Defining Future Climate Conditions for a River Basin in Northeast Brazil

Combining GCMs Predictions, Promoting Scenario Planning, and Embracing Uncertainty

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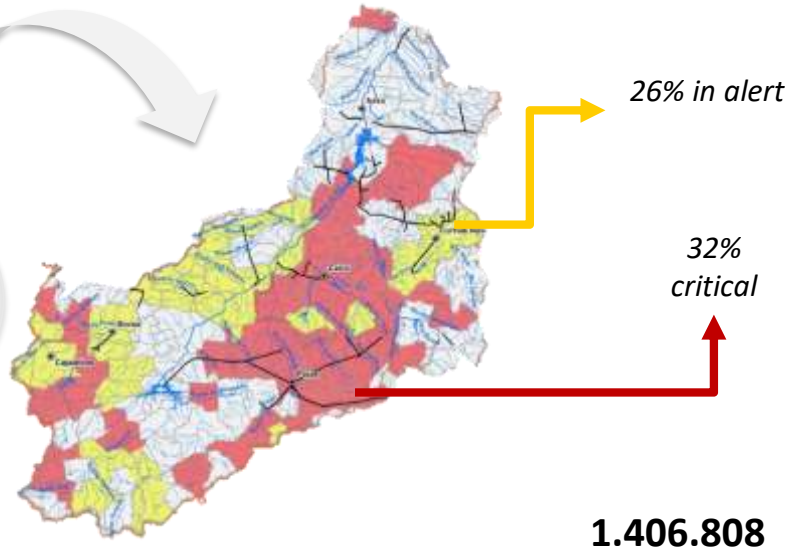
REGION OF INTEREST: NORTHEAST BRAZIL



1.406.808 habitants (2010)

- Potential worst CC impacts
- Already at risk (water crisis): severe droughts
- Systems of intermittent reservoirs: All rain drops between February and May
- Rural profile

THE CONTEXT: A COST-BENEFIT ANALYSIS

QUESTION 1
Where and from what are we at risk?

Water deficits on a monthly basis for each district of the analyzed river basin

QUESTION 2
What is the magnitude of the expected losses?

Economic loss in monetary terms divided by type of user

QUESTION 3
How can we respond?

Cost/benefit ratio of each measure

SCENARIO PLANNING APPROACH

- Deal with uncertainty in a proactive matter
- Apart from predicting the future, be prepare for whatever it might happen
- Scale up a decision-making process that takes into account a range of possible and plausible future scenarios
- Set a satisfactory setting that can represent future conditions of interest

INPUT DATA BACKGROUND

- Given the national interest in the region, it has been focus of different researches
- An previous study compiled IPCC's 21 GCMs results (4.5 and 8.5 RCP) of precipitation and evaporation, considering the coordinates of the two biggest reservoirs in the basin, also running a hydrologic model to obtain flow rates series in each reservoir.

METHODOLOGICAL STEPS

A. Assume each simulation as an independent prediction

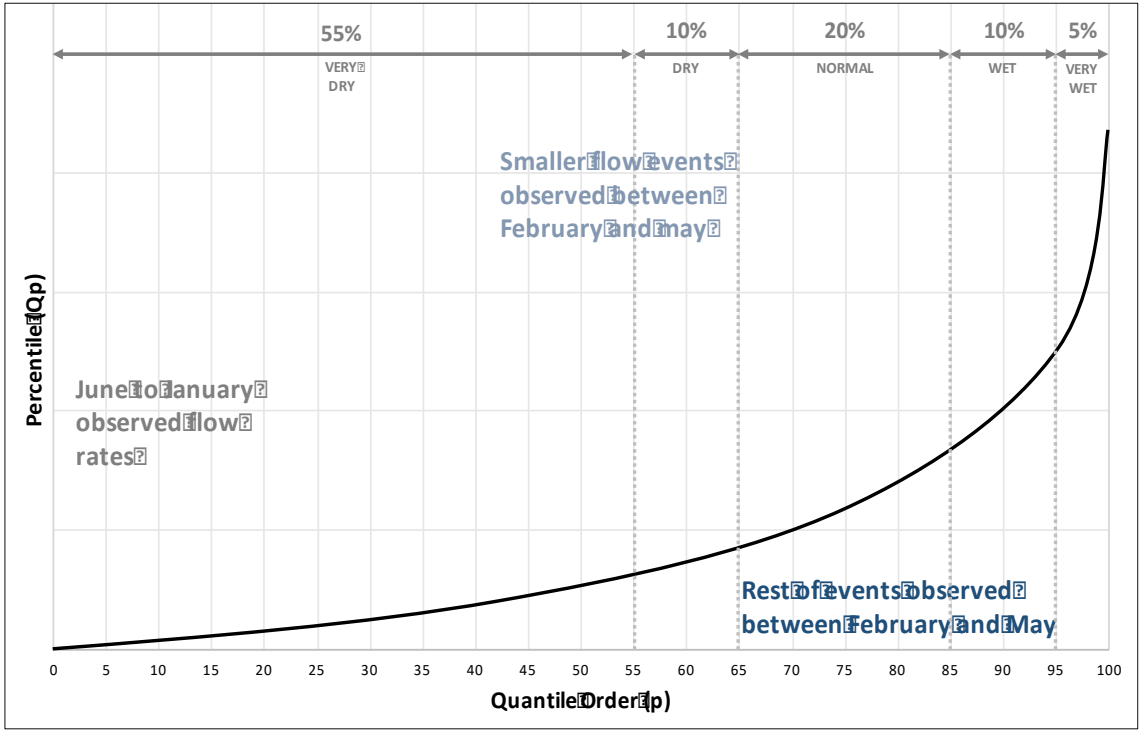
- Use the GCMs results as a tool for a robust planning process.
- Each one of the 42 resulted simulations is taken as independent predictions

B. Apart from absolute values, deal only with the predicted variation rates by each projection

- Overcome inconsistencies and debatable absolute values: categorizing and evaluating only the predicted changes in flow rates according to each projection

C. Analyze data per five classes of events defined by percentiles ranges

The Quantile Technique: analyzing hydrological events by classes



$$'very\ dry' \rightarrow X \leq Q_{15\%}$$
$$'dry' \rightarrow Q_{15\%} < X \leq Q_{35\%}$$
$$'normal' \rightarrow Q_{35\%} < X \leq Q_{65\%}$$
$$'wet' \rightarrow Q_{65\%} < X \leq Q_{85\%}$$
$$'very\ wet' \rightarrow Q_{85\%} < X$$

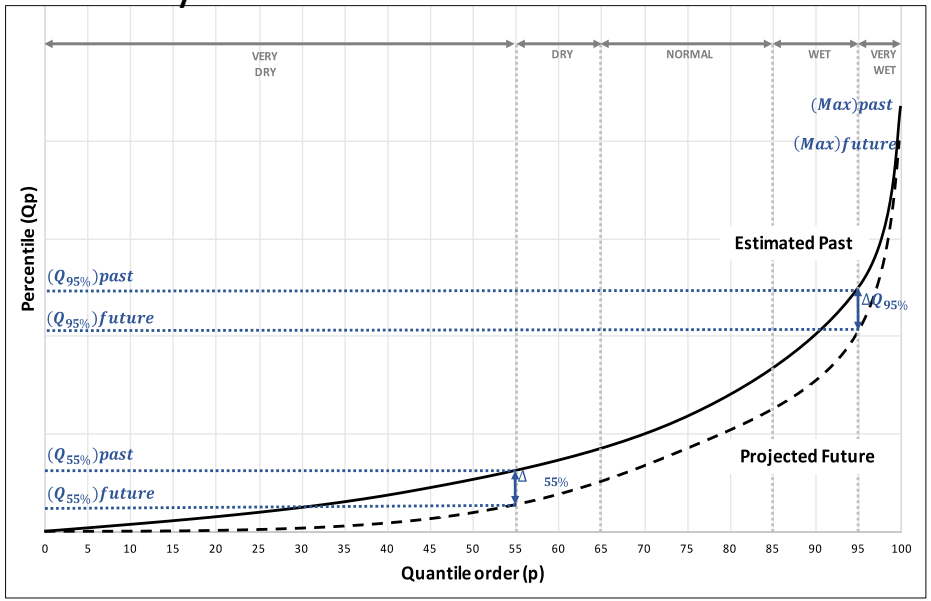
From recognized references

$$'very\ dry' \rightarrow X \leq Q_{55\%}$$
$$'dry' \rightarrow Q_{55\%} < X \leq Q_{65\%}$$
$$'normal' \rightarrow Q_{65\%} < X \leq Q_{85\%}$$
$$'wet' \rightarrow Q_{85\%} < X \leq Q_{95\%}$$
$$'very\ wet' \rightarrow Q_{95\%} < X \leq MAX$$

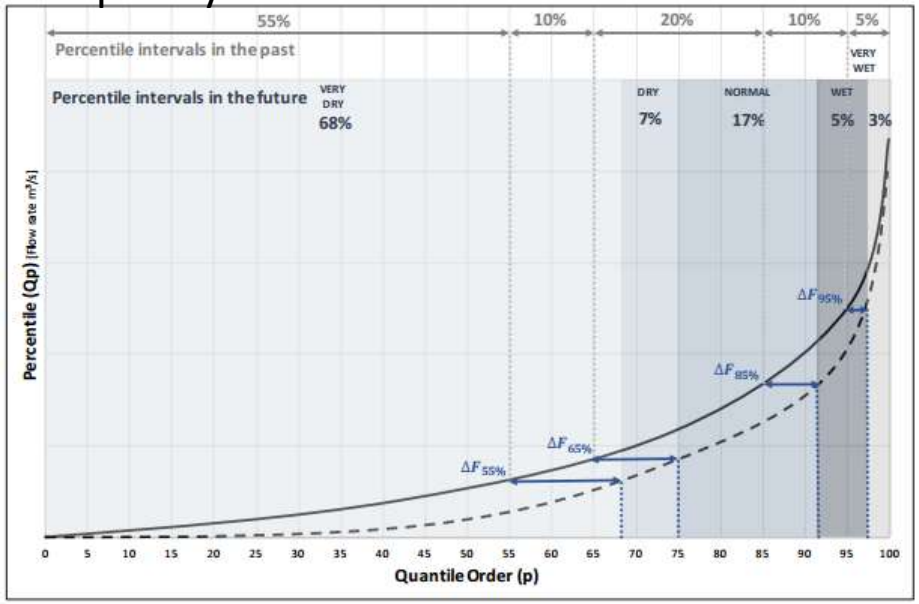
Assumed for the study

D. Mapping hydroclimate parameters: intensity, frequency and distribution of flow rate events

Intensity



Frequency



E. Triage the models per majoritarian trend observed in each class of events among all projections

Very dry **Dry** **Normal**	**More than 70% of the projections pointed the events of these classes would become more dry**
Wet **Very wet**	There was not agreement on the behavior of these classes

Majoritarian trends for flow rate intensity variation per class of event

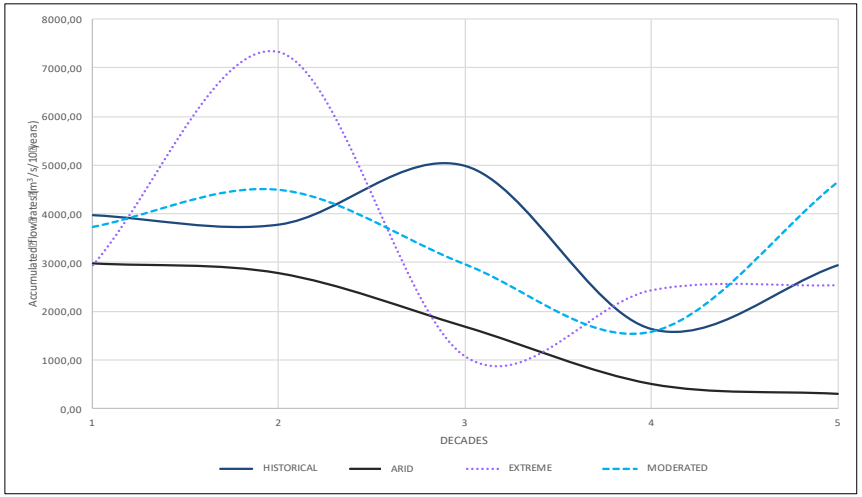
Majoritarian trends of event frequency variation per class of event

Very dry	**More than 70% of the projections pointed that the number of events of this class is getting higher**
Dry Normal Wet	More than 80% of the projections pointed that the number of events of these classes are getting lower
Very wet	There was not agreement on the behavior of this class

F. Chose the proper projection taken as representative of each scenario of interest

- Through different criteria, such as eliminating the projections that did not cope with the majoritarian trends, get a final sample of future scenarios

G. Apply the variation rates predicted by the chosen GCMs on historic flow data producing the estimated future values



- **Moderate**
- **Extreme**
- **Arid**

ACKNOWLEDGEMENTS

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THANK YOU!!

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