The Need for Common Dialogue and Communication

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What can both sides, climate and health, learn from each other?
What opportunities exist for cross disciplinary research?
What common language can be developed?
What is the present state of uncertainty and certainty in climate science and related dangers in overselling?
What are the challenges with working with uncertain information?
Regional limitations in today's climate models and role of downscaling?
Status of regional/sector applications
Warming is Unequivocal

- Rising atmospheric temperature
- Rising sea level
- Reductions in NH snow cover
- And oceans...
- And upper atmosphere....

Changes in Temperature, Sea Level, and Northern Hemisphere Snow Cover

(a) Global mean temperature
(b) Global average sea level
(c) Northern hemisphere snow cover
Most of the global average temperature increase of the past 50 years is very likely (90%) due to GHG increases [IPCC, 2007]
Key Points:

- Warming pattern similar in all panels, magnitude different.
- This pattern will be overlaid with natural variability.
- Land areas tend to warm more than adjacent oceans.
- High latitudes tend to warm more than low latitudes.
New in AR4: Drying in much of the subtropics, more rain in higher latitudes, continuing the broad pattern of rainfall changes already observed. Note improved agreement of pattern of currently observed rainfall and models. But... heavy precip?
Key Points:
- Precipitation changes more uncertain than temperature changes.
- Models do not agree on *sign* of the change in many areas.
- High latitudes tend to receive more precipitation, especially in winter.
- The Mediterranean region tends to dry.
Unprecedented rise in long-lived anthropogenic greenhouse gases, a "driver" of climate change.

Warming of the climate system is unequivocal. Warming unusual in at least the last 1300 years.

Most of the increase in global-mean temperatures since mid-20th century is very likely due to anthropogenic greenhouse gas increases.

Better understanding of water vapor feedback results in better estimate of the range for climate sensitivity.

Climate projected to warm further; increased greenhouse gases are very likely larger changes than observed in 20th century, and higher confidence in projected patterns of warming.
Uncertainties/ gaps
Understanding and attribution

§ Confidence in attributing some climate change phenomena limited by uncertainties in forcing, feedbacks and observations

§ Attribution at smaller than continental scales and time scales less than 50 years limited by larger climate variability on smaller scales, uncertainties in small-scale forcing details, and uncertainties in simulations at such scales including modes of variability

§ Less confidence in understanding of forced changes in precipitation and surface pressure than in temperature

§ Incomplete global data for analyses of extremes, and model uncertainties still restrict regional detection studies of extremes

§ Uncertainties in model-simulated internal variability still limit some aspects of attribution studies e.g., ocean heat content

§ Limitations in modeling leading to uncertainties in quantifying the anthropogenic contributions to sea level rise
Uncertainties/ gaps

Model evaluation and climate sensitivity

$\$ Proven set of metrics comparing simulations with observations, for use in narrowing range of climate projections, yet to be developed.

$\$ Most models continue to have difficulty controlling climate drift, particularly in the deep ocean.

$\$ Problems remain in simulation of some modes of variability (e.g., MJO, recurrent ‘blocking’, extreme precipitation).

$\$ Systematic biases in most models’ simulation of SO linked to uncertainty in the transient climate response

$\$ Models remain limited by the: spatial resolution afforded by present computer resources; need for more ensembles; and by the need to include additional processes.

$\$ Models differ considerably in the strengths of the different climate feedbacks.

$\$ Large uncertainties remain about cloud feedbacks.
Uncertainties/ gaps

Global Projections

§ Likelihood of a large abrupt change in MOC beyond end of 21\textsuperscript{st} C cannot yet be assessed reliably. A permanent reduction in MOC cannot be excluded if the forcing is strong and long enough.

§ Model projections for extremes of precipitation show larger ranges in amplitude and locations than for temperature.

§ Responses of some major modes of climate variability (e.g., ENSO) still differs from model to model; may be associated with differences in space-time representation of present-day conditions.

§ Robustness of many model responses of tropical cyclones to climate change is still limited by the spatial resolution.

§ Changes in key processes that drive some global and regional climate changes are poorly known (e.g., ENSO, NAO, MOC, land-surface feedbacks, tropical cyclone distribution).

§ Magnitude of future carbon cycle feedbacks is till poorly determined.
Open Questions

§ Attribution of rainfall changes, why are observed rainfall and SLP changes larger than simulated, role of aerosol forcing?

§ Extremes: few attribution studies. Large observational uncertainties (for example, for changes in tropical cyclones)

§ Ocean heat content variability poorly understood

§ Changes in modes of climate variability poorly understood

§ Understanding impacts really needs credible results on regional scales, affected by modelling and forcing uncertainties
Smaller scales:

- Difficulties remain in reliably simulating and attributing observed temperature changes at smaller scales.
- Natural variability higher
- Uncertainties in forcings, feedbacks, and teleconnections

=> GHG contribution difficult to estimate.

However, these scales are essential for impacts – and connect closely to WGII questions.
Uncertainties/ gaps

Regional projections

$ In some regions, there has been only very limited study of key aspects of regional climate change, particularly with regard to extreme events.

$ Coupled climate models show no consistency in simulated regional precipitation change in some key regions (e.g., northern South America, northern Australia and the Sahel).

$ In many regions where fine spatial scales in climate are generated by topography, there is insufficient information on how climate change will be expressed at these scales.
Regional modeling:

High resolution, nested, embedded, or stretched grid models.

Boundary conditions often provided by coarse grid, global models, issues of both downscaling and upscaling

Considerably less international coordination/archives

PRUDENCE, (regional downscaling for Europe) is best example

NARCCAP (downscaling over North America) is patterned after PRUDENCE

Statistical downscaling relies on stationary statistics

Winter mean precipitation in Western U.S.
The Regional Integrated Sciences and Assessments (RISA) Program

A goal of the RISA program is to enable decision-support that will:

• reduce vulnerability to seasonal to centennial climate variation (and change)

• create opportunities in the face of climate variation (and change)

• enable the best return for climate science investment
The Regional Integrated Sciences and Assessments (RISA) Program

**ARE stakeholder-driven**

**ARE all about partnership**
- with stakeholders
- with federal, state and local agencies (funding, research and operations)

**ARE interdisciplinary, place-based and multi-stress oriented**

**ARE focused on a RISA research process:**
- assessments and problem identification
- integrated/interdisciplinary research
- provision and assessment of prototype information, methods and tools
The Regional Integrated Sciences and Assessments (RISA) Program

ARE NOT just climate change science (instead, the focus is on seasonal to centennial-scale climate variability)

ARE NOT climate change assessment (instead, the focus is on assessing stakeholder needs and how well we can meet them)

ARE NOT basic or applied research (instead, the focus is on “user-driven research”)

ARE NOT an operational program (instead, the focus is on iterative process of translational research, prototyping and assessment)
RISA’s are spreading to regions that can benefit from improved climate decision-support...
The Regional Integrated Sciences and Assessments (RISA) Program

§ Lessons learned

It isn’t just climate: *multi-stress approach is key*

Decision-driven “place-based” climate science works (demand exists and *is growing*).

Development and maintenance of stakeholder *partnerships can only take place at local to regional scales*.

*Regional stakeholder partnerships must be sustained to ensure credibility (and maintain trust) with partners (otherwise, partnerships are at risk).*
**climate**
temperature, precipitation, humidity, extreme weather events

**biology**
microbe replication/movement, vector reproduction/movement, microbe/vector evolution

**ecosystem**
vegetation, soil moisture, species competition

**social factors**
sanitation, vector control, travel/migration, behavior/economy, population/demographics

**disease outcome**
risk, rate of transmission
The IRI Mission

IRI’s mission is to enhance society's capability to understand, anticipate and manage the impacts of seasonal climate fluctuations, in order to improve human welfare and the environment, especially in developing countries.
Approach

- Problem focus
- Partnerships/collaboration
- Research/learning
- Tailoring of information/tools development
- Demonstration of potential value
- Capacity building
- Improved decisions
In Africa, the semi-arid areas are prone to negative, anti-development outcomes such as hunger (figure 1), disasters (figure 2), and epidemic disease outbreaks (figures 3-4).

These breakdowns occur as climate impacts accrue across many sectors, and ripple through the economy.
Semi-arid = variable climate

- Drought constitutes the lower tail of the rainfall distribution
- Impacts also occur in high-precipitation years
Public Health

Malaria in Botswana

- Epidemic prone country
- Good surveillance system for epidemics
- 20 years of data for historic analysis
- Interested in incorporating seasonal climate forecasts into malaria control planning (Currently: observed climate anomalies)
Activities:
Demonstrate the use of climate information in malaria control

Expected Output
Malaria Early Warning System

RBM
MoH
WHO
Examples of On-going Activities

Anomalies in DJF SSTs, DJF rainfall (CMAP) and national malaria incidence (Jan-Jun) in Botswana (1982-2003)

SSTs  DJF and Malaria:
Potential of Seasonal Climate Forecast to predict high/low Malaria years
Observed rainfall and DEMETER rainfall forecast in relation to high and low malaria anomaly years

Information can be used to initiate timely interventions
Tailored malaria forecast made December, for DJF 2004-05

Map A: Probability of dry

V: 25%
IV: 35%
III: 30%
II: 10%
I: 10%

Map B: Probability of wet

V: 25%
IV: 15%
III: 15%
II: 35%
I: 40%
In summary, the intersection of climate change and human health occurs at each stage of the following:

Innovative working relationships are needed to promote and sustain dialogue and communication across and among the climate change and human health communities, near term opportunities involving T+P.