat it becomes imperative to understand the hydrological cycle and monitor its constituents.

GRACE indirectly estimates water storage changes that have tremendously revolutionized global and continental-scale hydrological studies.

GRDC: the potential of runoff estimation from water-balance-based methods, land surface models, and an empirical predictor.

GPCC: It gridded gauge-analysis products derived from quality-controlled station data. It is recommended for global and regional water balance studies, calibration/validation of remote sensing-based rainfall estimations, and verification of numerical models.

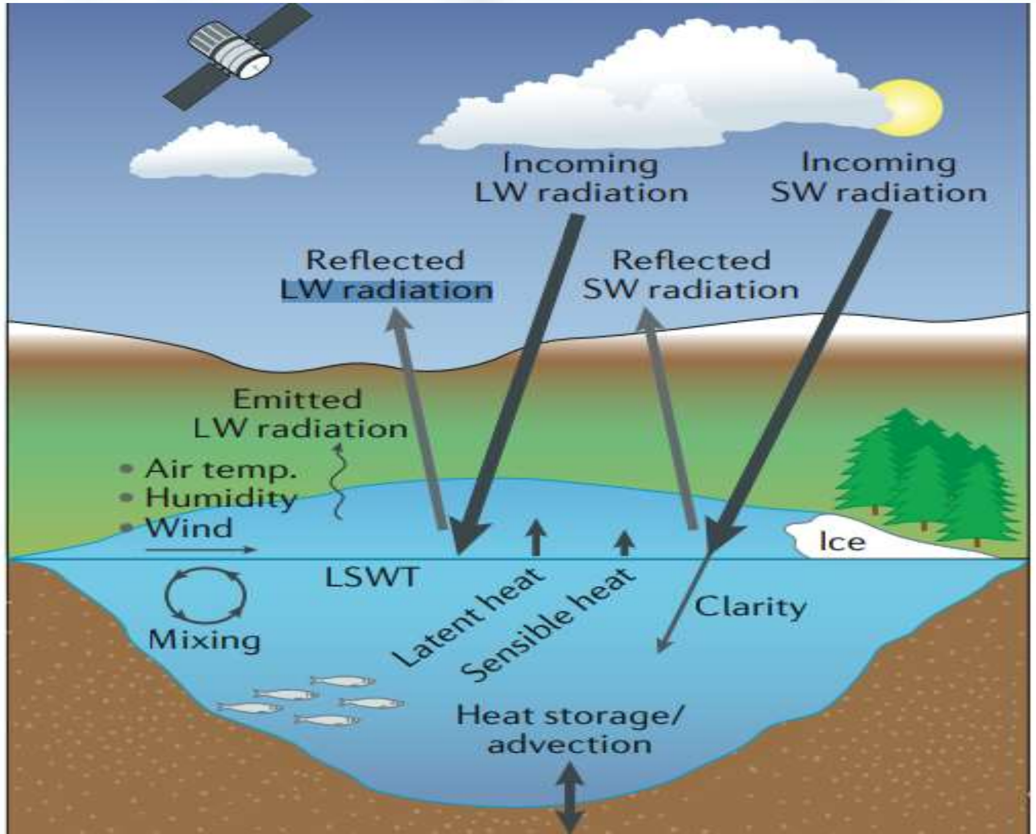
GLEAM: calculates potential evaporation based on observations of net surface radiation and near-surface air temperature.

WATER BUDGET EQUATION

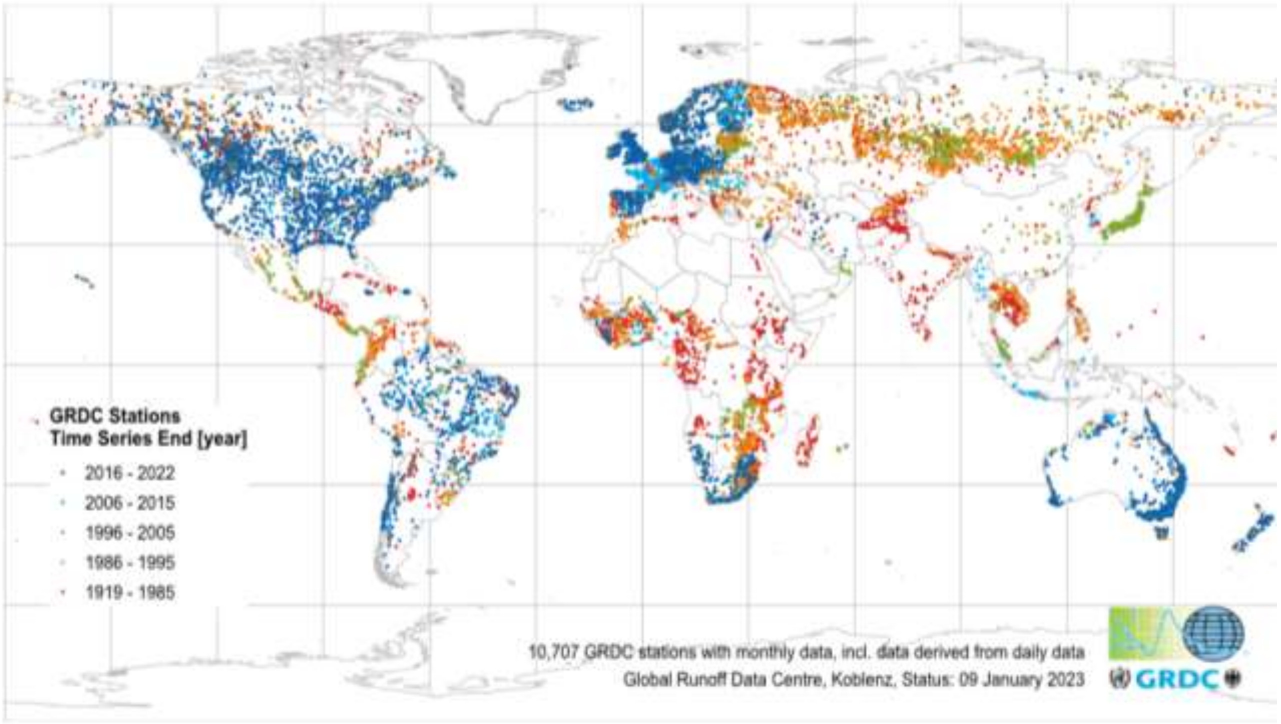
This method uses only hydrological variables to arrive at runoff estimates; it will henceforth be called the hydrological approach.

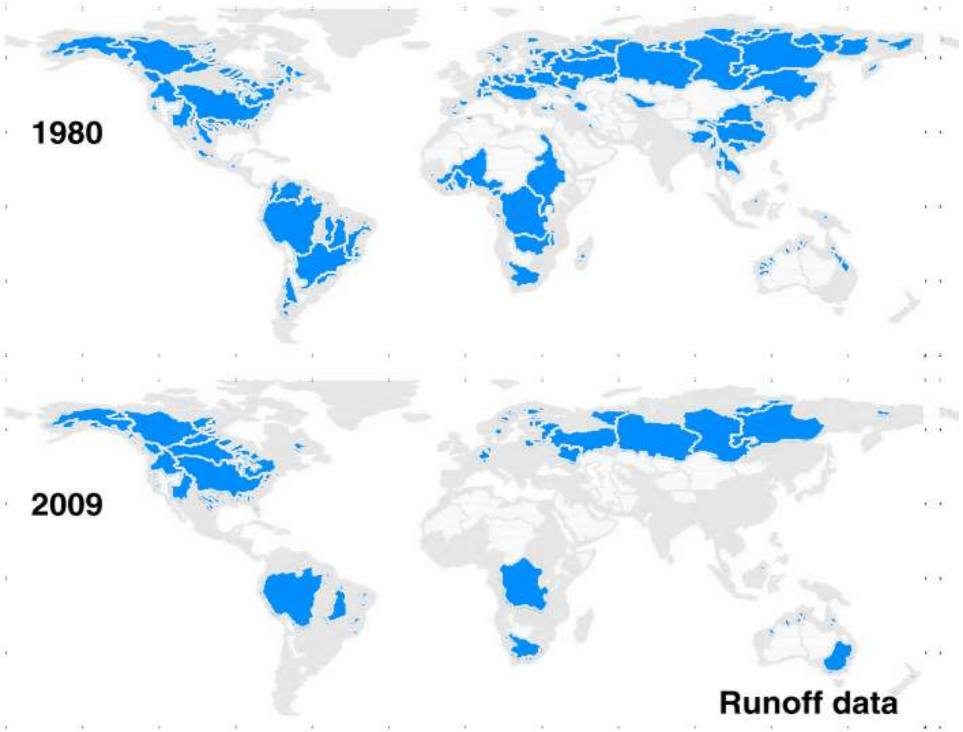
P – R - E = change is storage

P: precipitation
R: Surface Runoff
E: Evaporation



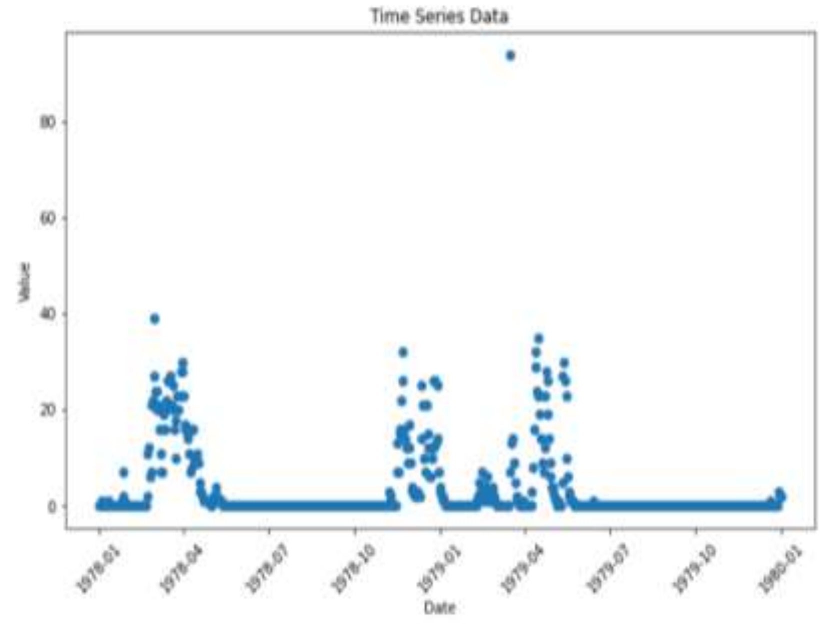
GRDC (GLOBAL RUNOFF DATA CENTER)

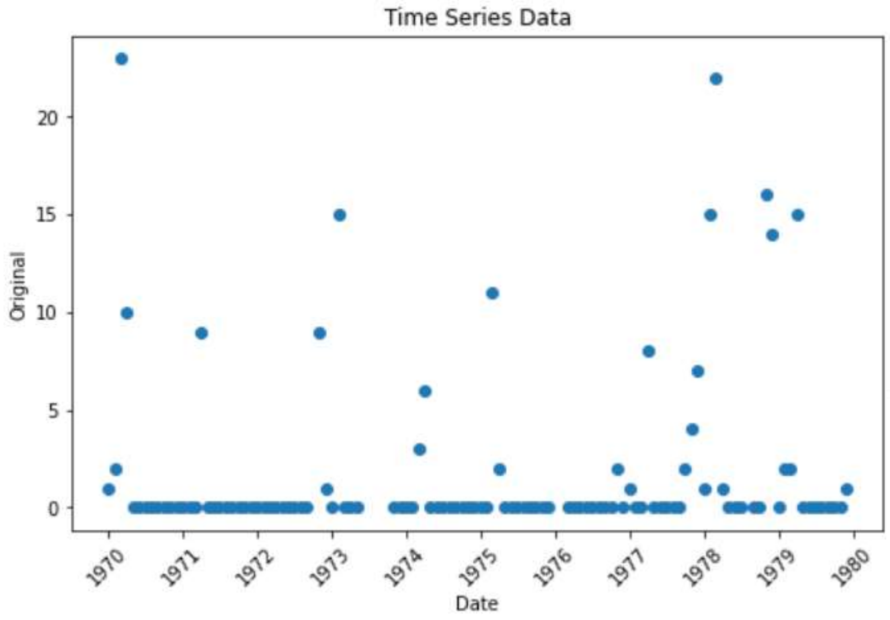


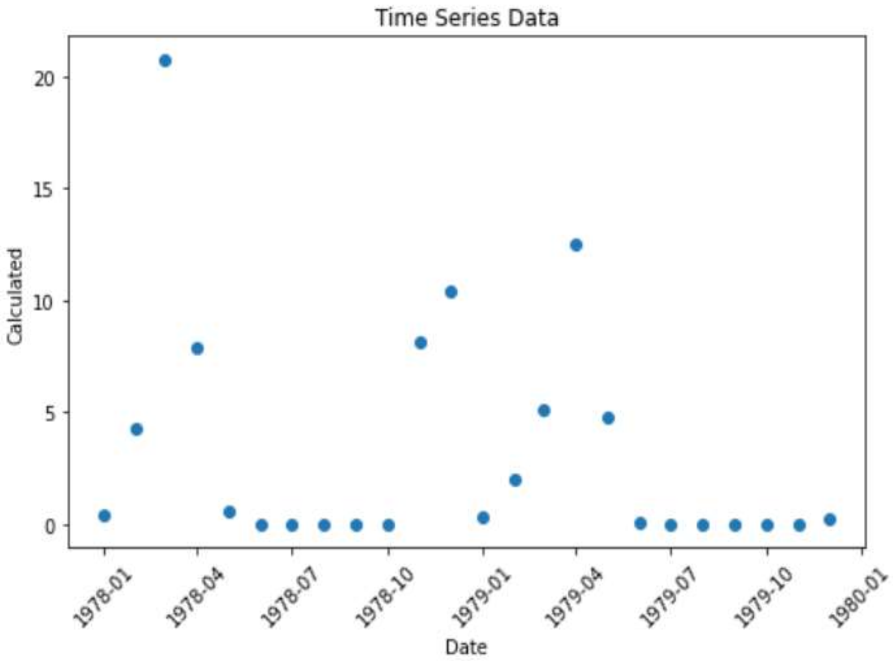


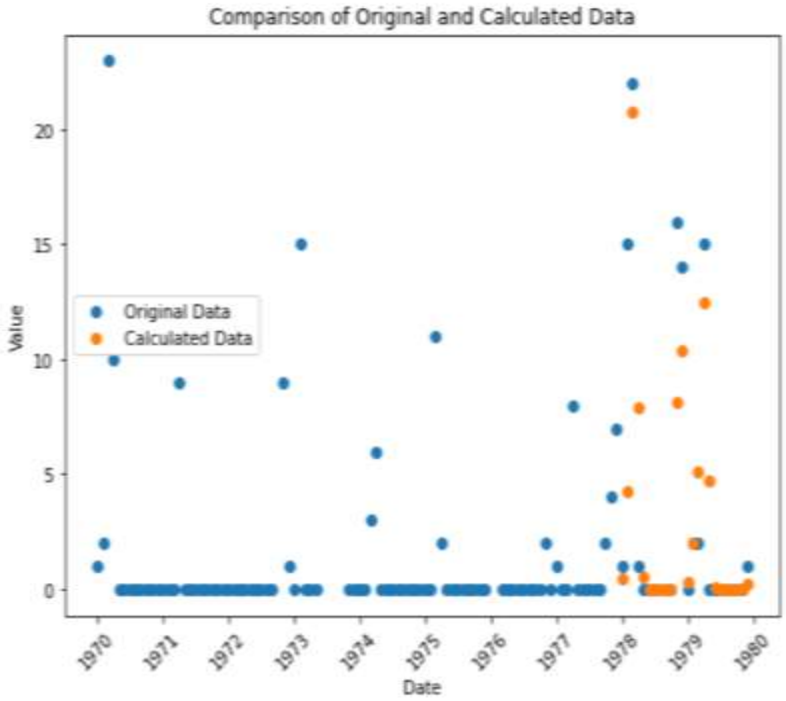
Source:
https://portal.grdc.bafg.de/applications/public.html?publicuser=PublicUser#dataDownl

MAGOGO CATCHM







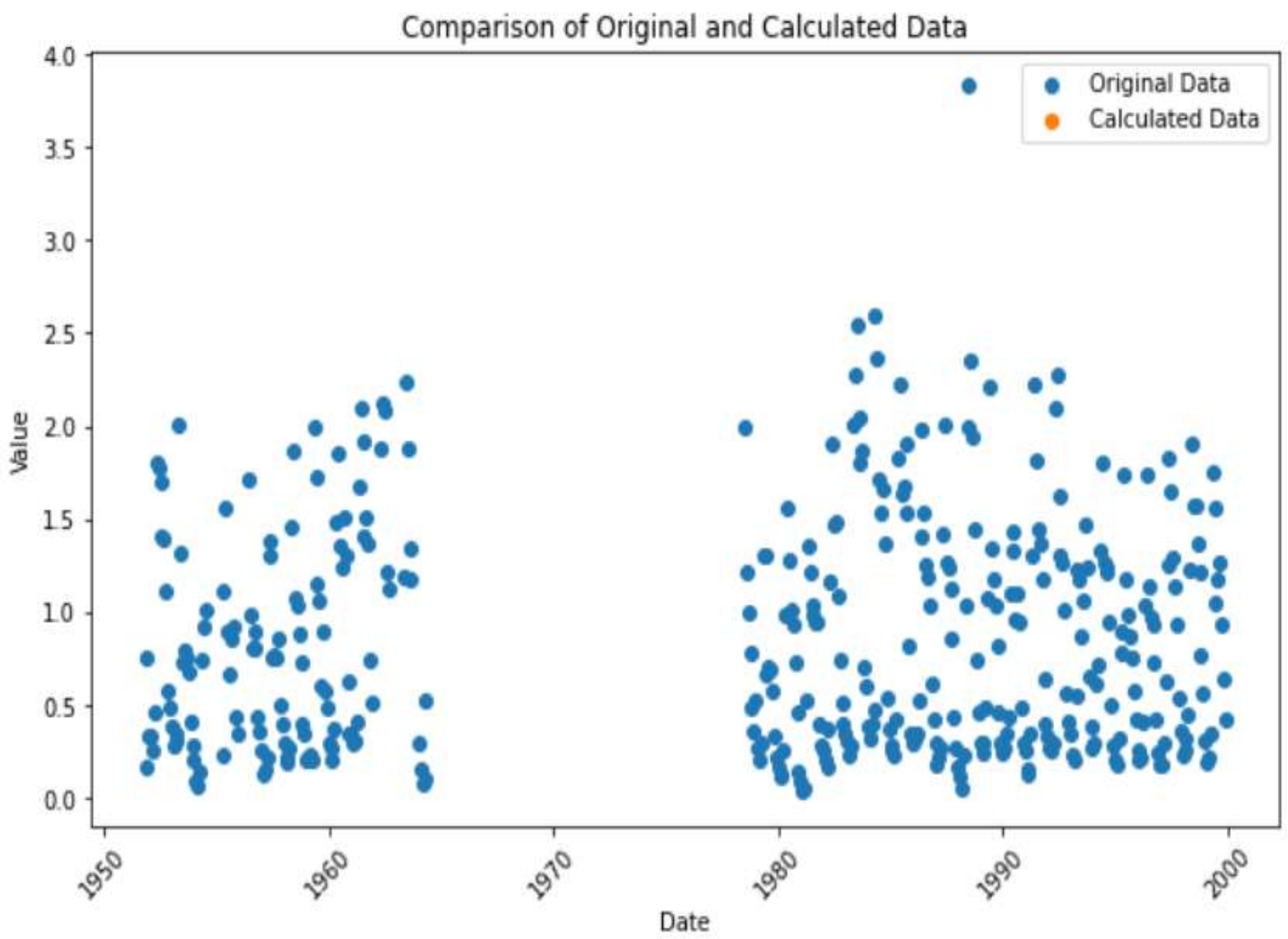


LAKE BAIKAL RUNOFF DATA

```
month_data
```

	Date	Original	Calculated
0	1951-11-01	0.75	NaN
1	1951-12-01	0.16	NaN
2	1952-01-01	0.33	NaN
3	1952-02-01	0.33	NaN
4	1952-03-01	0.25	NaN
...	...	...	...
573	1999-08-01	1.18	NaN
574	1999-09-01	1.26	NaN
575	1999-10-01	0.93	NaN
576	1999-11-01	0.64	NaN
577	1999-12-01	0.42	NaN

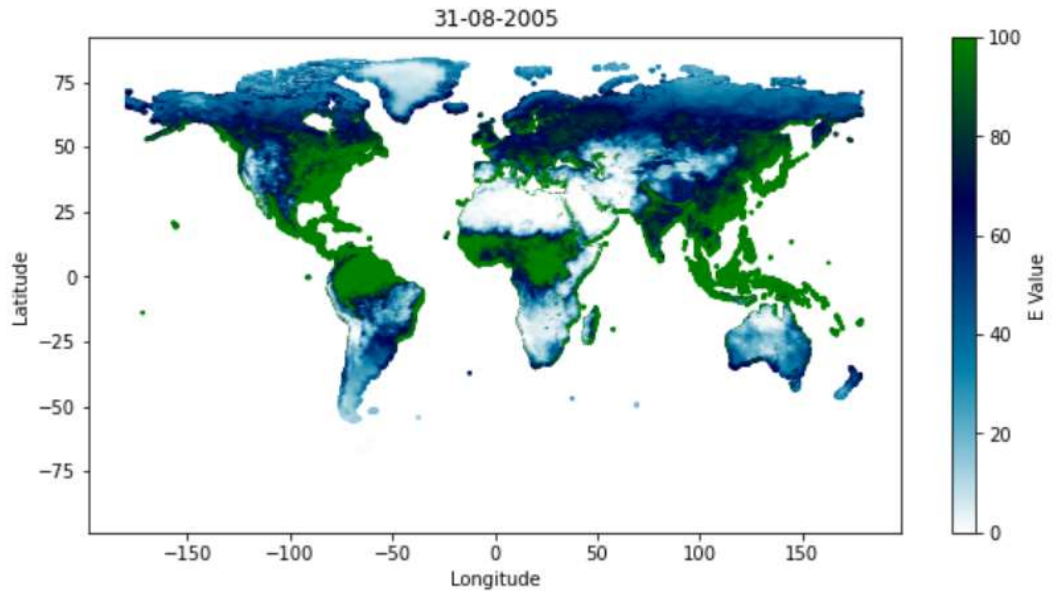
578 rows × 3 columns

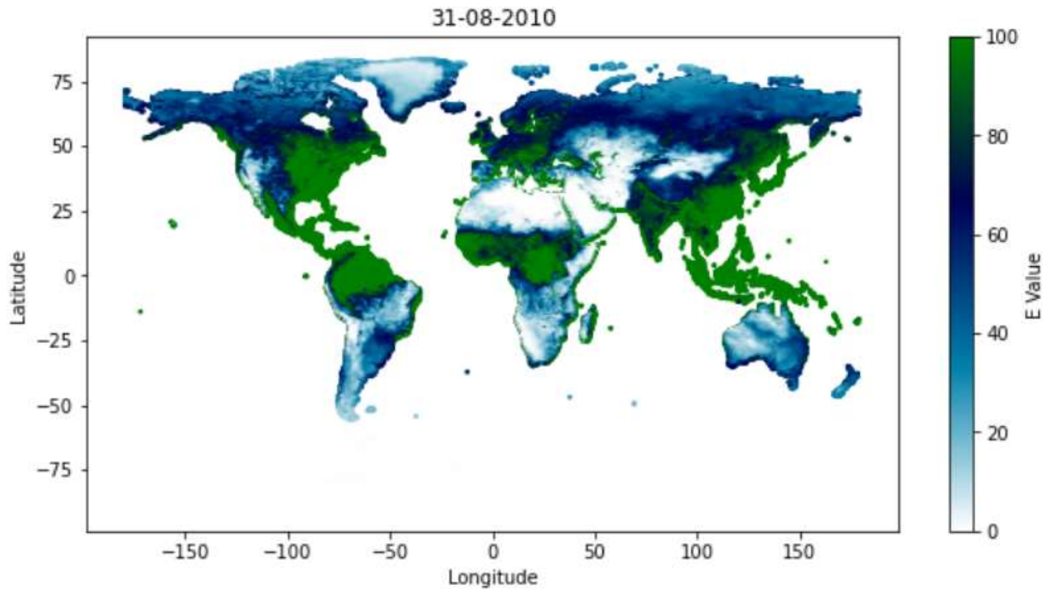


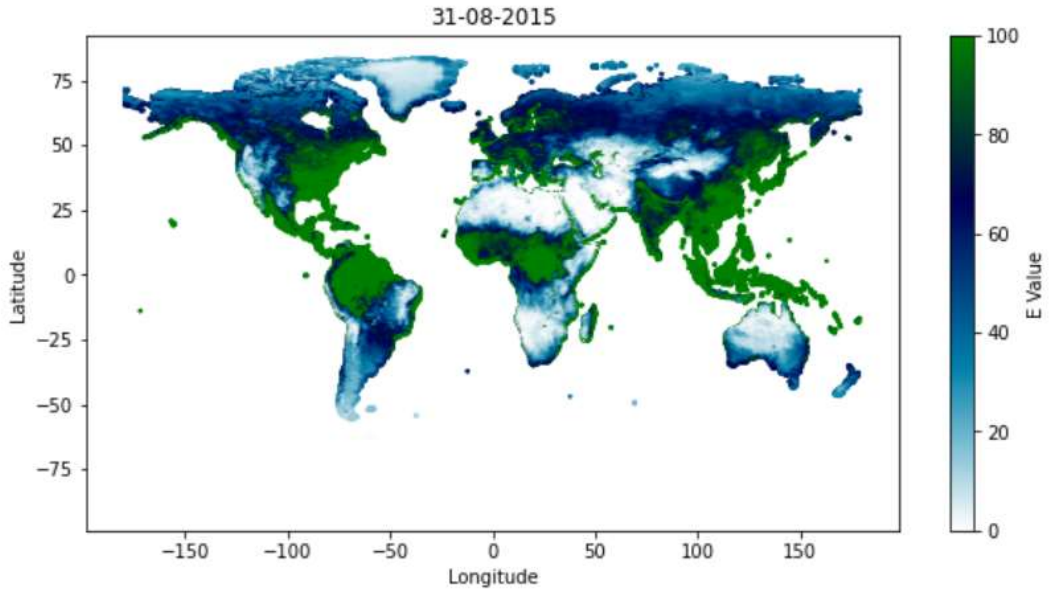
GLEAM(GLOBAL LAND EVAPORATION AMSTERDAM MODEL

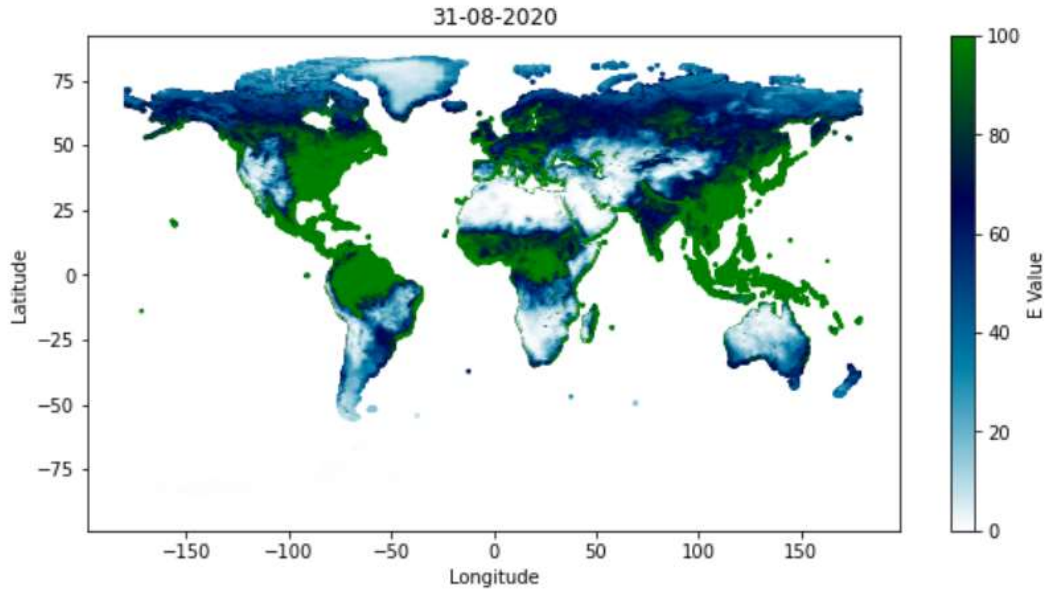
GLEAM v3.7b: a global dataset spanning the 20 years from 2003 (January 1st) to 2022 (December 31st). The dataset is based on satellite data.

```
<xarray.Dataset>
Dimensions:  (lon: 1440, lat: 720, time: 240)
Coordinates:
  * lon      (lon) float64 -179.9 -179.6 -179.4 -179.1 ... 179.4 179.6 179.9
  * lat      (lat) float64 89.88 89.62 89.38 89.12 ... -89.38 -89.62 -89.88
  * time     (time) datetime64[ns] 2003-01-31 2003-02-28 ... 2022-12-31
Data variables:
    E        (time, lat, lon) float32 ...
Attributes:
    Dataset:      Global Land Evaporation Amsterdam Model
    Version:      3.7b
    Authors:      Hydro-Climate Extremes Lab (H-CEL)
    Institution:  Ghent University
    Contact:      info@gleam.eu
    Reference1:   Martens, B. et al. 2017: GLEAM v3: satellite-based land eva...
    Reference2:   Miralles, D.G. et al. 2011: Global land-surface evaporation...
```


31-08-2005
Latitude
Longitude
E Value
75
50
25
0
−25
−50
−75
−150
−100
−50
0
50
100
150
100
80
60
40
20
0


31-08-2010
Latitude
Longitude
E Value
75
50
25
0
−25
−50
−75
−150
−100
−50
0
50
100
150
100
80
60
40
20
0


31-08-2015
Latitude
Longitude
E Value
75
50
25
0
−25
−50
−75
−150
−100
−50
0
50
100
150
100
80
60
40
20
0


31-08-2020
Latitude
Longitude
E Value
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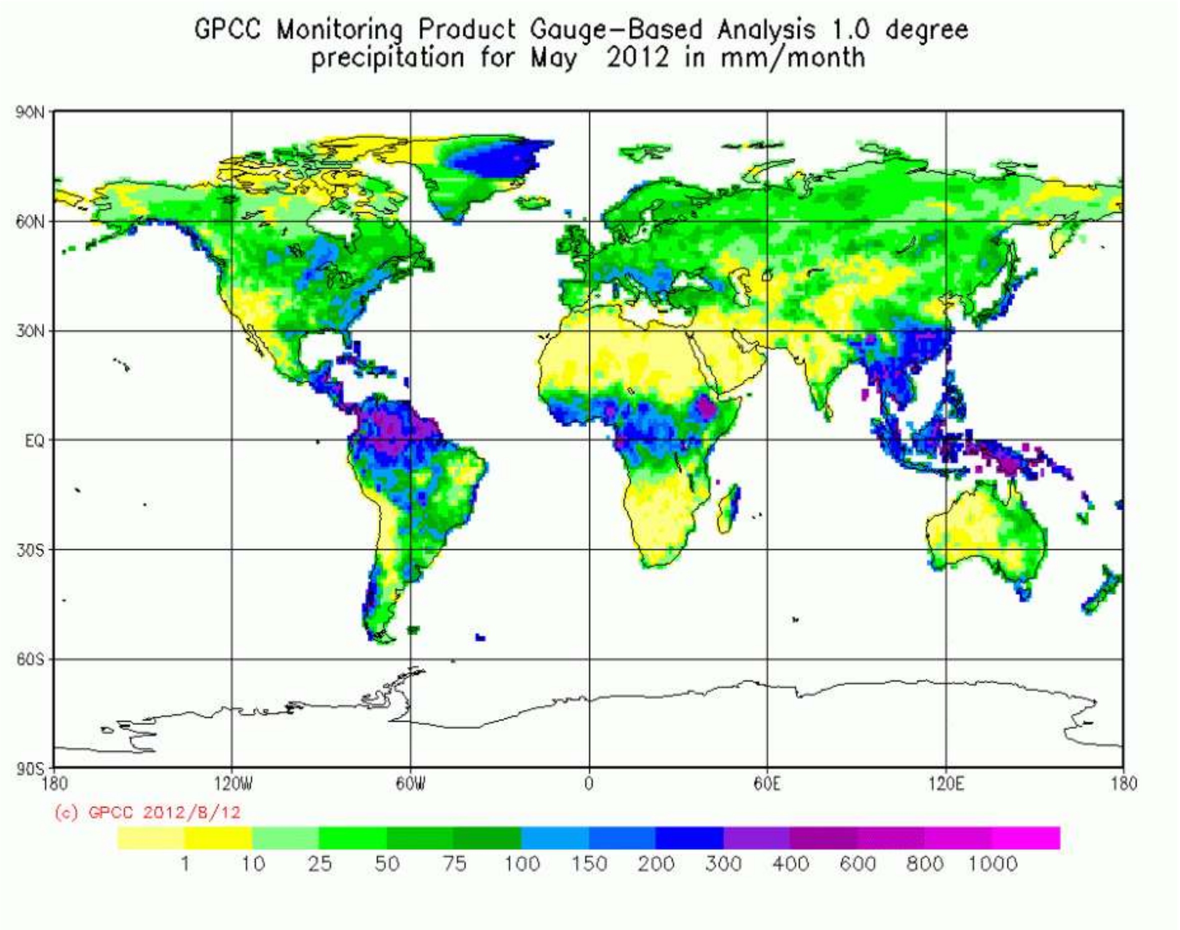
50
25
0
−25
−50
−75
−150
−100
−50
0
50
100
150
100
80
60
40
20
0

GPCC Global Precipitation Climatology Centre

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<xarray.Dataset>
Dimensions:                     (lon: 360, lat: 180, time: 120)
Coordinates:
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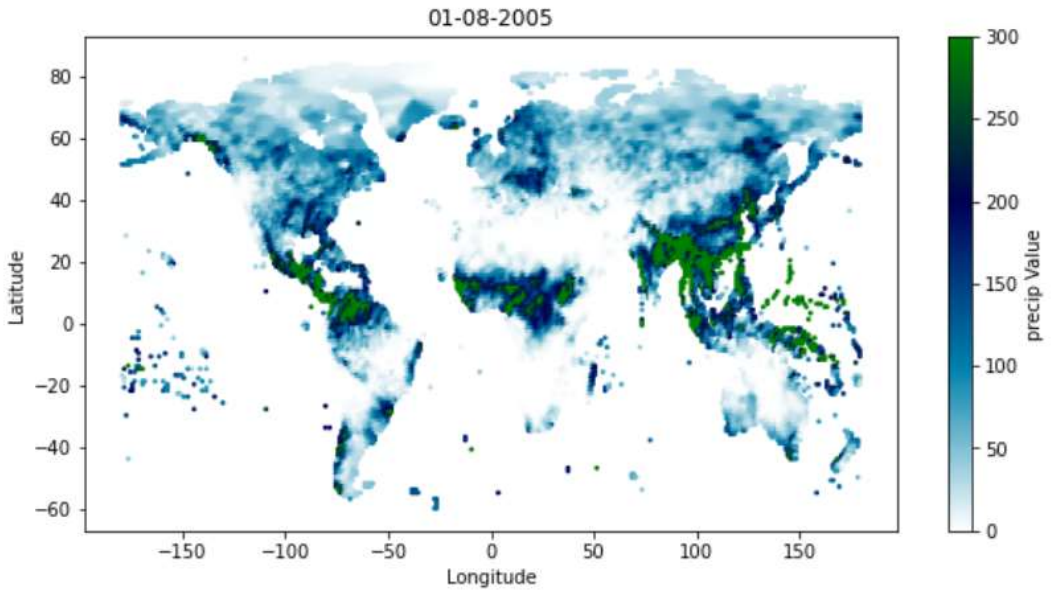
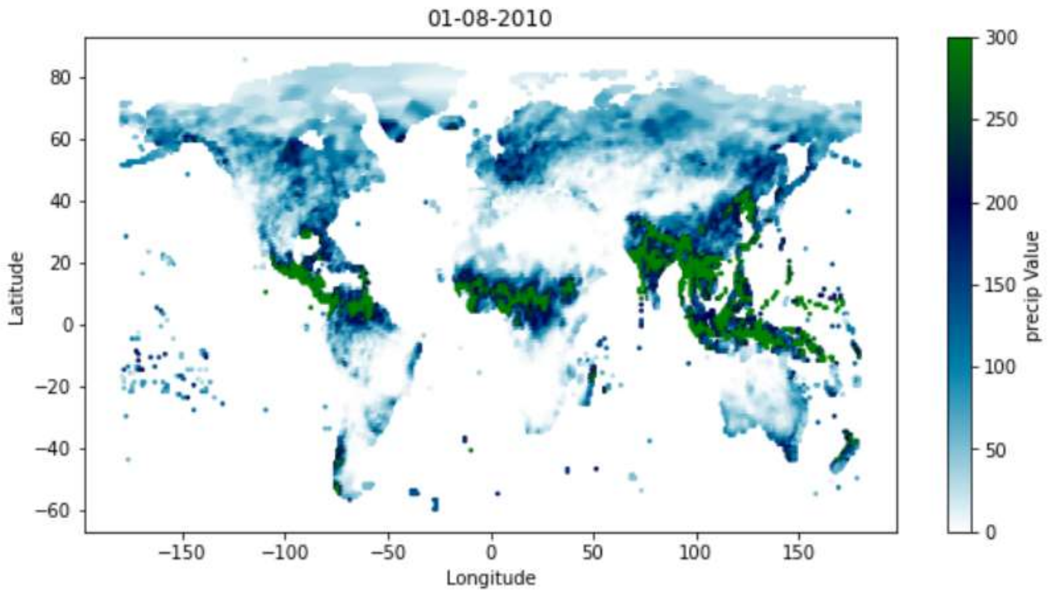
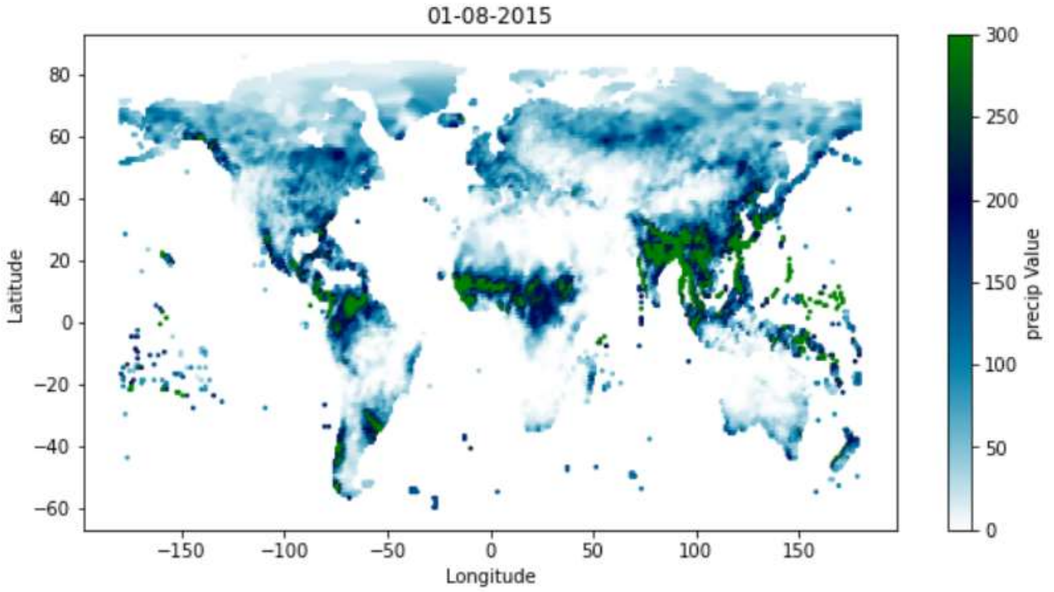
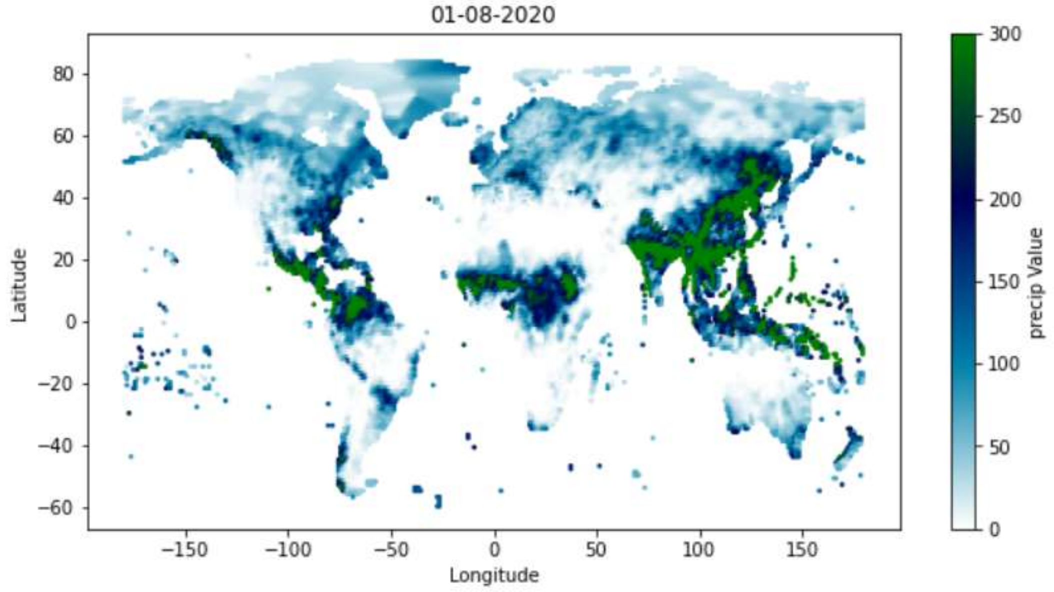
  * lat                         (lat) float64 89.5 88.5 87.5 ... -88.5 -89.5
  * time                        (time) datetime64[ns] 2011-01-01 ... 2020-1...
Data variables:
    precip                      (time, lat, lon) float32 ...
    numgauge                    (time, lat, lon) float32 ...
    infilled_numgauges          (time, lat, lon) float32 ...
    interpolation_error         (time, lat, lon) float32 ...
    interpolation_error_infilled (time, lat, lon) float32 ...
    diff_new_old_method         (time, lat, lon) float32 ...
Attributes: (12/20)
    CDI:                       Climate Data Interface version 1.7.0 (http://m...
    Conventions:               CF-1.4
    history:                   Sat May 28 08:56:58 2022: cdo -setgatts,gattfi...
    title:                     GPCC Full Data Monthly Product Version 2022, p...
    summary:                   The Full Data Monthly Product is of much highe...
    keywords:                  precipitation climatology,gpcc,global,gpcp,
    ...                        ...
    time_coverage_resolution:  month
    geospatial_lat_min:        -90.
    geospatial_lat_max:        90.
    geospatial_lon_min:        -180.
    geospatial_lon_max:        180.
    CDO:                       Climate Data Operators version 1.7.0 (http://m...
```

Source
https://climatedataguide.ucar.edu/climate-data/gpcc-global-precipitation-climatology-centre


01-08-2005
Latitude
Longitude
precip Value


01-08-2010
Latitude
Longitude
precip Value


01-08-2015
Latitude
Longitude
precip Value


01-08-2020
Latitude
Longitude
precip Value

CHALLENGES FACED

1. It took around 2-3 days to determine what the dataset wanted to convey.
2. There were always issues in 3D plotting in adjusting the array size of lat, lon, and time so at last, I preferred to go for 2D plotting.
3. Firstly I tried to plot a scatter plot of daily data, but it was showing negligible changes, and taking the mean of every month’s data is useless.
4. I preferred monthly data to see many variations but at last scatter plot turns out that there was very less variation in the GPCC and GLEAM dataset even in the gap of 5 years.

ACKNOWLEDGEMENT

I want to thank Prof Balaji Devaraju for providing me with this beautiful opportunity to work on a Global Lake Responses to Climatic Change project. I also want to convey my heartfelt gratitude to Abhilasha Garkoti ma’am, for her tremendous support and assistance in my ongoing project. The project was only possible with their help and insights.

THANK YOU