Exploring the Potential of Global Climate Indices in Predicting Seasonal Rainfall Variability: A Case Study in Ethiopia

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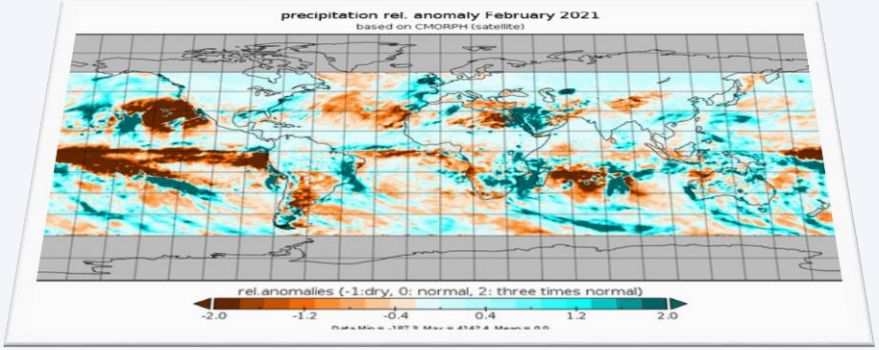
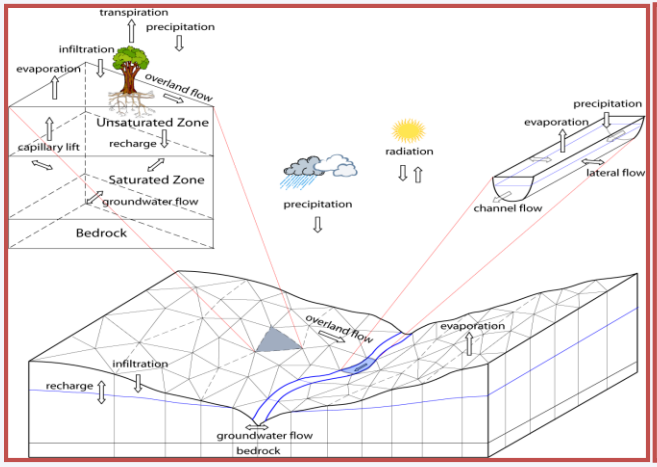
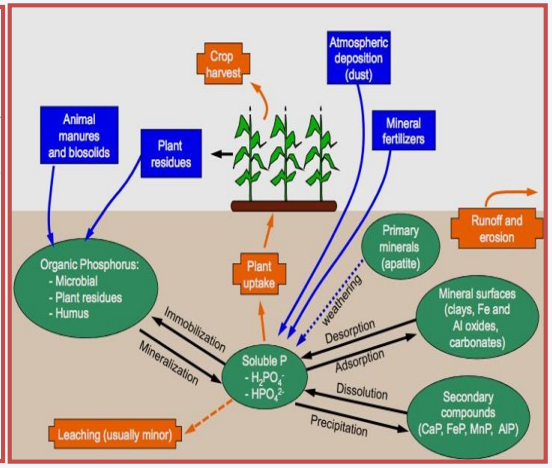
Rainfall Variability and Prediction

- Rainfall variability in Ethiopia is shaped by both large-scale climate drivers and local land feedback making accurate drought predictions challenging.
- Some climate drivers are more effective than others in different regions, highlighting the need for localized models.
- Existing models that forecast rainfall tend to be generalized, posing challenges for tailored intervention and adaptation strategies.

Translating Information Across Scales



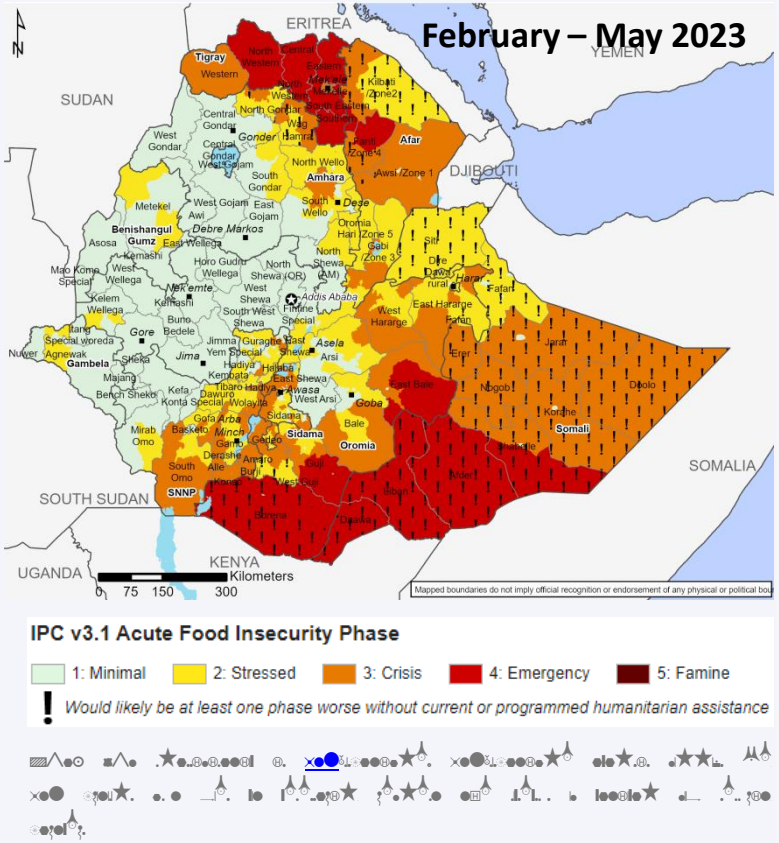




https://cds.climate.copernicus.eu/cdsapp#!/dataset/insitu-gridded-observations-global-and-regional?tab=overview
http://water.state.co.us/SurfaceWater/SWRights/WaterDiagrams/Pages/default.aspx

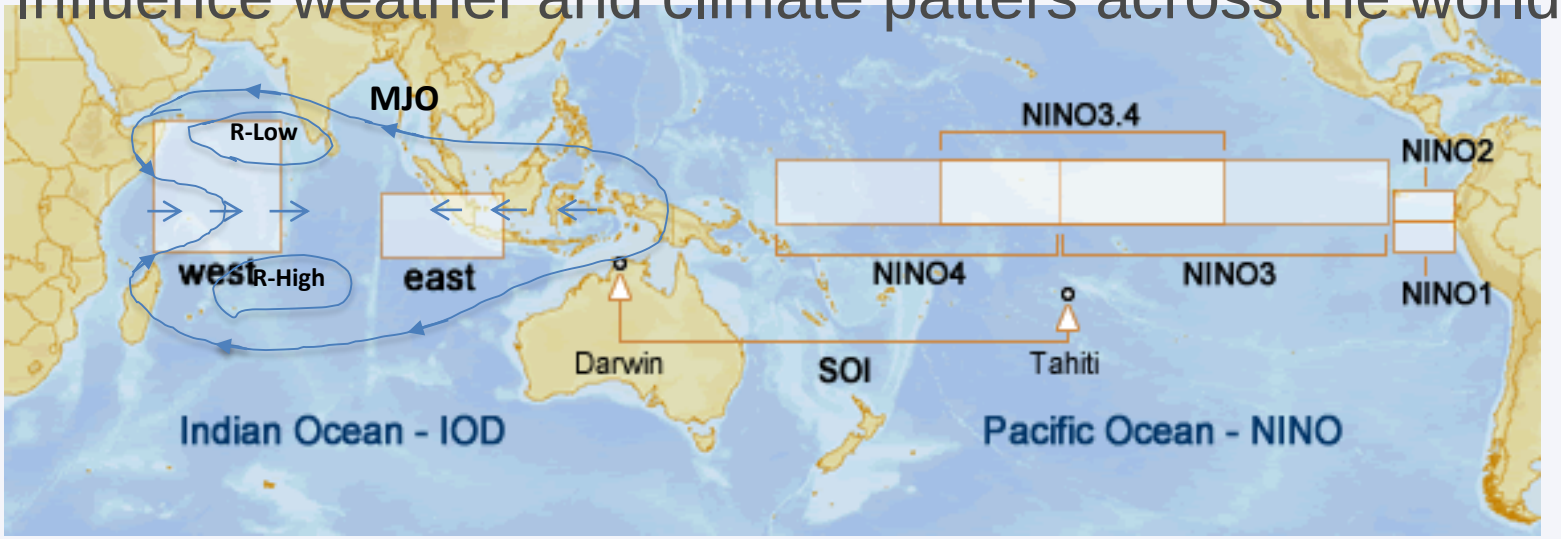
Challenges in Ethiopia

- Recurring droughts in Ethiopia 1984, 2002, 2009, 2015, 2022
- Drought relief through rainfall but recovery is hampered by several years of crop failure.
- Lack of societal resilience due high reliance of rainfall.
- Reactive approach to drought management through food assistance.
- Drought predictions are not adequately used and/or non-compatible.

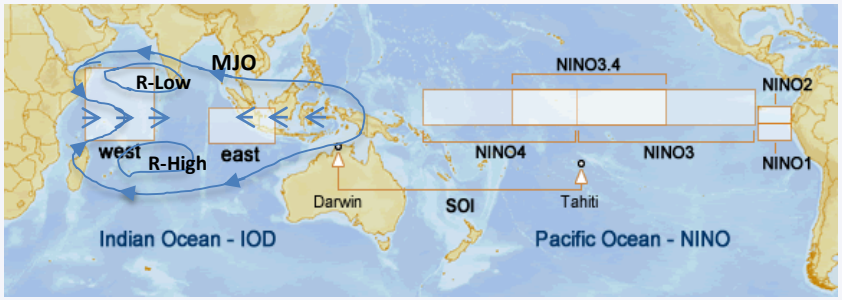


Impact of Large-Scale Climate Drivers

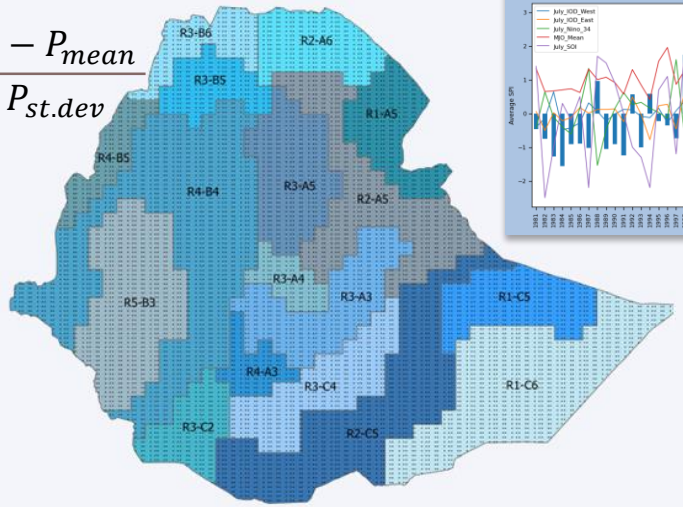
- Represented by GCIs, cause prolonged precipitation deficits.
- Affect weather and climate through altered atmospheric circulation and ocean temperatures.
- Influence weather and climate patters across the world.

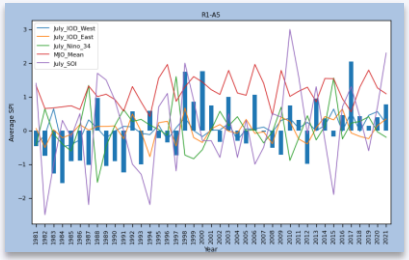


Random Forest Classification Model



$$ST_p = \frac{P_t - P_{mean}}{P_{st.dev}}$$





CHIRPS monthly rainfall 1981-2021

Seasonal rainfall prediction (Summer and Spring)

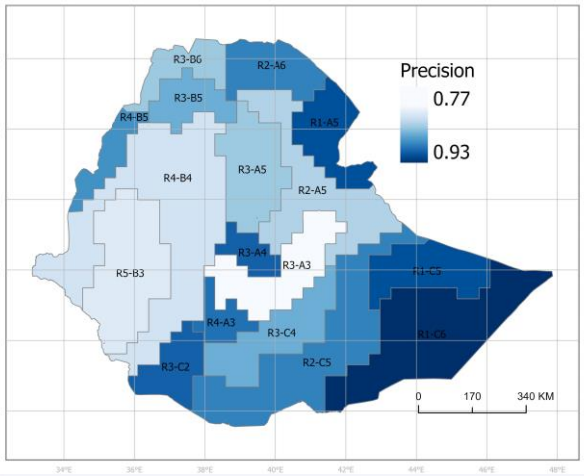
- Dry
- Normal
- Wet

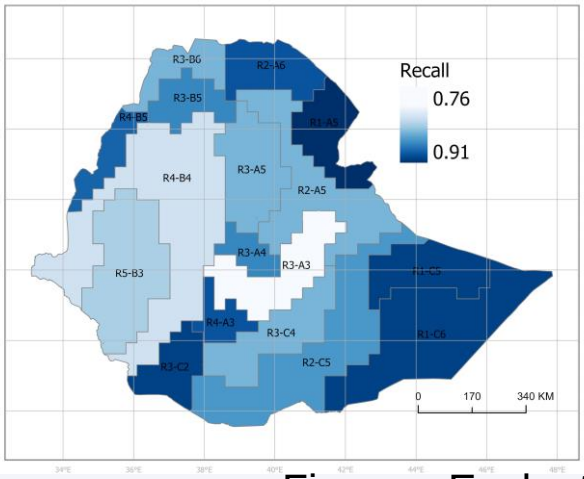
Evaluate model performance

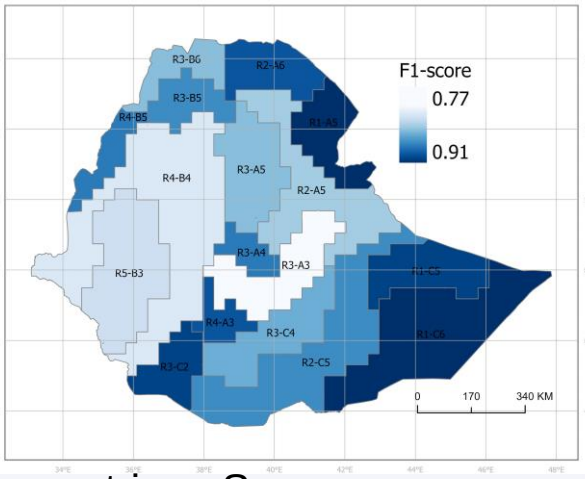
- Recall, precision and F1-score
- Receiver operating characteristics

Rank predictors based on importance for each region

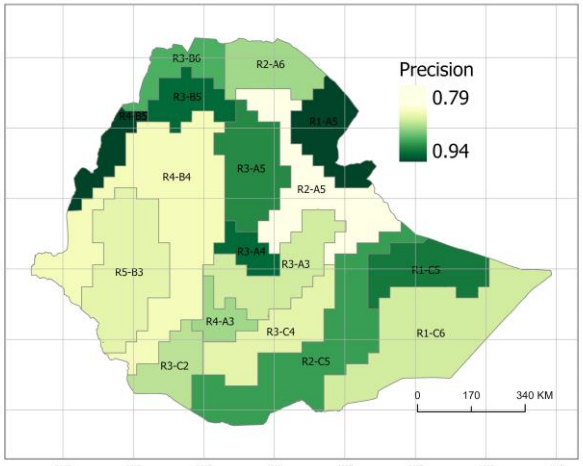
Seasonal Rainfall Predictions

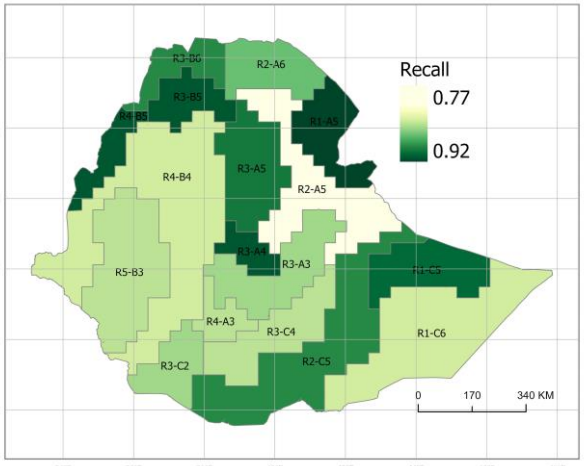


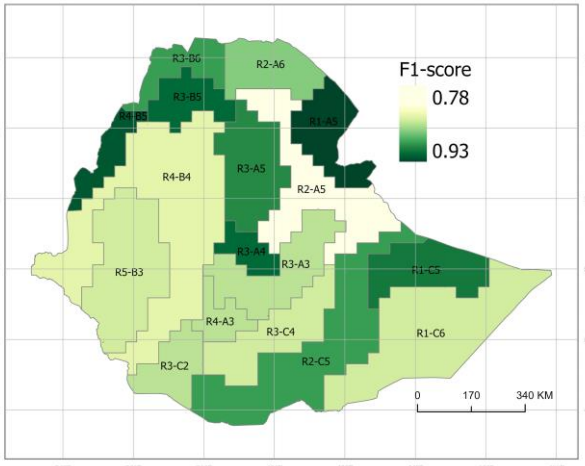




Figures: Evaluation metrics - Summer season

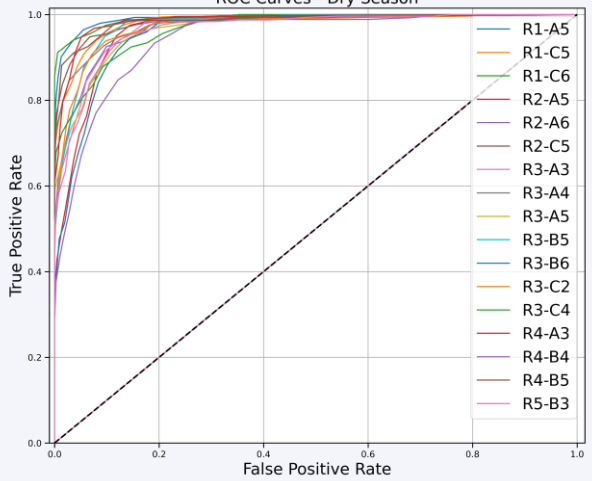


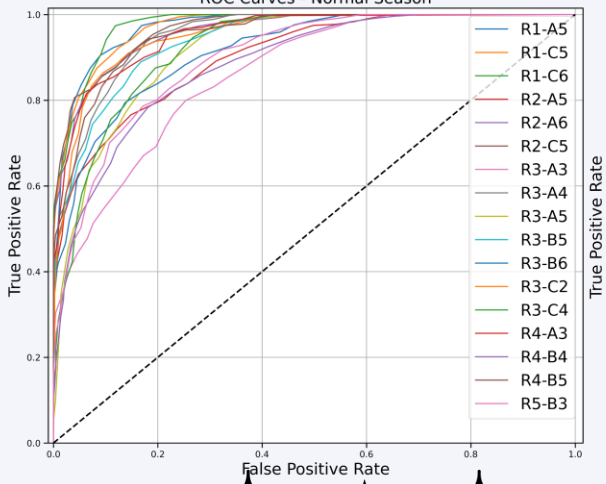


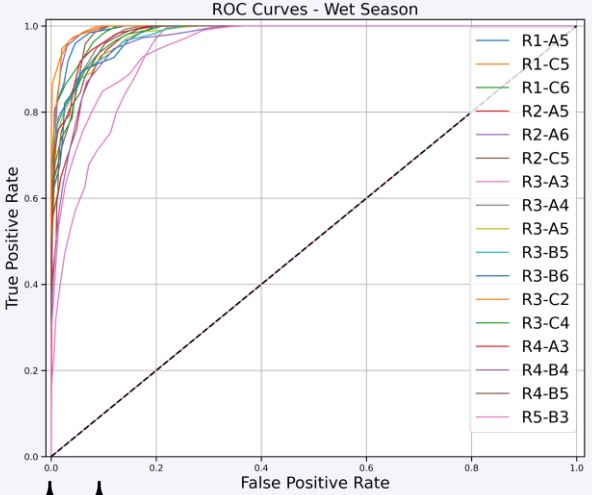


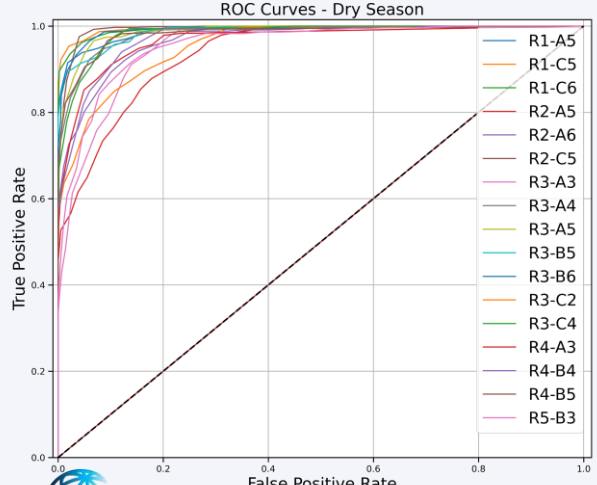
Figures: Evaluation metrics - Spring season

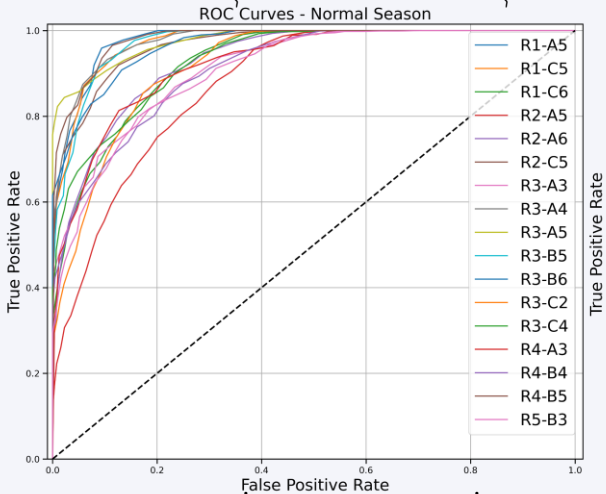
Seasonal Rainfall Predictions

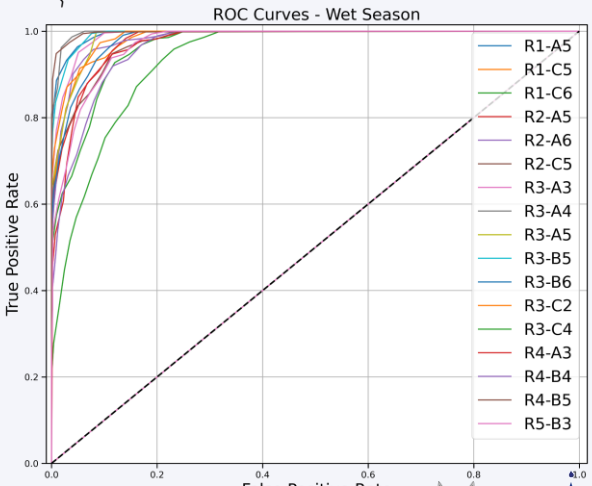












Predictor Skill and Relative Importance

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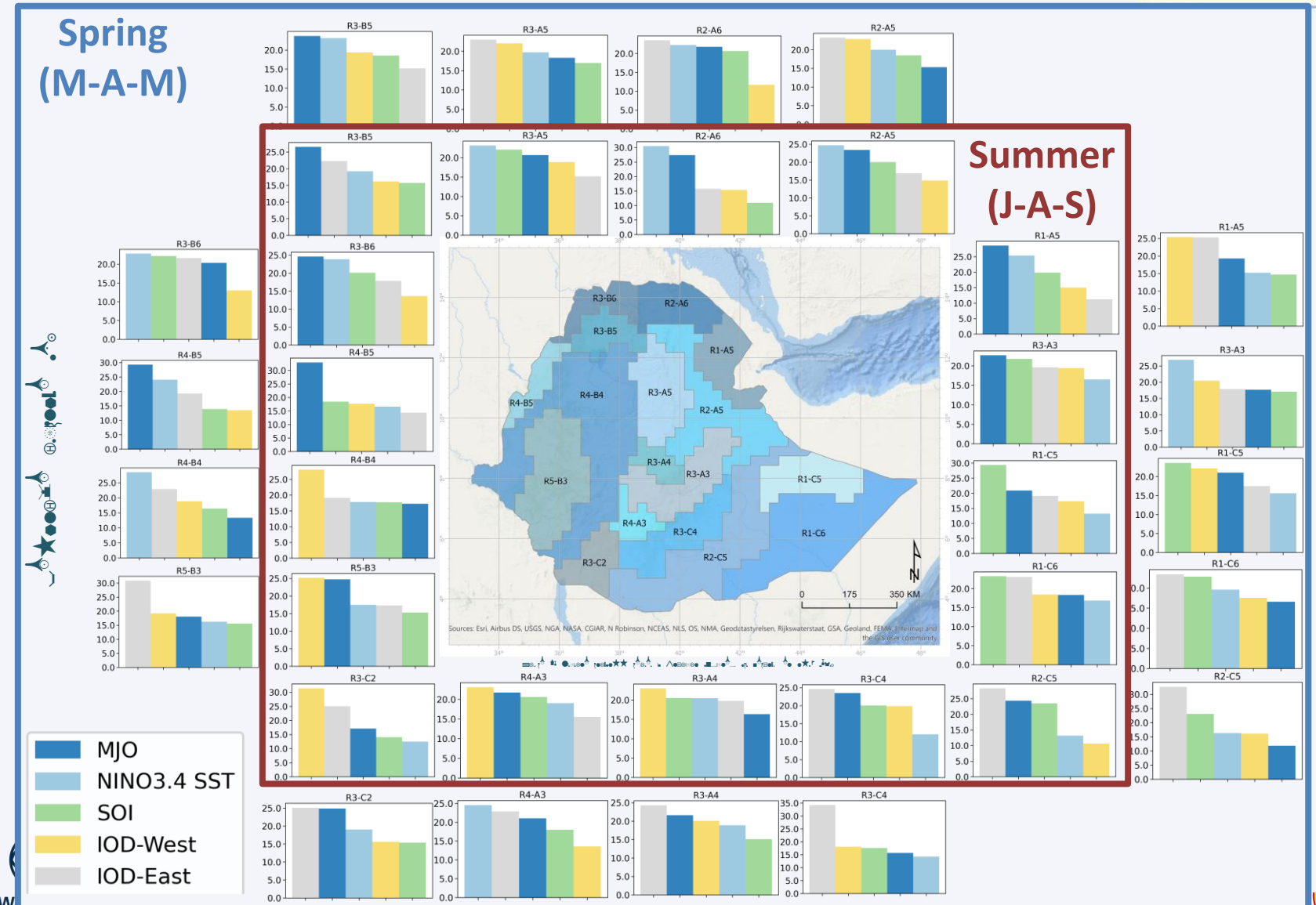
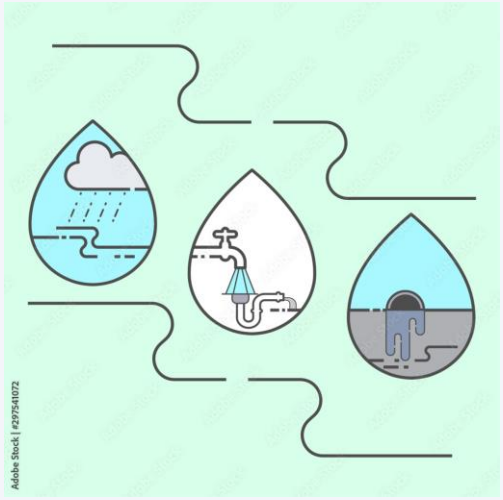
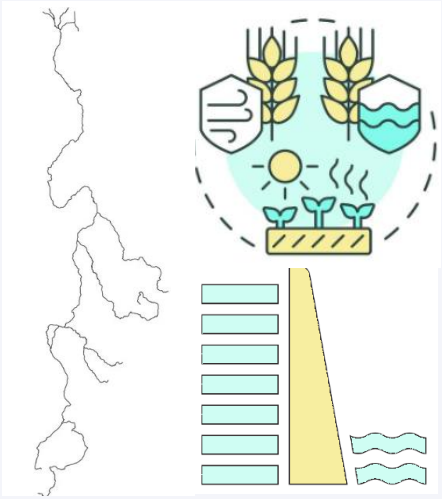


Applications

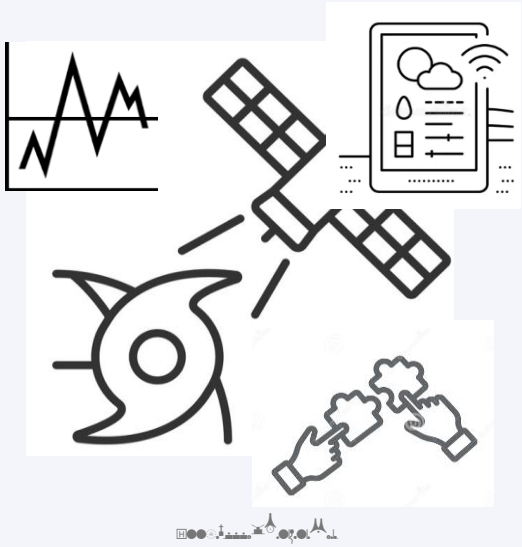
Enhance water resources management using predictive models



Tailor climate resilience strategies for basin tributaries



Promote regional collaboration through climate monitoring networks

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THANK
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