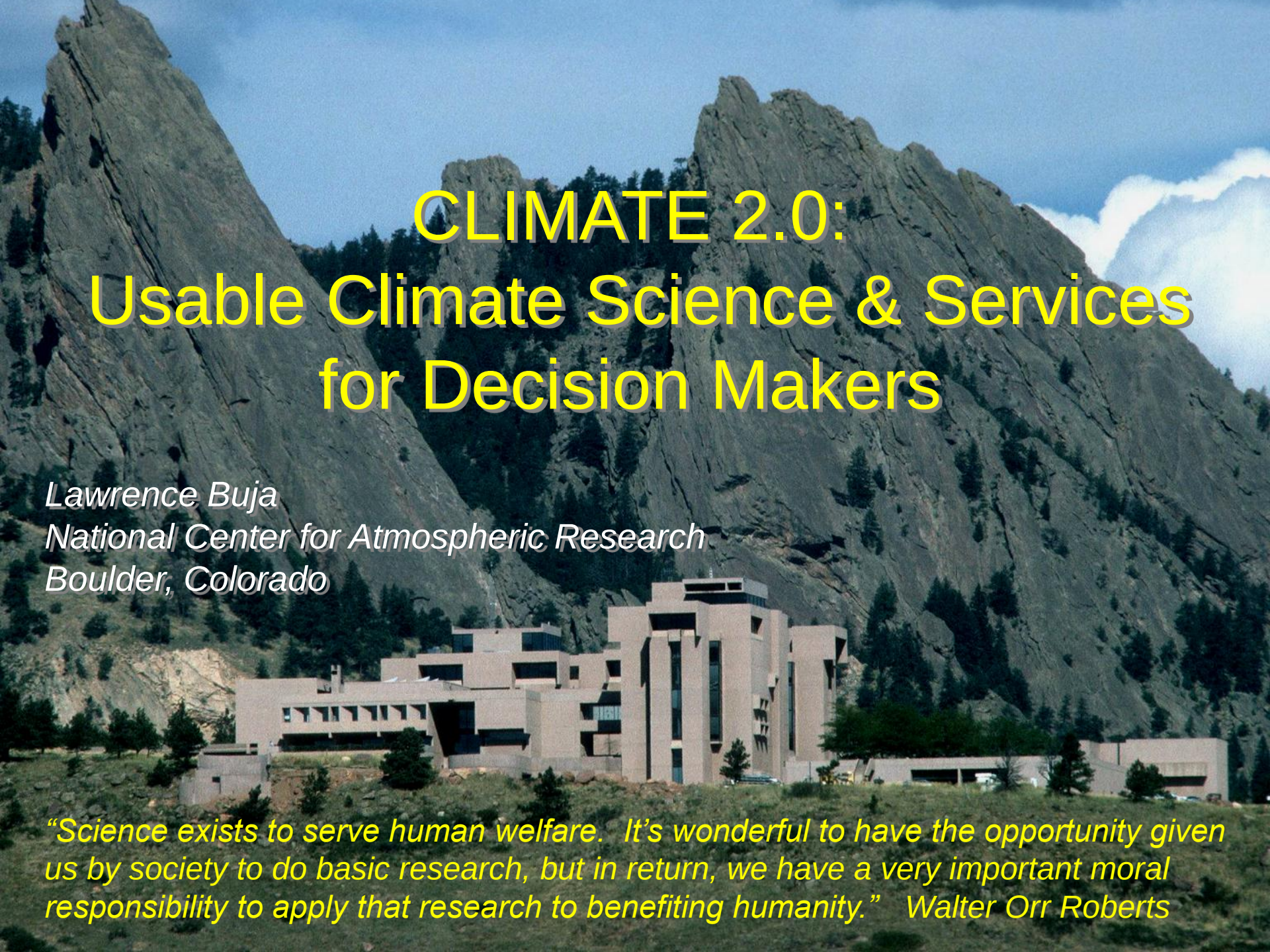


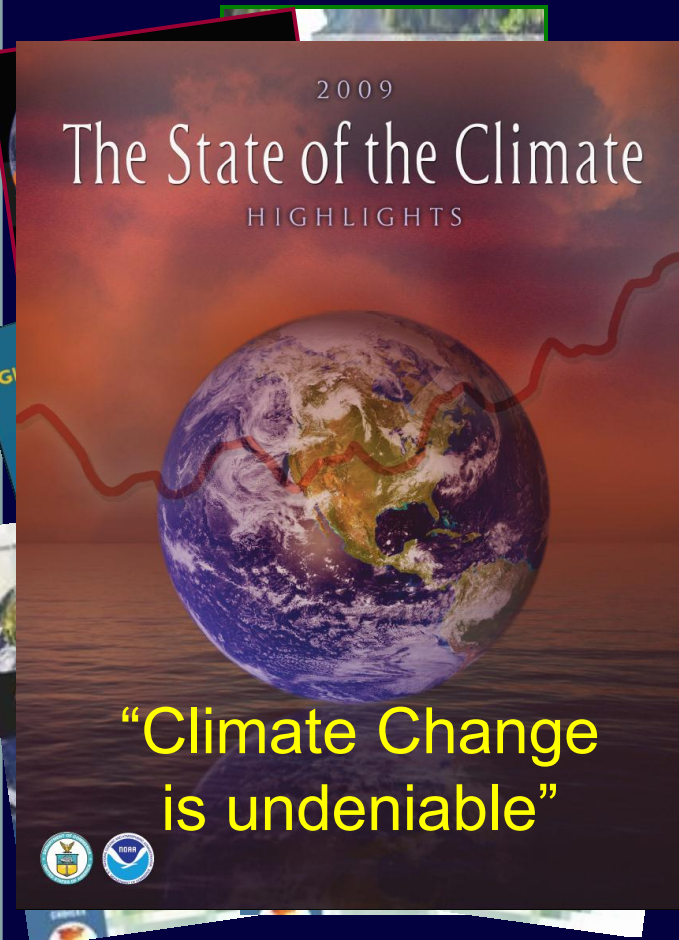


CLIMATE 2.0: Usable Climate Science & Services for Decision Makers

*Lawrence Buja
National Center for Atmospheric Research
Boulder, Colorado*

“Science exists to serve human welfare. It’s wonderful to have the opportunity given us by society to do basic research, but in return, we have a very important moral responsibility to apply that research to benefiting humanity.” Walter Orr Roberts

Spin, Science and Climate Change



4 Core Conclusions from Climate Science

1. Climate Change is occurring.
2. Main cause is human activity.
3. Changes in climate are already harming humans & the environment.
4. Harm is like to grow to higher levels w/o extensive Adaptation & Mitigation

Robust results, independent of hacked emails or minor errata in the IPCC report

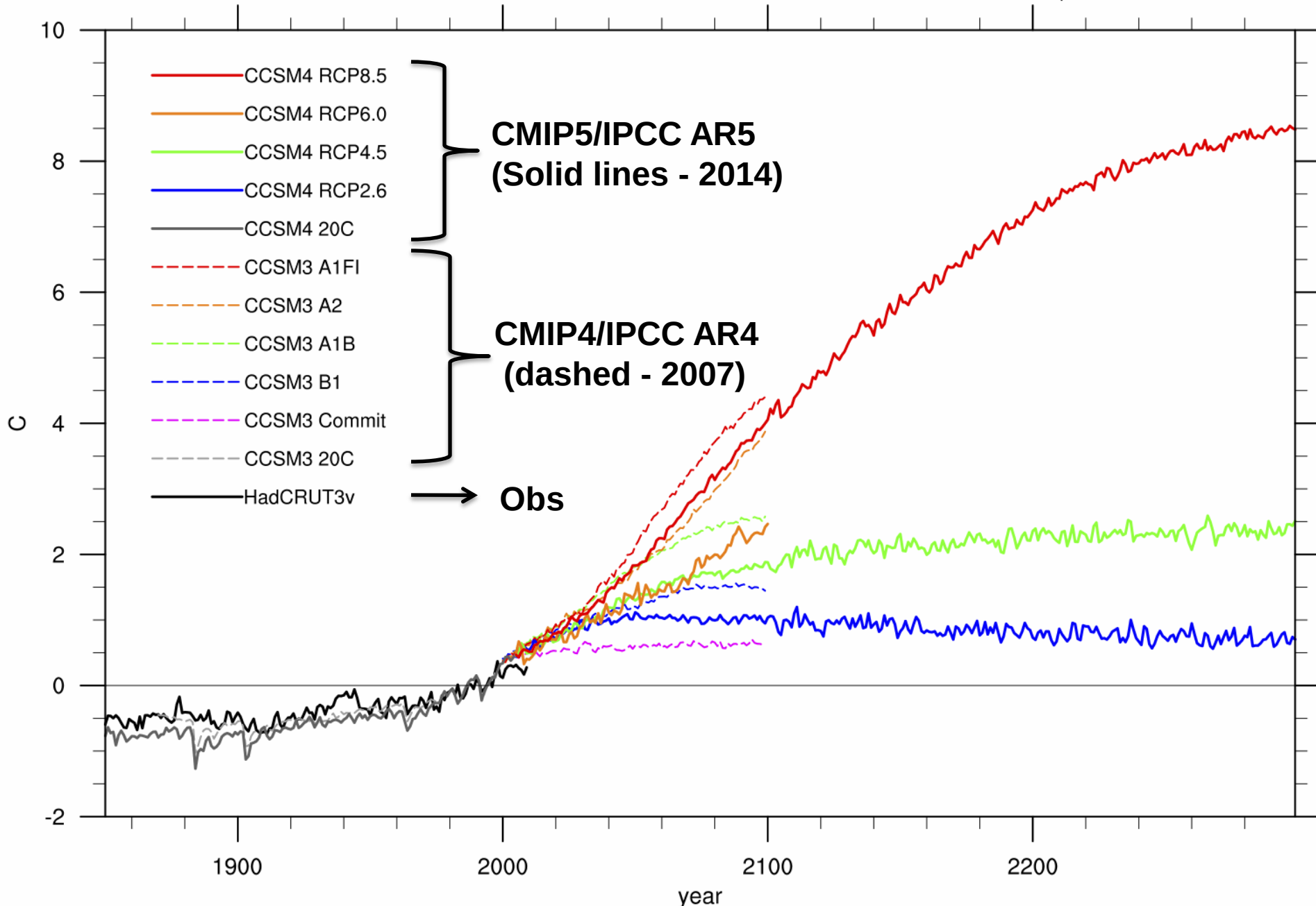
“Society has three choices: Mitigate, Adapt or Suffer”

John Holdren (US Science Adviser)

Surface temperature

anomaly from 1980-1999, annual and global mean

Sat Apr 23 09:58:32 MDT 2011



Climate 2.0 - Usable Science for Society

The fundamental question that society is asking of climate science has dramatically changed.

Climate 1.0 Is anthropogenic climate change occurring?

- Classic, low-resolution, global climate modeling (past 40 years)
- After IPCC AR4 findings, the question is now....

Climate 2.0 What is the impact of this climate change on our coupled human & natural systems?

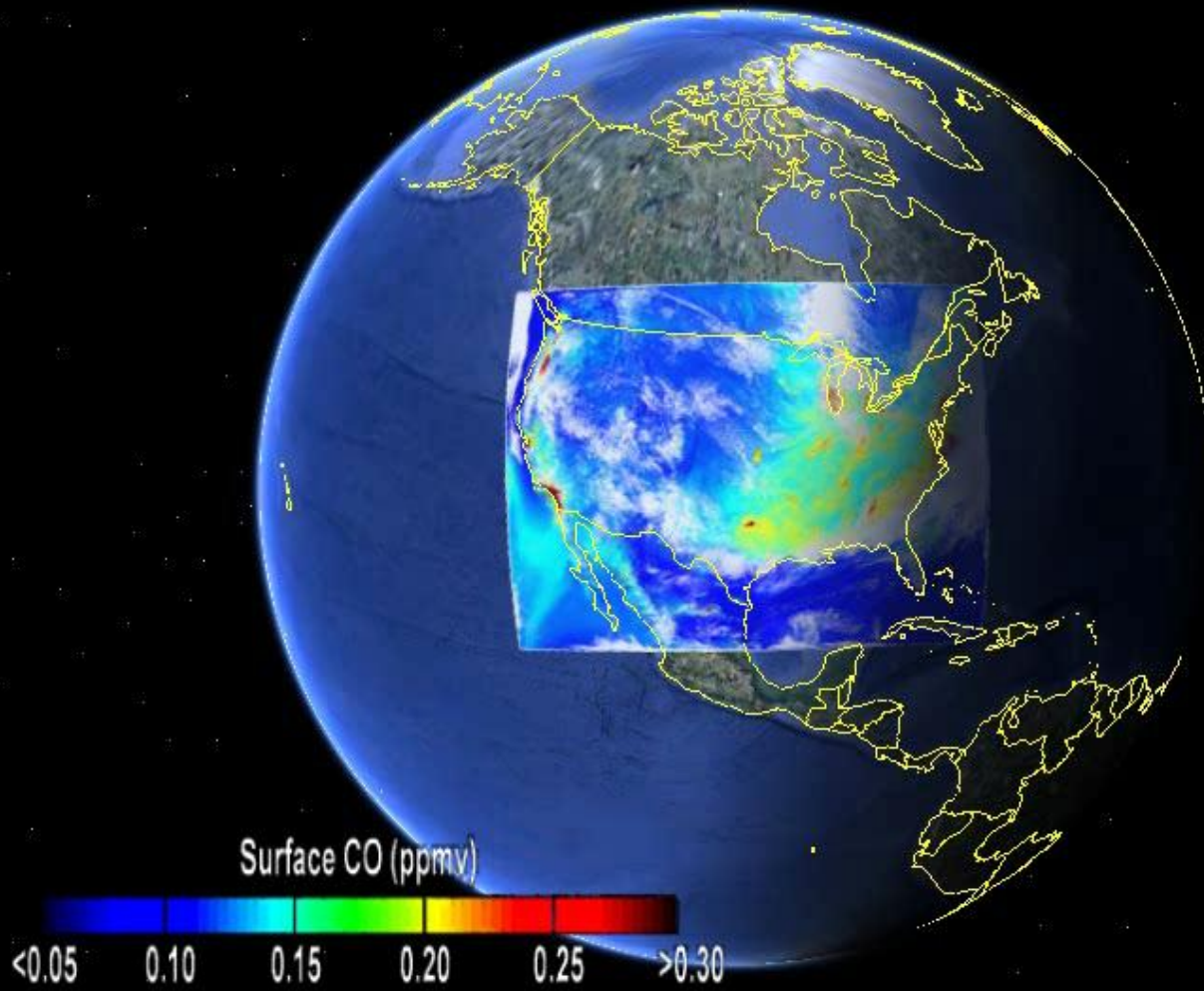
- Magnitude and speed? Direct and indirect impacts?
- Adaptation and mitigation - options & limits?
- Regional/Local focus on “usable” science
- Sustainable Systems: Energy, Food, Water, Health, Cities, Ecosystems
- Societal Impacts: GIS, extremes, climate services

Addressing these much more complex, questions requires:

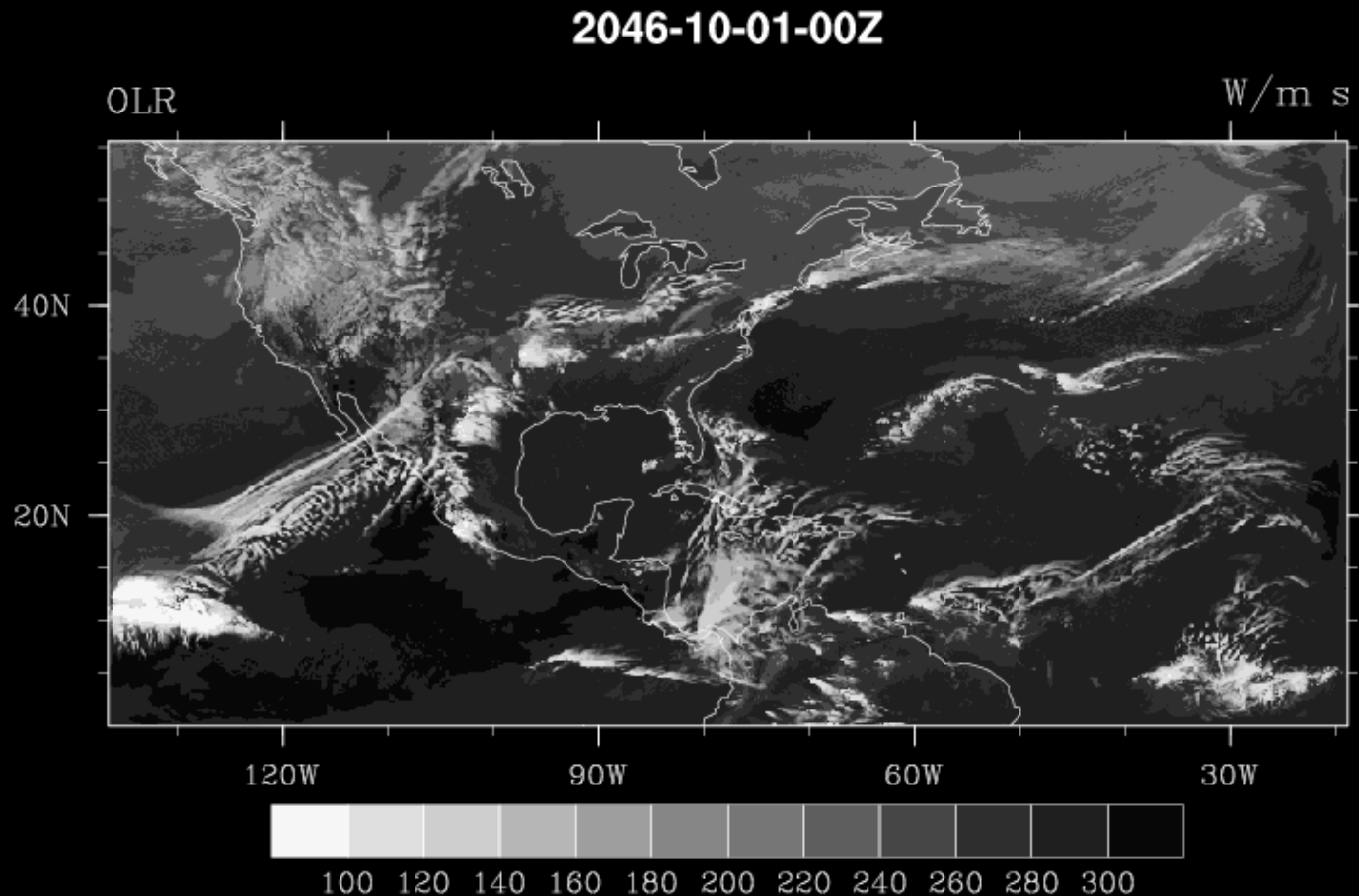
- Vast improvements to existing climate tools (CESM & WRF/NRCM)
- Integrating new approaches, priorities, capabilities,
- New collaborators & partners

Precision WRF: WRF-Hurricane, WRF-Chem, WRF-Health, WRF-Crop

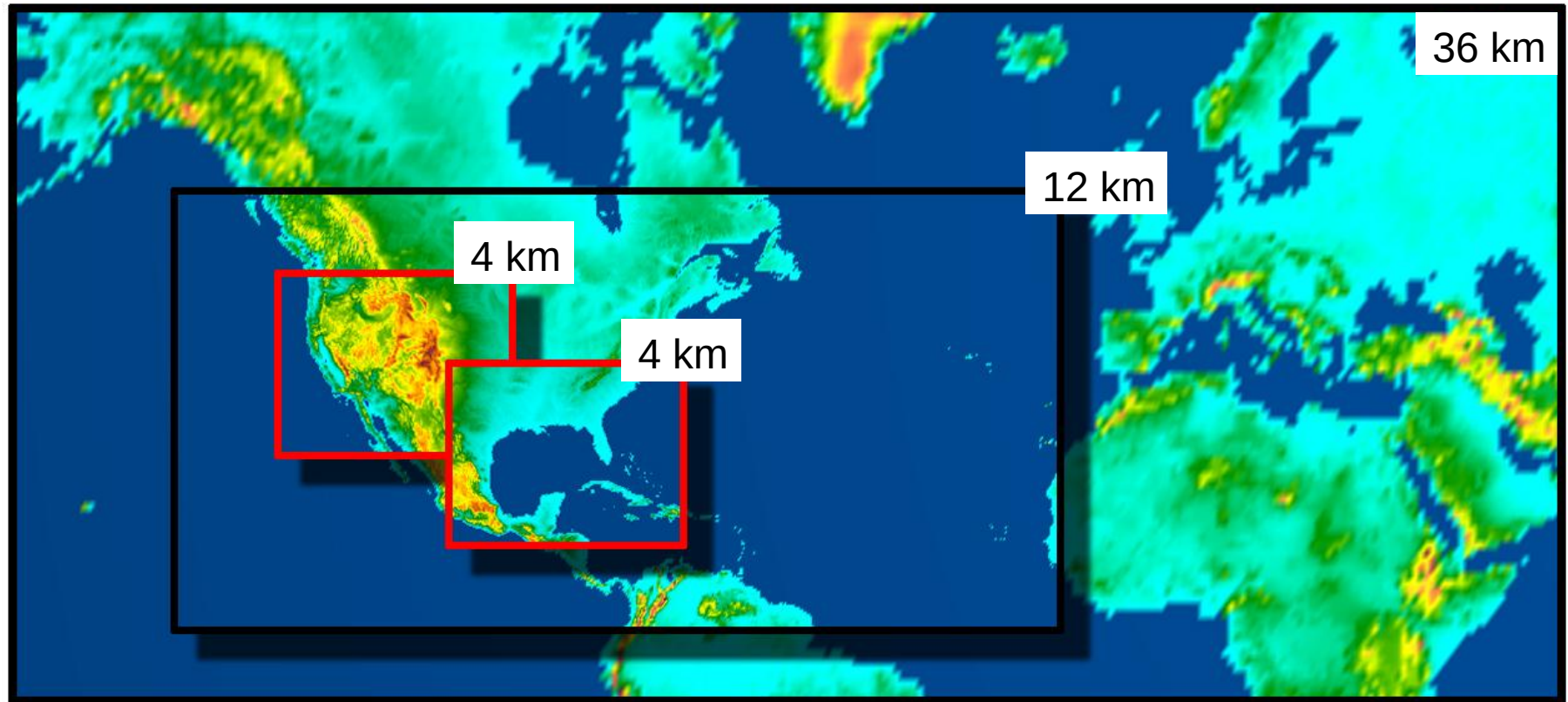
WRF Chem predicting CO concentrations across US
based on known emissions and prevailing weather



Regional Climate Simulation for 2046



Multi-decadal Regional Climate Predictions of High-Impact Weather Over North America & the Caribbean



- Global Model: 3 Ensembles from 1950-2060
- NRCM: 1995-2005 Obs, 1995-2005, 2020-2030, 2045-2055,
- 3 ensembles at 36km, 1 at 12 km, specific cases at 4 km.
- Use of statistical downscaling to fill in intermediate periods

Climate Services:

“The timely production and delivery of useful climate data, information and knowledge to decision makers”

(NRC, 2001)

“Give me information in such a way that I can make decisions at a local level. What does this mean for me in the next 3-5 years”

- Jargon-free, clear,
- actionable,
- expose the uncertainties
- Science-brokers/translators are important

(Pew Report “Lost in Translation”)

“Issued” climate products & processes allow planners to move ahead with major, climate-informed, infrastructure decisions
....and stay out of court.

Climate Services:

“Issued” climate processes and products....

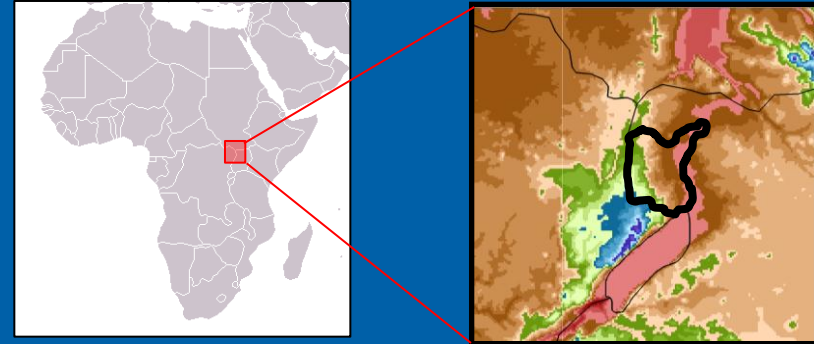
- Decision makers are being approached by many consultants, but can't tell good from bad
- How to define these processes and products?
 - What metrics would regions/sectors have for success?
 - Quantification/communication of uncertainty and applicability?
 - Issued $\neq$ perfect (e.g. NWS weather forecasts)
 - WH OSTP/CEQ: not 1 big center, nor many new small centers, -> interface between existing data centers + domain expertise
 - How to connect public data & private sector decision networks?
 - Structure under development, yet decisions are being made NOW
- Strong push to Federate existing data portals

Weather, Climate and Health

Mary Hayden, Andy Monaghan

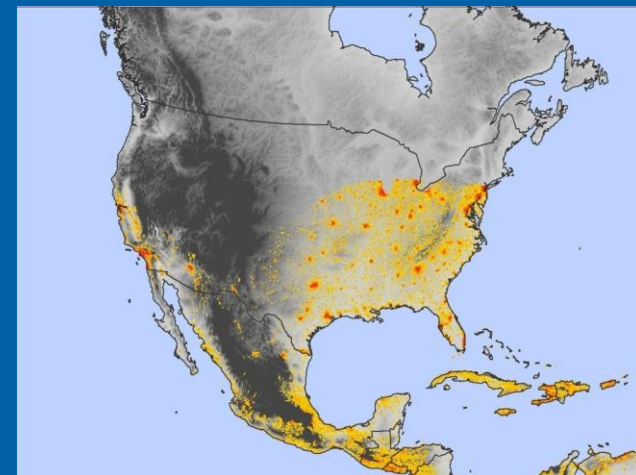
**Uganda: CDC Modeling Human
Plague Incidence**

Ghana: The WX-Meningitis Project

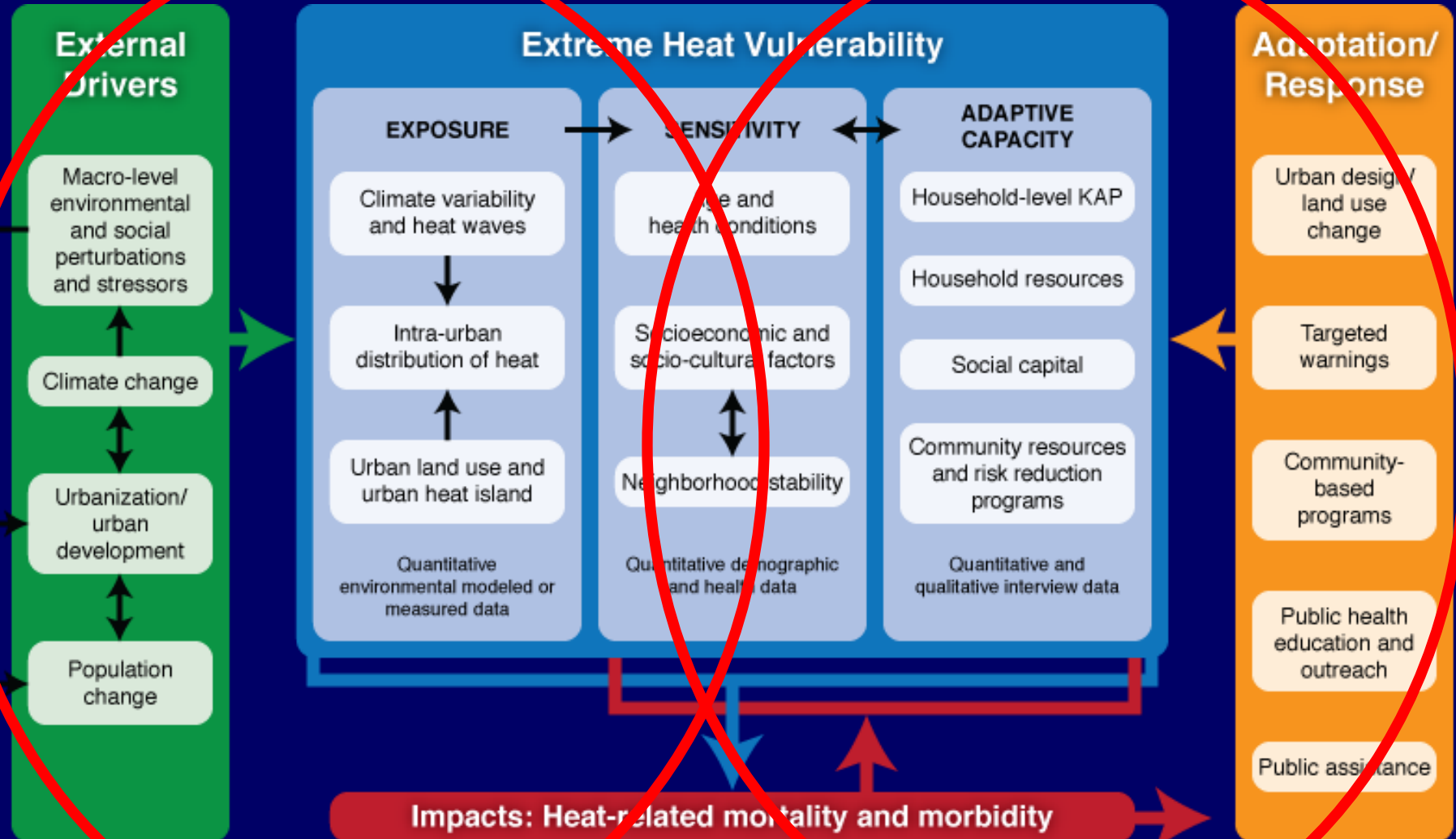


**Phoenix: An Framework of local Vulnerability
& Adaptive capacity to Extreme Heat**

**North America: *Aedes aegypti* range
expansion in the Americas
Mexico: Dengue transects**

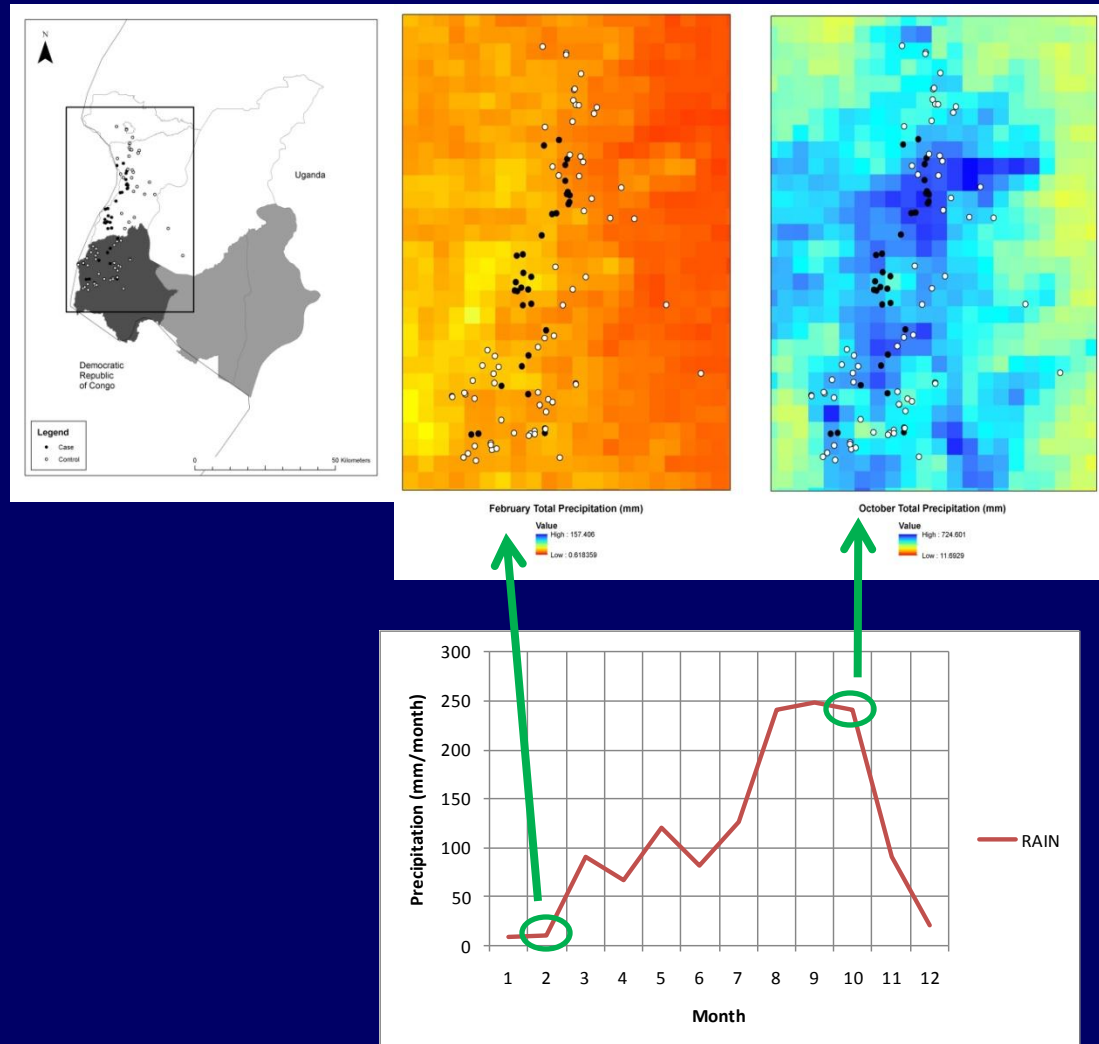


Extreme Heat Vulnerability Framework



Plague cases are associated with wetter areas above the Rift Valley escarpment

- Case and control locations were discriminated based on the following climatic variables (10 yr averages).
 - Total precipitation in February (dry season) (+)
 - Total precipitation in October (wet season) (+)
 - January specific humidity (-)
 - Above 1300 m (+)
- AUC = 0.93



Thanks! Any Questions?



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