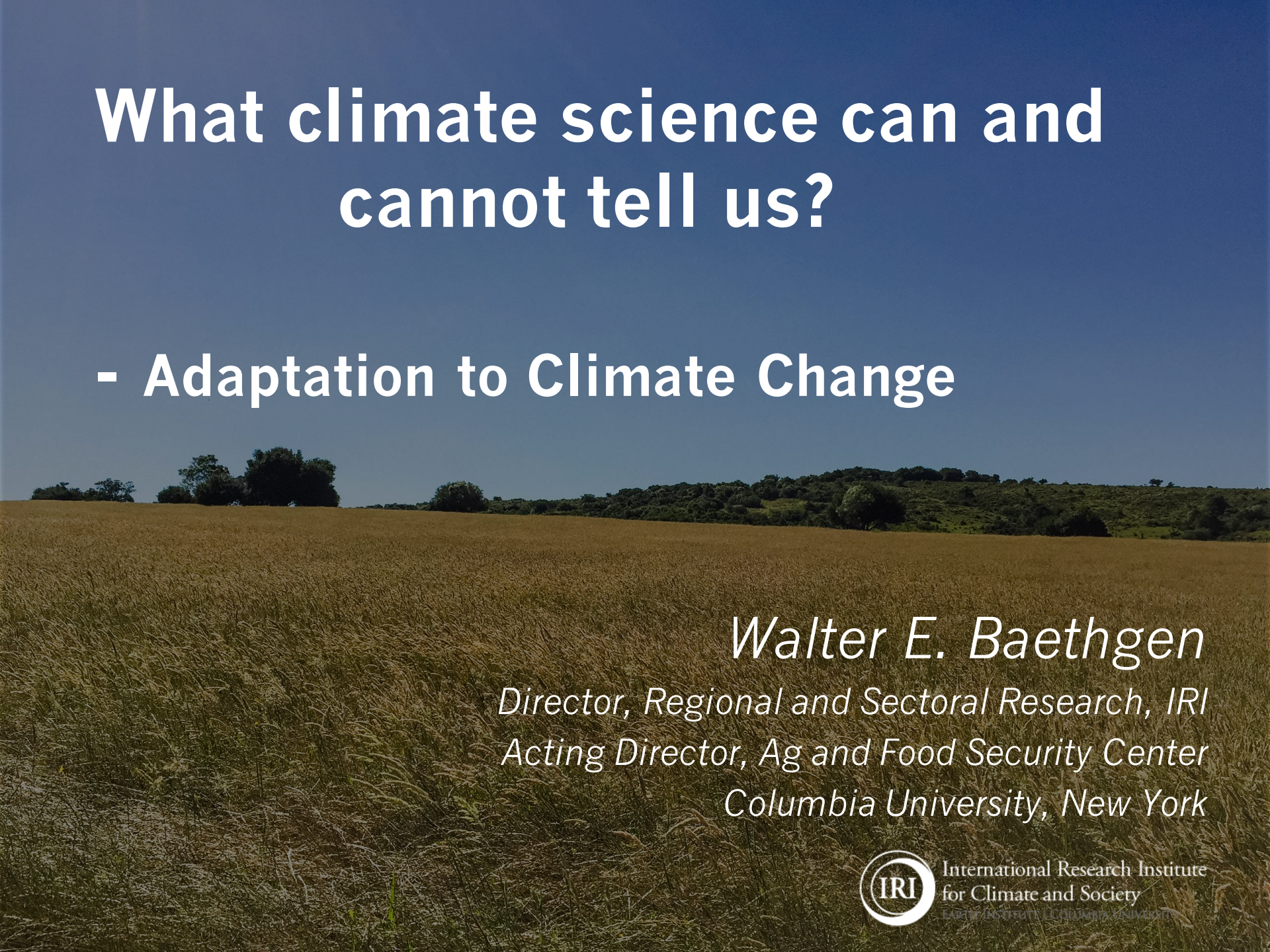
What climate science can and cannot tell us?

- Adaptation to Climate Change



Walter E. Baethgen

Director, Regional and Sectoral Research, IRI

Acting Director, Ag and Food Security Center

Columbia University, New York

IRI International Research Institute for Climate and Society
EARTH INSTITUTE | COLUMBIA UNIVERSITY

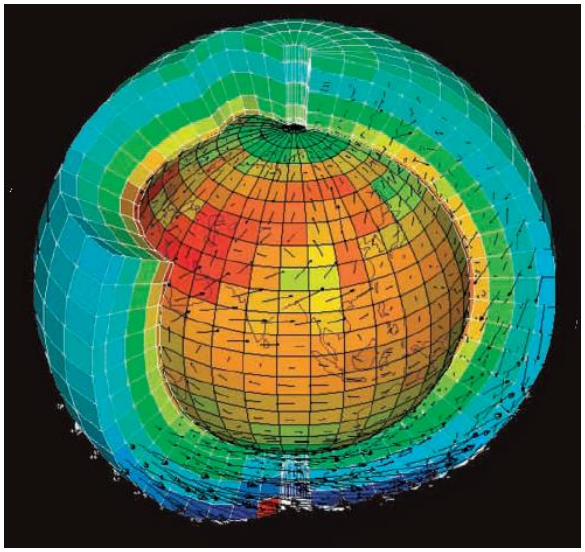
Climate Change: Key to work in the Causes (Mitigation)

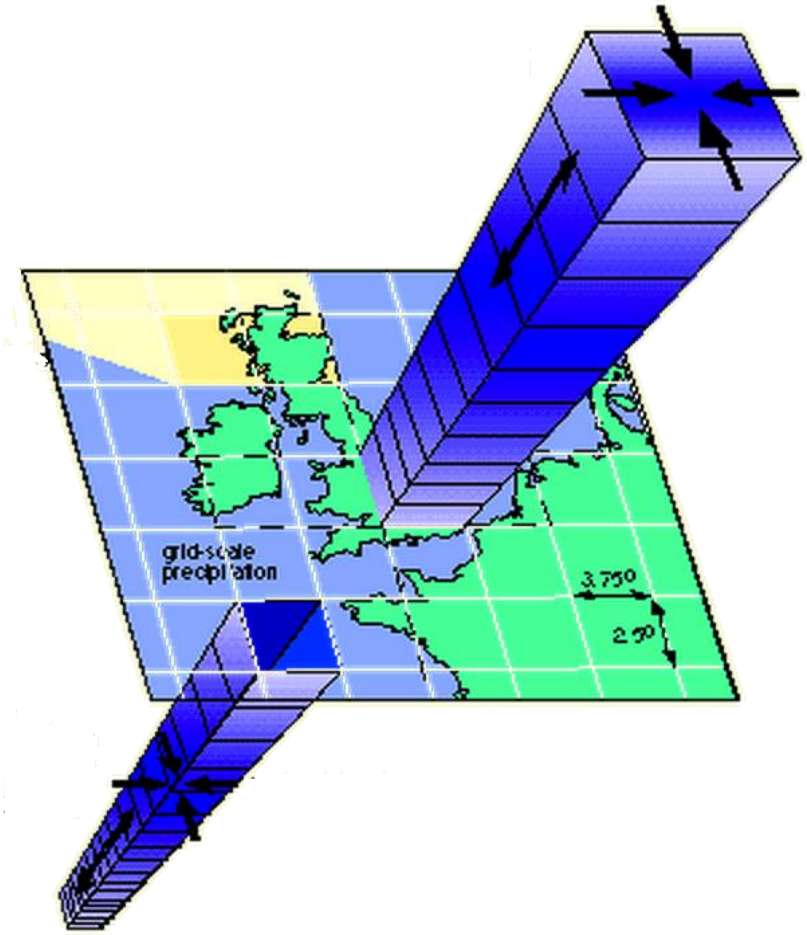
But: Inertia of current and past emissions→
Effects in Climate for Decades

Need to Adapt

Improving Adaptation to CC: Being Climate Smart
Adapt to What? Future Climate?

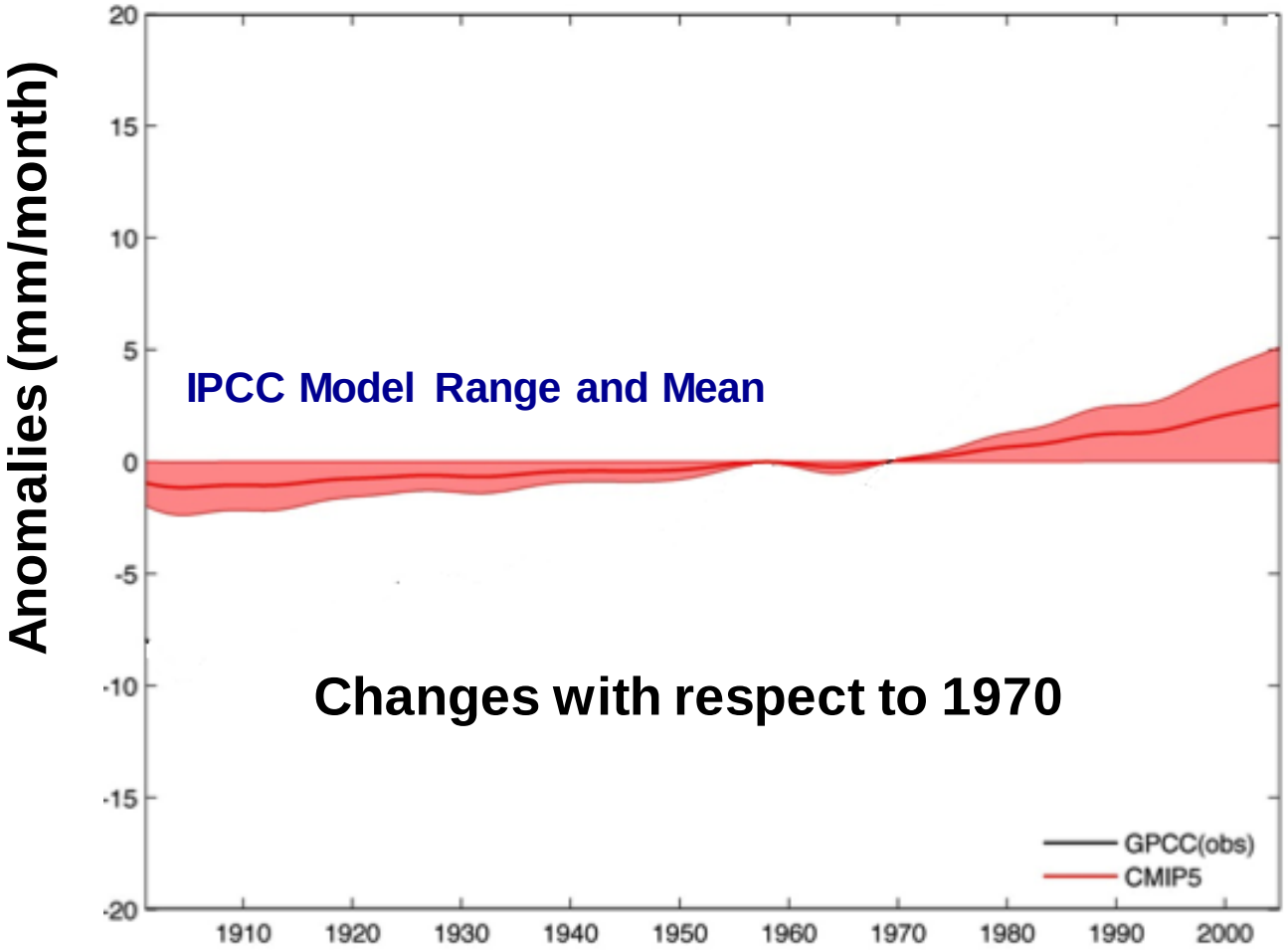
Climate Change Scenarios: Climate Models (GCMs)





Climate Models: Simulating Past Observed Climate

Example: SE South America Sep - Feb



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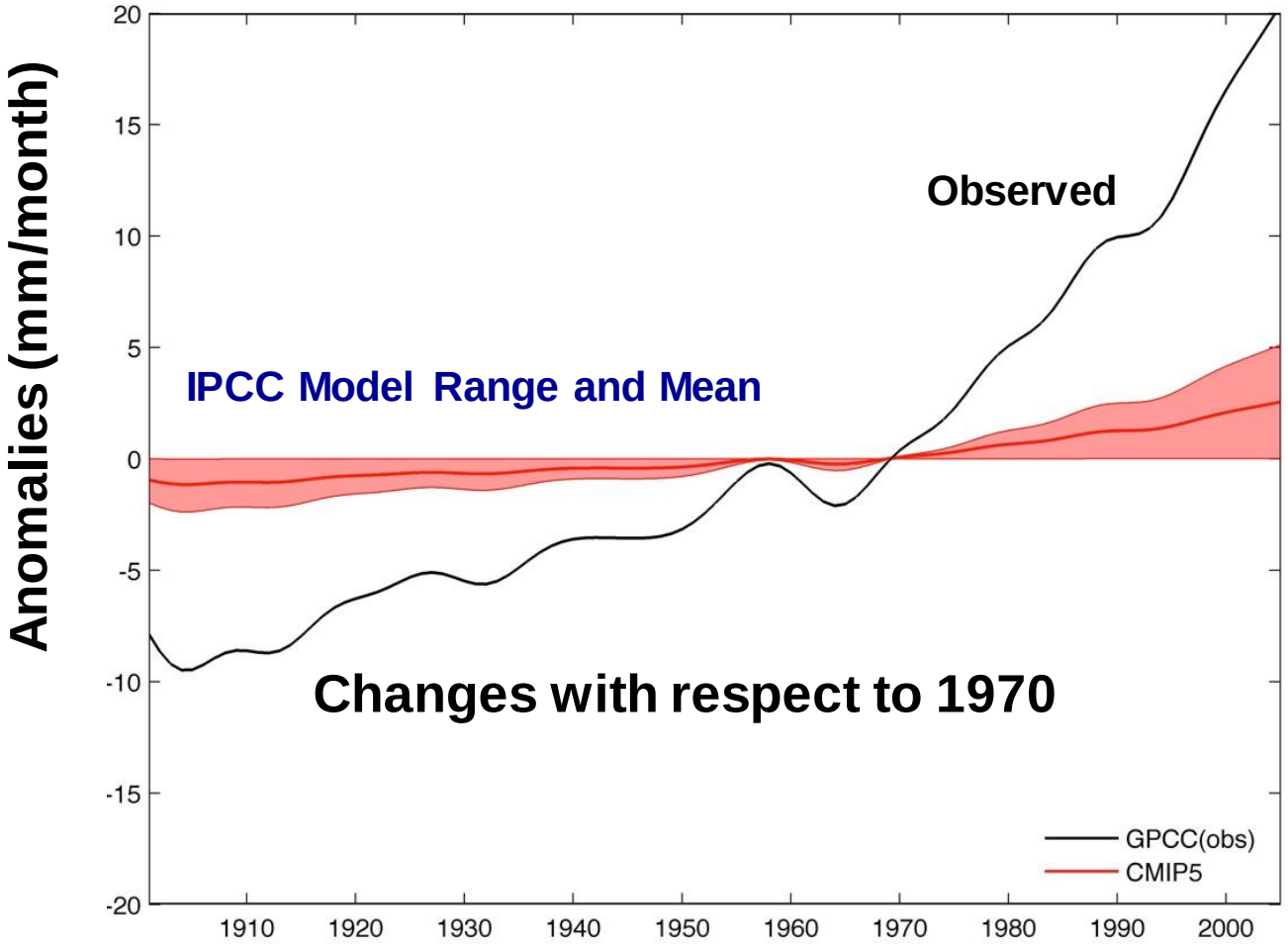


(Gonzalez et al. 2014, *Clim. Dyn.)*

Climate Change Scenarios: Climate Models (GCMs)

1. Great advances in science, but still lots to understand:

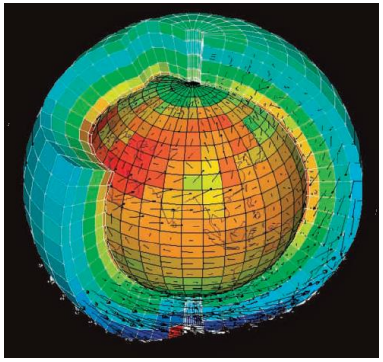
   Limitations of the Models

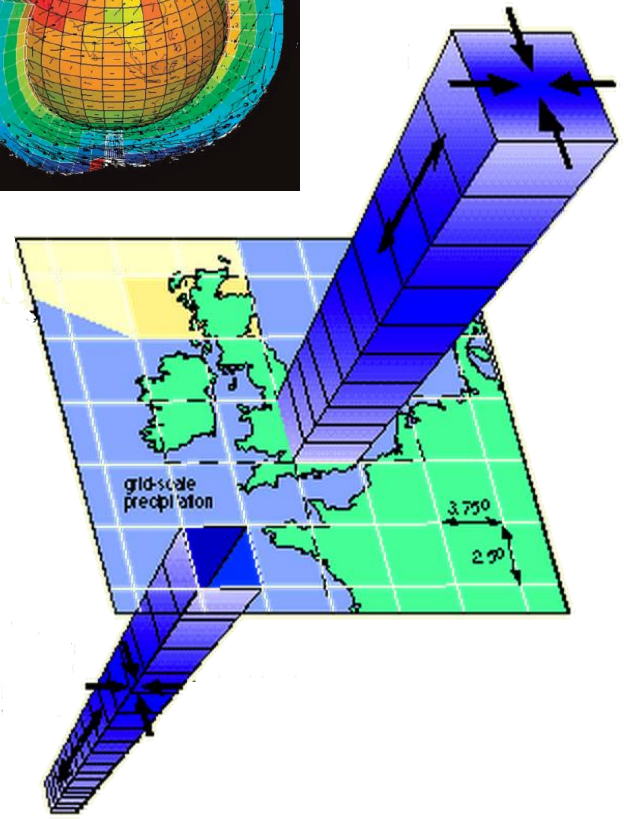
2. Key Input:
   GHG Emissions

Assumptions:
(e.g., in 2080-2100)

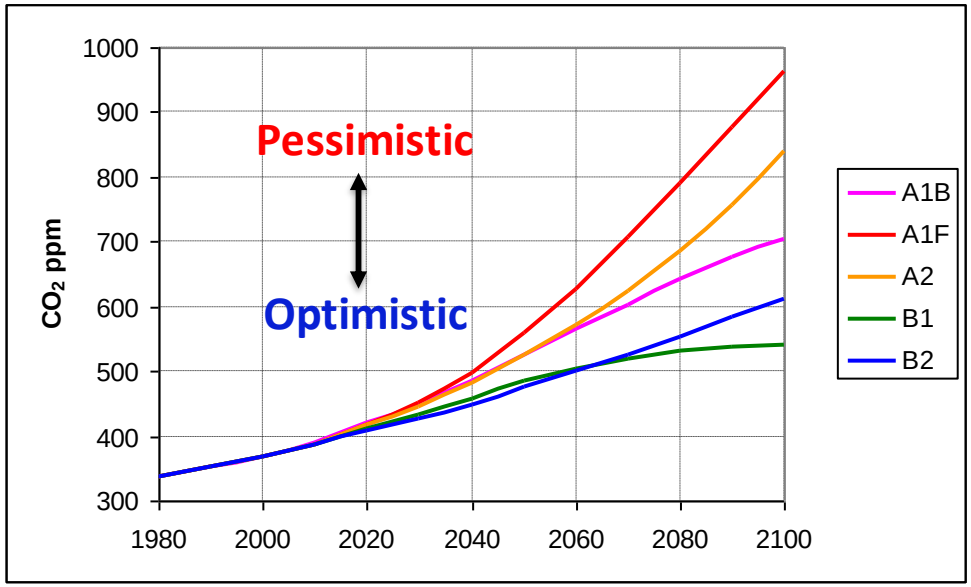
Technologies?
Energy Sources?
Deforestation rates?
Population?

Uncertainties





Future Socioeconomic Scenarios



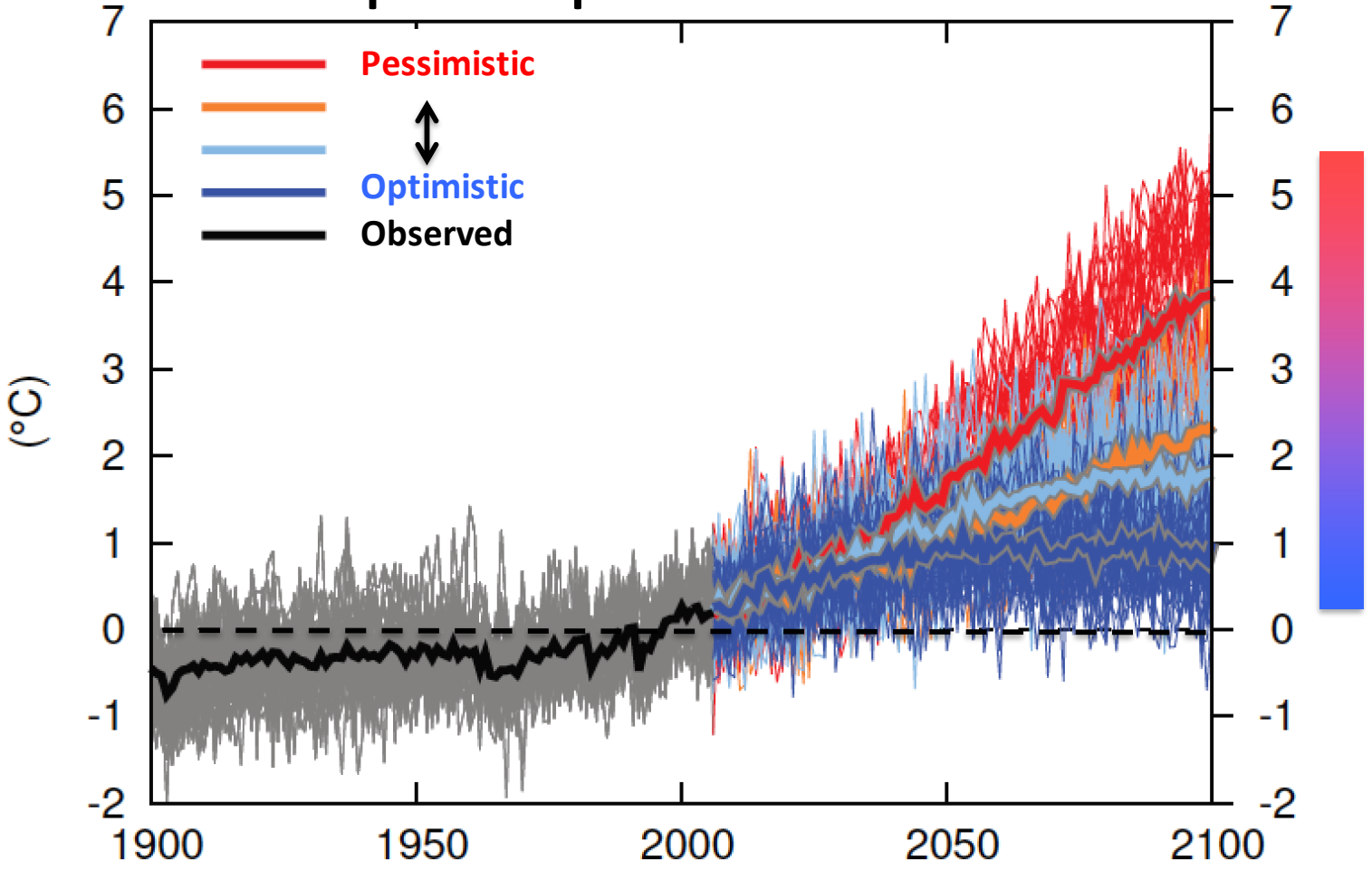
CO_2 atmospheric concentration for different development options

In AR5: Radiative Forcing Values (similar assumptions)

GHG Emission Scenarios + Climate Models

Climate Change Scenarios (IPCC)

Example: Temperature in SE Asia

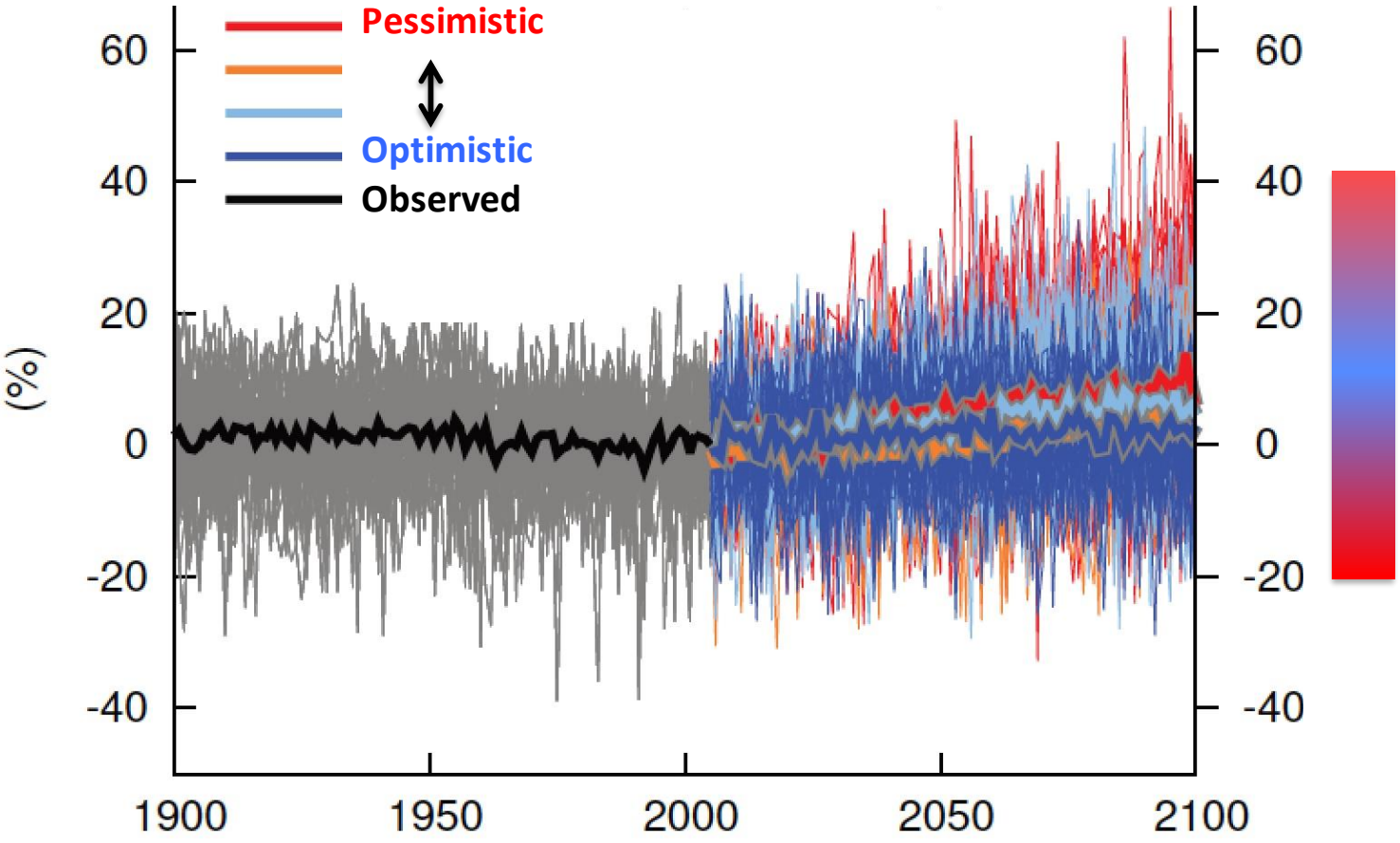


This is for the whole Region

Much more Uncertain for Local Scale

Rainfall: Much Higher Uncertainties

Example: Rainfall in SE Asia (Apr-Sep)



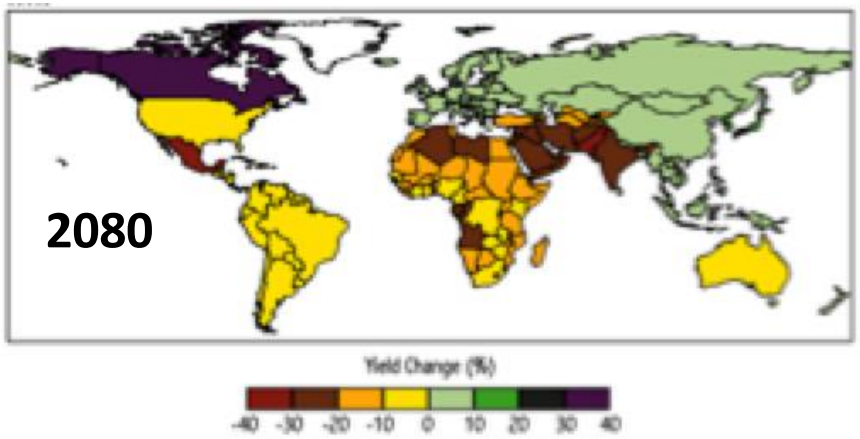
This is for the whole Region

Much more Uncertain for Local Scale

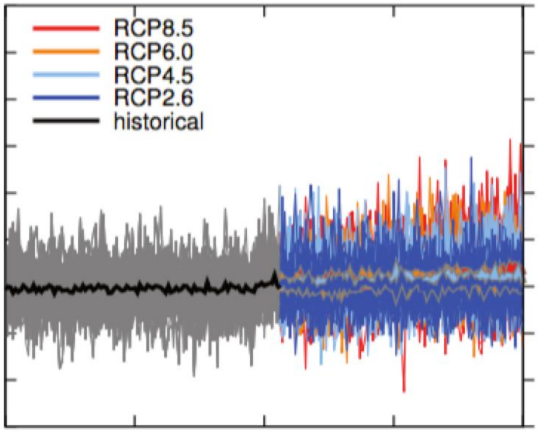
Conclusion: Climate Change Scenarios are Uncertain
IPCC's objective was not to create scenarios for impact assessment

Bruce in preparation to Galway meeting:
What should the R&D community be doing differently?
What should we be doing more of? What should we doing less of?

Less (to none) of this: % change in Crop Yields by 2080



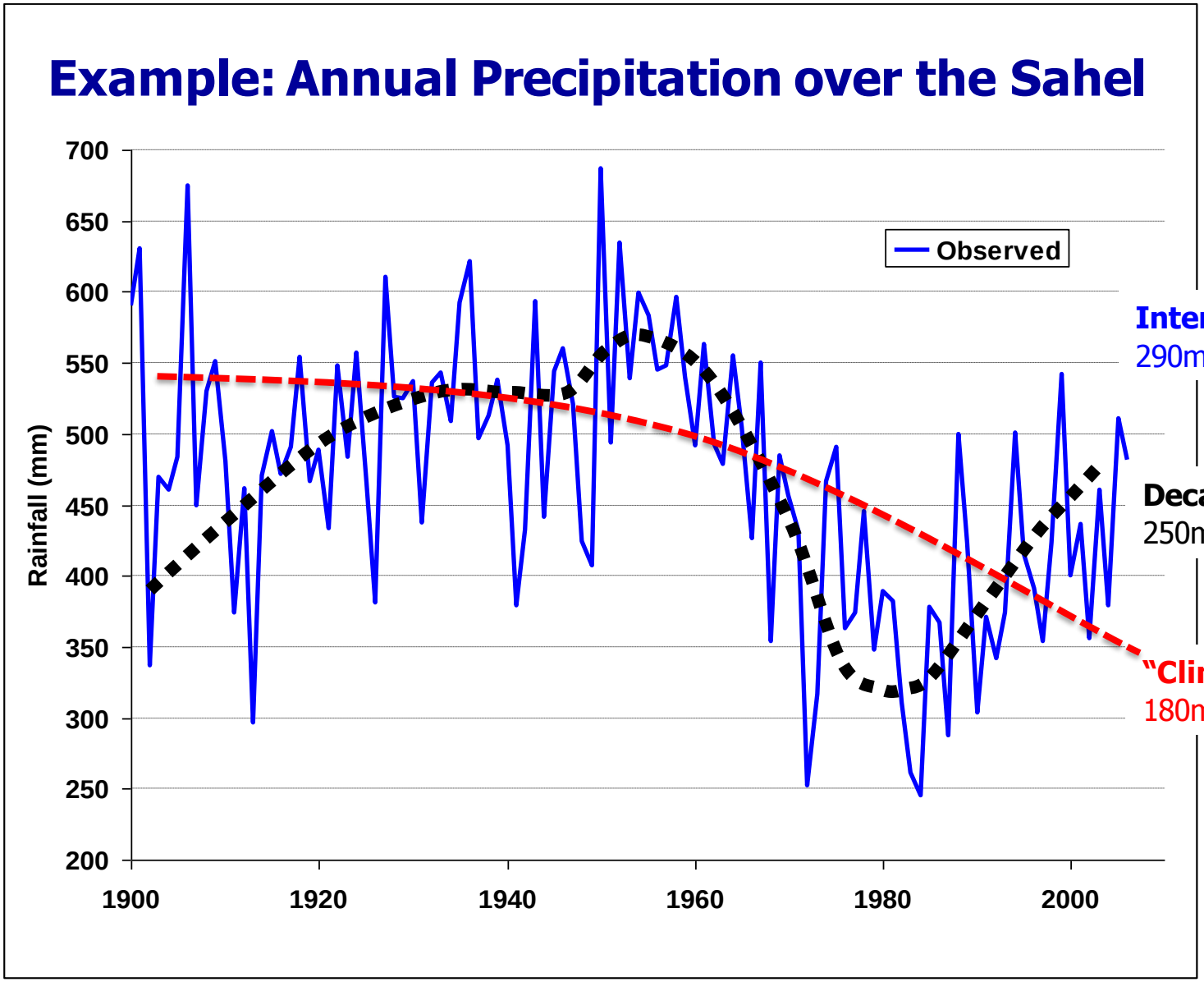
ADDITIONAL PROBLEM:
This is easily understood
Can be "erroneously" believed
and lead to Maladaptation



Uncertainty?

Need a Different Approach (Bruce's R&D "more of…")

1. Consider Different Temporal Scales of Climate Variability

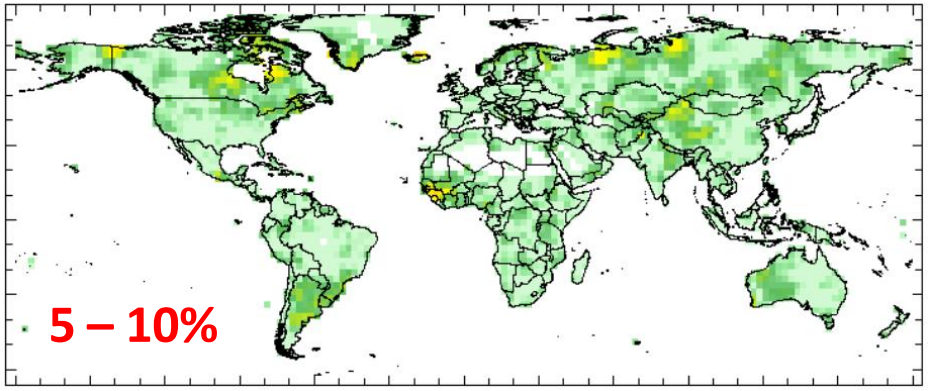


Climate Varies at Different Temporal Scales (trend, decadal, interannual)

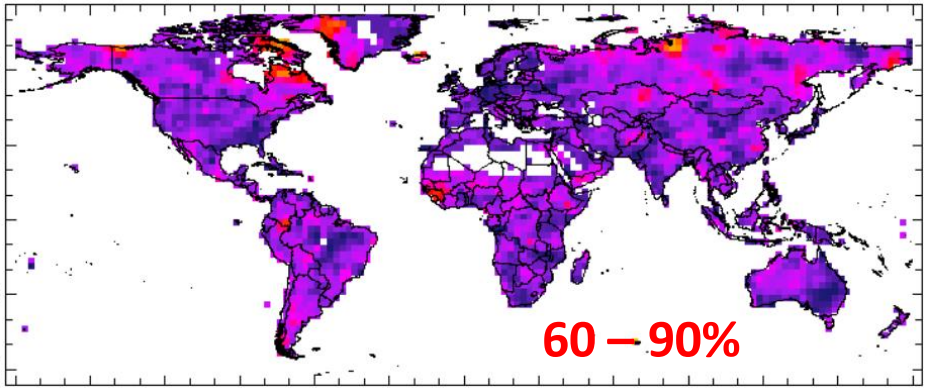
How Important is Each Scale? Which one Explains More of the Past?

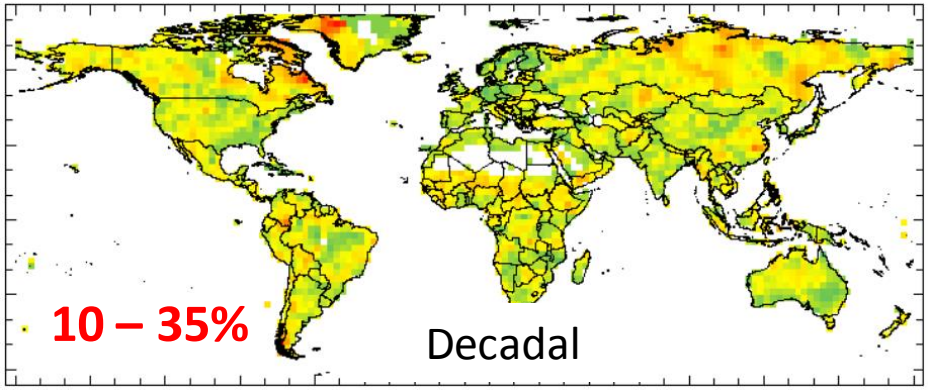
Example: Observed Annual Rainfall in the Last 100 Years

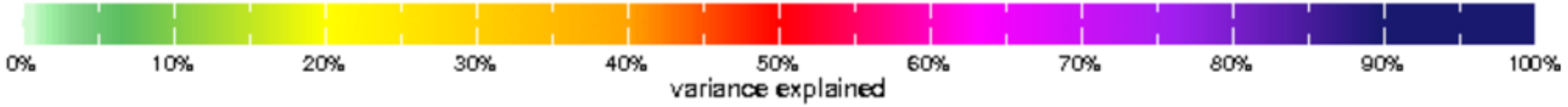
Trend ("Climate Change")



Interannual (year to year)





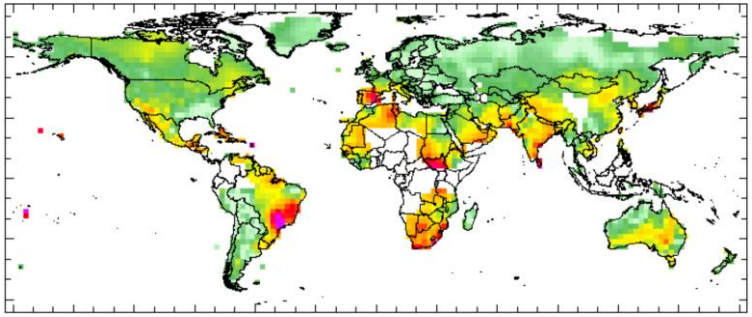


http://iridl.ldeo.columbia.edu/maproom/Global/Time_Scales/

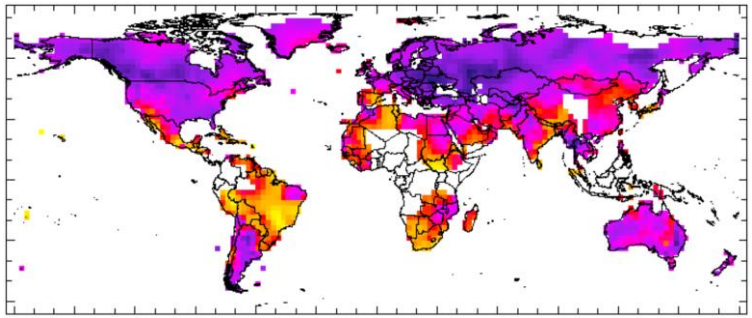
Temperature Temporal Scales: Trend, Decadal, Interannual

Example: Observed Annual Temperature in the Last 100 Years

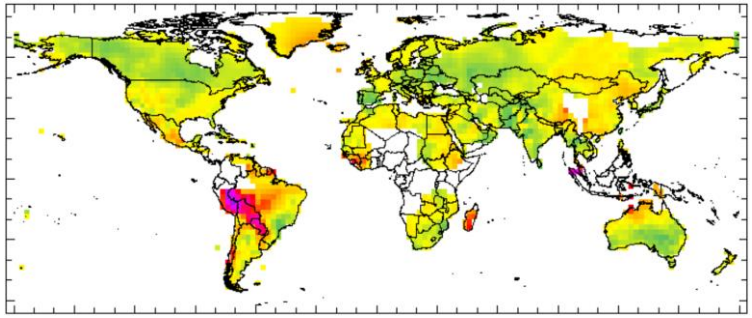
Climate Change (10 - 40%)

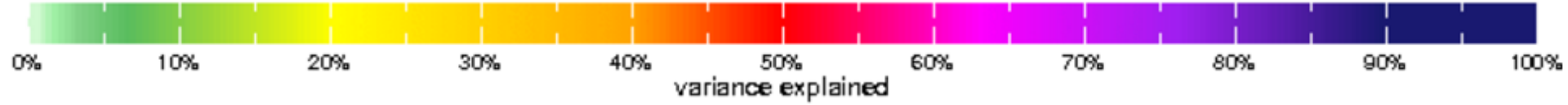


Year to Year (30 - 80%)



Decades (10 - 40%)

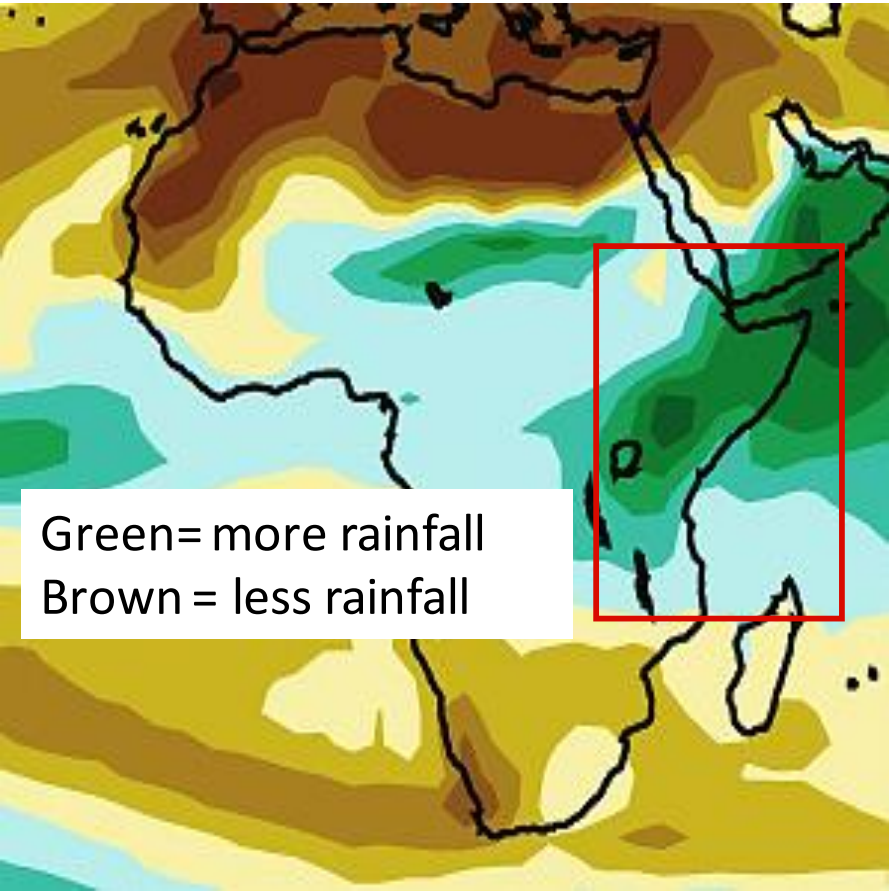




The Climate Paradox of East Africa:
Eastern Africa by 2100: Increased Rainfall?

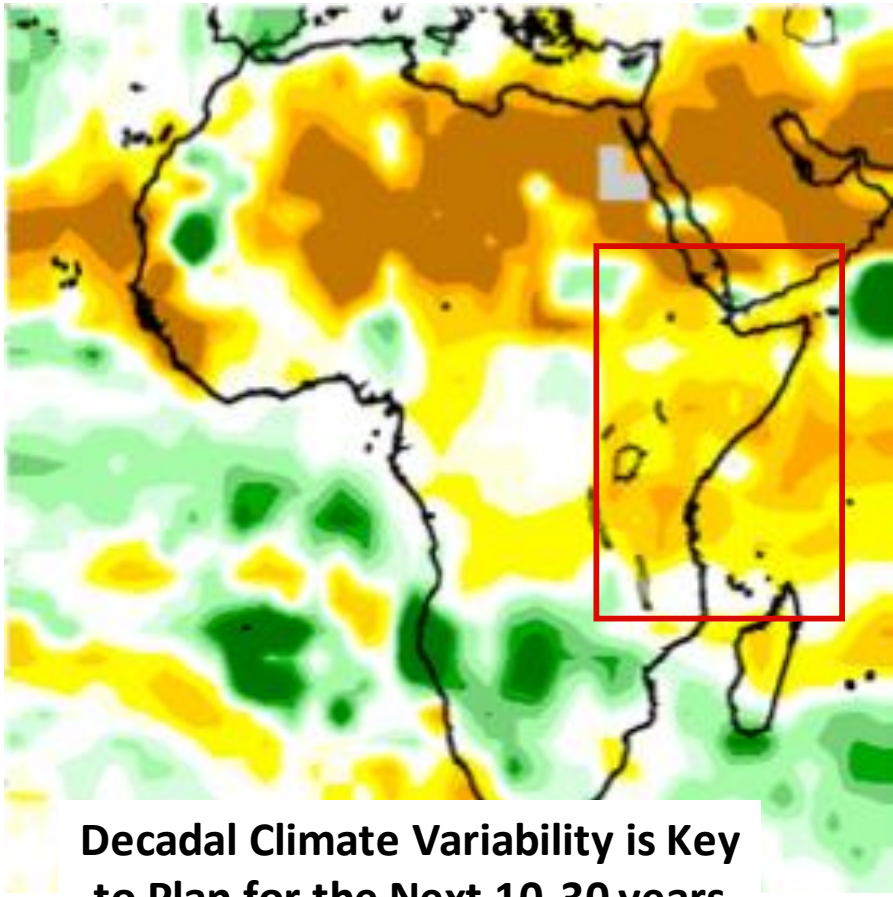
Climate Change Projections

(end of 21st Century)



Observations

(Last 15 years)



Decadal Climate Variability is Key to Plan for the Next 10-30 years

Brad Lyon, IRI / Un. Maine

Scenarios for Adaptation to Climate Change

Very far in the future: 2080-2100 *(and agendas with urgent needs)*

Very coarse in spatial scale *(and local needs)* Downscaling does not help…

Very uncertain (especially at local level, much worse for rainfall)

Models only consider "Trend" *(explains a small portion of variance)*

Difficult to consider in actual decisions

Need a Different Approach

Climate Change is a problem of the **PRESENT** (happening already) as opposed to a problem of the FUTURE

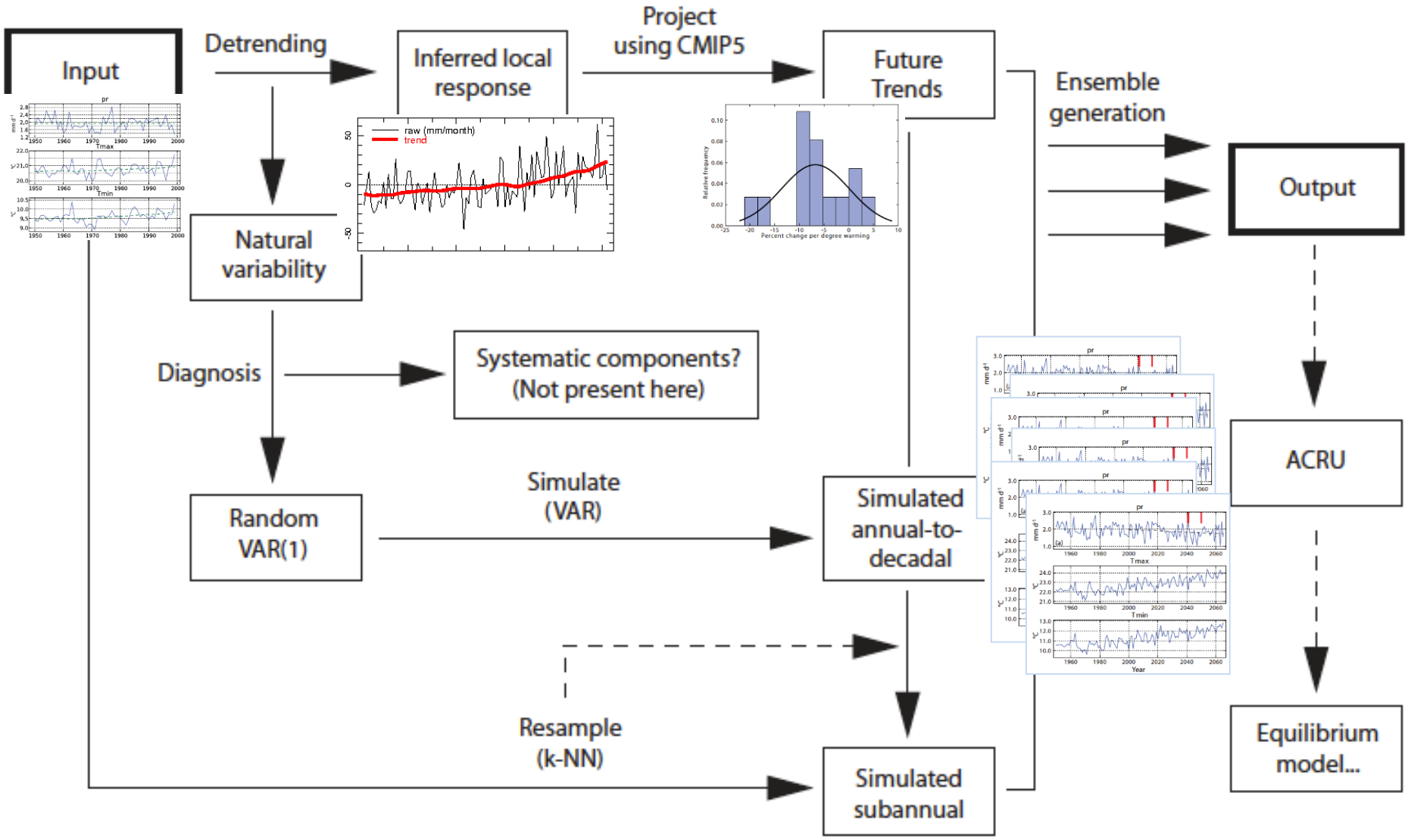
Some of the most damaging impacts of Climate Change:
Increased Year to Year Climate Variability (droughts, storms, heat waves)

Improving Adaptation to **Today's Climate Variability** will lead to **More Resilient Production Systems in the Future**

With this approach, actions are needed at a time scale that is relevant for Farmers, Policy Makers, Development Programs

Existing User Demand for Future Climate:
Infrastructure, Water Reservoirs, Development Programs
Work in "**Near-term**" **Climate Change** (i.e., 10-30 years)

SIMULATIONS: *Characterize variability on top of projected trends and decadal variability*



(Greene, et al. 2012)

Need a New Paradigm

Current Paradigm: Noah's Ark

Perfect Information about the Future: a Climatic Cataclism is coming
Action: Build infrastructure and save Biodiversity

But: We do not have (will not have) Perfect Information of the Future Climate

(R. Terra, 2017, in prep)

Paradigm 2: Ginkgo biloba

Somehow 6 Ginkgos Survived
How? Why?

- 2 million years of Evolution
- Adapted (resilient) to a wide range of conditions
- Survived an unprecedent extreme event (bomb)

Ginkgo at Shukkeien garden in 1945

Ginkgo biloba

Approx 1,000m from epicenter in Hiroshima

Paradigm: Adapt with "flexibility"

- **We will not have "perfect" information**
- **Adapt to a range of plausible conditions**
- **Start by Adapting to Today's Climate Variability**

(R. Terra, 2017, in prep)

Final Comments

Development, Agriculture and Climate Change

Climate Change: Key is Reducing Net Emissions of GHG
But: Need to Adapt

Limitations of Traditional Approach *(Scenarios, Uncertain, Far in the Future, Explain little Variance, Can Lead to Mal-Adaptation)*

A Smart Way to Improve Adaptation to Future Climate is Start by Improving Adaptation to Current Climate (CSA). Attractive to Policy / Development Plans

Adapt with Flexibility, Seek Resilience: Gingko Biloba vs Noah's Ark

Thank you

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