
*6th Workshop on Water Resources in Developing Countries:
Hydroclimate Modeling, Information Tools and Simulation Techniques
May 20-31, 2024*

*Applications of PERSIANN data and CHRS web-based interfaces
(Reported by CHRS students)*



ICTP – Trieste, Italy

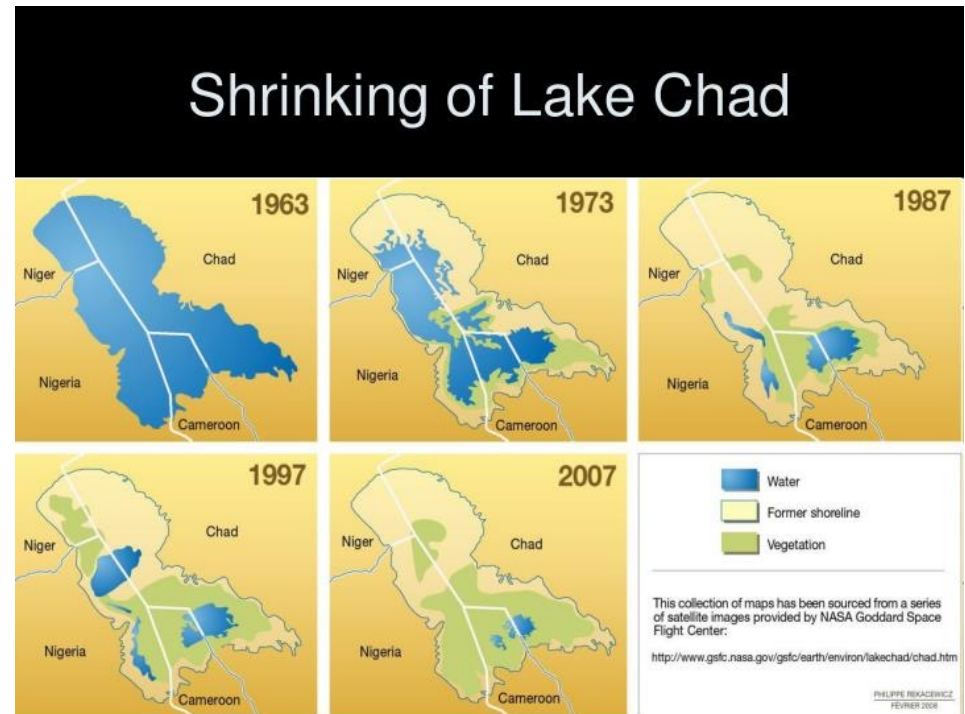
Problem 1

Title

*Precipitation and temperature data analysis over basins:
Application to Lake Chad*

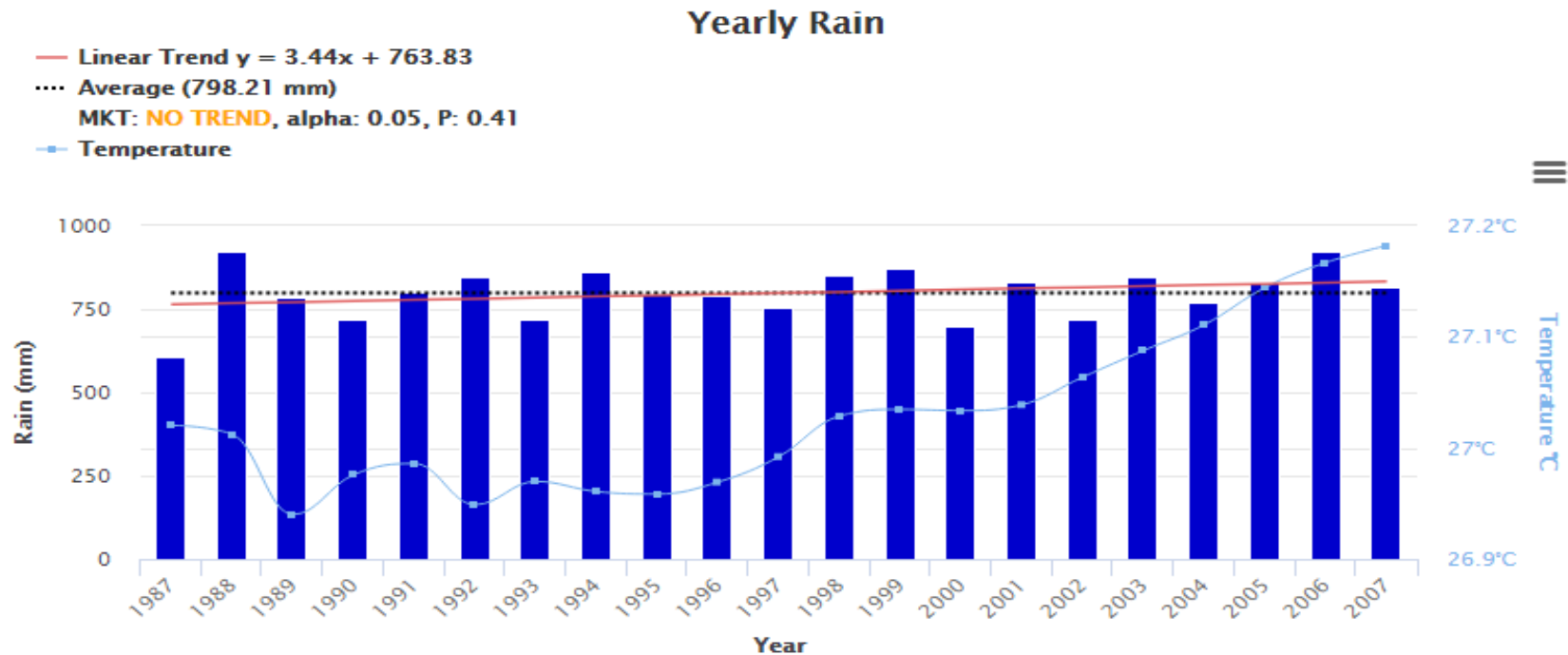
Objective of the analysis

To understand the response of the lakes and reservoirs to climate change and variability



Shrinking of Lake Chad

Problem 1

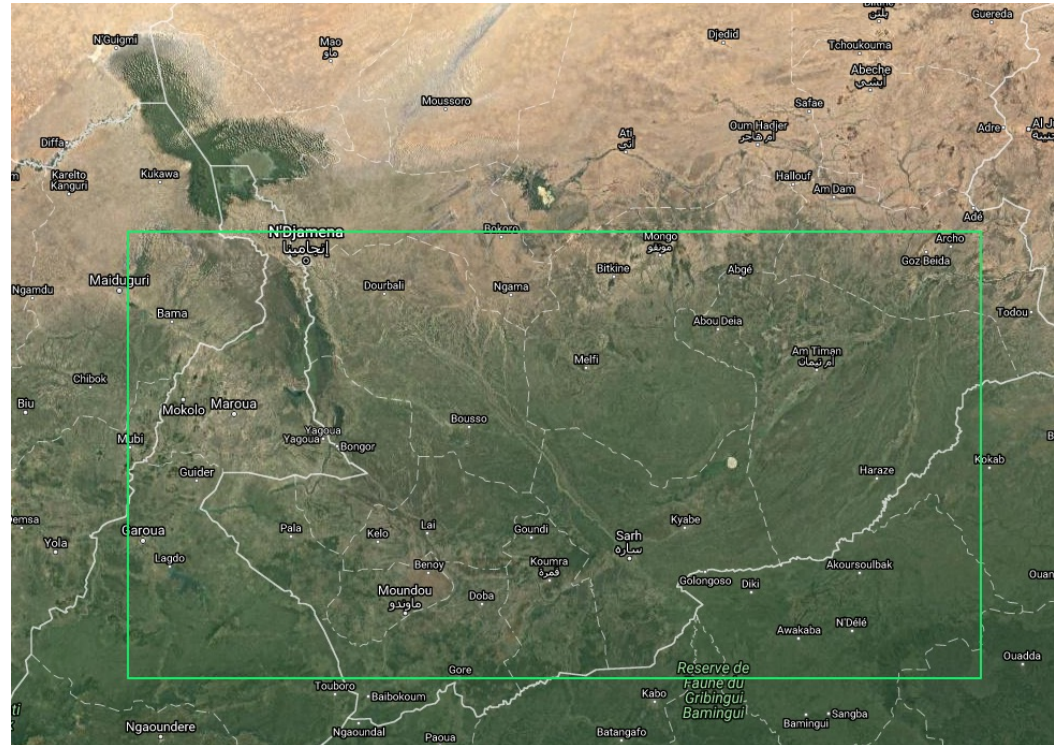


Annual rainfall of Lake Chad

Problem 1



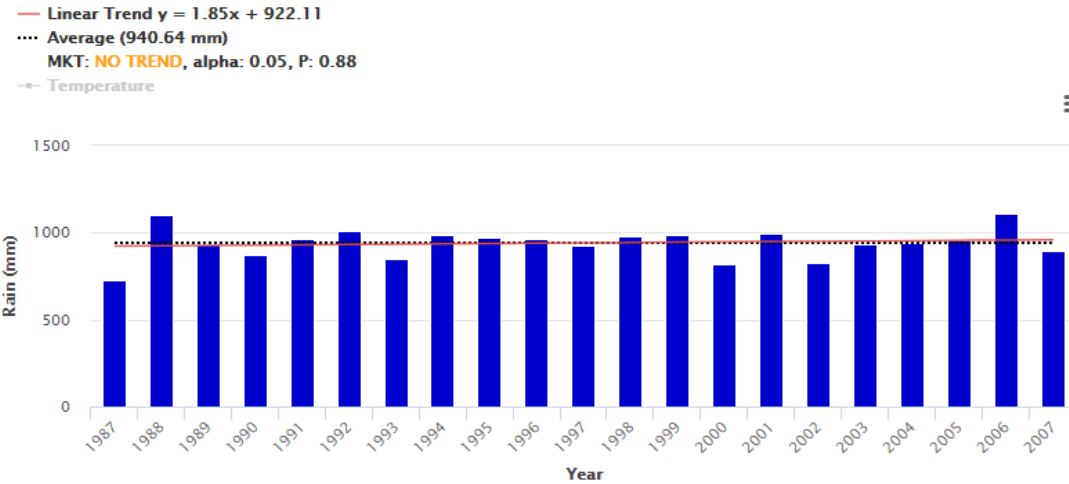
Map of Lake Chad



Rectangle area covering Chari river

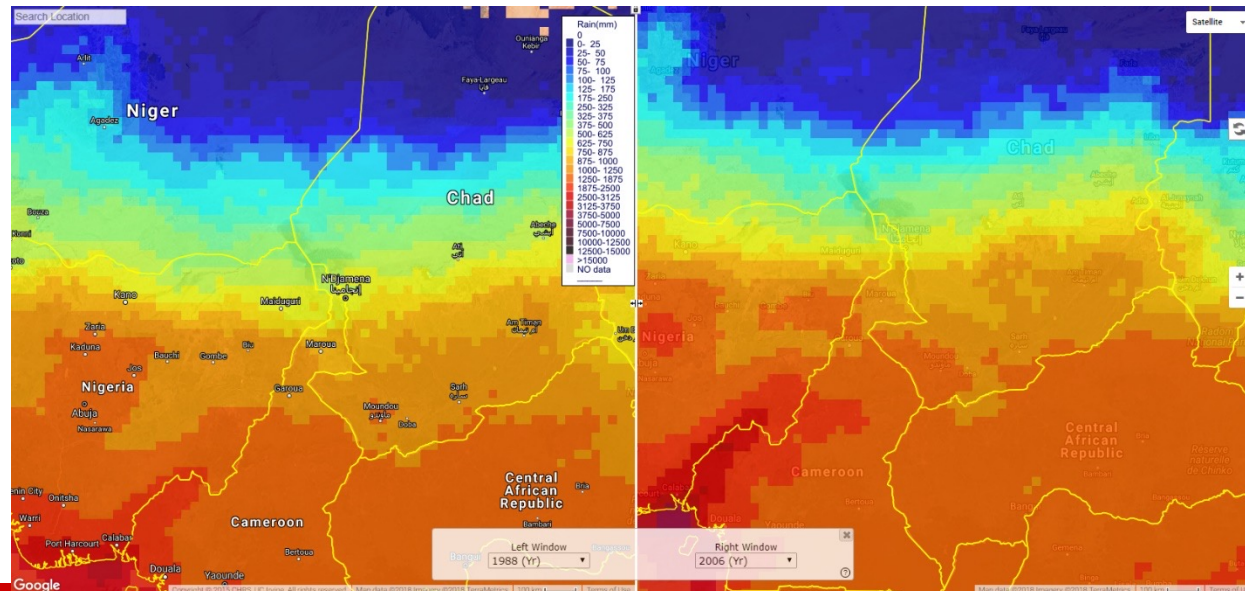
Problem 1

Yearly Rain



Annual rainfall over the rectangle research area

Side by side comparison of annual rainfall of 1988 and 2006



Problem 2

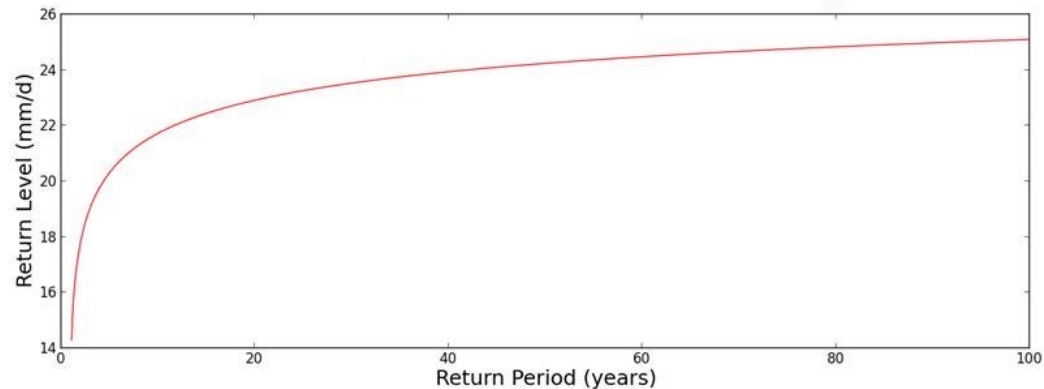
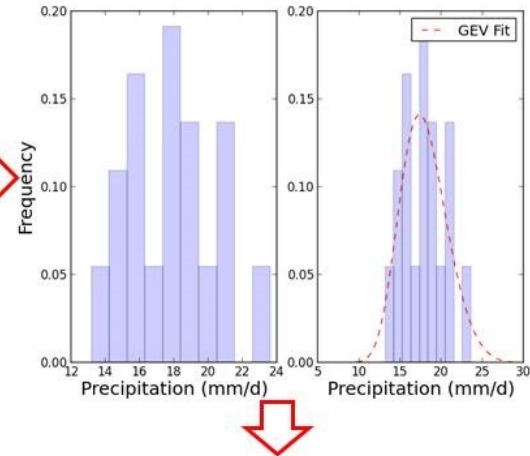
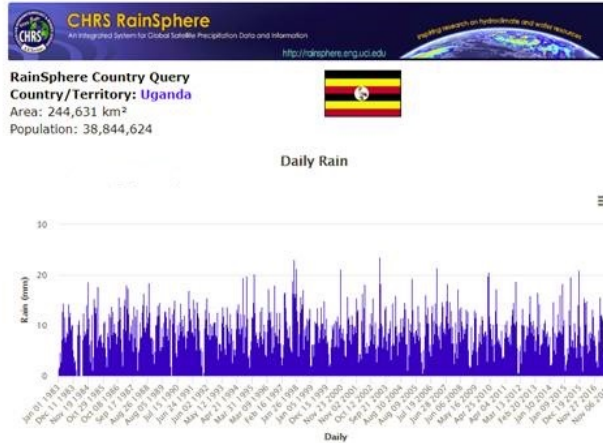
Title

IDF analysis

Objective of the analysis

To deduce return period and return level for annual maximum daily rainfall for Uganda from PERSIANN-CDR data obtained on the CHRS RainSphere website (<http://rainsphere.eng.uci.edu/>)

Problem 2



Return period and return level for annual maximum daily rainfall for Uganda from PERSIANN-CDR data

Problem 3

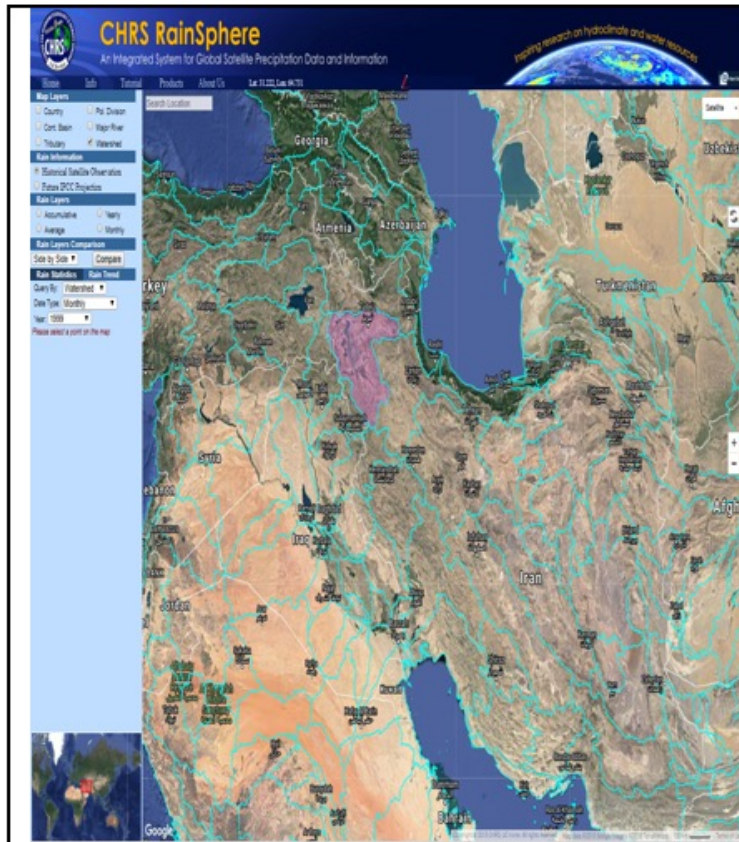
Title

Assessment of PERSIANN-CDR rainfall trend in relation to water level of Lake Urmia

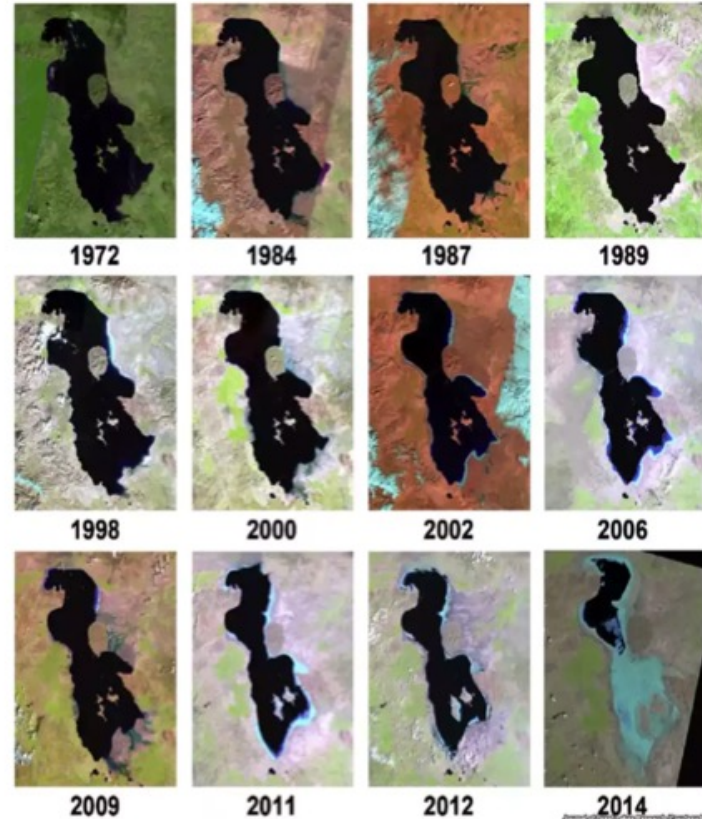
Objective of the analysis

Assess the effect of varying precipitation on lake water level for water management purposes.

Problem 4



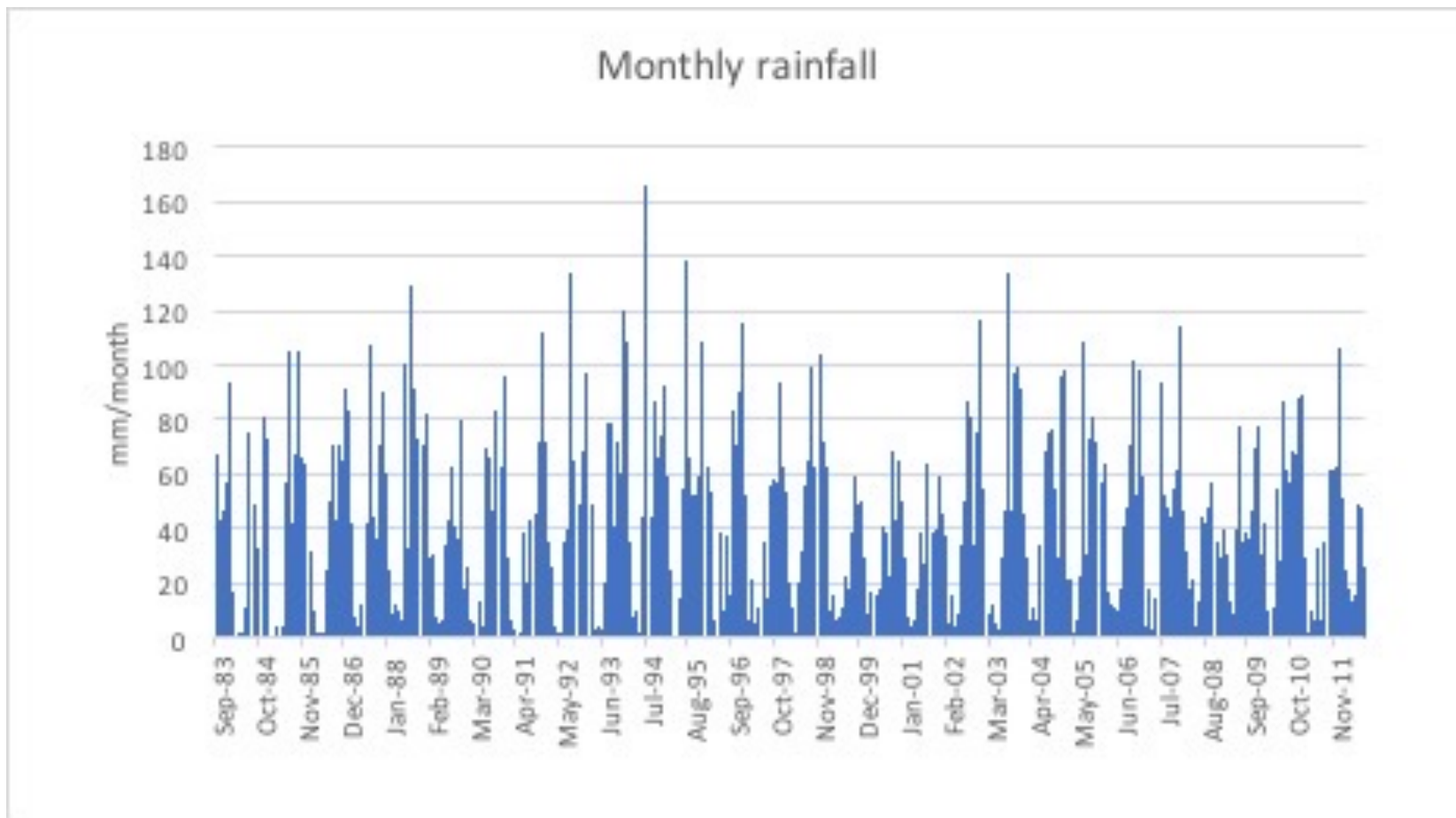
CHRS RainSphere (<http://rainsphere.eng.uci.edu/>)



Lake Urmia Photograph: Kaveh Madani

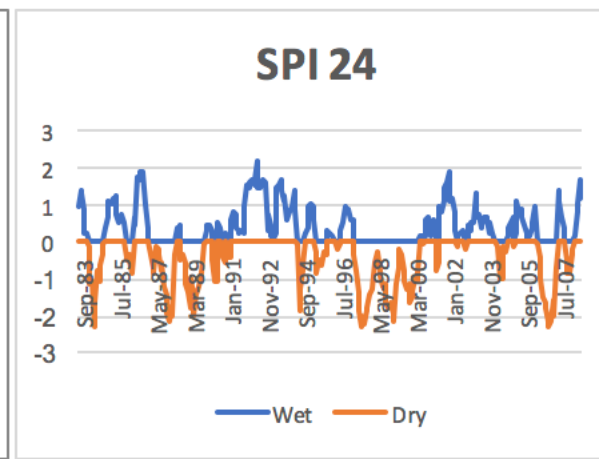
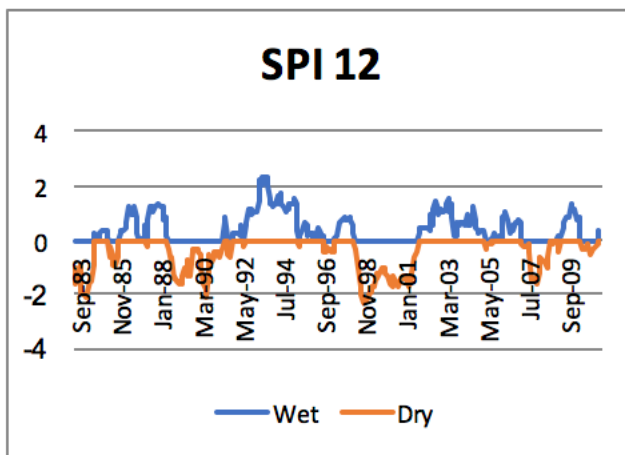
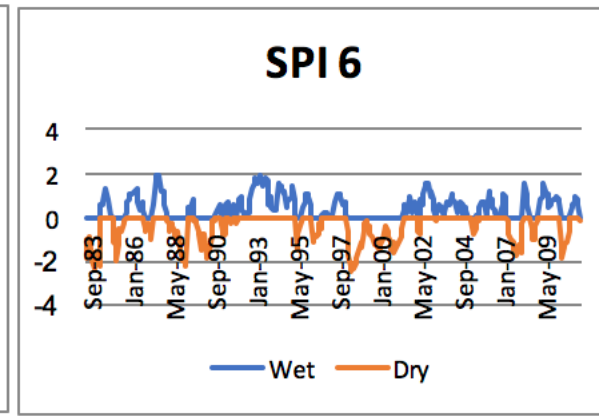
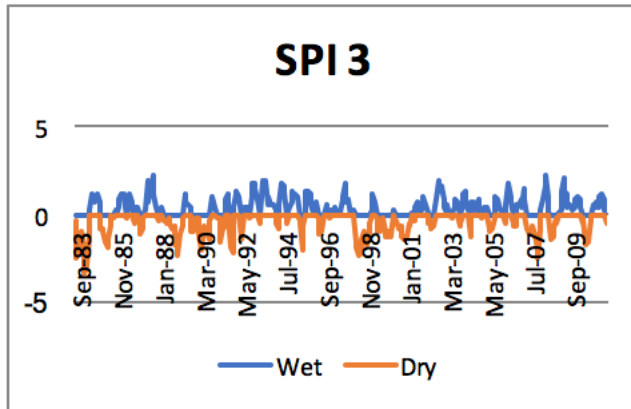
Lake Urmia

Problem 3



PERSIANN-CDR Rainfall data over Lake Urmia

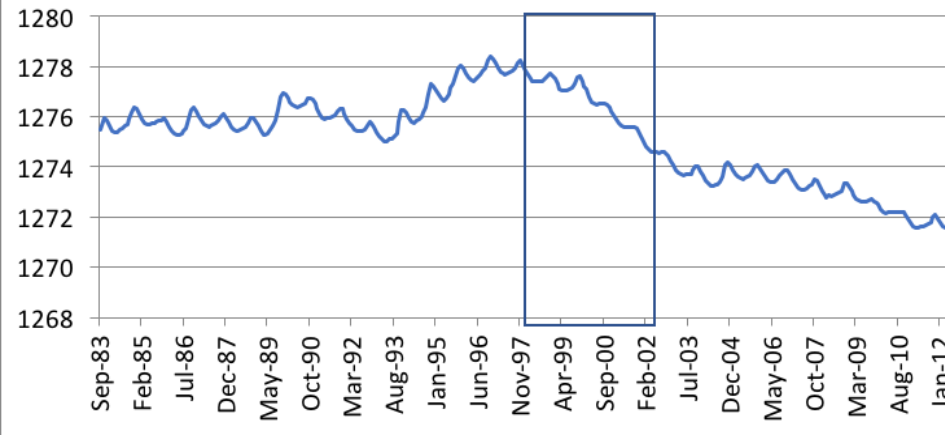
Problem 3



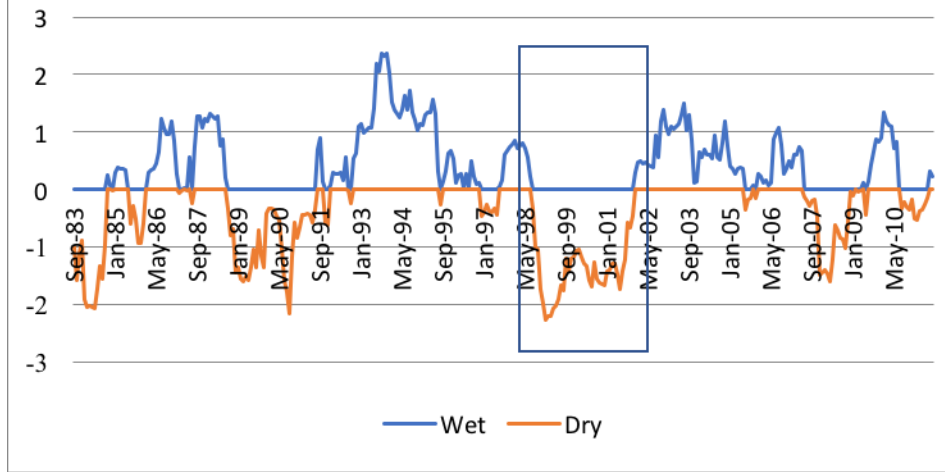
Standardized Precipitation Index (SPI)

Problem 3

Water Level Monthly Data



SPI 12



Water level monthly data

Problem 4

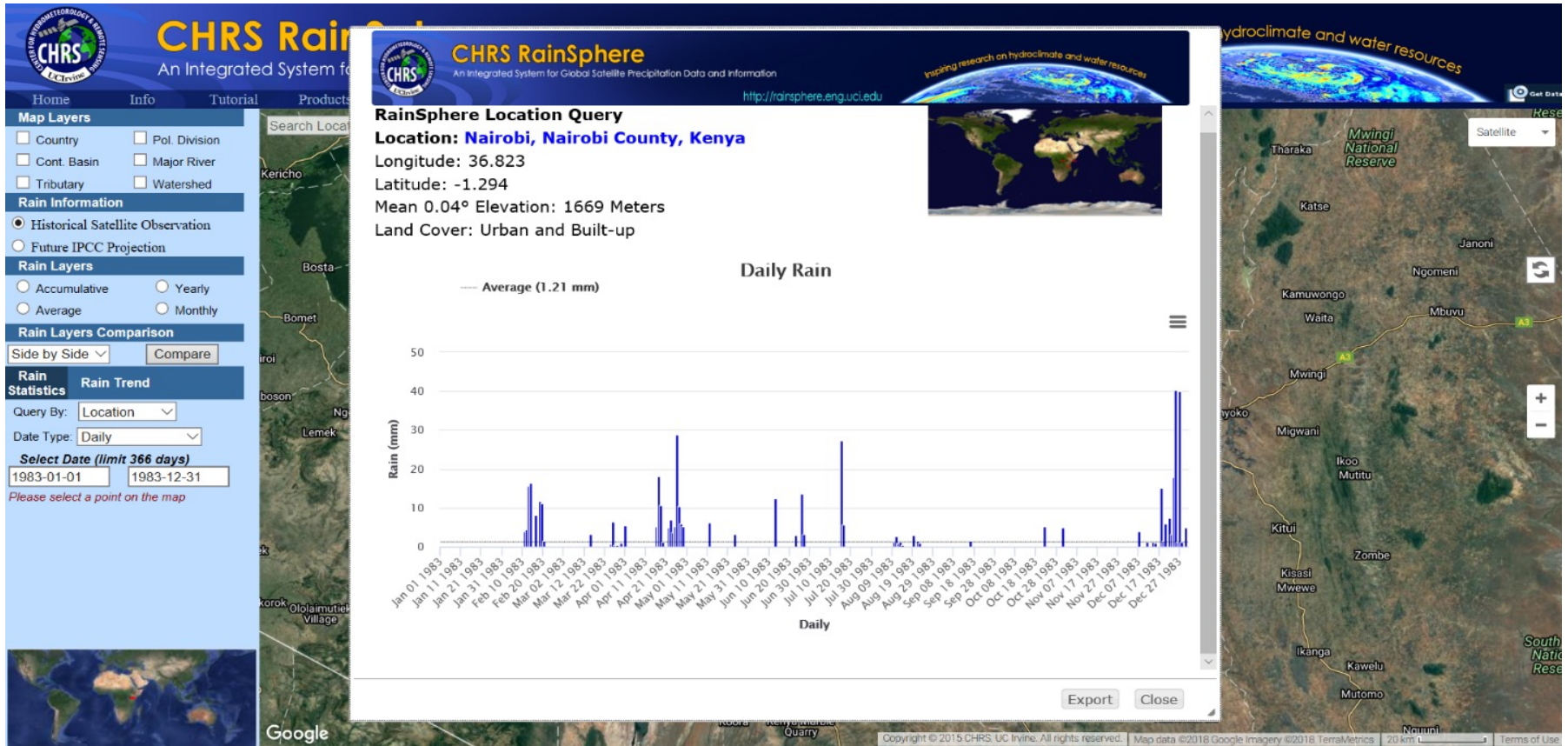
Title

Trend Analysis of extreme rainfall events frequency.

Objective of the analysis

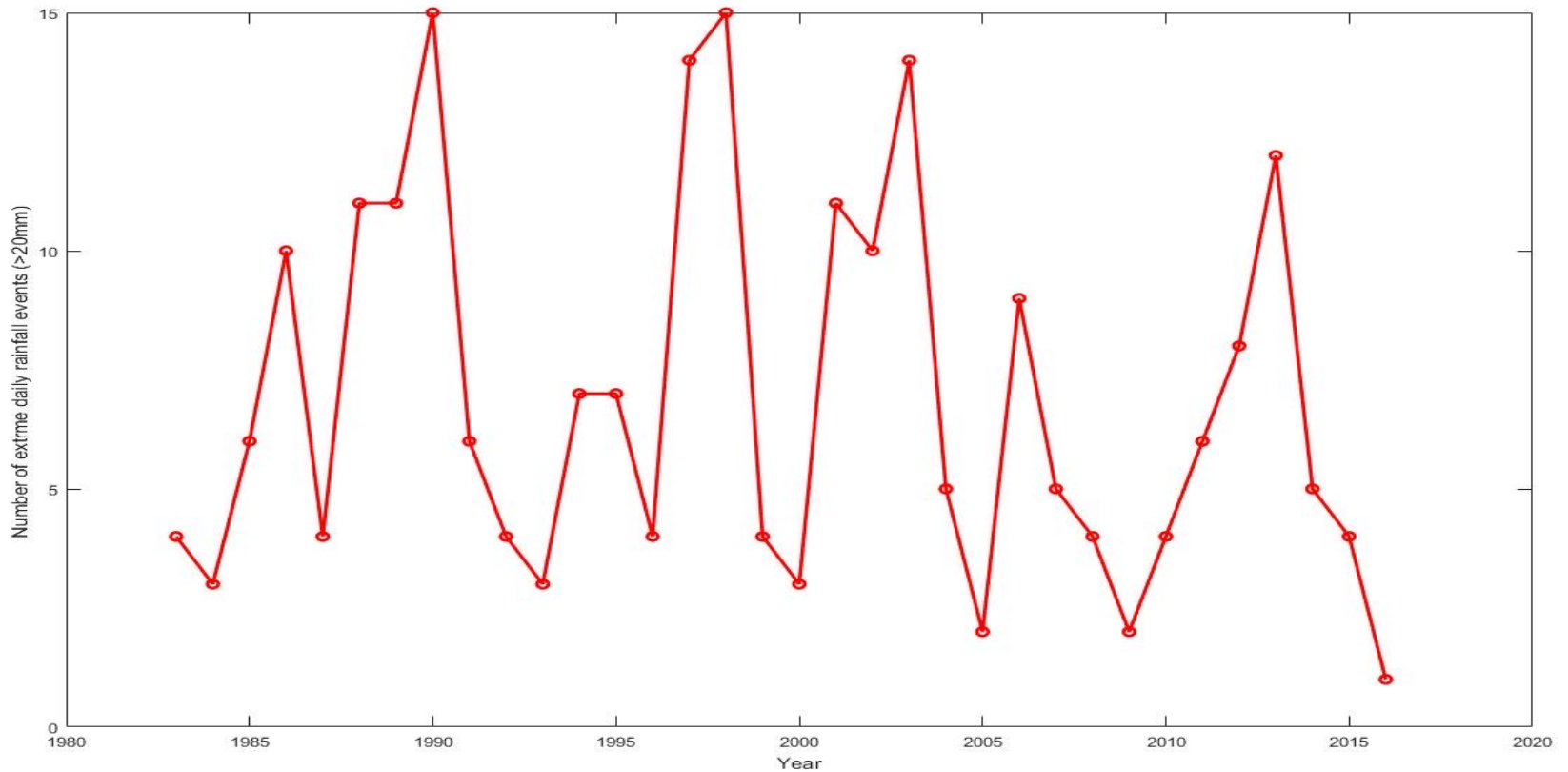
To improve understanding of the changes in frequency of annual extreme rainfall events. This application is potentially helpful for infrastructure design under a changing climate.

Problem 4



Location query for daily precipitation in Nairobi, Kenya

Problem 4



Annual number of daily rainfall events above 20 mm for the record (1983-2017)

Problem 4



Location query for annual precipitation in Nairobi, Kenya

Problem 5

Title

Relationship between rainfall trend and flooding in Uganda

Objective

Using CHRS RainSphere portal to show the fact that in Uganda like most of the African countries, people are currently experiencing more floods due to the downpour. However, analysis shows a drop in the rainfall received in these countries for the past years. This happens due to increases in the amount of heavy rain in these countries. CHRS RainSphere for Projection shows that in the future the situation will become worse for these countries because the number of heavy rains are increasing.

Problem 5

 **CHRS RainSphere**
An Integrated System for Global Satellite Precipitation Data and Information
<http://rainsphere.eng.uci.edu> *Inspiring research on hydroclimate and water resources*

RainSphere Country Query

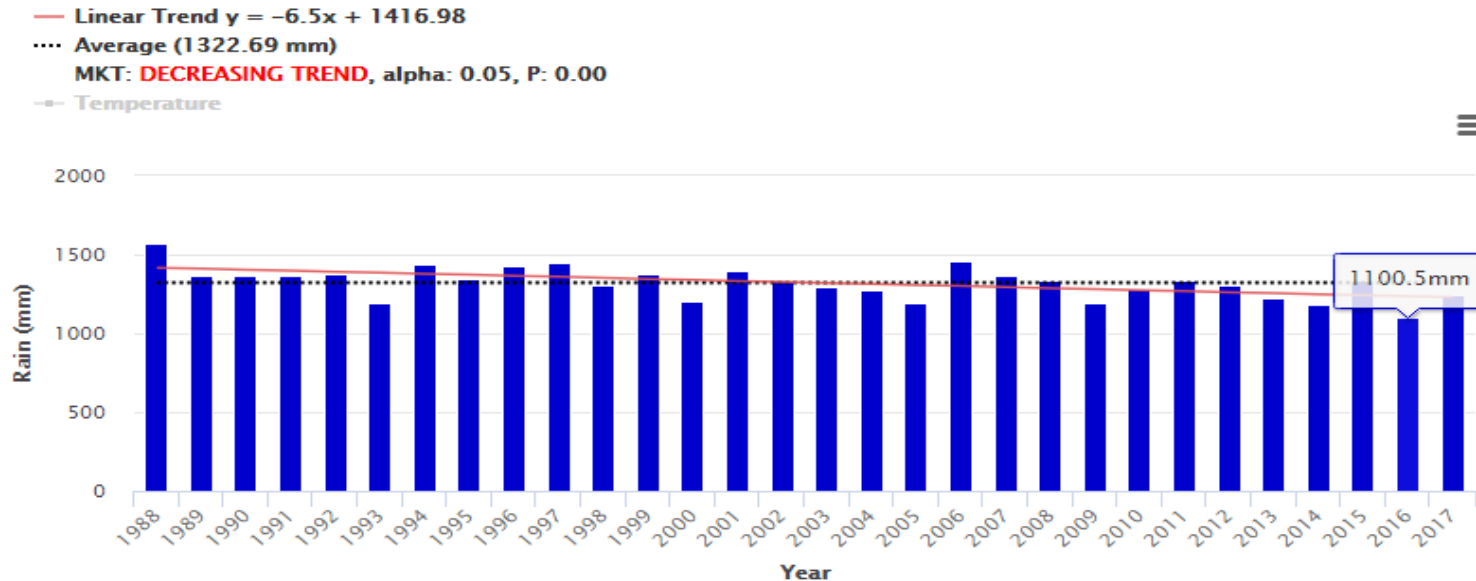
Country/Territory: **Uganda**

Area: 244,631 km²

Population: 38,844,624



Yearly Rain



Precipitation trend in Uganda from 1988 to 2017

Problem 5

 **CHRS RainSphere**
An Integrated System for Global Satellite Precipitation Data and Information
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RainSphere Country Query

Country: **Uganda**

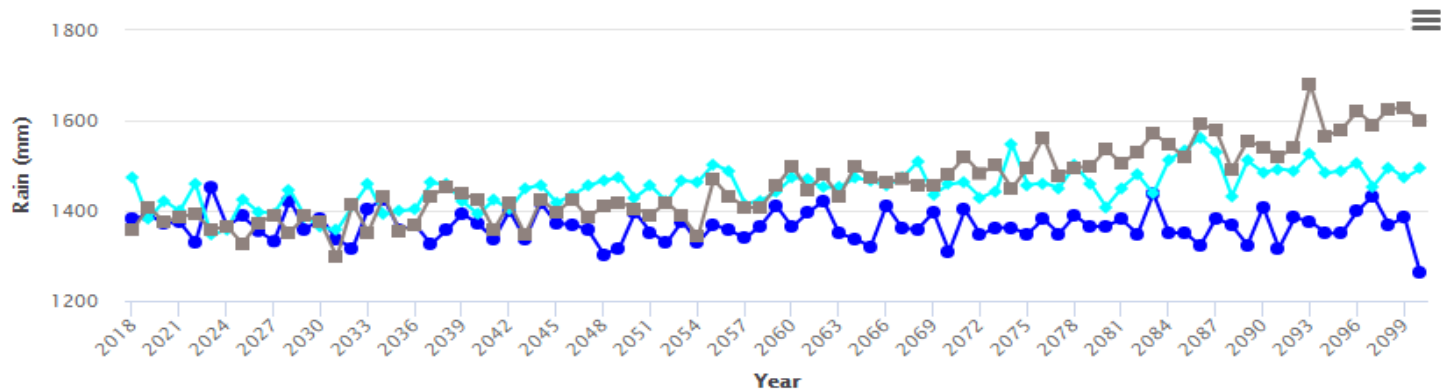
Area: 244,631 km²

Population: 38,844,624



Yearly Rain – IPCC Projection

- RCP2.6 (Low Emissions Scenario) (mm)
- RCP4.5 (Stabilization Emissions) (mm)
- RCP8.5 (High Emissions) (mm)
- ... RCP26 Average
- ... RCP45 Average
- ... RCP85 Average
- Linear Trend $y = -0.11x + 1370.65$
- Linear Trend $y = 1.24x + 1400.45$
- Linear Trend $y = 3.06x + 1333.16$
- MKT: **NO TREND**, alpha: 0.05, P: 0.67
- MKT: **INCREASING TREND**, alpha: 0.05, P: 0.00
- MKT: **INCREASING TREND**, alpha: 0.05, P: 0.00
- Temperature RCP2.6
- Temperature RCP4.5
- Temperature RCP8.5



Precipitation projections in Uganda till 2099

Problem 5

 **CHRS RainSphere**
An Integrated System for Global Satellite Precipitation Data and Information
<http://rainsphere.eng.uci.edu>

Inspiring research on hydroclimate and water resources

RainSphere Country Query

Country: **Uganda**

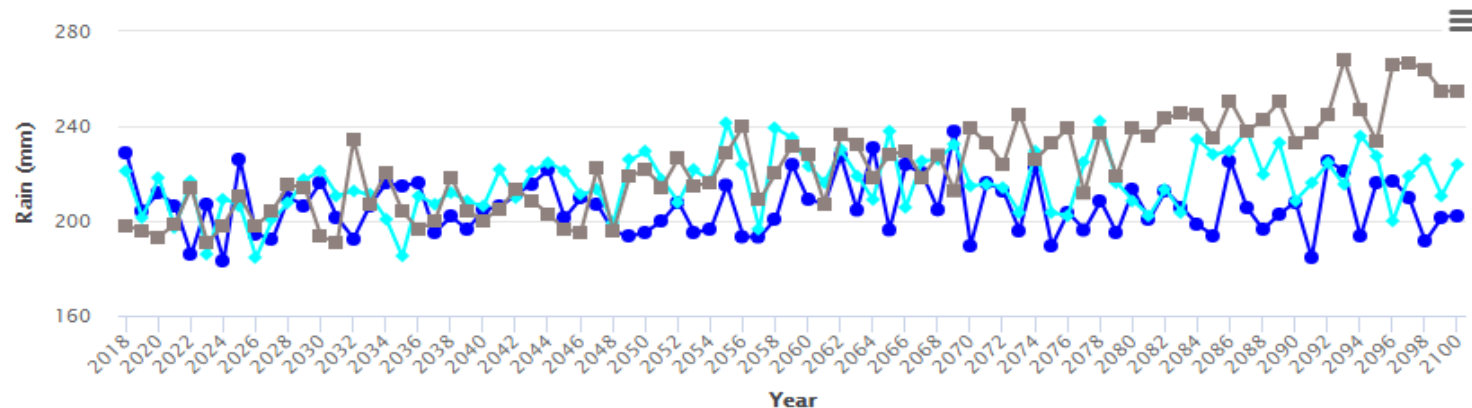
Area: 244,631 km²

Population: 38,844,624



Monthly by Year Rain – November – IPCC Projection

- RCP2.6 (Low Emissions Scenario) (mm)
- ◆ RCP4.5 (Stabilization Emissions) (mm)
- RCP8.5 (High Emissions) (mm)
- ... RCP26 Average
- ... RCP45 Average
- ... RCP85 Average
- Linear Trend $y = 0.01x + 205.79$
- Linear Trend $y = 0.2x + 207.99$
- Linear Trend $y = 0.7x + 194.51$
- MKT: **NO TREND**, alpha: 0.05, P: 0.96
- MKT: **INCREASING TREND**, alpha: 0.05, P: 0.00
- MKT: **INCREASING TREND**, alpha: 0.05, P: 0.00
- Temperature RCP2.6
- Temperature RCP4.5
- Temperature RCP8.5



Precipitation projections till 2100 for November using RainSphere

Problem 6

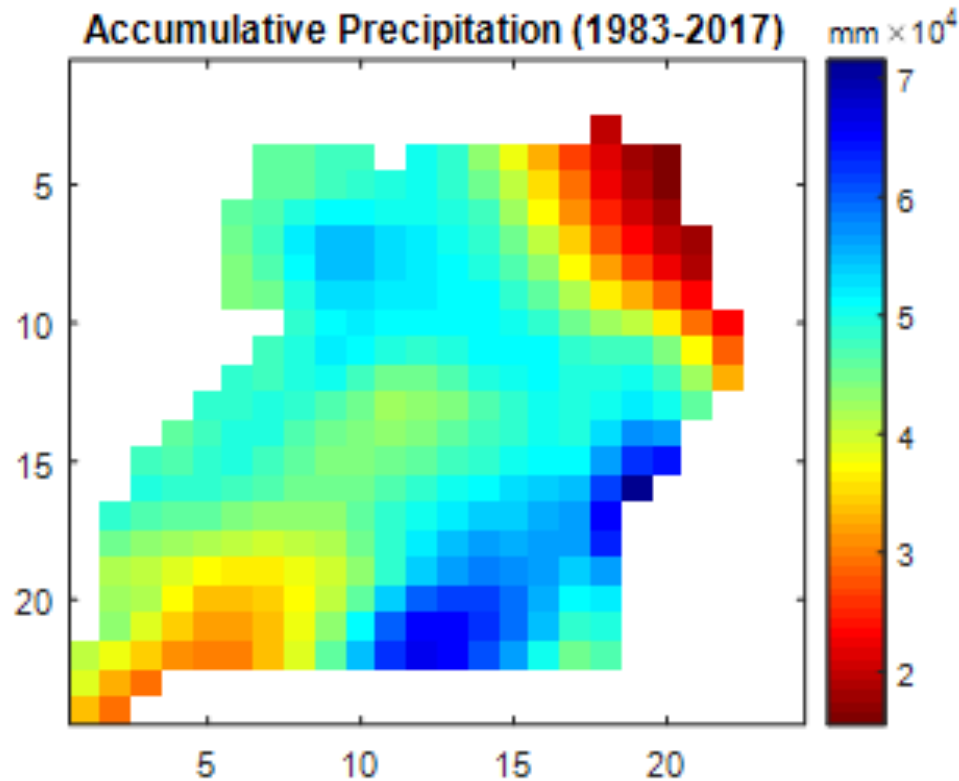
Title

Drought indices analysis (SPI: Standardized Precipitation Index)

Objective of the analysis

The main goal of this study is using the PERSIANN-CDR dataset to calculate the popular Standardized Precipitation Index (SPI) for detecting drought events over Uganda using gridded PERSIANN-CDR dataset.

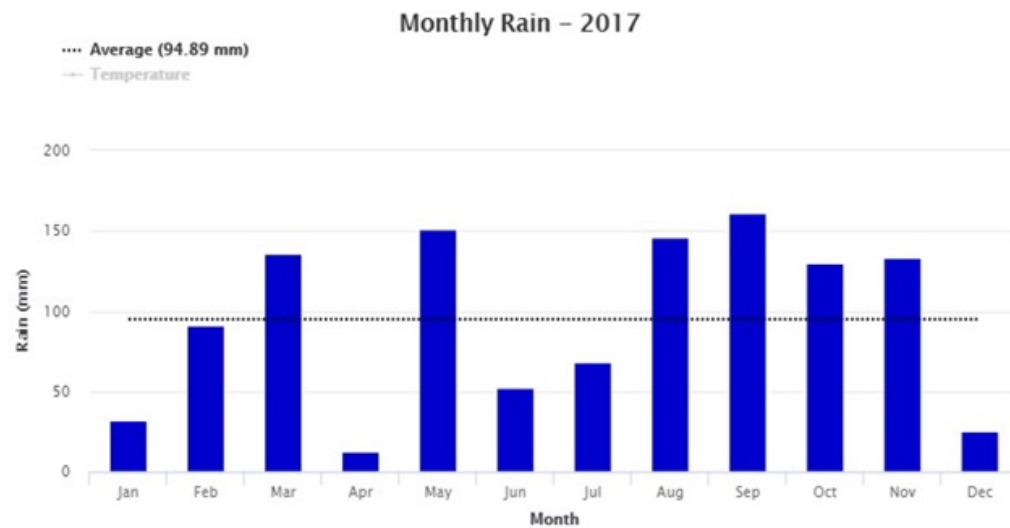
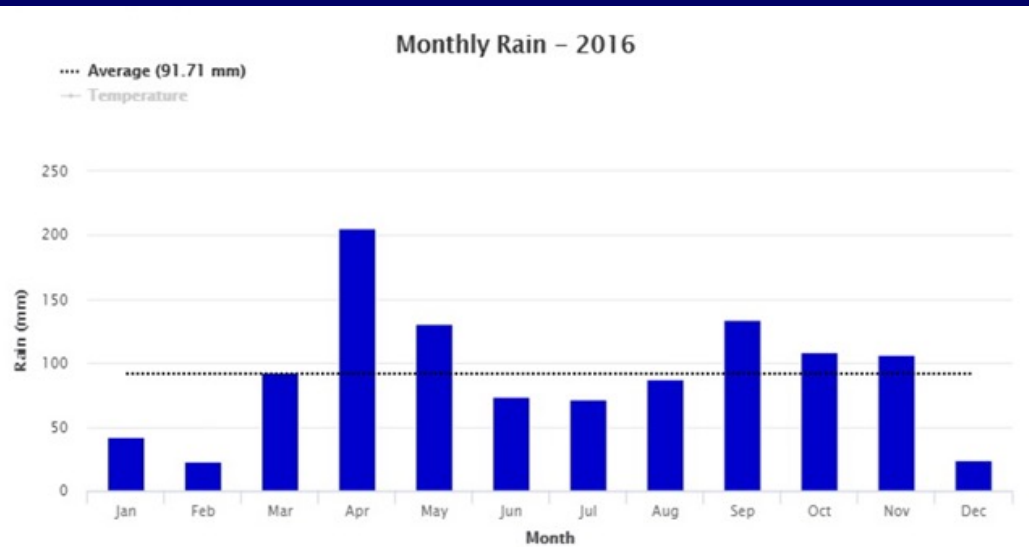
Problem 6



SPI Value	Category
2.0 and above	Extremely wet
1.5 to 1.99	Severely wet
1.0 to 1.49	Moderately wet
-0.99 to 0.99	Near normal
-1.0 to -1.49	Moderately dry
-1.5 to -1.99	Severely dry
-2.0 and less	Extremely dry

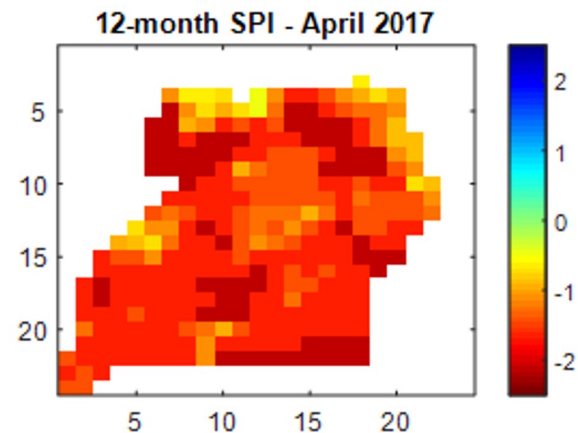
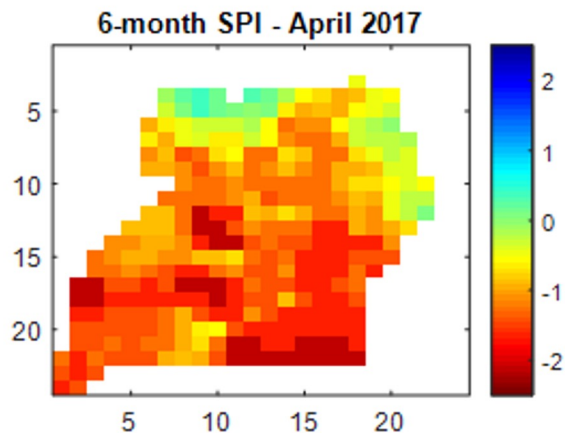
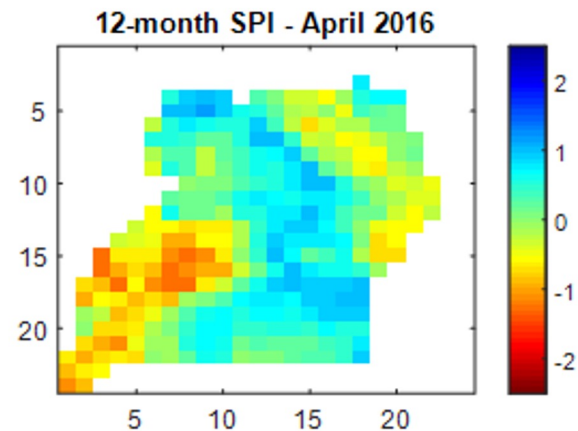
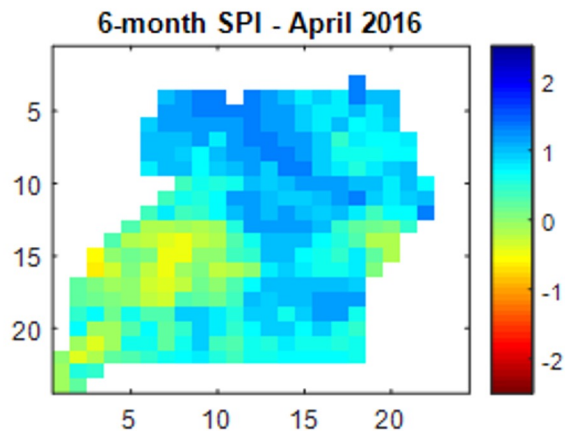
***Accumulative precipitation data (PERSIANN-CDR)
over Uganda from 1983-2017***

Problem 6



Monthly precipitation data for drought analysis for two years

Problem 6



6-month and 12-month SPI data for April 2016 and 2017 over Uganda

Problem 7

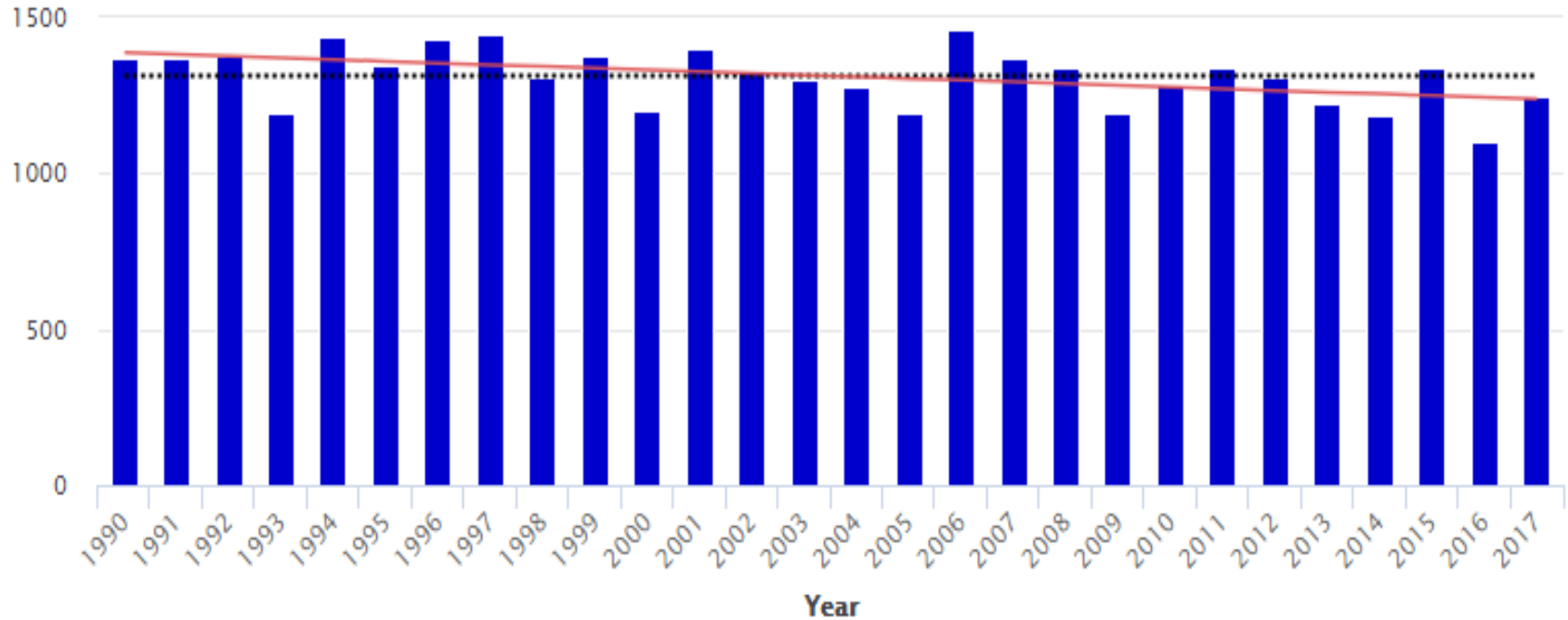
Title

Correlations between precipitation trends and GDP and other economic indices

Objective of the analysis

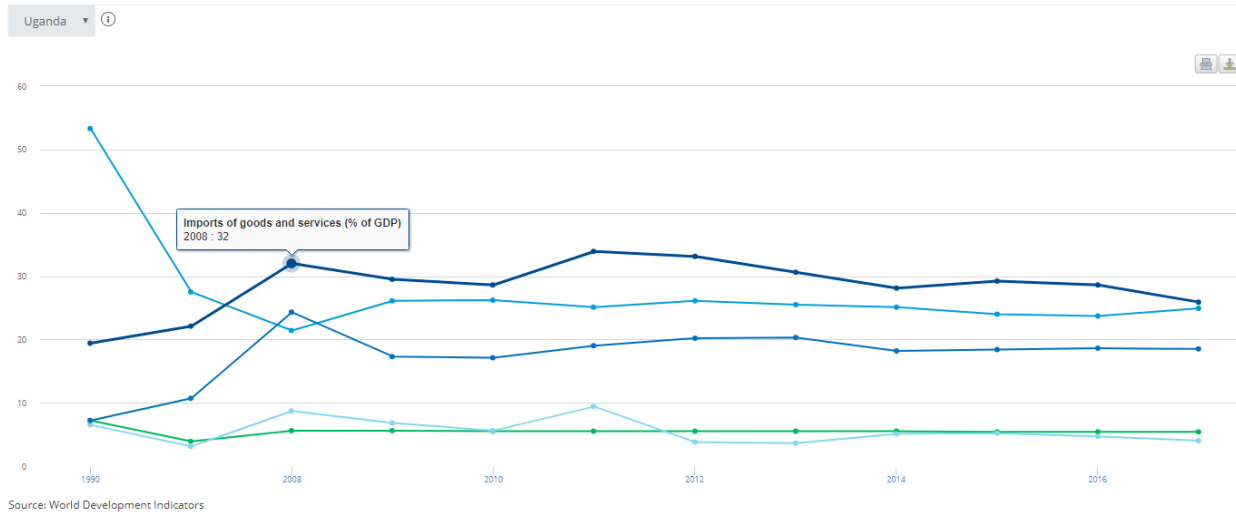
Analyze the effect that precipitation trends have on the economy of Uganda, and analyze what future economic impacts could occur due to projected changes in hydroclimate.

Problem 7

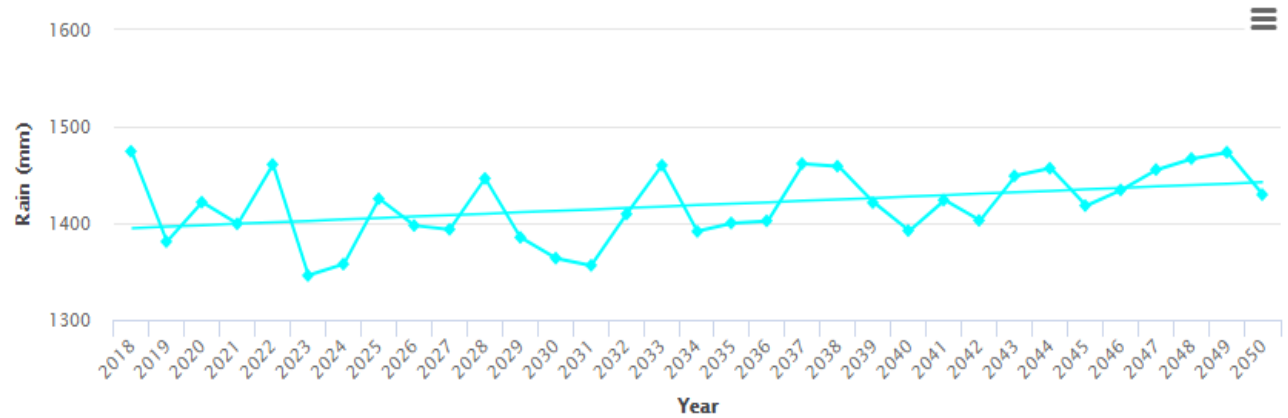


Annual rainfall (mm/year) over Uganda

Problem 7



GDP and other economic matrices of Uganda



Future precipitation projection of Uganda

Problem 8

Title

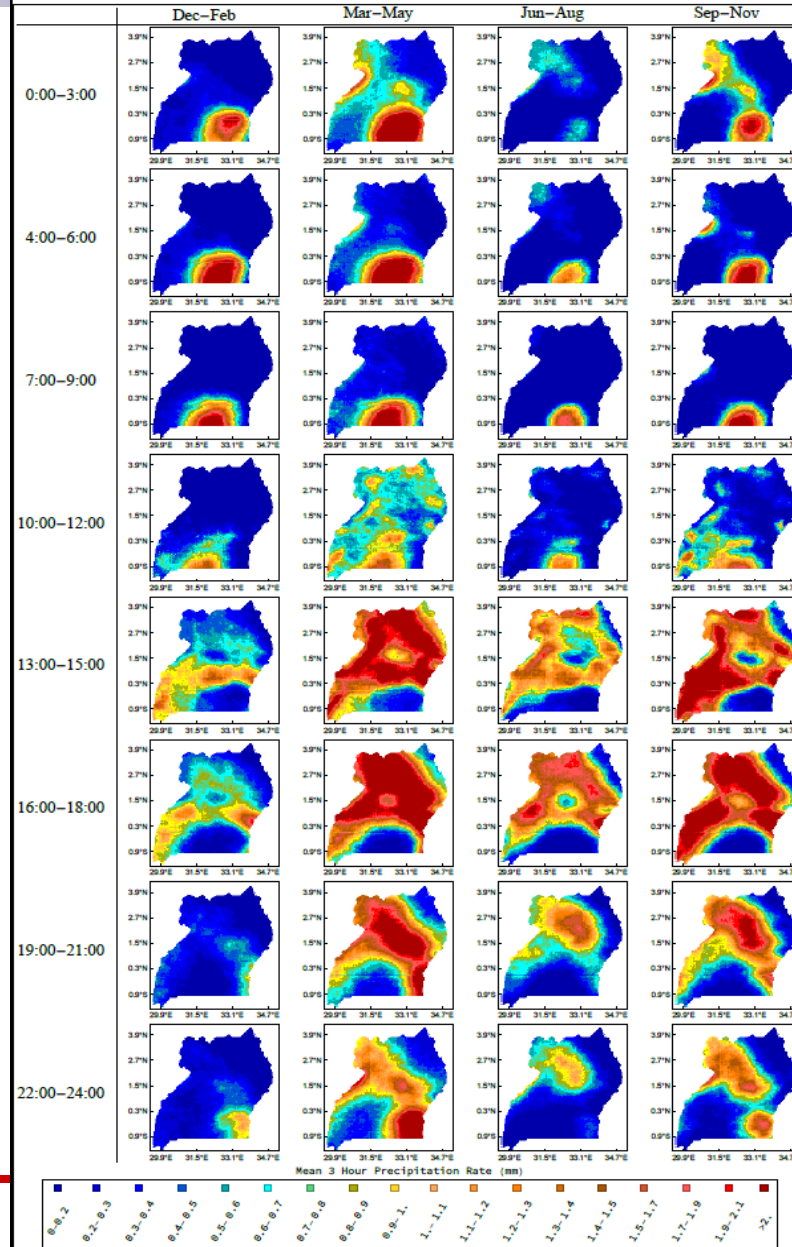
Diurnal Cycle Analysis

Objective

Here we apply the long record high resolution satellite-based precipitation product, namely PERSIANN-CCS (Precipitation Estimation from Remotely Sensed Information using the Artificial Neural Network - Cloud Classification System) to illustrate the diurnal cycle of precipitation in Uganda.

Problem 8

The Precipitation Diurnal Cycle in Uganda
Data Source: PERSIANN-CCS 2003-2018



**Precipitation
diurnal cycle
in Uganda**