Utilization of Global Climate Models (GCMs) to Study Precipitation Extremes in Pakistan

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Presentation Layout

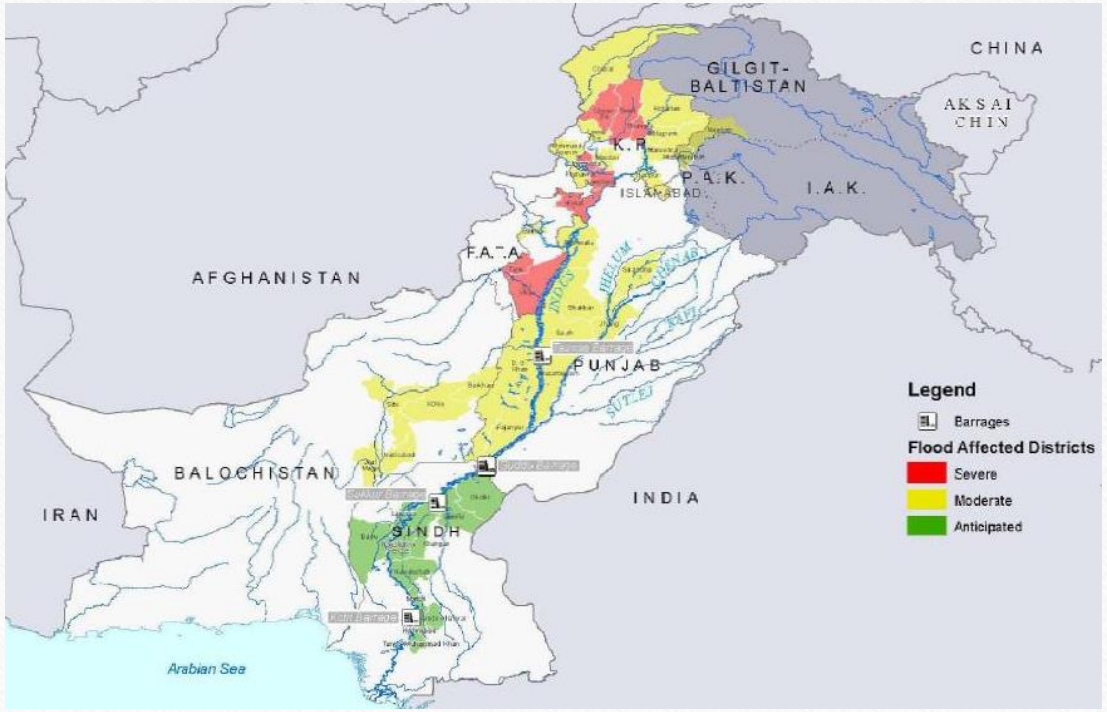
- Introduction
- Objectives
- Methodology
- Results

Introduction

- Change detection in hydrological cycle(an important stream of today's research)
  - extreme precipitation events
  - availability of water resources
  - durability and predictability
- Precipitation and Streamflow are important tools to identify spatial and temporal changes in water cycle
- Variability in Precipitation affects generation of streamflow(abrupt variations)
- Spatial and Temporal variations in Monsoon rainfall
- Owing to the abrupt changes in climate conditions because of global warming and human impacts, understanding of precipitation and streamflow dynamics is important

Study Area (Pakistan)

- Pakistan is located in South Asia
- Area = 796,000 Km2
- Arid to Semi arid climate
- It has the natural wealth of Himalayan glaciers in the north and five fresh water rivers
- The impact of climate change has affected the pattern of rainfall



Map retrieved from: https://blogs.agu.org/landslideblog/2010/08/04/latest-update-on-the-flood-wave-in-pakistan/

Objectives

- Downscaling and Bias Correction of GCM outputs.
- To interrogate the precipitation extremes based on General Circulation Models in Pakistan.
- To predict the trends of precipitation for future scenarios using outputs of GCMs on annual and seasonal scale

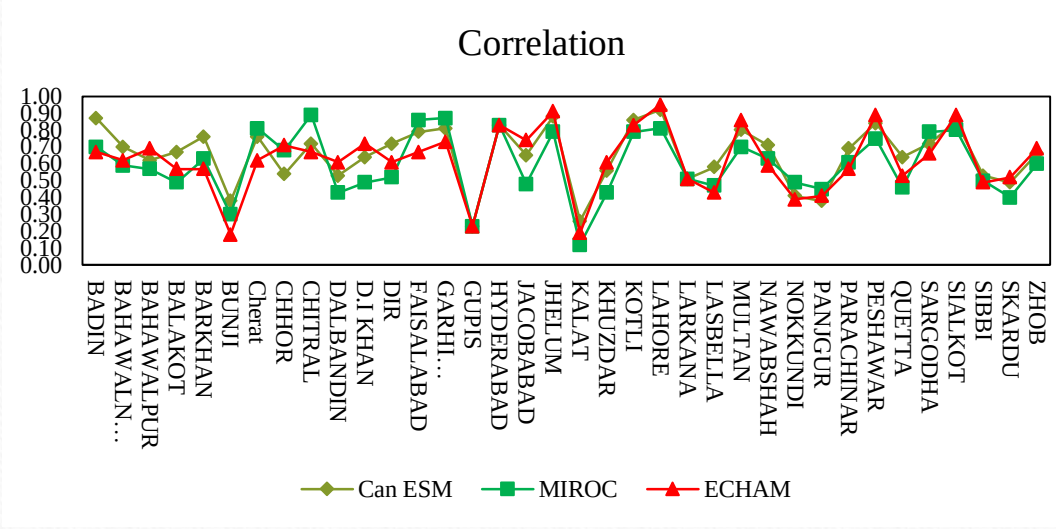
Methodology

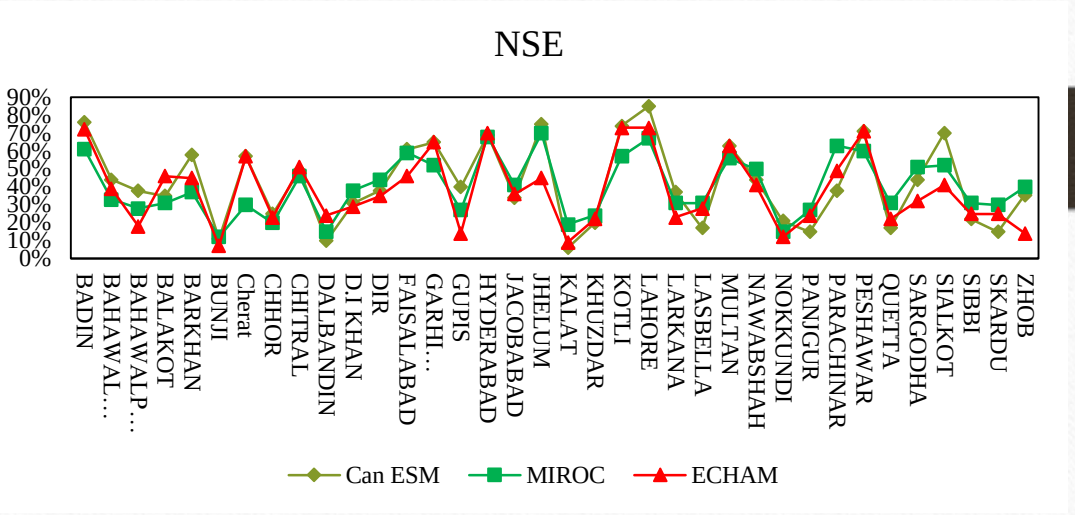
- Observed values acquisition from Pakistan Meteorological Department
- Extraction of precipitation data from three GCMs, MIROC, ECHAM and CanESM
- Bias Correction of the data
- Statistical analysis using various statistical measures
  - Taylor Diagram
  - Nash Sutcliffe Efficiency
  - RMSE
  - Pearson Correlation Coefficient
  - Coefficient of Determination
- Trend analysis using Mann Kendell's test

Outcomes

- Downscaling of the GCMs data for study area and future use
- Validation of the GCMs data against ground observations using statistical indicators
- Believe of use in satellite data for data scarce regions

Efficiencies of 3 GCMs output computed with PMD precipitation data





Conclusion

- This research interrogates the precipitation inconsistency over Pakistan on seasonal and annual scale by using Mann-Kendall (MK), Sen's slope estimator tests and statistical analysis.
- The results of this study displayed noteworthy trends at twenty (20) PMD stations in four seasons.
- The analysis predicted significant rising trends at five stations in the winter precipitation and rising trend for autumn precipitation time series at three stations.
- There is significant trend on 20 out of 36 stations on annual scale.
- Twelve out of twenty stations show increasing trends while eight stations show a decreasing trend.