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Effects of Different Spatial and Temporal Weather Data Resolutions on the Streamflow Modeling of a Semi-arid Basin, Northeast Brazil

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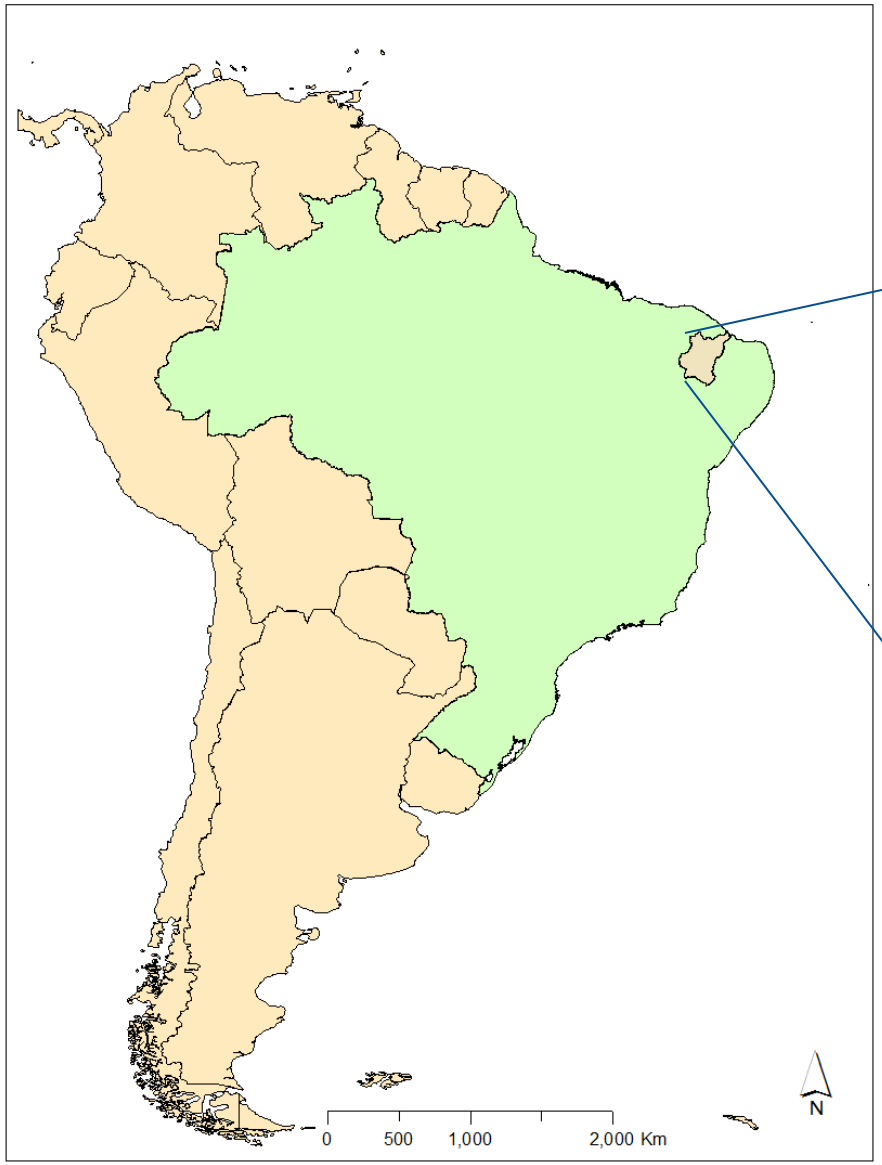
Background and Objectives

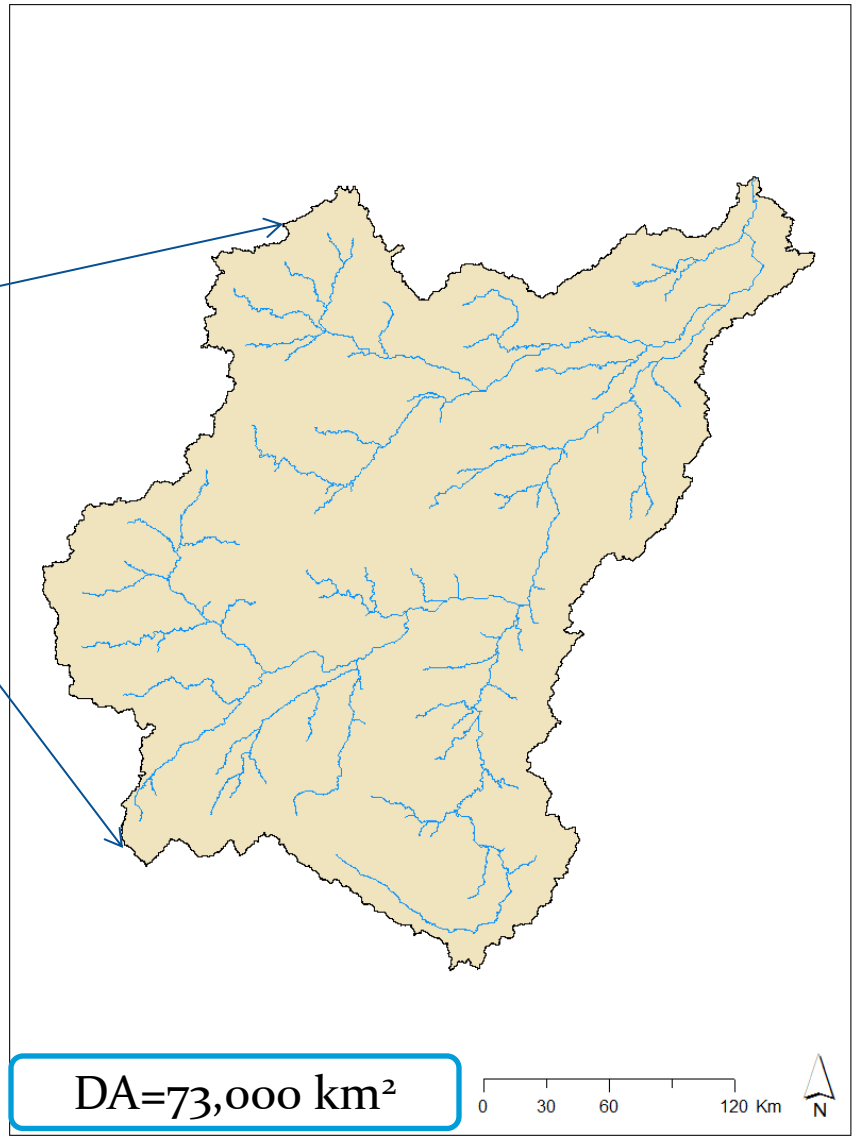
- One **major difficulty** in the application of distributed hydrological models is the **availability of data** with sufficient **quantity and quality** to perform an **adequate evaluation of a watershed** and to capture its dynamics.

- This paper uses SWAT to **analyze stream flow** responses to **different sources, spatial and temporal resolutions of weather inputs** for the semi-arid Jaguaribe watershed (73,000 km^2) in northeastern Brazil.

- Four different simulations were conducted, based on four groups of weather and precipitation inputs.

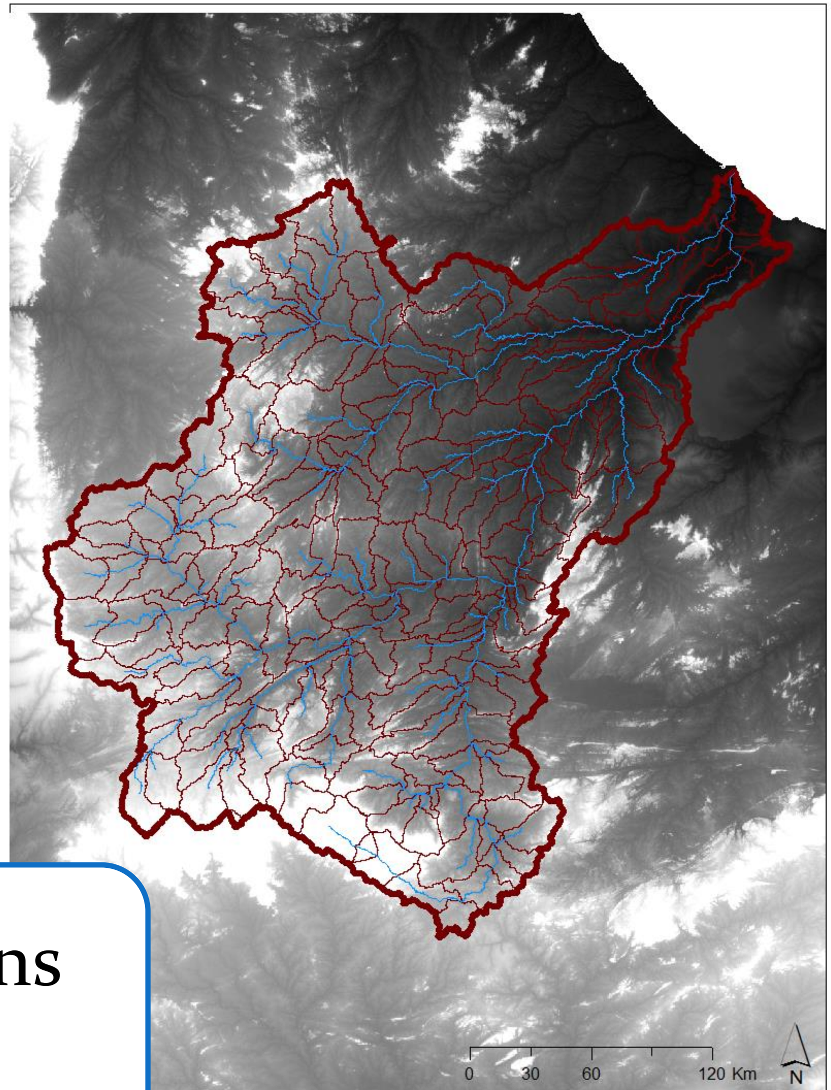
Study Area





SWAT Model Set-up and Data Sets

- The Jaguari… up using the ArcSWAT…
- “Adapting Wa… Operation to Climate Varia… Selected River Basins in Nor…
- the data from… y Mission (SRTM) was… oximately 90 meters;
- Which establ… ocal government agencies.



232 sub-basins
A=315 km²

SWAT Model Set-up and Data Sets

- Soils Data

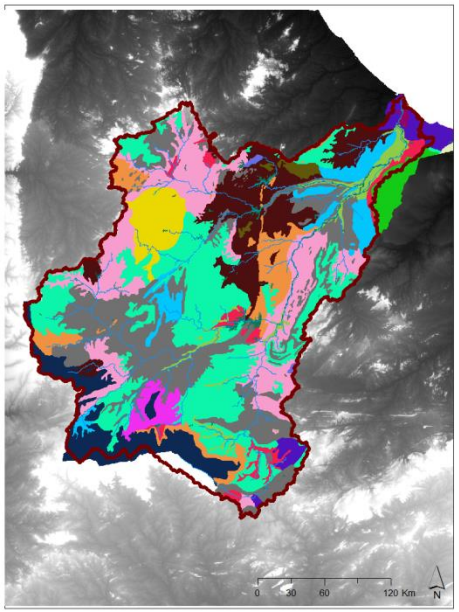
Soils Map is the 1:600.000 from MA/SUDENE (1973) and was vectorized by FUNCEME

ISRIC World Soil Information

Texture, Organic Matter, and soil depths

Pedotransfer Functions (Saxton & Rawls, 2006)

Soil & Water Assessment Tool SWAT



SWAT Model Set-up and Data Sets

- Land Use:
- Map from FUNCEME (FUNCEME, 2009)
- Municipal Agriculture Production data for Ceará State, from the Brazilian Institute of Geography and Statistics (IBGE, 2009).

Land Use Map	Adopted Crop	From SWAT Data Base
Agriculture	Corn and Cowpea	Corn and Cowpea
Agriculture and Forest	Cassava	Potato
Agriculture with Irrigation	Sugar Cane and Cashews	Sugar Cane and Banana
Plantations	Cashews	Banana

SWAT Model Set-up and Data Sets

- Fo
a

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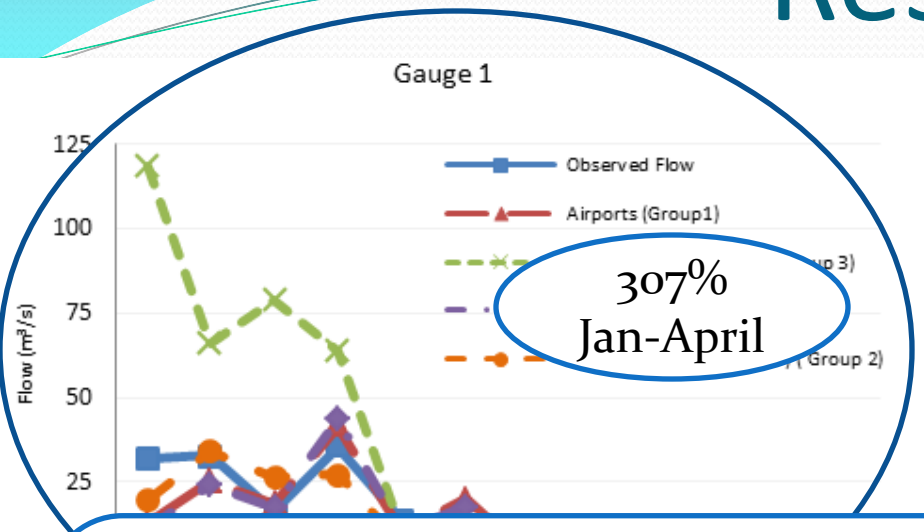
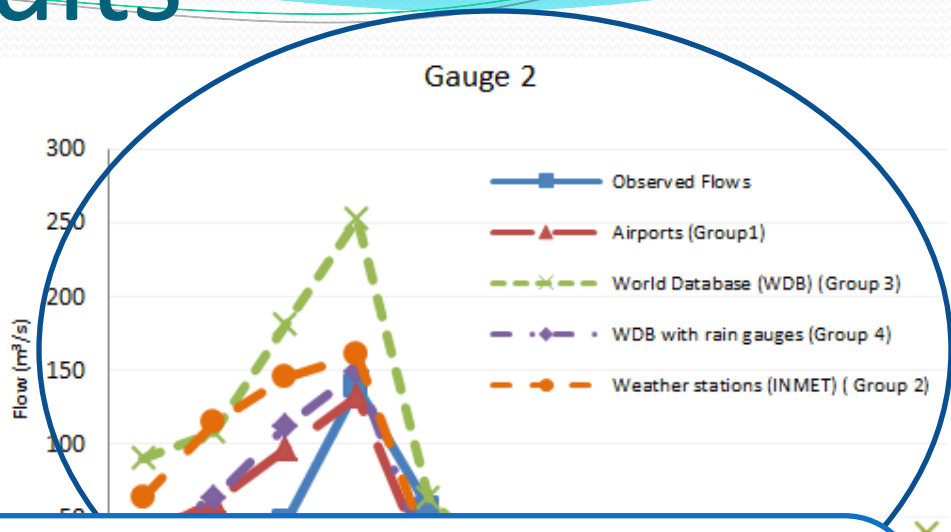
4.

- This is an uncalibrated model, so a few changes on the parameters were conduced:
- ESCO=0.6

- Groundwater parameters:
- SHALLST; DEEPST; GWQMIN; GW_REVAP; REVAPMN were also estimated to best fit the study area.

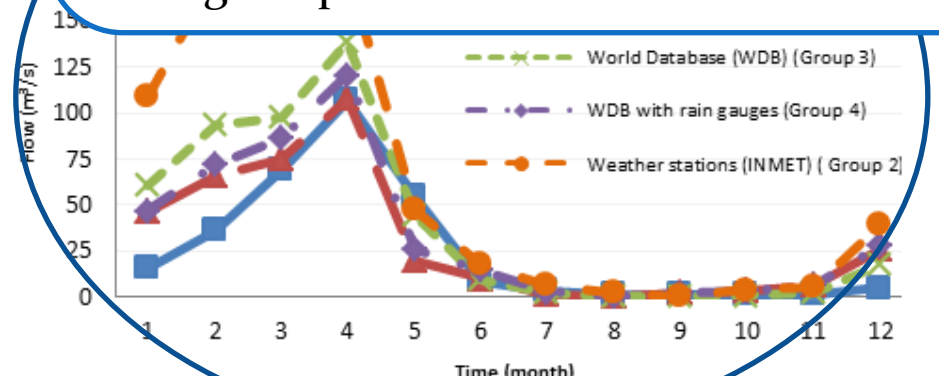
Results

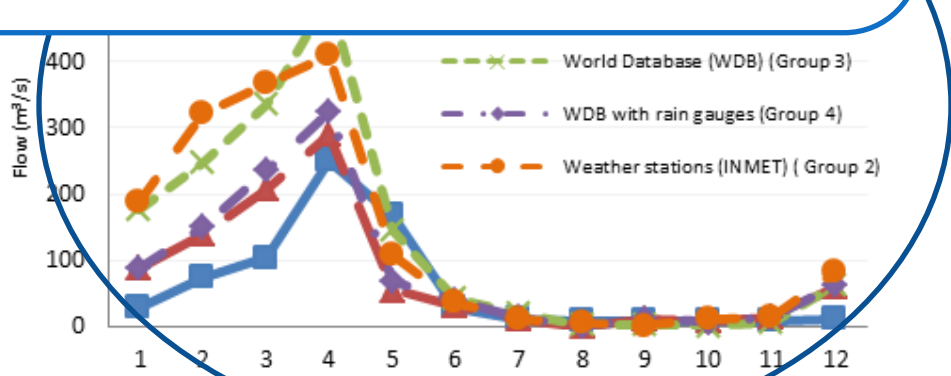




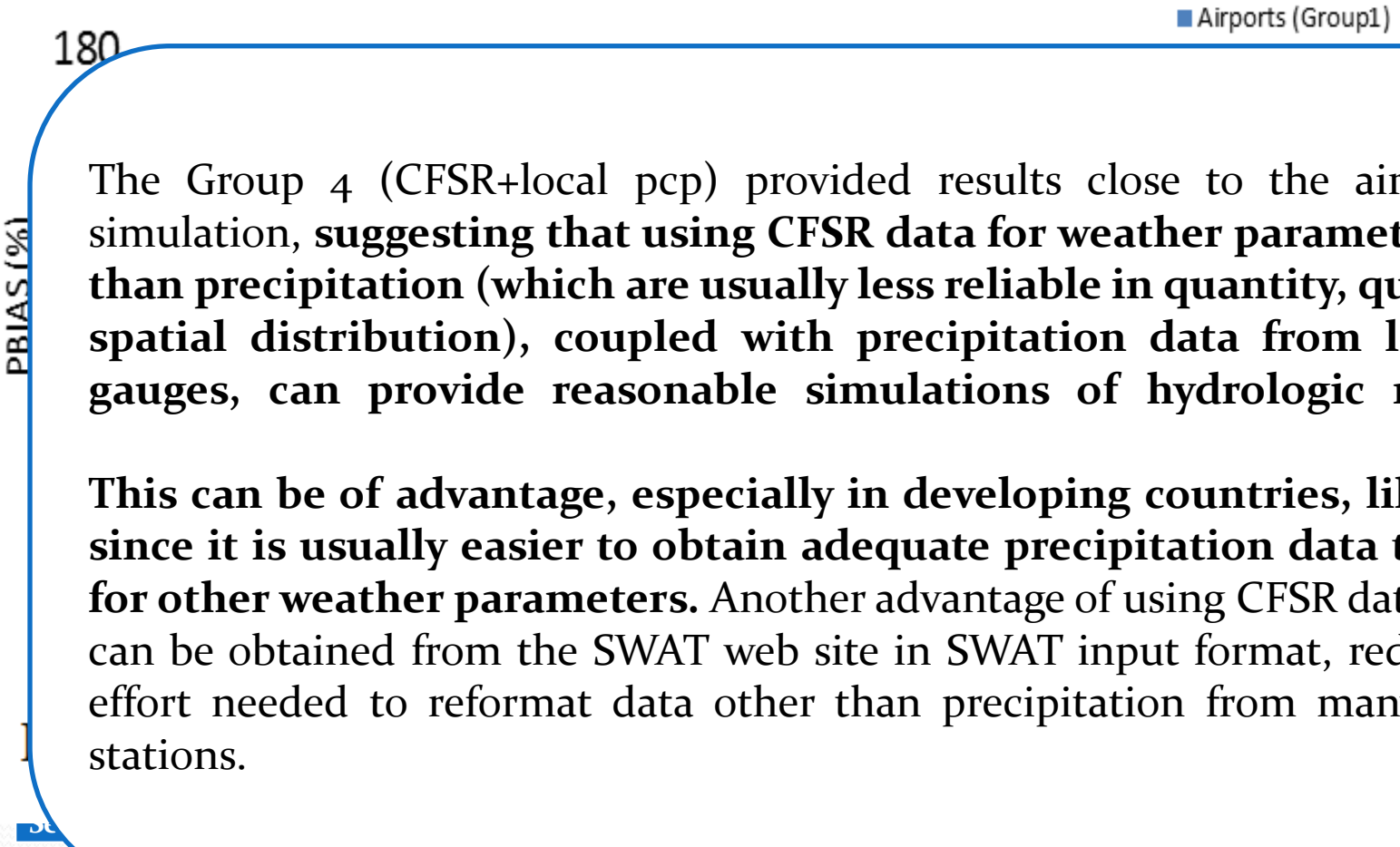
The daily measured weather data from the 14 local gauge stations are actually providing worse estimates than the monthly mean from the 4 airports that are outside the study area.

This is due to the uncertainty related to daily measures, and also to the fact that the stations had a great deal of missing data, with an average of 36% of data missing during the period of simulation.





Results



The Group 4 (CFSR+local pcp) provided results close to the airport data simulation, **suggesting that using CFSR data for weather parameters other than precipitation (which are usually less reliable in quantity, quality and spatial distribution), coupled with precipitation data from local rain gauges, can provide reasonable simulations of hydrologic response.**

This can be of advantage, especially in developing countries, like Brazil, since it is usually easier to obtain adequate precipitation data than data for other weather parameters. Another advantage of using CFSR data is that it can be obtained from the SWAT web site in SWAT input format, reducing the effort needed to reformat data other than precipitation from many weather stations.

Conclusions

- In this study we demonstrate that **large uncertainties in hydrologic simulation result from inadequate weather input data**, and that, in this regard, the choice of the data to be used is very important.
- The simulation with the monthly data from the **airport** stations with SWAT's weather generator and local precipitation **performed best overall**
- followed by the simulation with the daily values from the world data base from **NOAA's CFSR coupled model**, but with precipitation from the local precipitation gauges.
- This suggests that **using CFSR** data for weather parameters other than precipitation, **coupled with precipitation** data from local rain gauges, can provide reasonable simulations of hydrologic response.
- This can be an advantage, since it is usually difficult to have quality data from a dense weather station network for all the weather data needed for SWAT, but it is easier to have a denser network of precipitation stations with longer periods of data.

Conclusions

- The daily measured weather data from the 14 local gauge stations actually provided worse estimates than those generated with SWAT's weather generator from monthly mean data from the 4 airports that are outside the study area, for the flow gauges where the flow was compared.
- **This is due to the uncertainty related to daily measures and to the fact that over one-third of the data from these stations was missing.**
- The simulation with the data from the **CFSR:**
  - **overestimates** measured flows more than the other simulations for 3 of the 4 gauged flow stations,
  - showed negative values of Nash-Sutcliffe for all the discharge gauges,
  - and also higher PBIAS values in 3 of the 4 stations.
  - The CFSR overestimated the precipitation for the area studied, with the average annual precipitation 20% higher than the precipitation from the local gauges, which has a large effect on hydrologic responses.
- This difference may have occurred because of the **region's semi-arid climate** with strong seasonal and inter-annual variability in precipitation, which may have resulted in the **CFSR data being poorly calibrated with local weather stations**.
- Better calibration of the CFSR precipitation data in the future could greatly reduce the problems we encountered using this data source.

Thank you very much!

- For more information:

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