

Climate Resilience in the Coming Decades: *Navigating the Intersection of Variability & Change*

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Climate Resilience

Adaptation + Preparation:

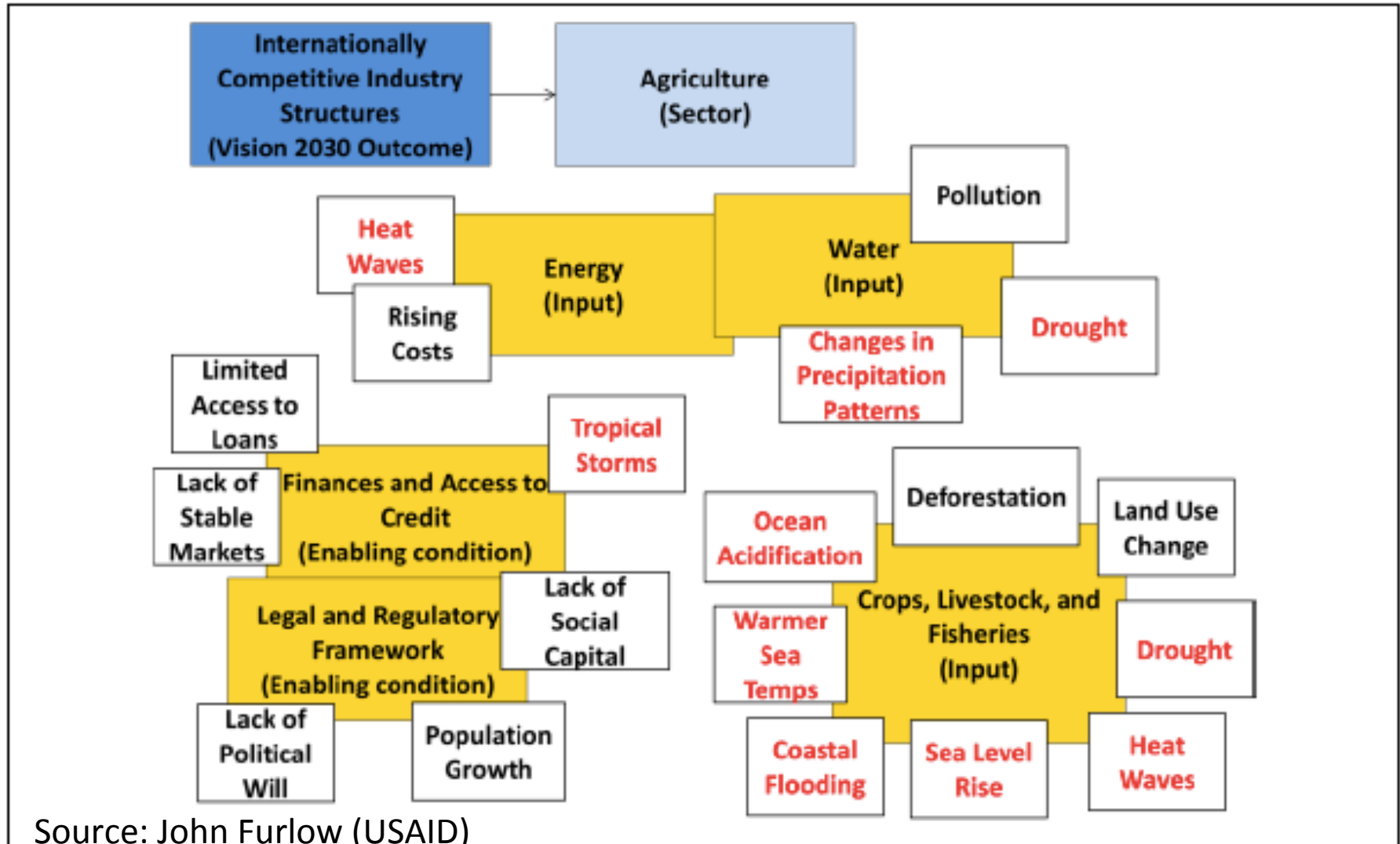


Climate Resilience

Adaptation + Preparation:

- Engineering/Infrastructure
- Resource Management (natural)
- Resource Programming (financial & human)
- Policy

Example: Agriculture (Jamaica)



Climate Resilience is NOT just
about climate change



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about climate change

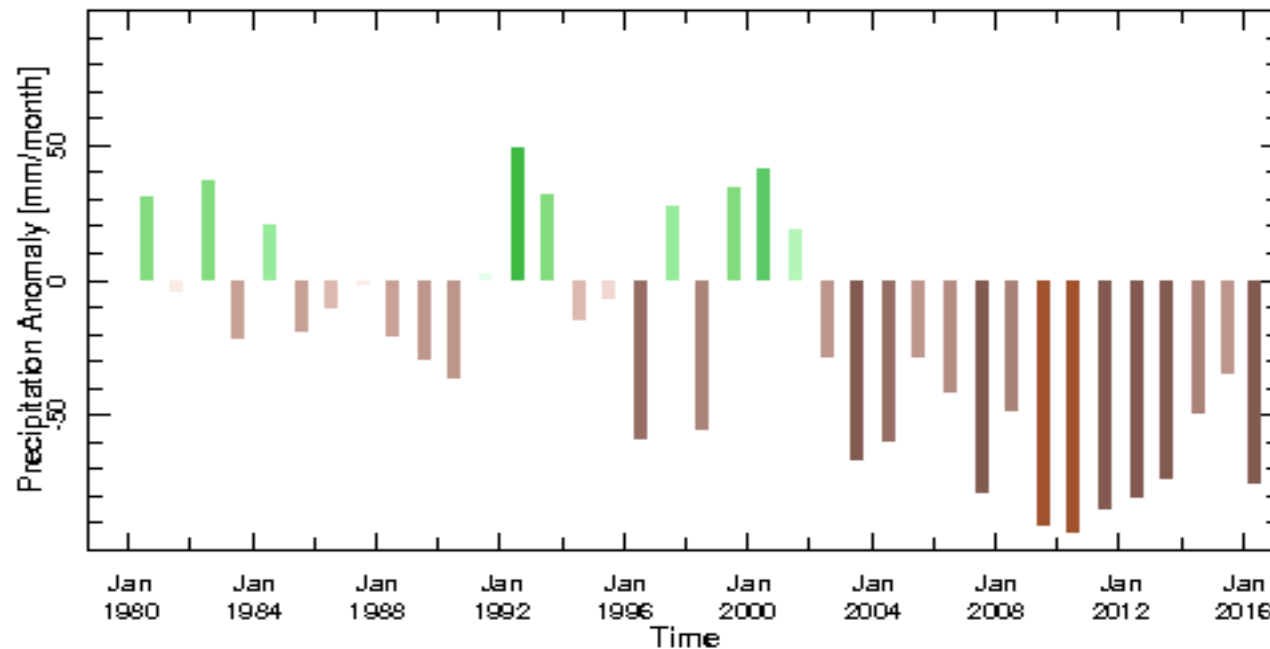
Climate varies across timescales



Climate Resilience is NOT just about climate change

Climate varies across timescales

May-September Rainfall Anomalies (near Santiago, CL)



Is this the “arrival” of climate change for Chile??

What is the longer-term context?

Climate Resilience is NOT just about climate change

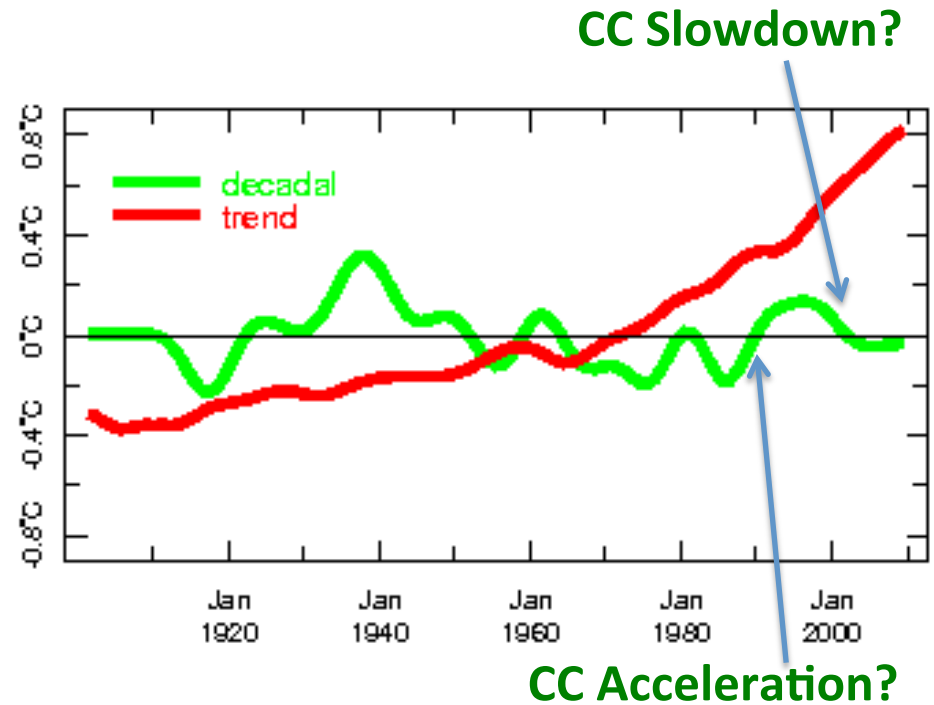
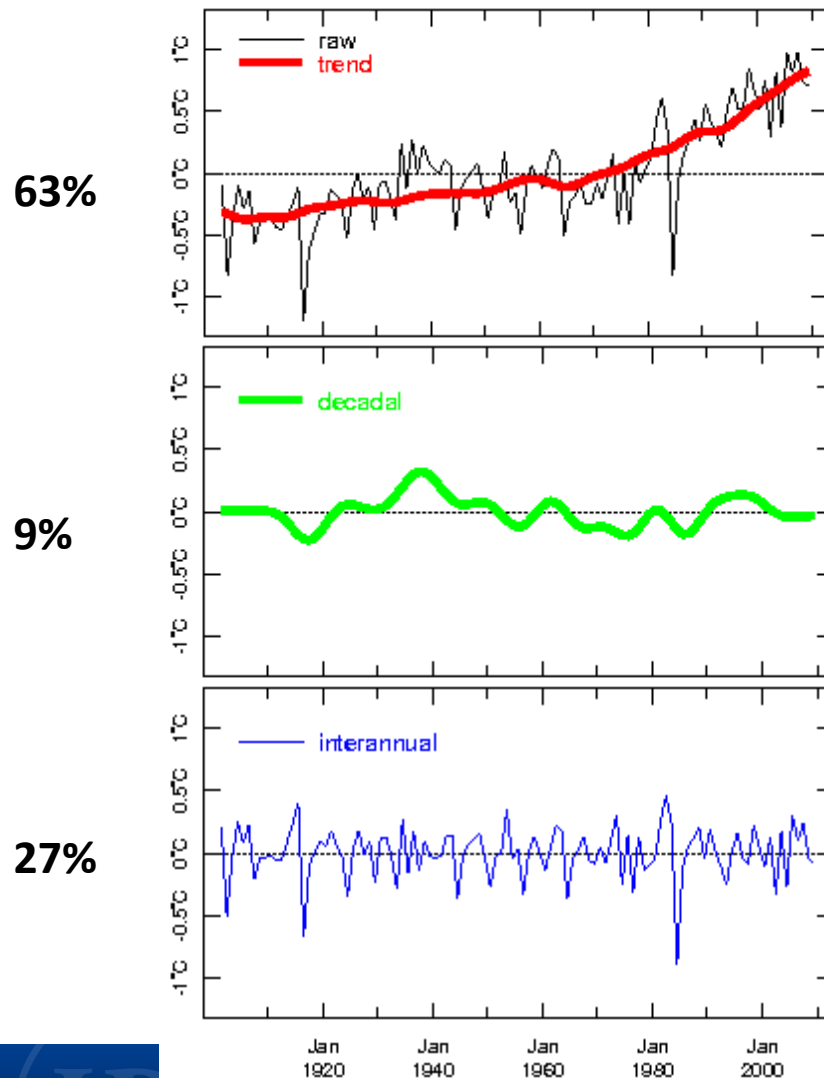
Climate varies across timescales

OUTLINE:

- Climate variability and change across timescales
 - What happened in the past?
 - What tools do we have to consider the future?
- Where climate information fits in the big picture

Climate Variability & Change Globally

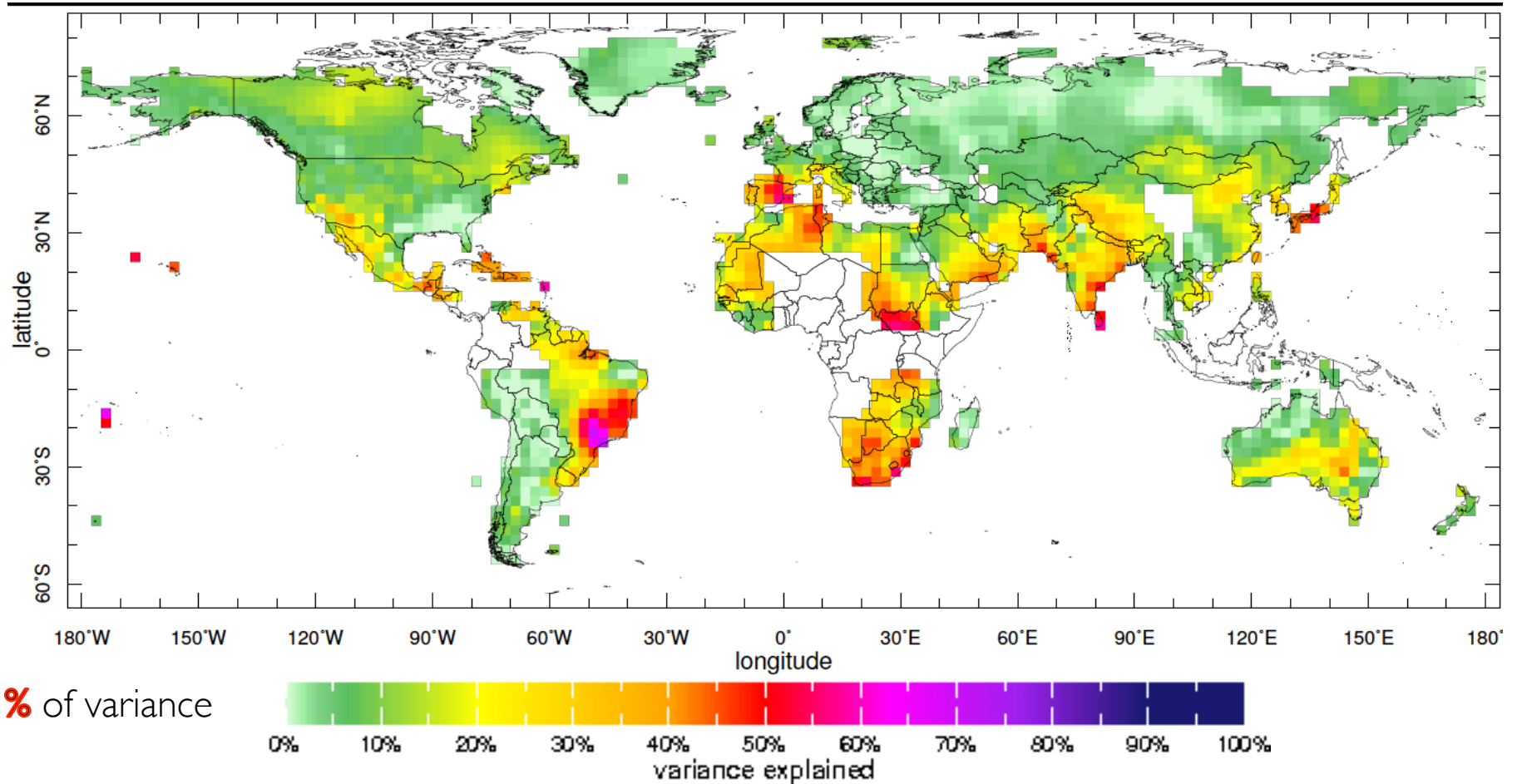
Annual Mean Temperature



(Greene, Goddard & Cousin, *EOS*, 2010)

Temperature Trends

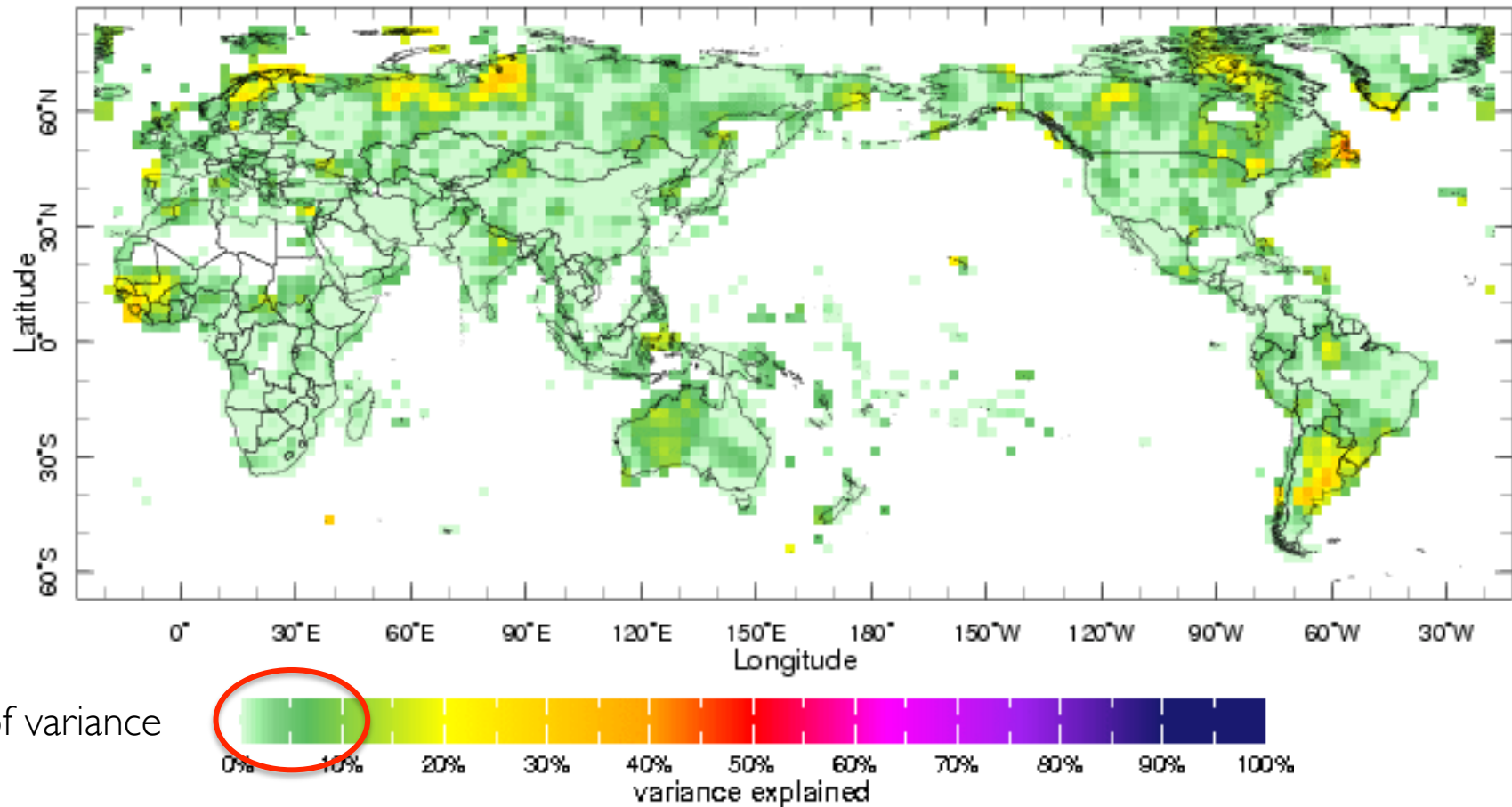
20th Century Observations -- Annual Means



http://iridl.ldeo.columbia.edu/maproom/Global/Time_Scales/

Precipitation Trends

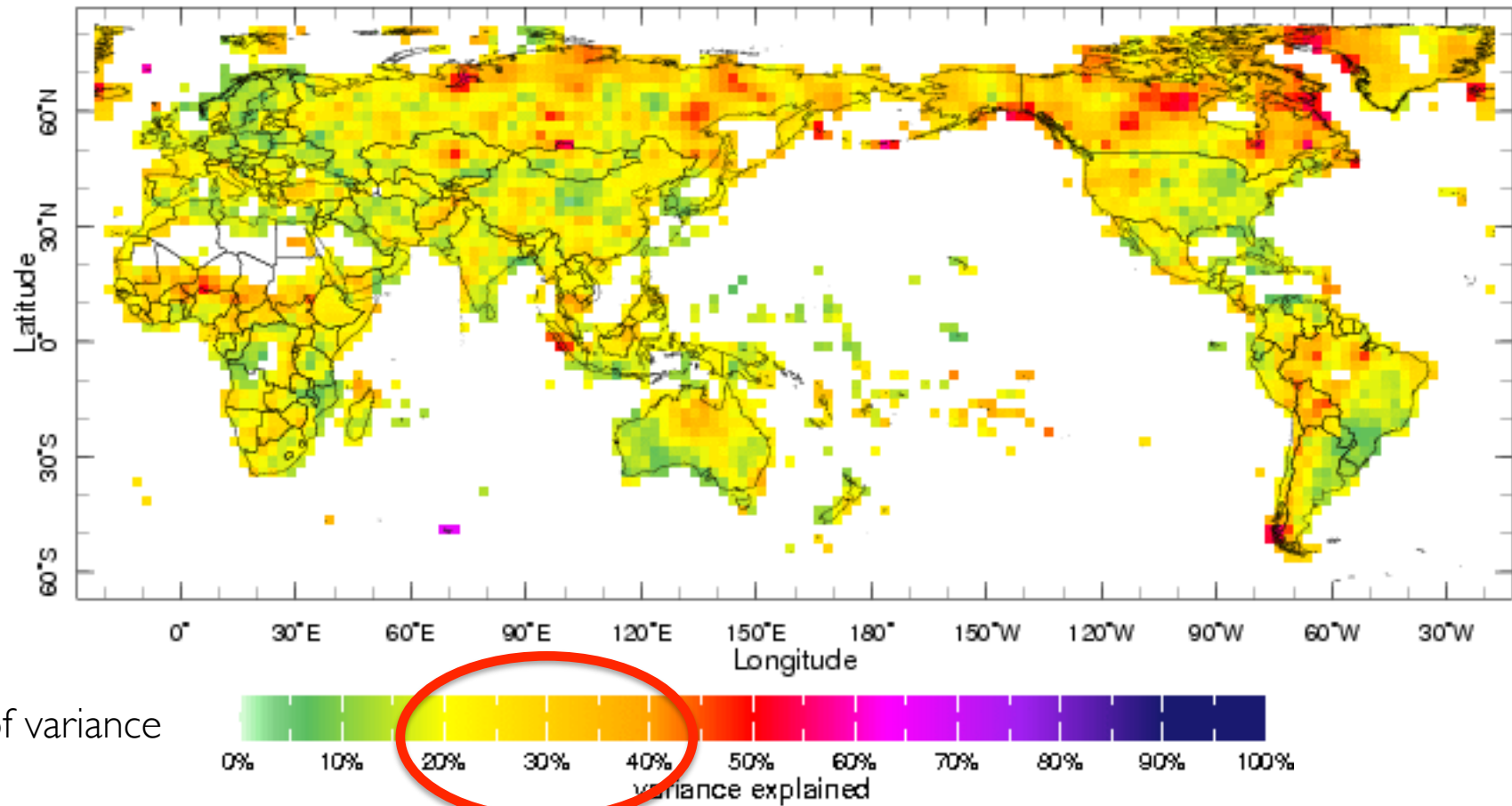
20th Century Observations -- Annual Means



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Precipitation Decadal Variability

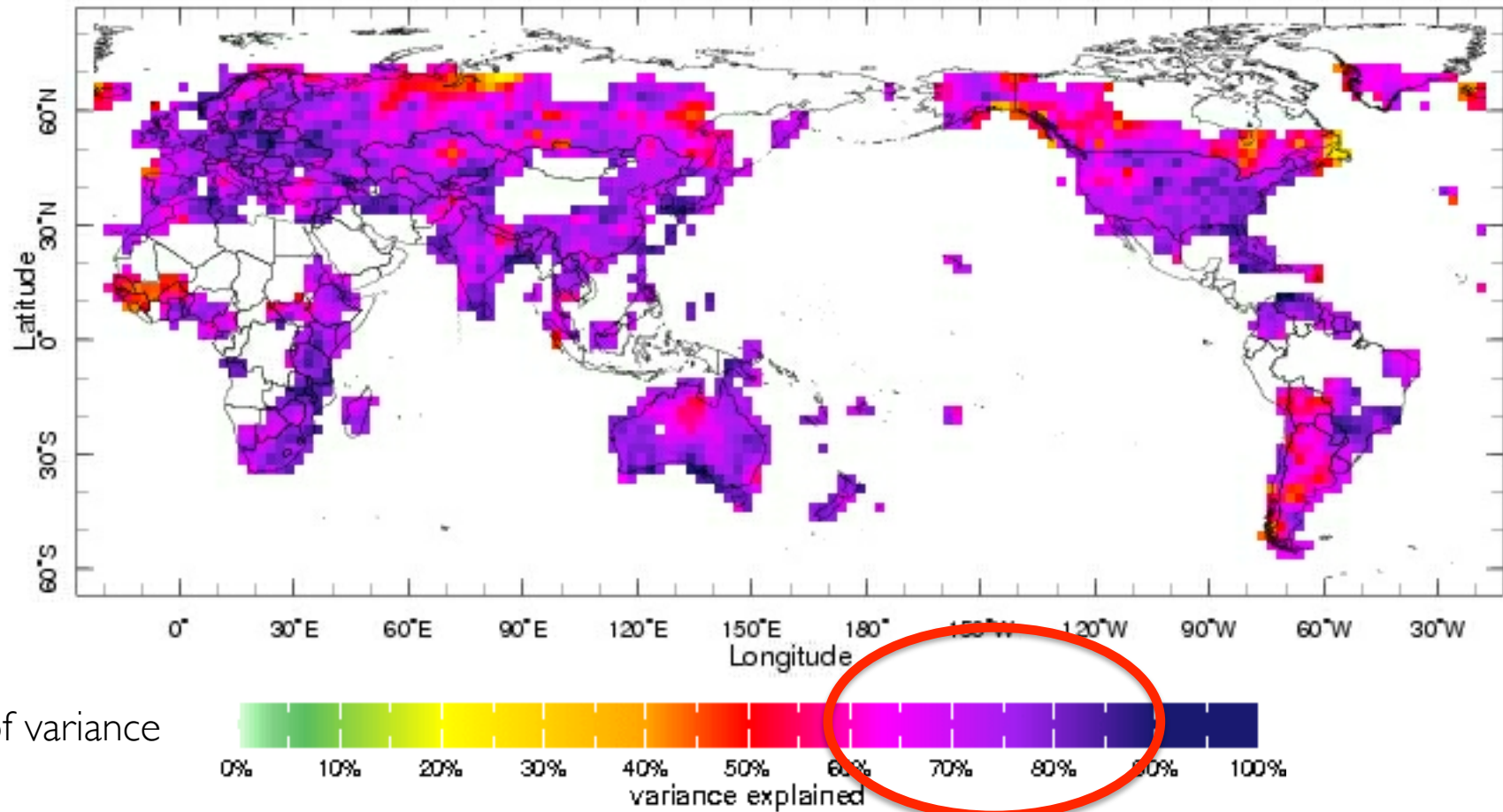
20th Century Observations -- Annual Means



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Precipitation Interannual Variability

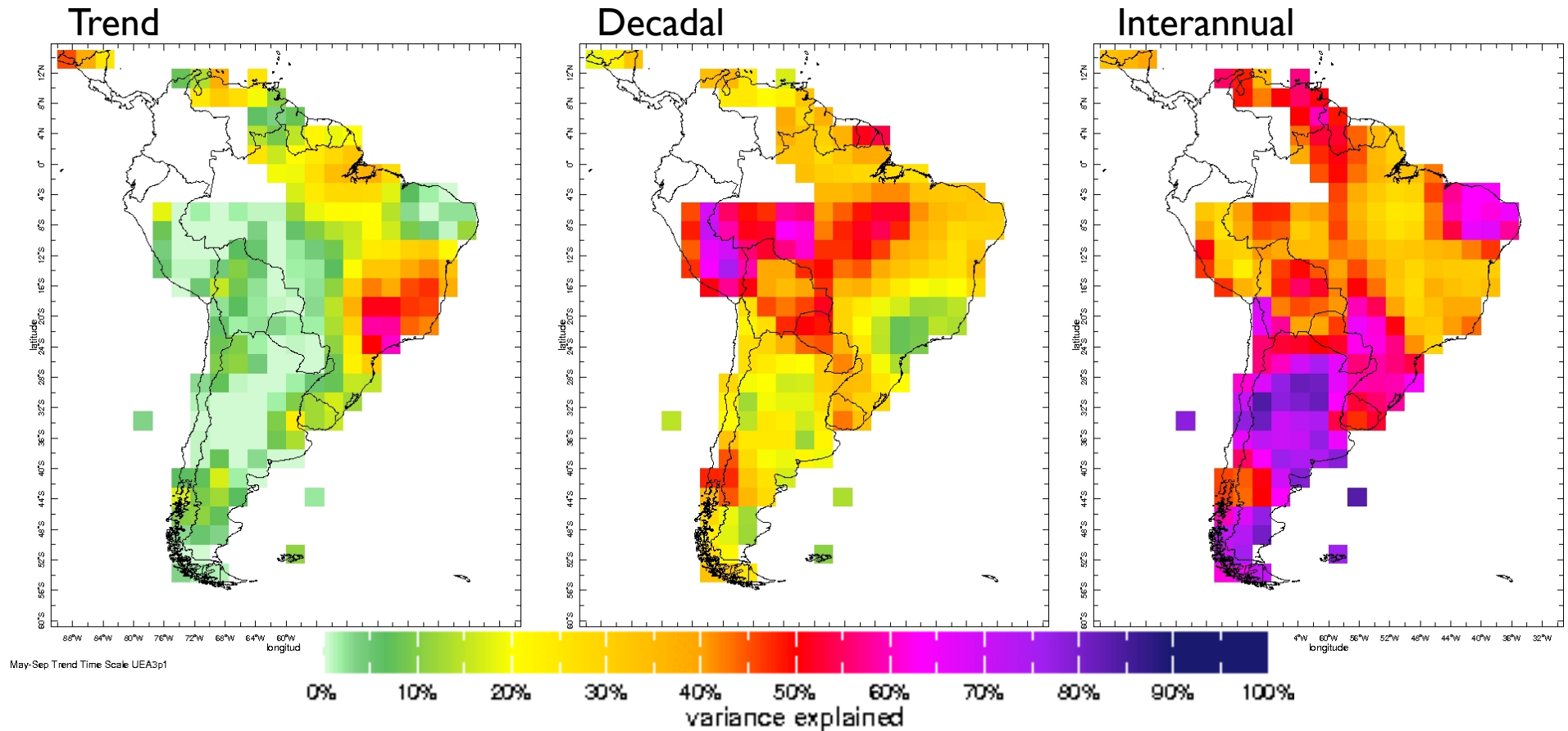
20th Century Observations -- Annual Means



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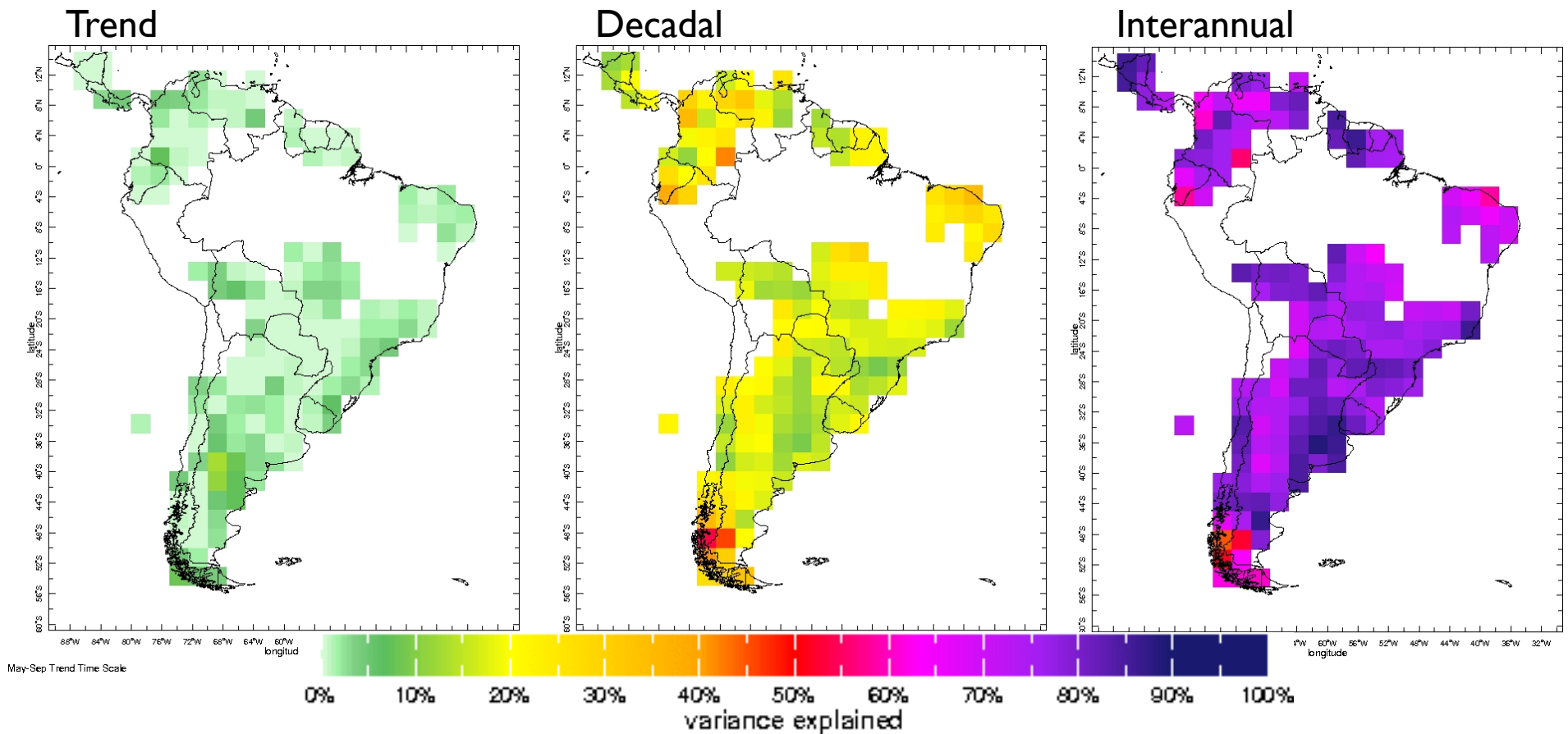
Timescale Decomposition for South America

20th Century Observed TEMPERATURE – May-September



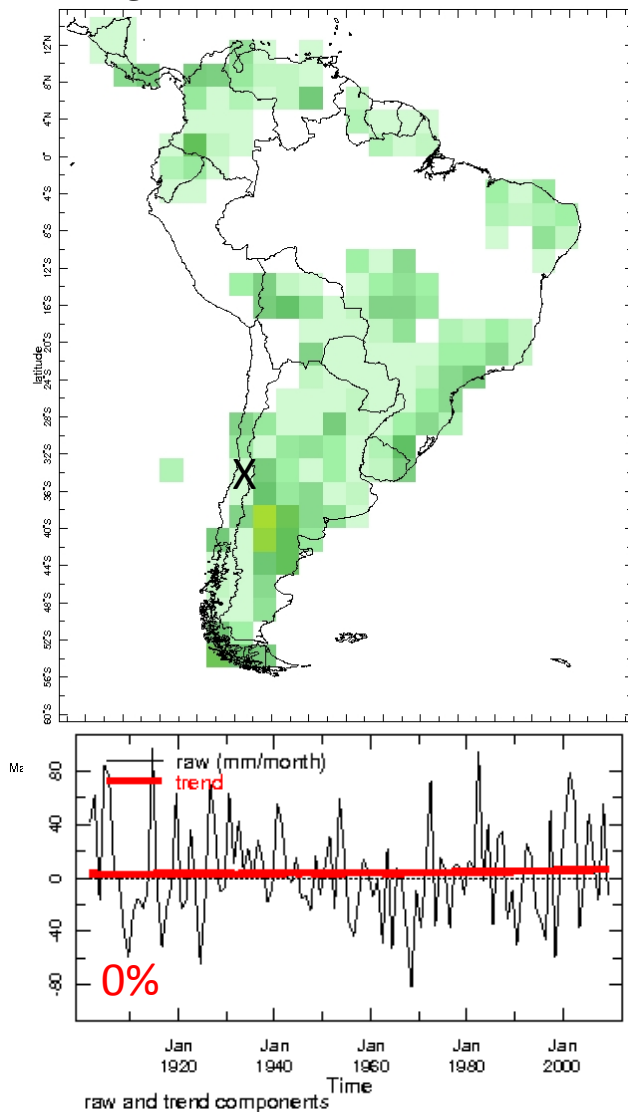
Timescale Decomposition for South America

20th Century Observed PRECIPITATION– May-September

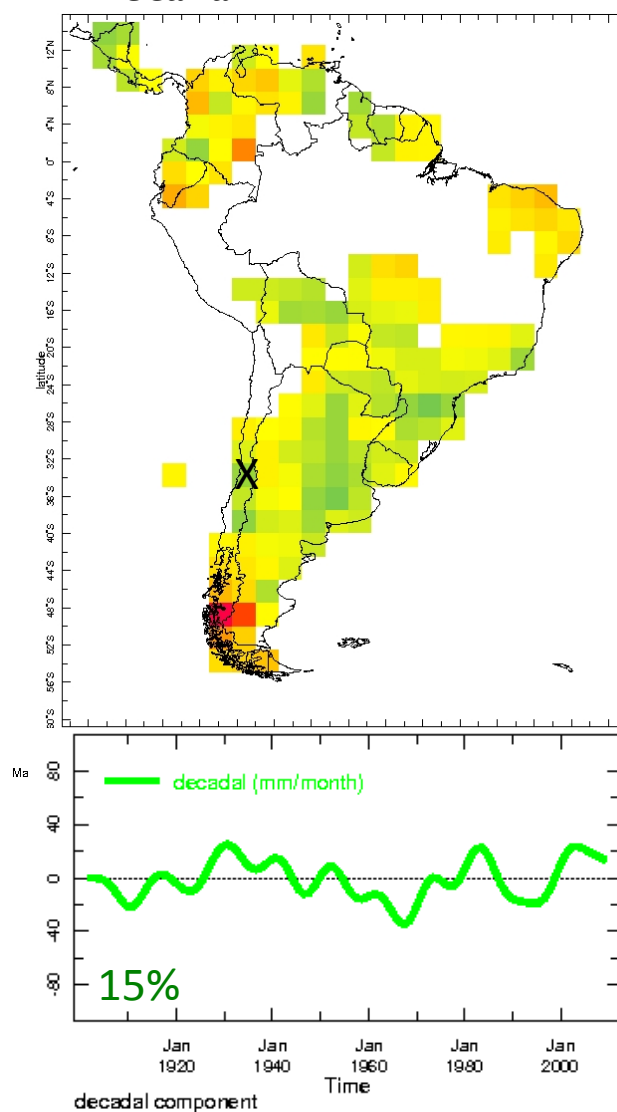


20th Century Observed PRECIPITATION– May-September

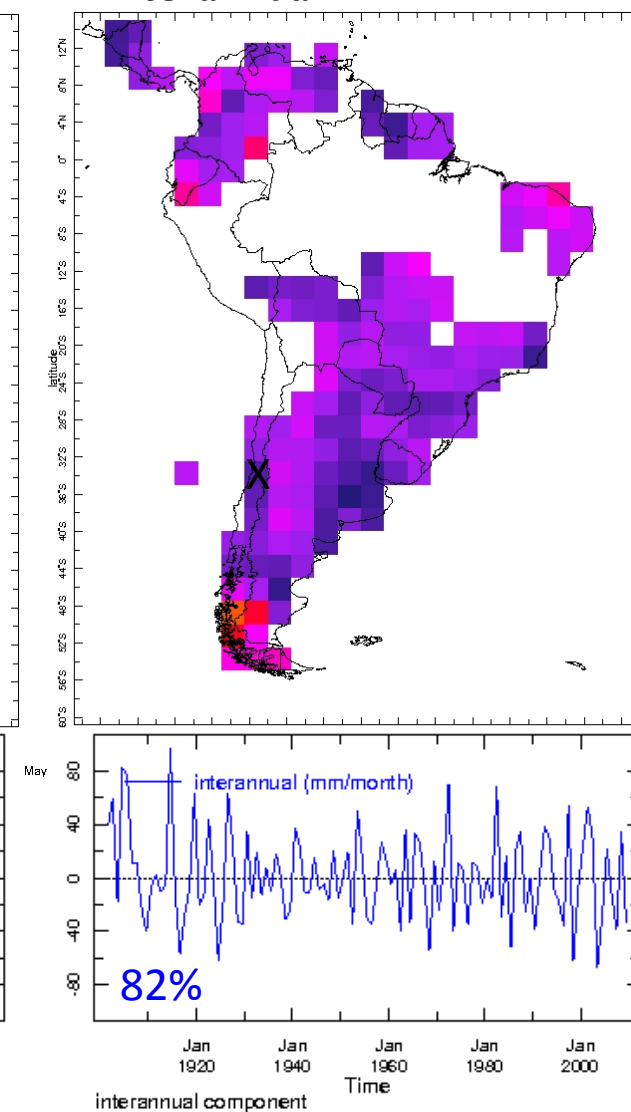
Trend



Decadal



Interannual



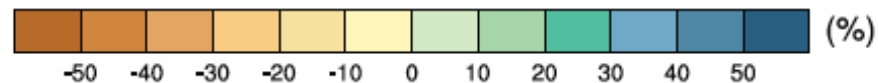
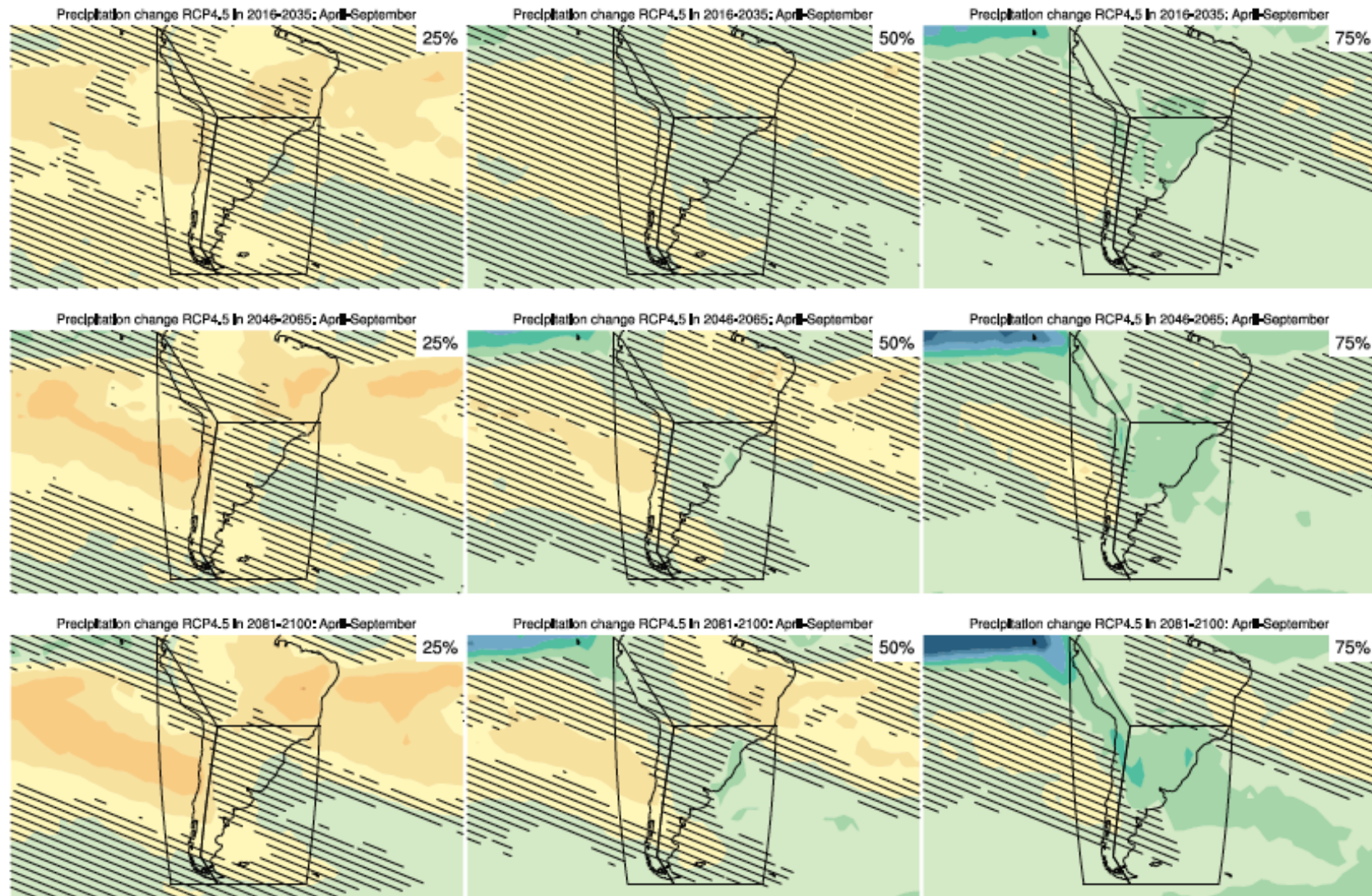


FUTURE AHEAD?

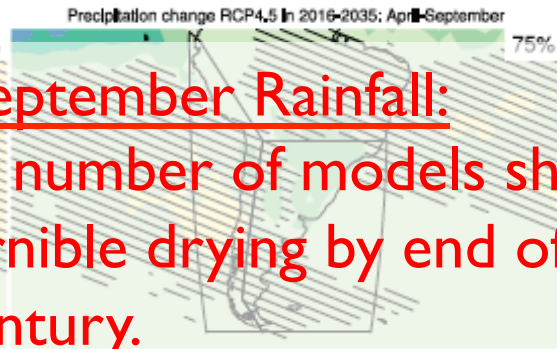
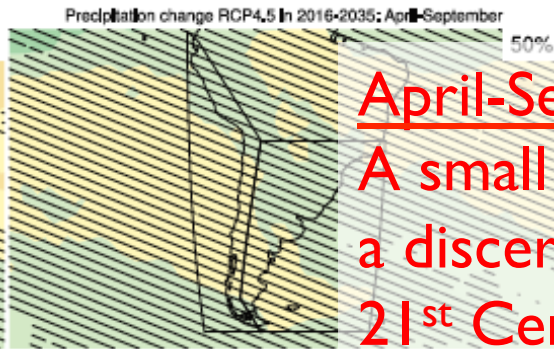
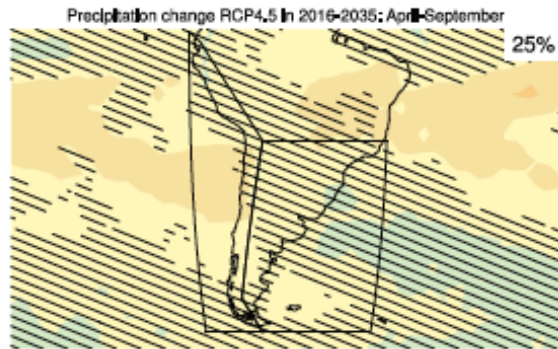


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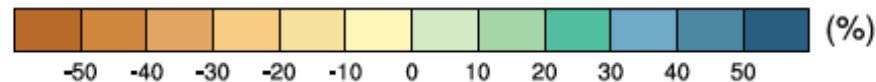
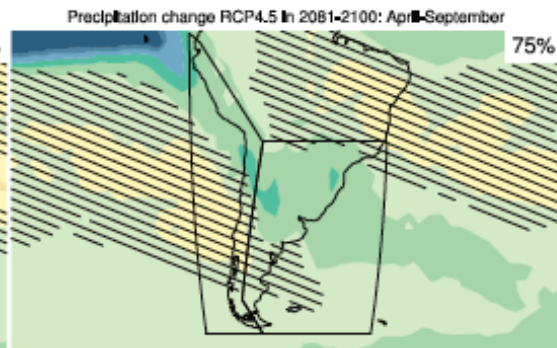
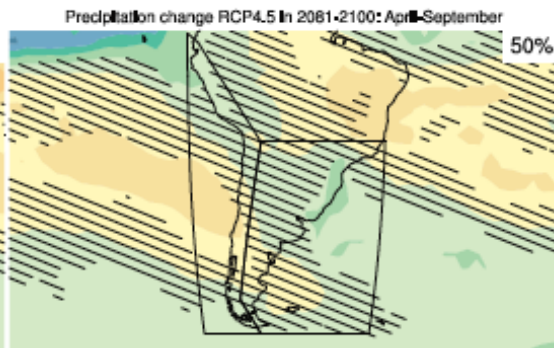
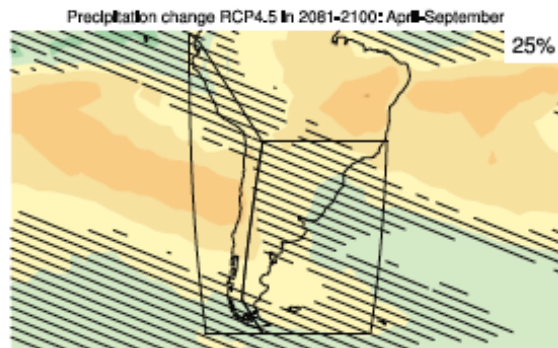
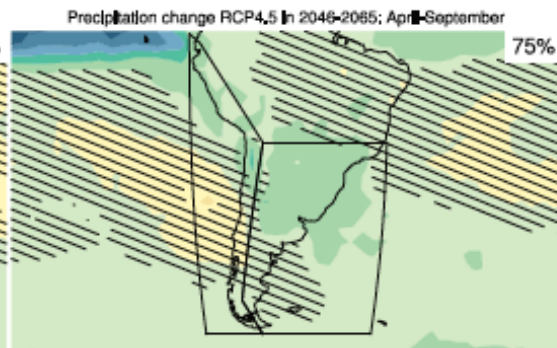
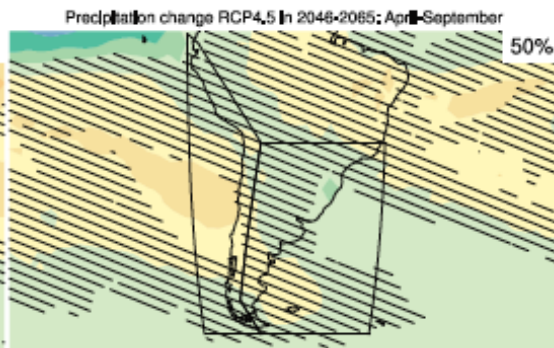
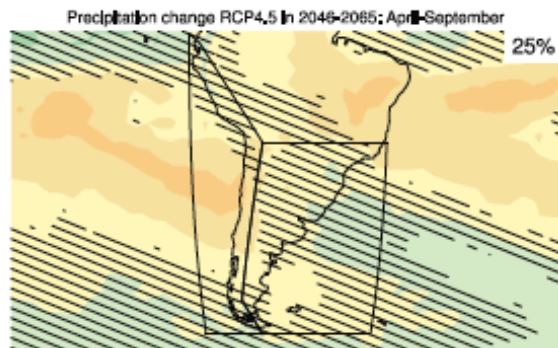
Climate Change Projections



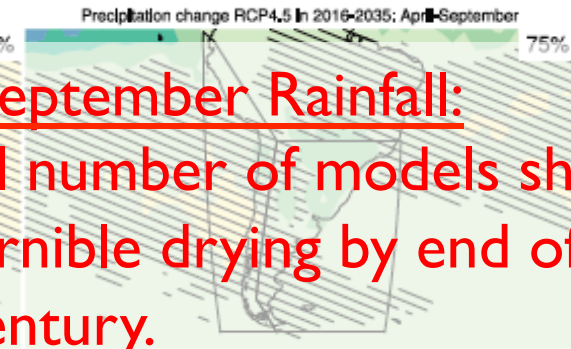
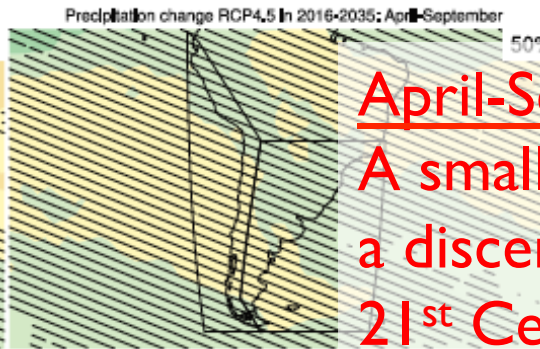
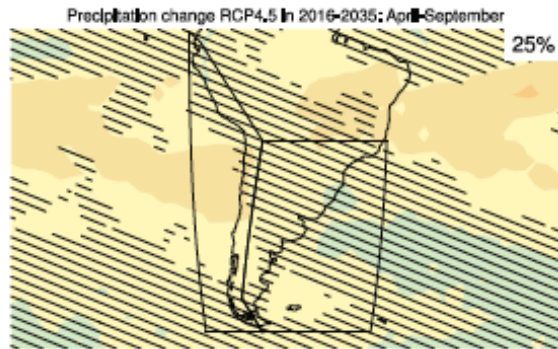
Climate Change Projections



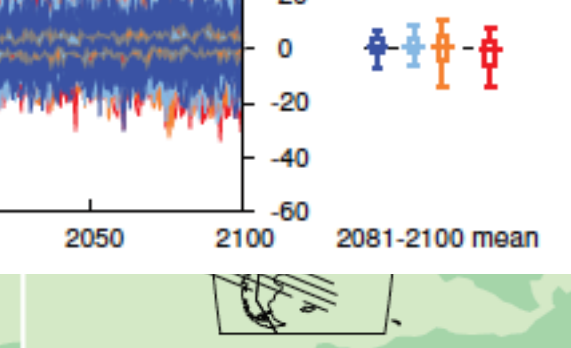
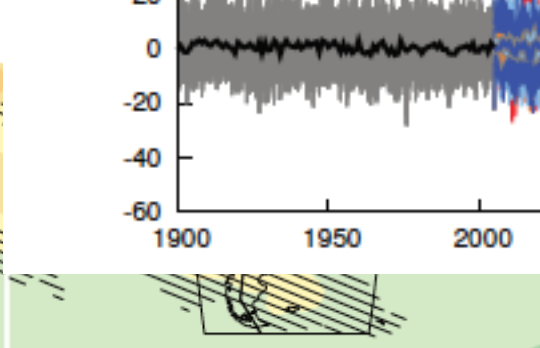
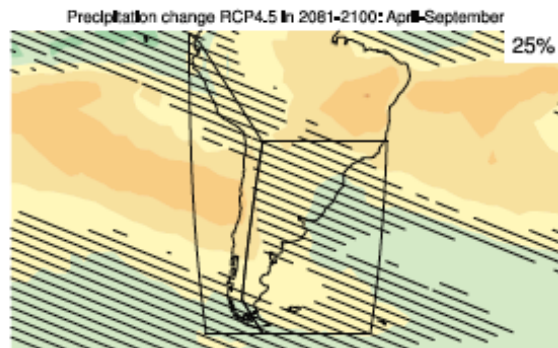
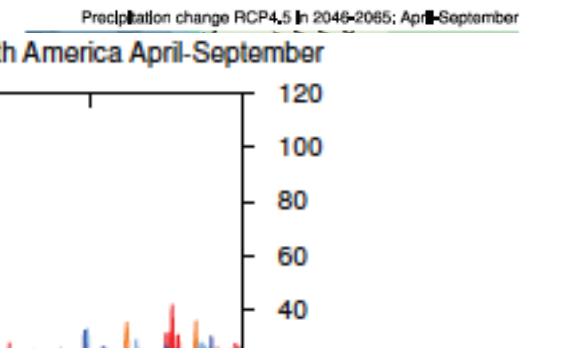
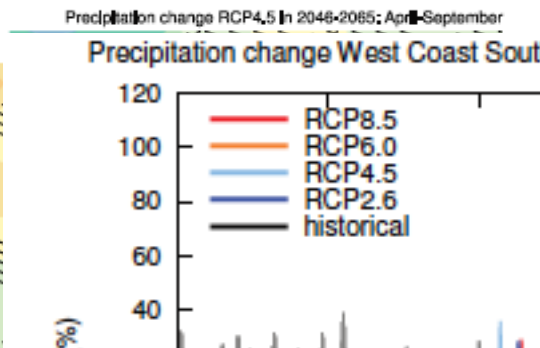
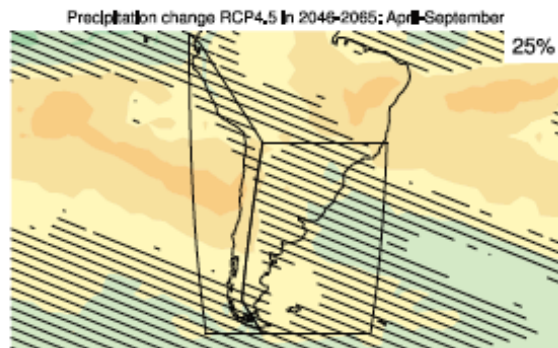
April-September Rainfall:
A small number of models show a discernible drying by end of 21st Century.



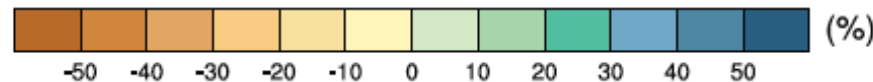
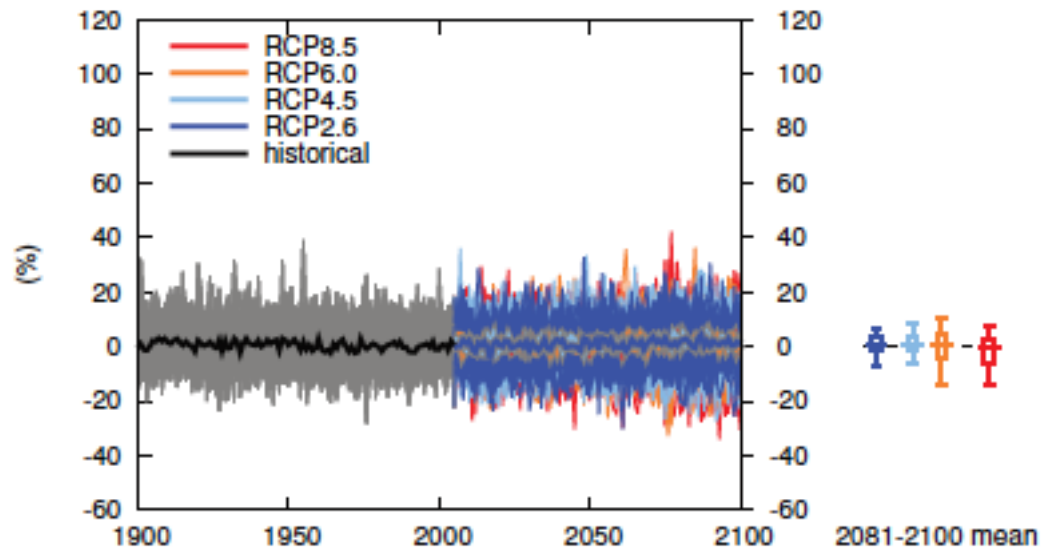
Climate Change Projections



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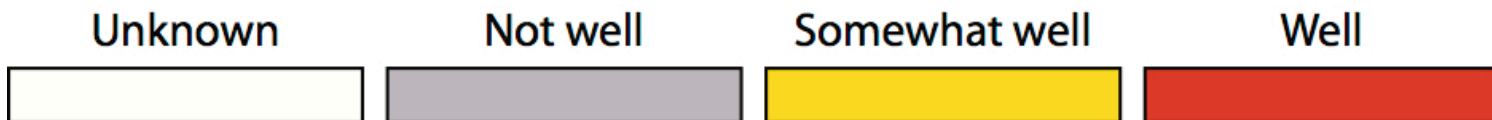
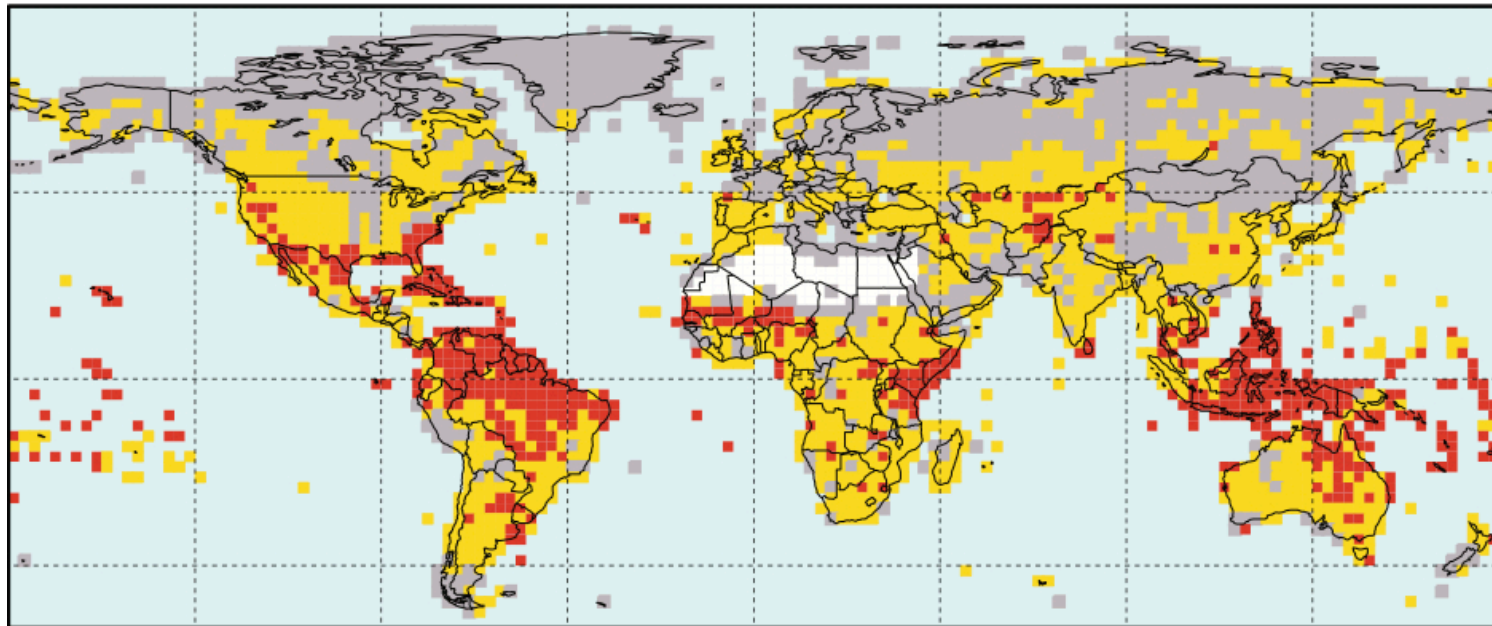


Precipitation change West Coast South America April-September



Seasonal Forecasts

How well can we predict seasonal climate?

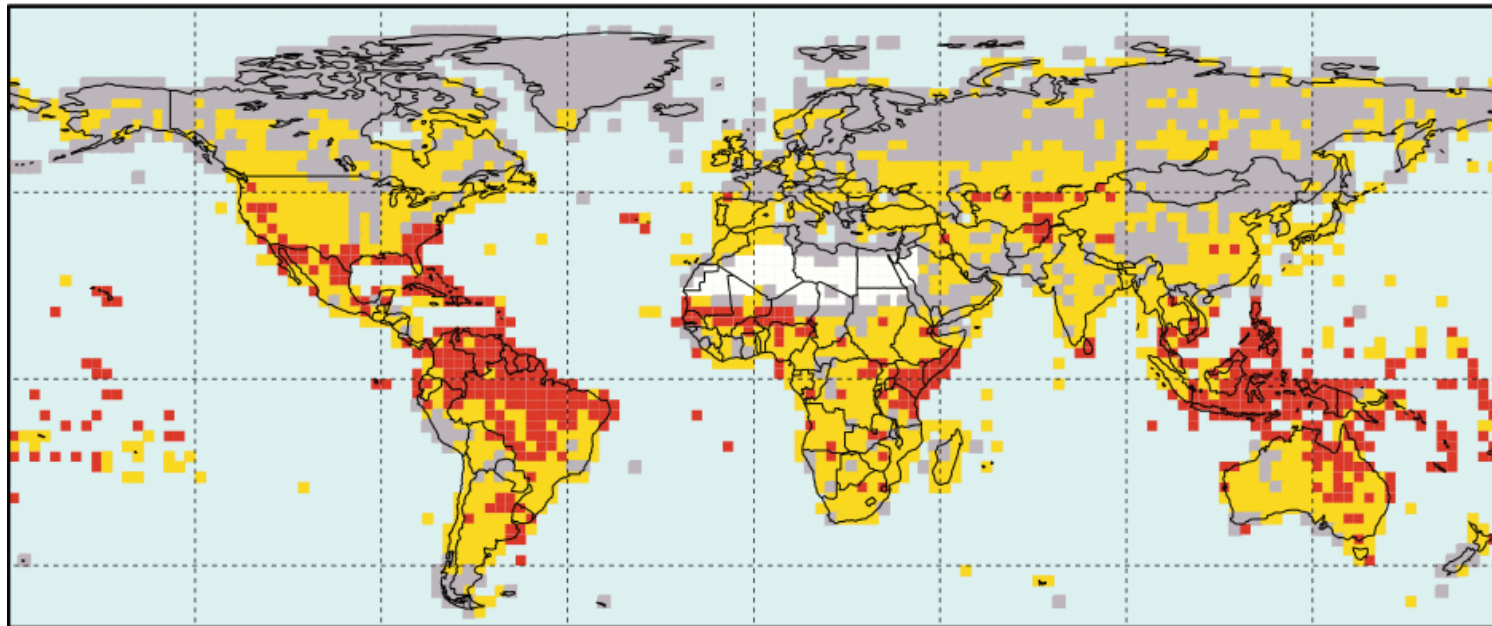


Seasonal Forecasts

Seasonal forecasts over Chile work “somewhat well”.

Greater skill exists during the rainy season, and in response to El Niño and La Niña events.

How well can we predict seasonal climate?

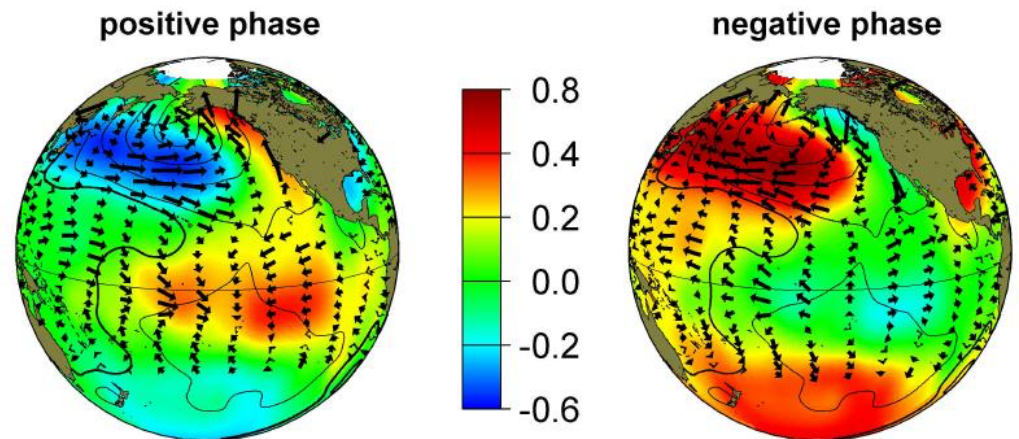


Decadal Variability

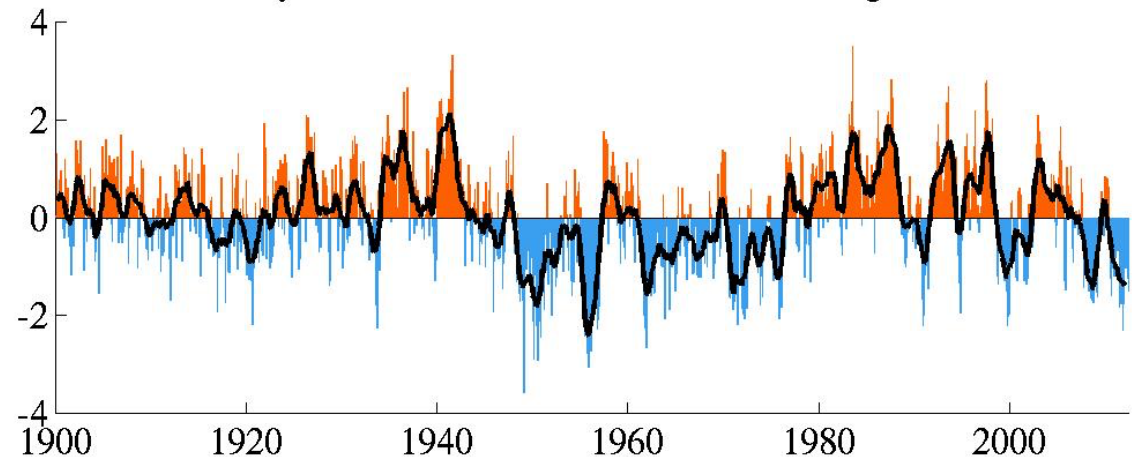
PDO (Pacific Decadal Oscillation) – The principal mode in the Pacific

- PDO refers mainly to N. Pacific sea surface temperatures (SSTs).
- The characteristic *pattern*, shows SST in the tropical Pacific out of phase with that in the higher latitudes.
- IPO (Inter-decadal Pacific Oscillation) considers both hemispheres

Pacific Decadal Oscillation



monthly values for the PDO index: 1900 - August 2012



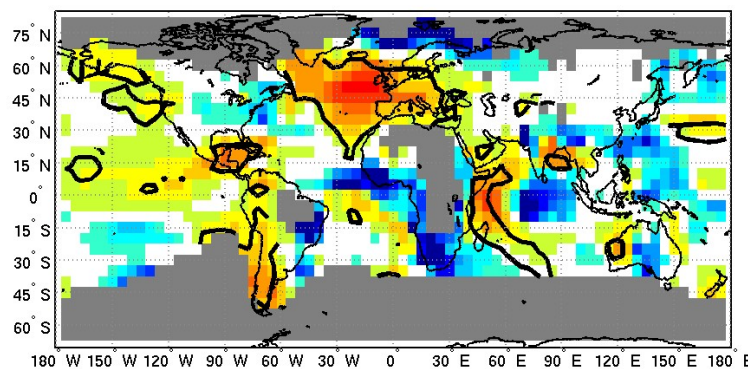
Skill: Decadal Predictions

Decadal Predictions: *Skill still to be demonstrated*

Multi-model Ensemble (12 models: Equal Weighting)

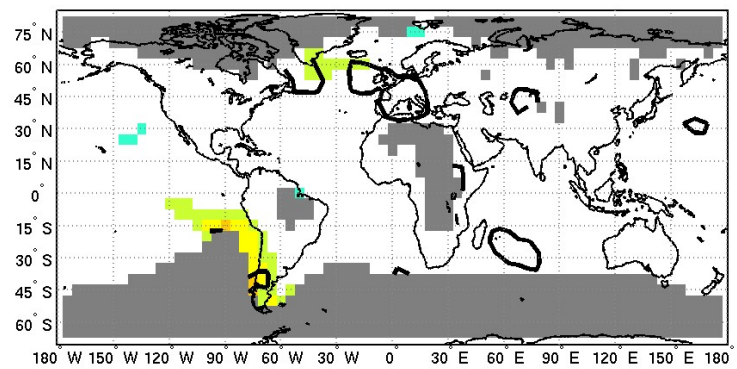
Mean Squared Skill Score

MME temp MSSS: year 2-9 ann
Initialized - Uninitialized

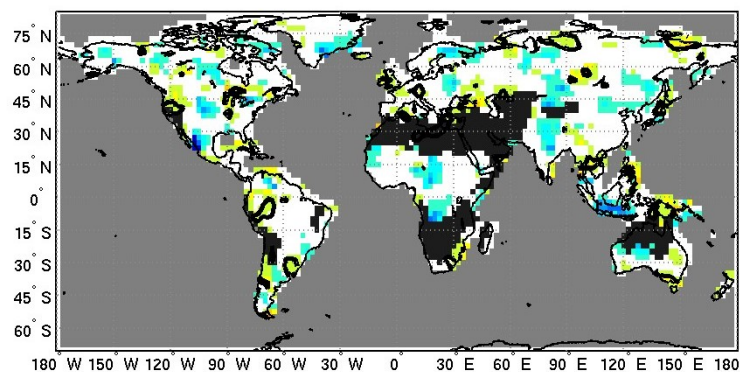


Correlation

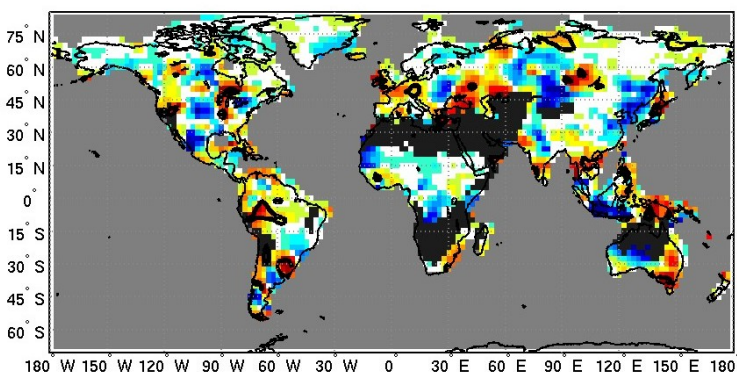
MME temp Correlation: year 2-9 ann
Initialized - Uninitialized



MME prcp MSSS: year 2-9 JAS
Initialized - Uninitialized

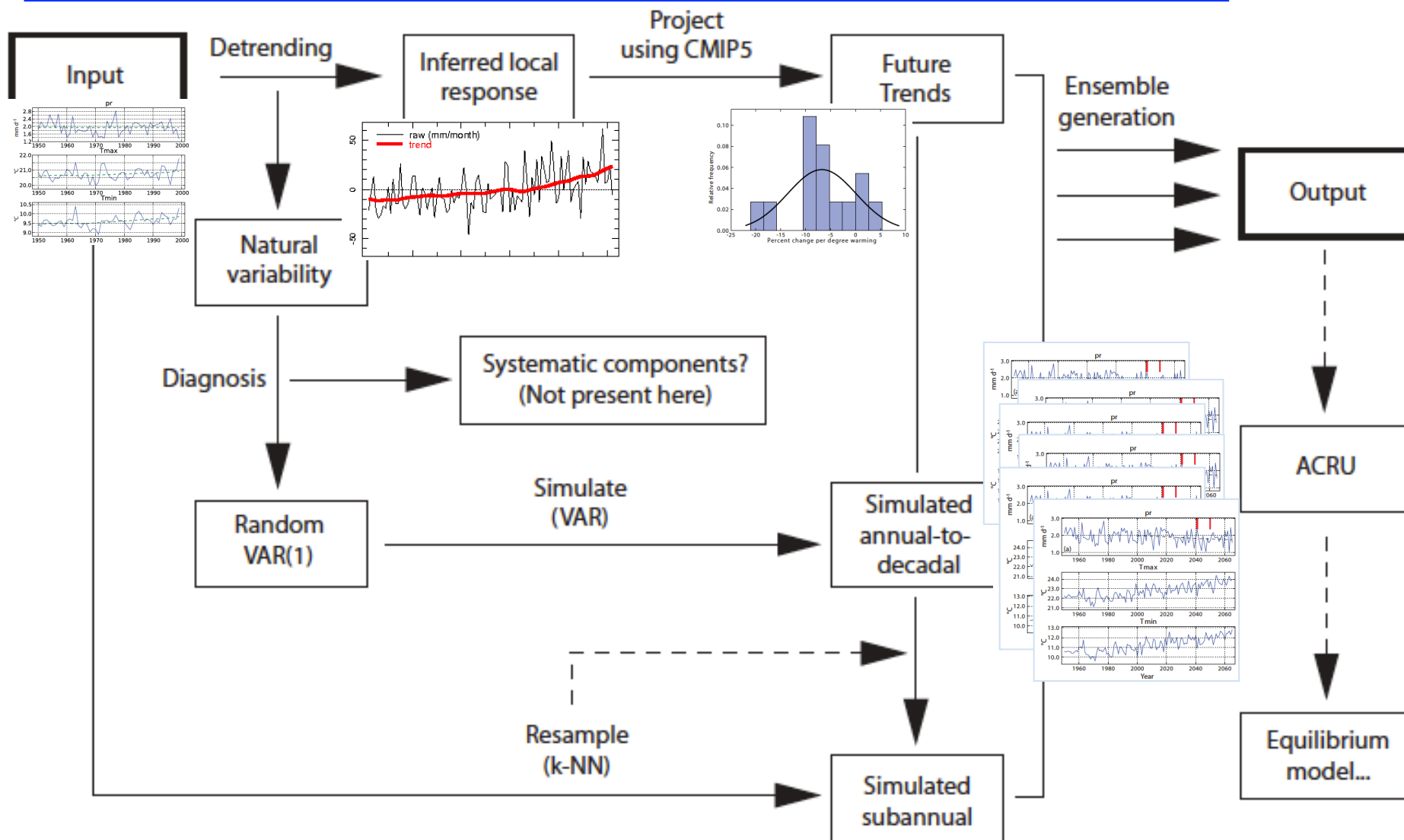


MME prcp Correlation: year 2-9 JAS
Initialized - Uninitialized



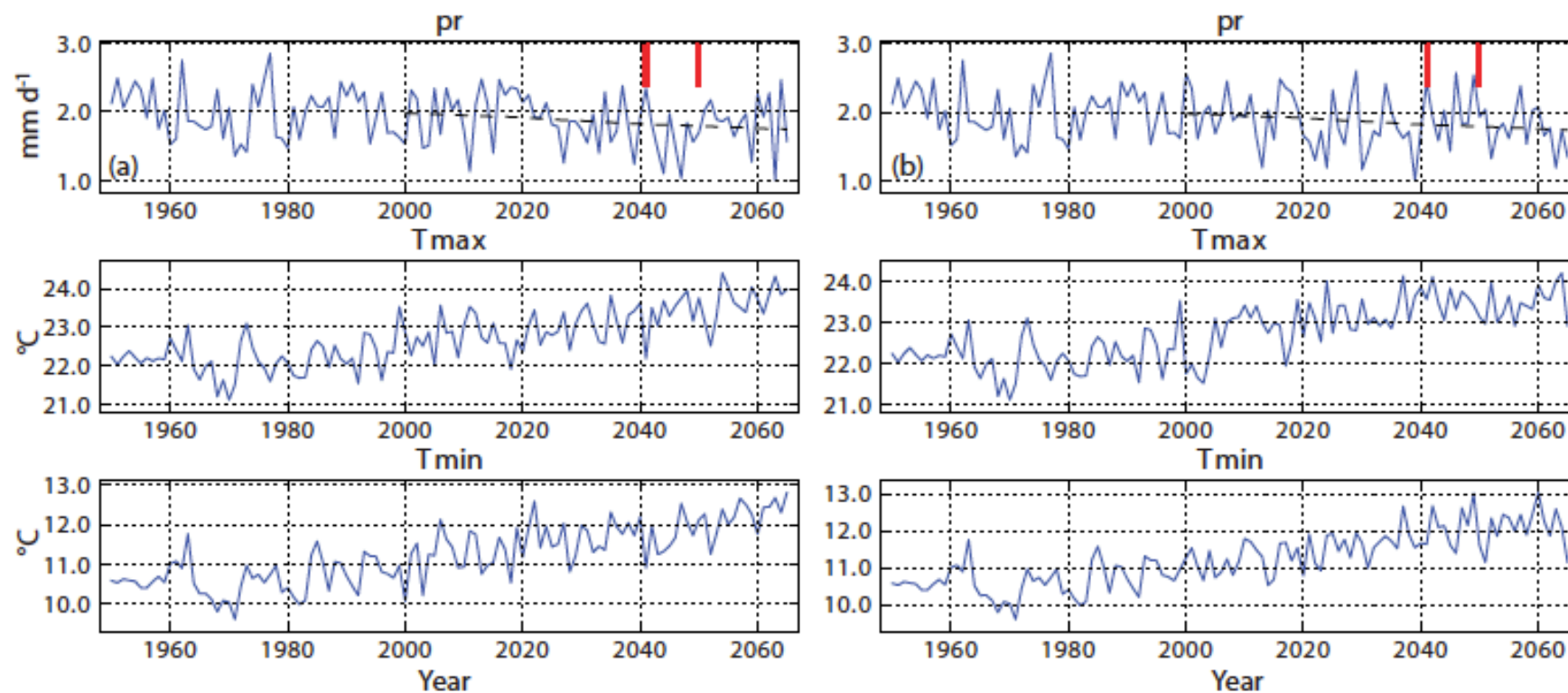
(based on Goddard et al. 2012, *Climate Dynamics*; See also <http://clivar-dpwg.iri.columbia.edu>)

STOCHASTIC SIMULATIONS: *Characterize variability on top of projected trends*



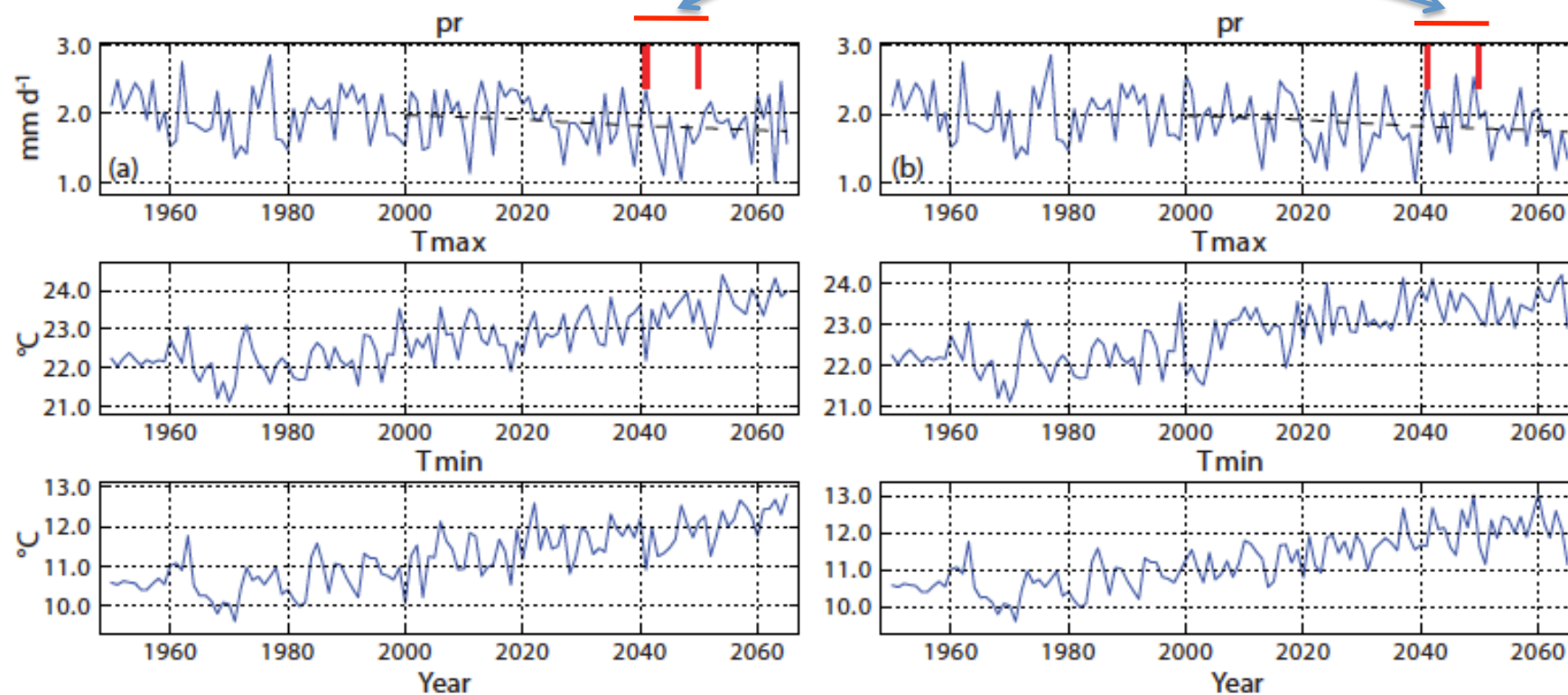
(Greene, et al. 2012)

STOCHASTIC SIMULATIONS: e.g. 2 *Ensemble Members*



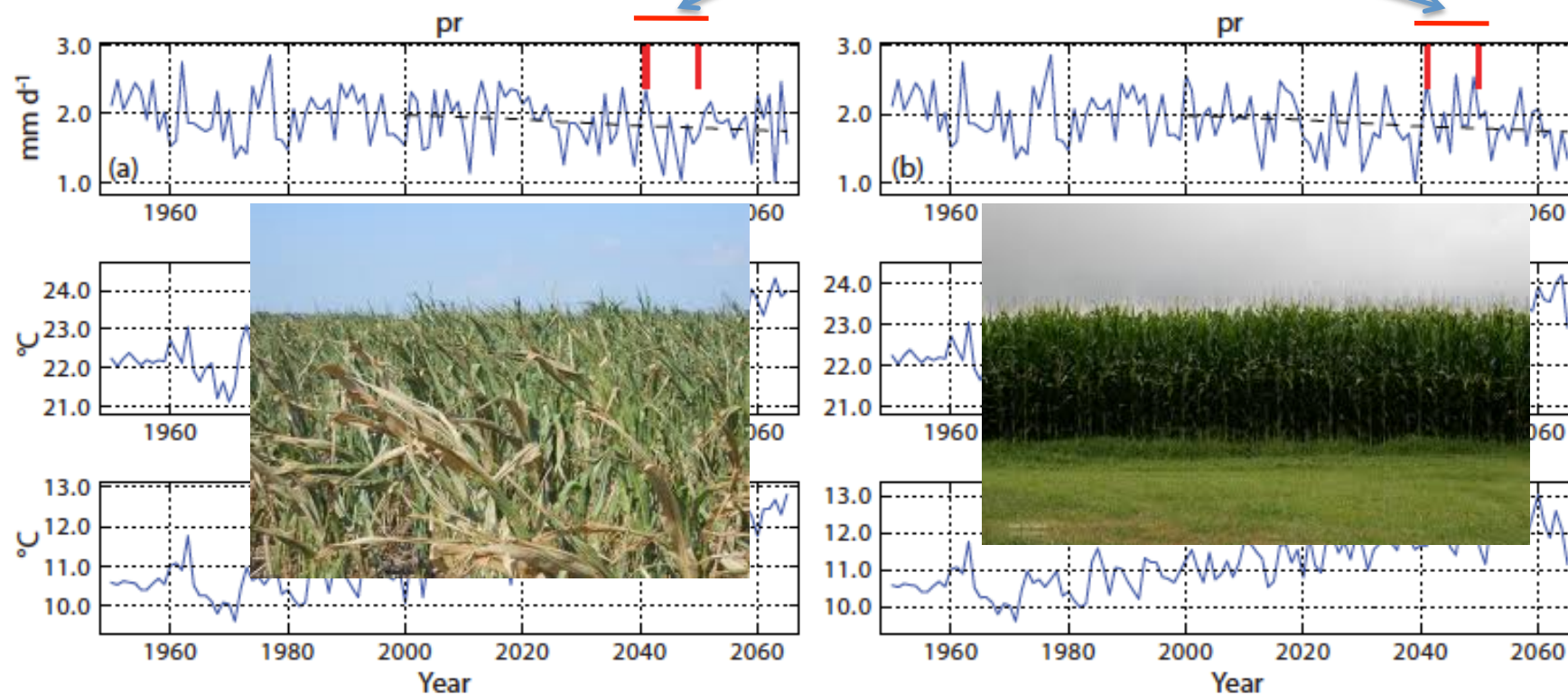
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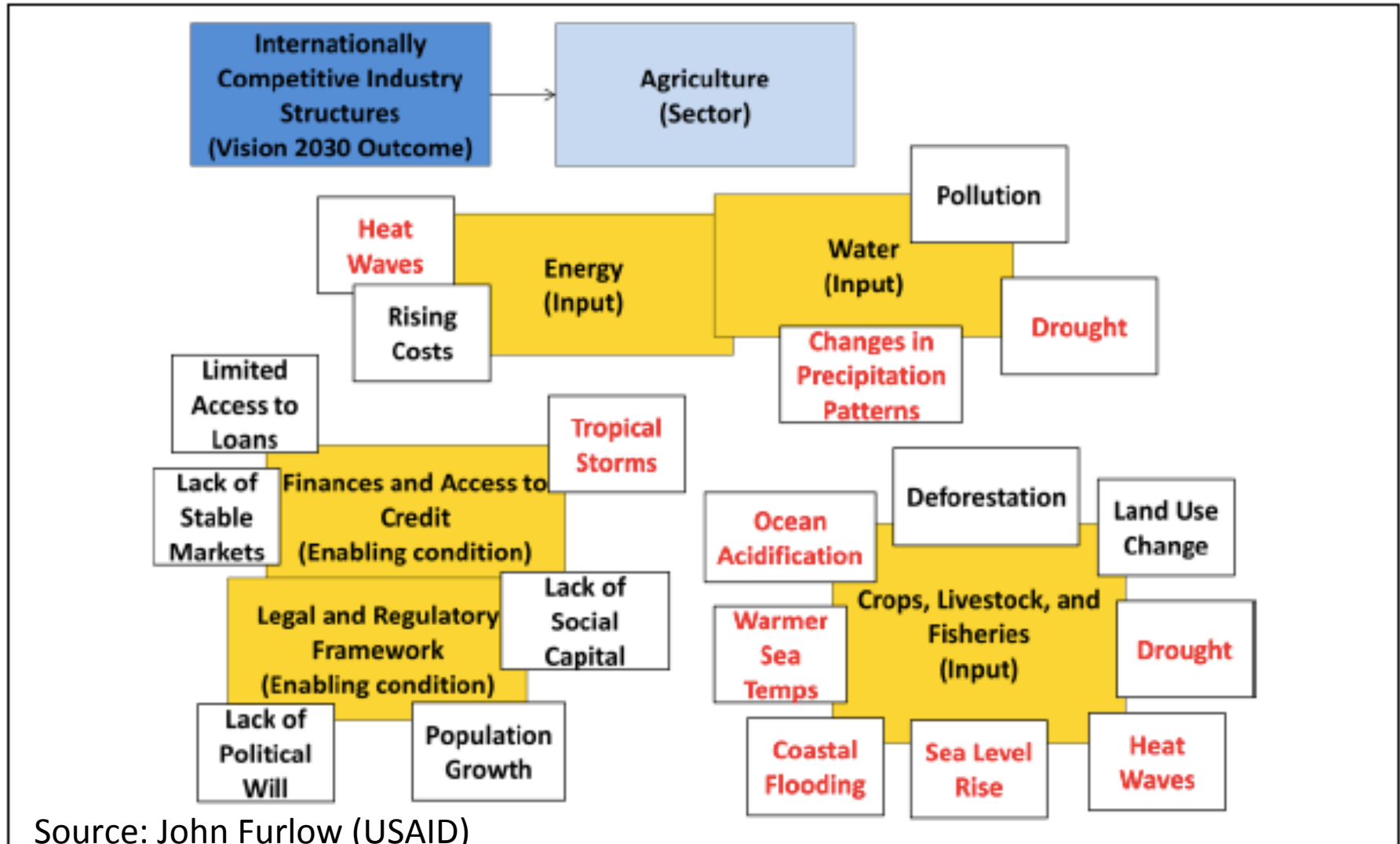


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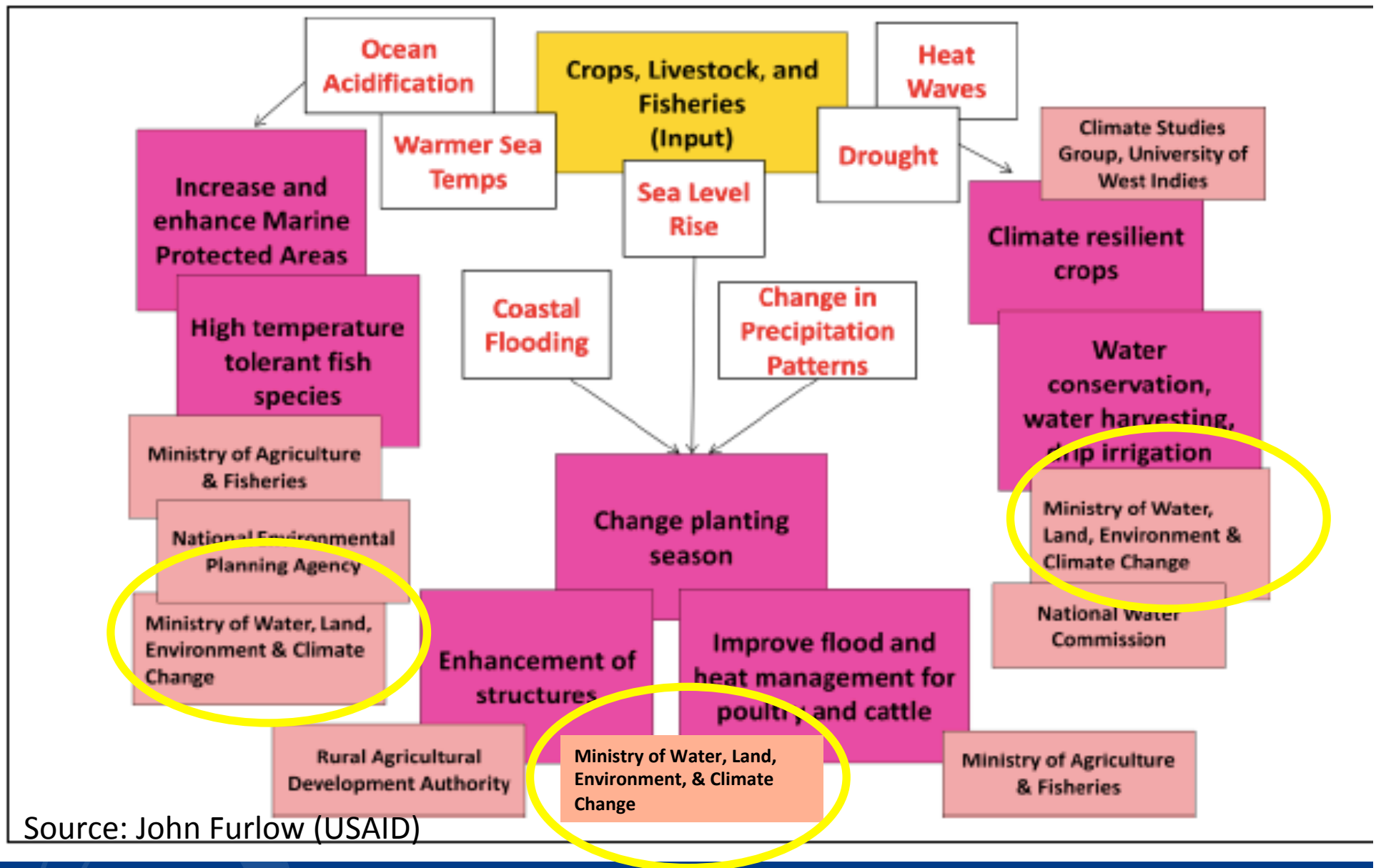
Decadal Variability



Example: Agriculture (Jamaica)



(Jamaica cont.) – **Crops, Livestock, Fisheries**



Source: John Furlow (USAID)

Identifying Climate Risks and Opportunities In Key Sectors



Source: John Furlow (USAID)



SUMMARY

- Long-term climate trends have been small over Chile.
- Year-to-year shocks dominate the climate and amplify the impacts of persistent decadal climate variability
- Policy is needed to guide action, as is strong science and climate information that is trust-worthy.
- Multi-disciplinary + trans-disciplinary teams must work together to realize effective solutions.

Thank You



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