

# **Are there Tensions between the Climate Science Community and the Impacts, Adaptation, Vulnerability Community?**

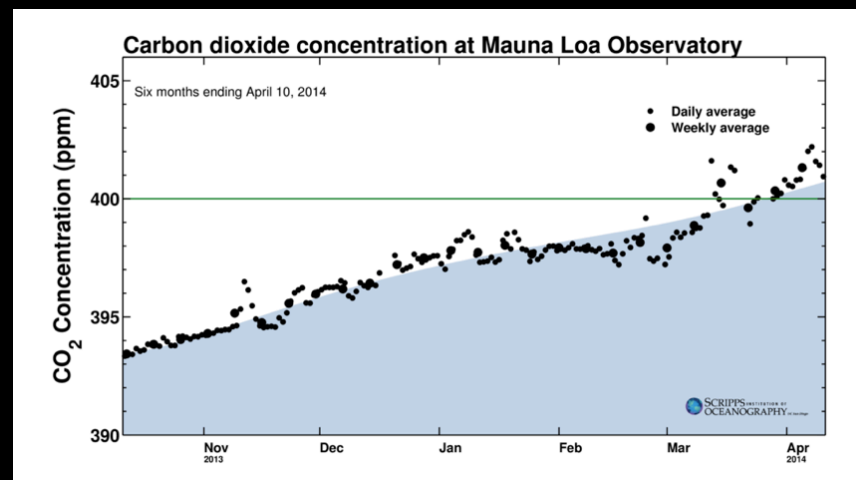
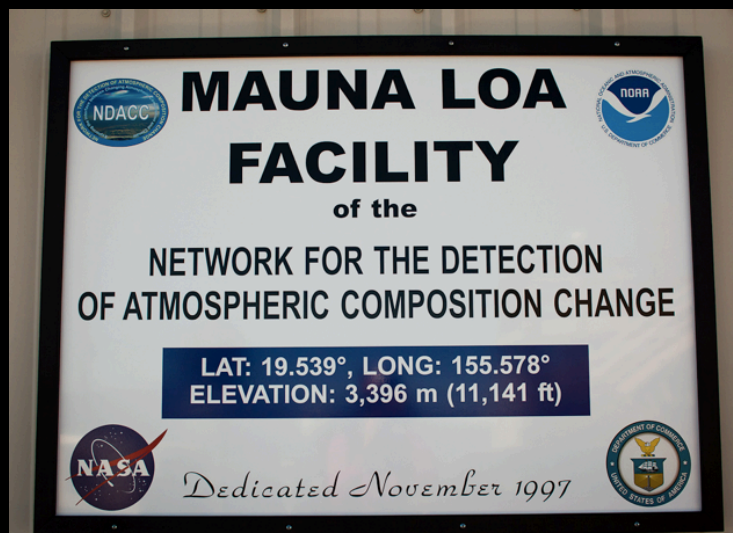
Guy P. Brasseur  
Aspen, CO, 2014

“Climate mitigation policy no longer  
needs a better understanding of  
climate”

*A person responding  
to the survey organized  
by WCRP 2014*

**An Historical Perspective of the  
Progress made by the Science in the  
last 50 years**

# Keeling





# An Important Milestone



This conference was followed by other UN conferences in Rio de Janeiro in 1992 and 2012.

- *The landmark UN Stockholm Conference* in 1972 recognized that:
- science and technology should be used to improve the environment,
- research and education in environmental sciences should be promoted,
- cooperation on international issues should be regarded as essential.



United Nations Environment Programme  
environment for development



Climate  
Change



Disasters  
& Conflicts



Ecosystem  
Management



Environmental  
Governance



Chemicals  
& Waste



Resource  
Efficiency



Environment  
Under Review

## Mission

"To provide leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations."



## Climate Change

Introduction | Science | Tools | Partners



**United Nations**  
Framework Convention on  
Climate Change

### Adaptation

Building resilience to  
climate change

### Mitigation

Moving towards low  
carbon societies

### REDD+

Reducing  
Emissions from  
Deforestation and  
forest Degradation

### Finance

New finance  
models for the  
green economy

In 1967, taking advantage of the ability of digital computers to numerically integrate absorption curves, Syukuro Manabe and Richard Wetherald made the first detailed calculation of the greenhouse effect incorporating convection (the "Manabe-Wetherald one-dimensional radiative-convective model"). In 1975, they redo the calculation with a GCM.



VOL. 32, NO. 1

JOURNAL OF THE ATMOSPHERIC SCIENCES

JANUARY 1975

## The Effects of Doubling the CO<sub>2</sub> Concentration on the Climate of a General Circulation Model<sup>1</sup>

SYUKURO MANABE AND RICHARD T. WETHERALD

*Geophysical Fluid Dynamics Laboratory/NOAA, Princeton University, Princeton, N.J. 08540*

(Manuscript received 6 June 1974, in revised form 8 August 1974)

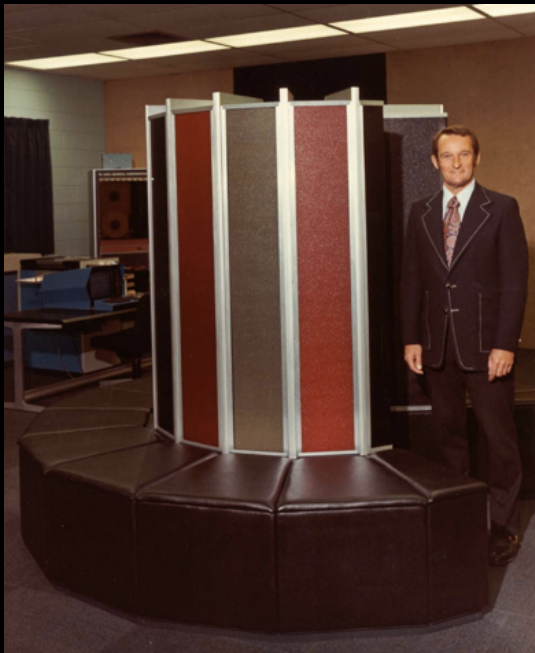
### ABSTRACT

An attempt is made to estimate the temperature changes resulting from doubling the present CO<sub>2</sub> concentration by the use of a simplified three-dimensional general circulation model. This model contains the following simplifications: a limited computational domain, an idealized topography, no heat transport by ocean currents, and fixed cloudiness. Despite these limitations, the results from this computation yield some indication of how the increase of CO<sub>2</sub> concentration may affect the distribution of temperature in the atmosphere. It is shown that the CO<sub>2</sub> increase raises the temperature of the model troposphere, whereas it lowers that of the model stratosphere. The tropospheric warming is somewhat larger than that expected from a radiative-convective equilibrium model. In particular, the increase of surface temperature in higher latitudes is magnified due to the recession of the snow boundary and the thermal stability of the lower troposphere which limits convective heating to the lowest layer. It is also shown that the doubling of carbon dioxide significantly increases the intensity of the hydrologic cycle of the model.

# Past Accomplishments of the Science

## The 1970s

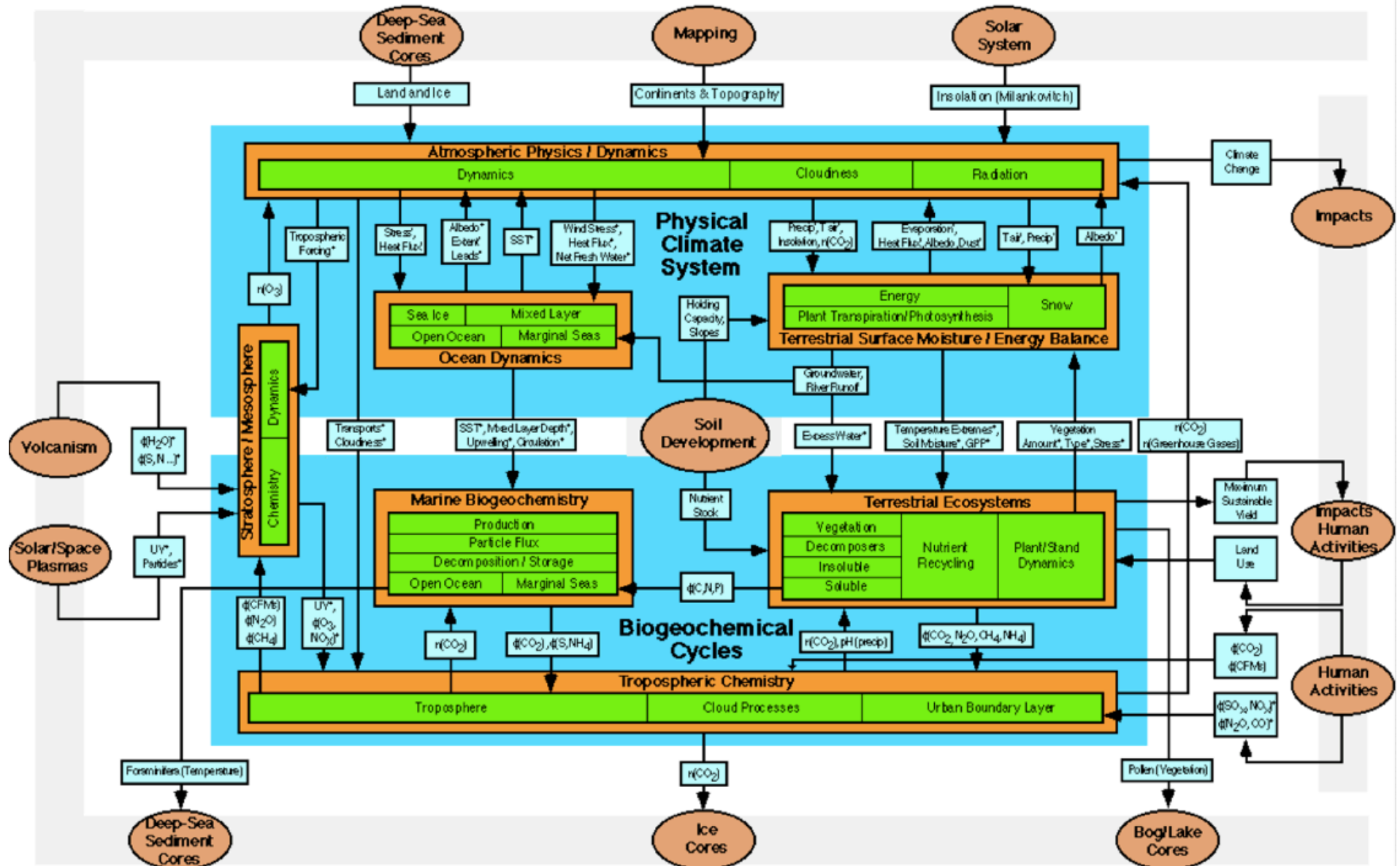
- ❑ Vector super-computing is born
- ❑ Satellite data transforms the field
- ❑ Global warming is simulated





# The Bretherton Diagram

CONCEPTUAL MODEL of Earth System process operating on timescales of decades to centuries



\* = on timescale of hours to days    \* = on timescale of months to seasons     $\phi$  = flux    n = concentration



Cryosphere and Climate



Cryosphere and Climate

Water, Energy and Climate

Atmosphere, Oceans and Climate

Atmospheric Chemistry and Dynamics

Climate Projections: Past, Present and Future

### Tweets

Follow

**WCRP**  
@WCRP\_climate  
21 Mar  
#LACC2014 seek to set a science agenda for improving capabilities of NHMs and climate services in Latin America and Caribbean region

**WCRP**  
@WCRP\_climate  
21 Mar

### WCRP conferences

Trending Now: Water



### WCRP upcoming events



**WCRP Grand Challenge**

### WCRP News

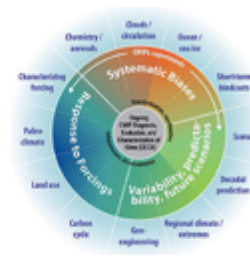
#### The 5th SPARC General Assembly in Brief 13.03.2014



Approximately 300 scientists from around the world participated in the **5th SPARC General Assembly**, which was held in Queenstown, New Zealand, on 12-17 January 2014. The program reflected the recently

### Science Highlights

#### CMIP6: Preparing for the Next Phase 21.03.2014



With the fifth phase of the Coupled Model Intercomparison Project (CMIP) mostly completed, the WCRP Working Group on

WMO Global Framework for Climate Services



Future Earth



## ABOUT

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## LATEST NEWS



**Mar 20, 2014**  
**Conference - Global  
Challenges: Achieving  
Sustainability**



photo: NASA-Visible Earth

## About

IGBP was launched in 1987 to coordinate international research on global-scale and regional-scale interactions between Earth's biological, chemical and physical processes and their interactions with human systems. IGBP views the Earth system as the Earth's natural physical, chemical and biological cycles and processes AND the social and economic dimensions.

Translate with Google Translate

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**IGBP CLIMATE CHANGE INDEX**



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## NEXT EVENTS

**Apr 7 - Apr 11, 2014**  
**29th IGBP SC Meeting**

**Apr 7 - Apr 12, 2014**  
**Arctic Science Summit**



# Earth System Science: the big picture

Ability to give the earth a "health check"

EO for Climate (Earth system)  
Diagnosis & Prediction

Cryosphere

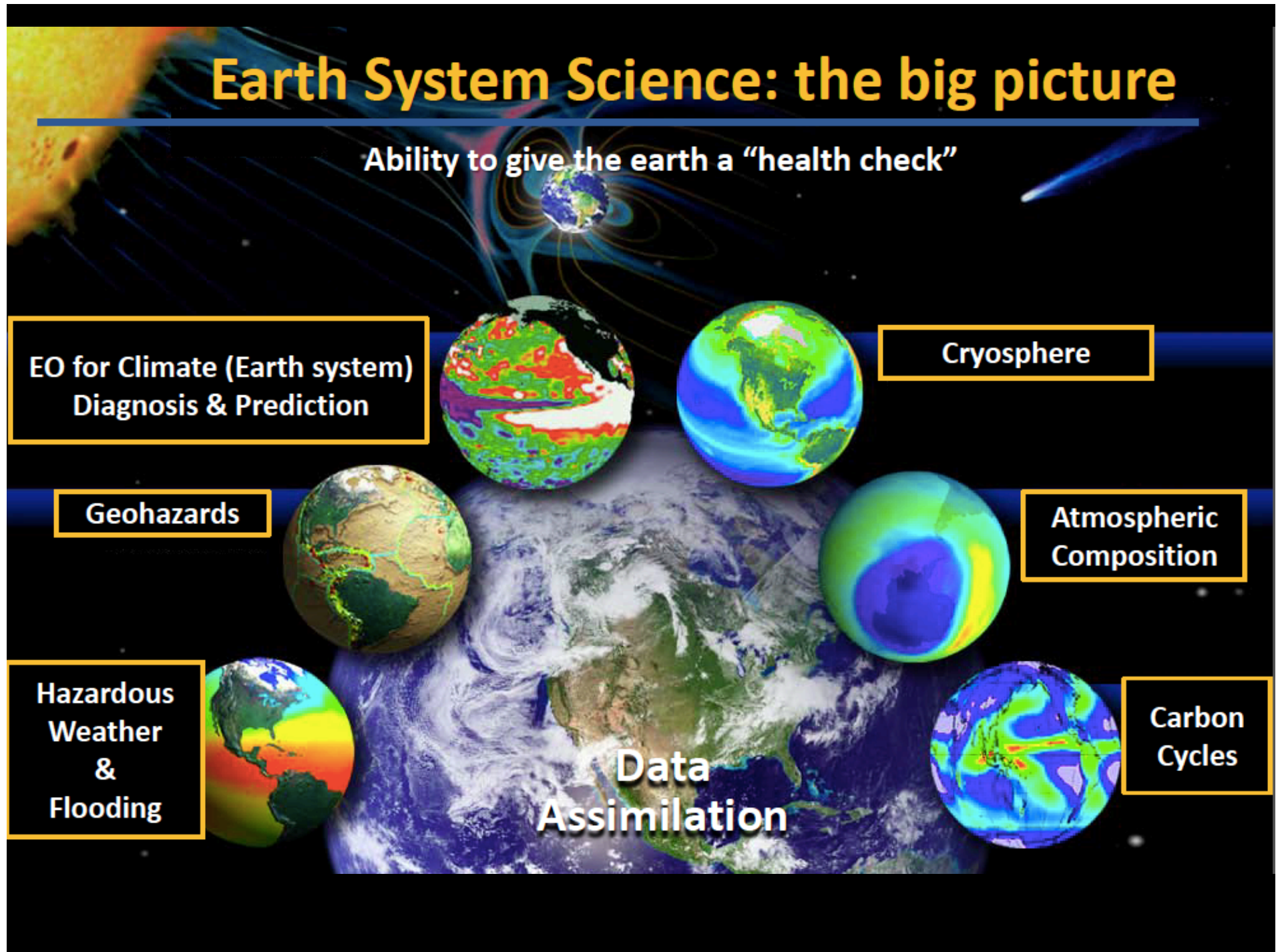
Geohazards

Atmospheric  
Composition

Hazardous  
Weather  
&  
Flooding

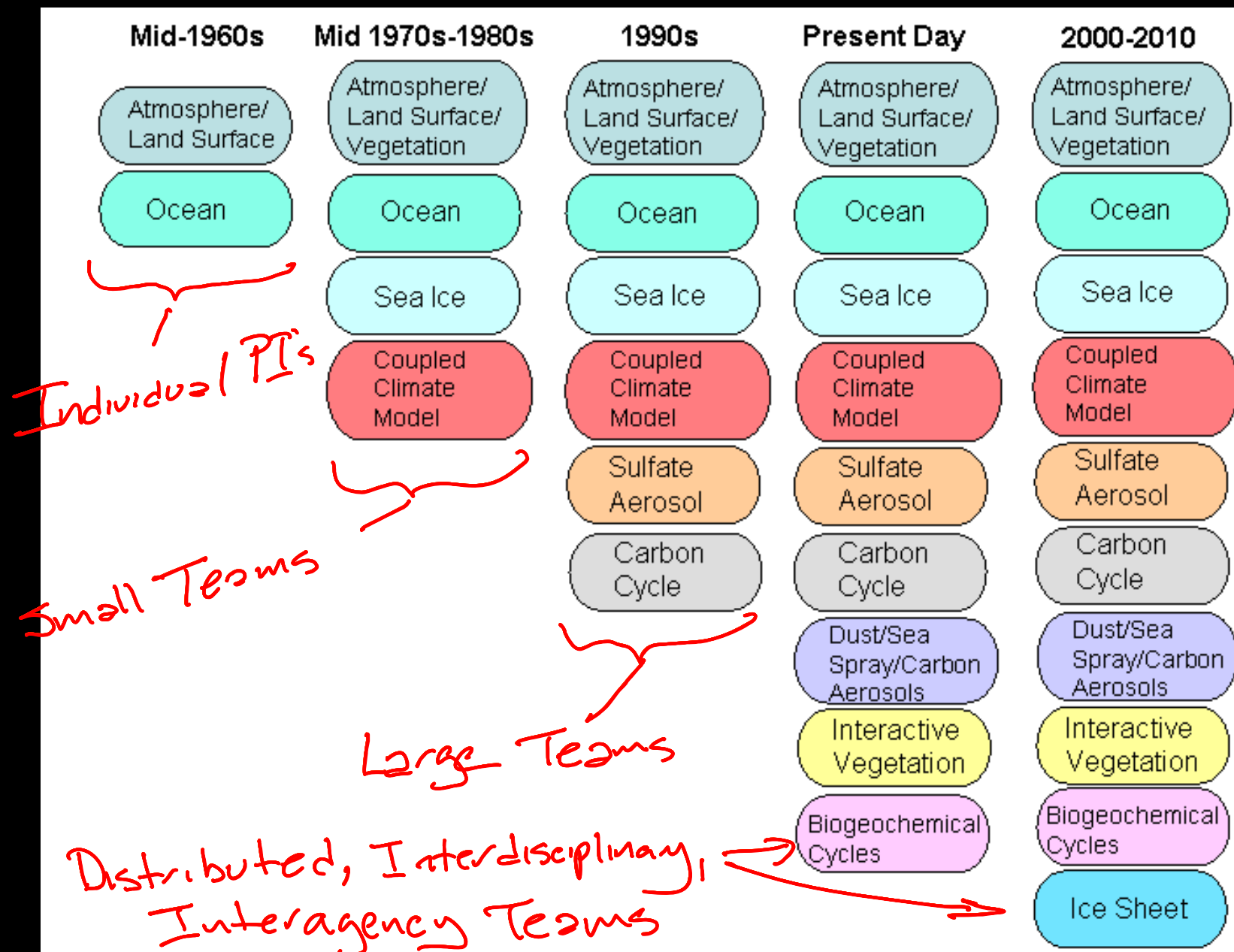
Carbon  
Cycles

Data  
Assimilation

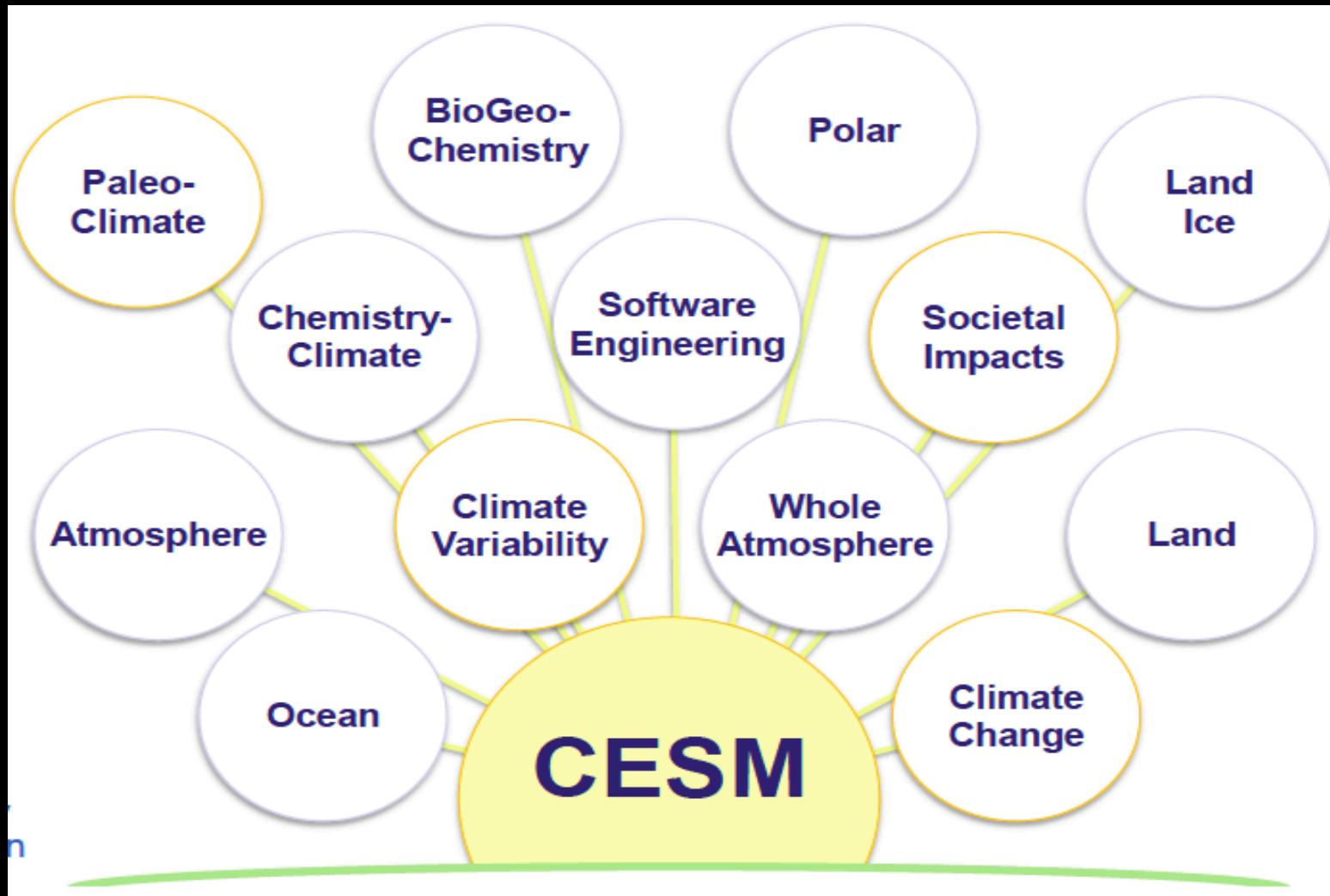




# Timeline of Climate Model Development



# The NCAR Community Earth System Model (CESM)



# Past Accomplishments of the Science

## The 1980' s

- ☐ Land models are being developed and are coupled to atmospheric GCM

## The 1990s

- ☐ Parameterization testing becomes organized
- ☐ Reanalysis begins
- ☐ The carbon cycle enters the models
- ☐ Aerosols and chemistry enter the models
- ☐ The IPCC Assessments begin
- ☐ Operational seasonal prediction begins

## The 2000' s

- ☐ Biogeochemistry is coupled to the physical climate
- ☐ Very high resolution global models are integrated

# Inter-government Panel on Climate Change

ipcc  
INTERGOVERNMENTAL PANEL ON climate change



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Procedures

Working Groups / Task Force

Activities

Calendar

Meeting Documentation

News and Outreach

Publications and Data

Presentations and Speeches

IPCC Scholarship Programme

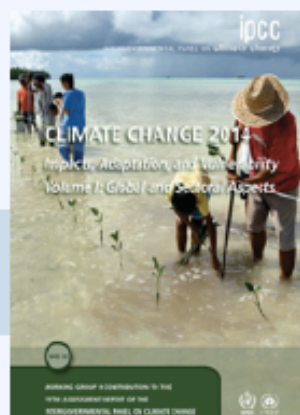
Links

Contact



Phone: +41-22-730-8208 /84/54  
Email: IPCC-Sec@wmo.int

## Fifth Assessment Report (AR5)



The Working Group II contribution to the Fifth Assessment Report considers the vulnerability and exposure of human and natural systems, the observed impacts and future risks of climate change, and the potential for and limits to adaptation. The chapters of the report assess risks and opportunities for societies, economies, and ecosystems around the world.

The Summary for Policymakers will be released on 31 March 2014.

1 2 3

### Current and Recent Reports

### Forthcoming Reports

#### Climate Change 2014: Impacts, Adaptation and Vulnerability

The Working Group II (WGII) contribution to the Fifth Assessment Report on impacts, adaptation and vulnerability will be considered in Yokohama, Japan, on 25-29 March 2014.

Summary for Policymakers

Media Portal

Climate Change 2013: The Physical Science Basis

## Plenary Sessions

Working Group II 10<sup>th</sup> / IPCC 38<sup>th</sup>

Yokohama, Japan, 25-29 Mar 2014

- Media Interviews **New**
- Media Advisory
- Documents
- Information Note ( Update)

Working Group III 12<sup>th</sup> / IPCC 39<sup>th</sup>

Berlin, Germany, 7-12 Apr 2014

- Media Advisory
- Documents
- Information Note

IPCC 37<sup>th</sup>

Batumi, Georgia, 14-18 Oct 2013

- Decisions

Task Force on National Greenhouse Gas Inventories (TFI)

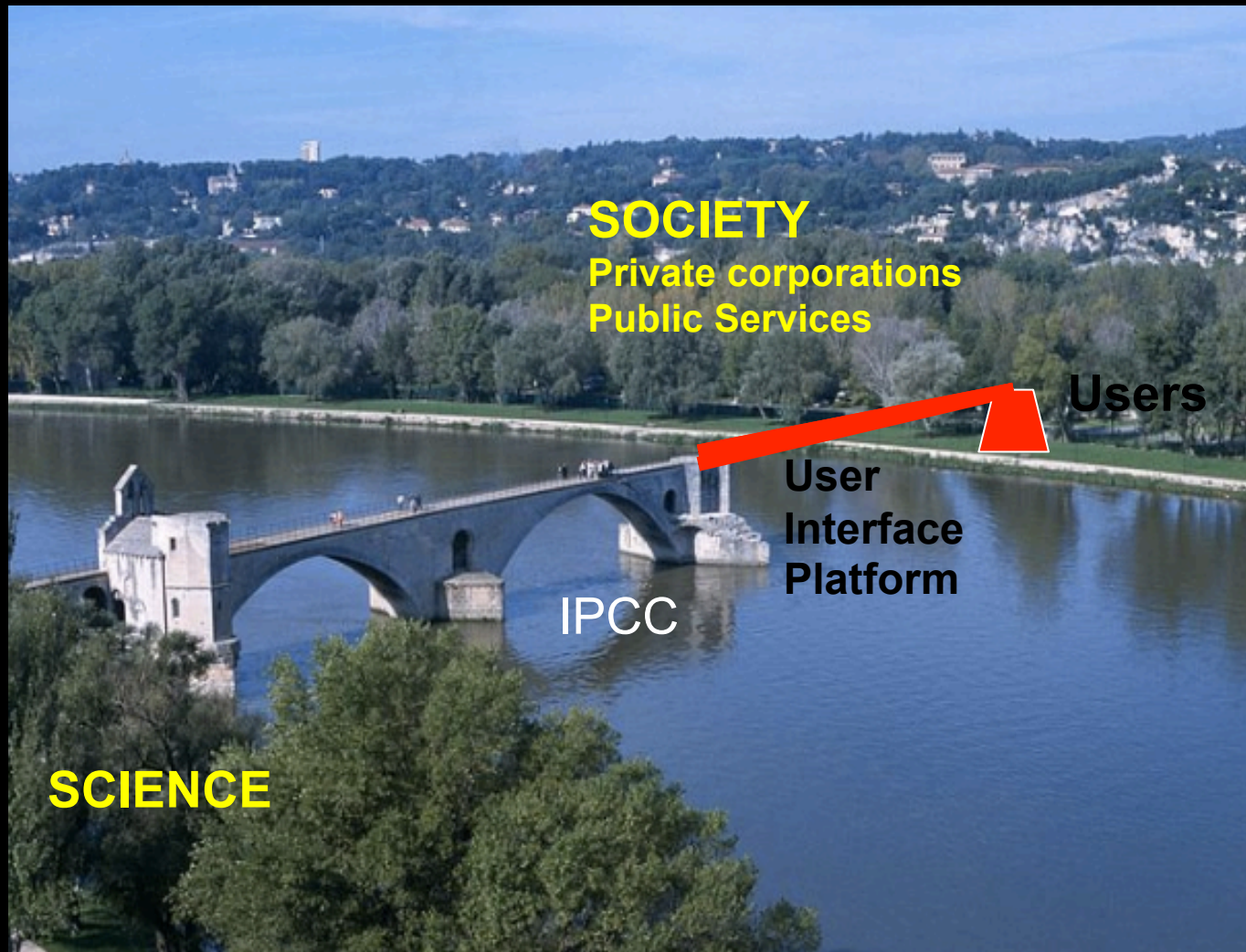
- Press release: publication of Methodology Reports

## Building the Second Half of the Avignon Bridge





## Building the Second Half of the Avignon Bridge



# Challenges

**Multiple stressors  
lead to major  
planetary problems**

Energy and Carbon  
Water Scarcity  
Food Availability  
Air Quality  
Human Health  
Urbanization and  
Population Migration  
Poverty and Education

**Addressing these  
complex questions  
requires**

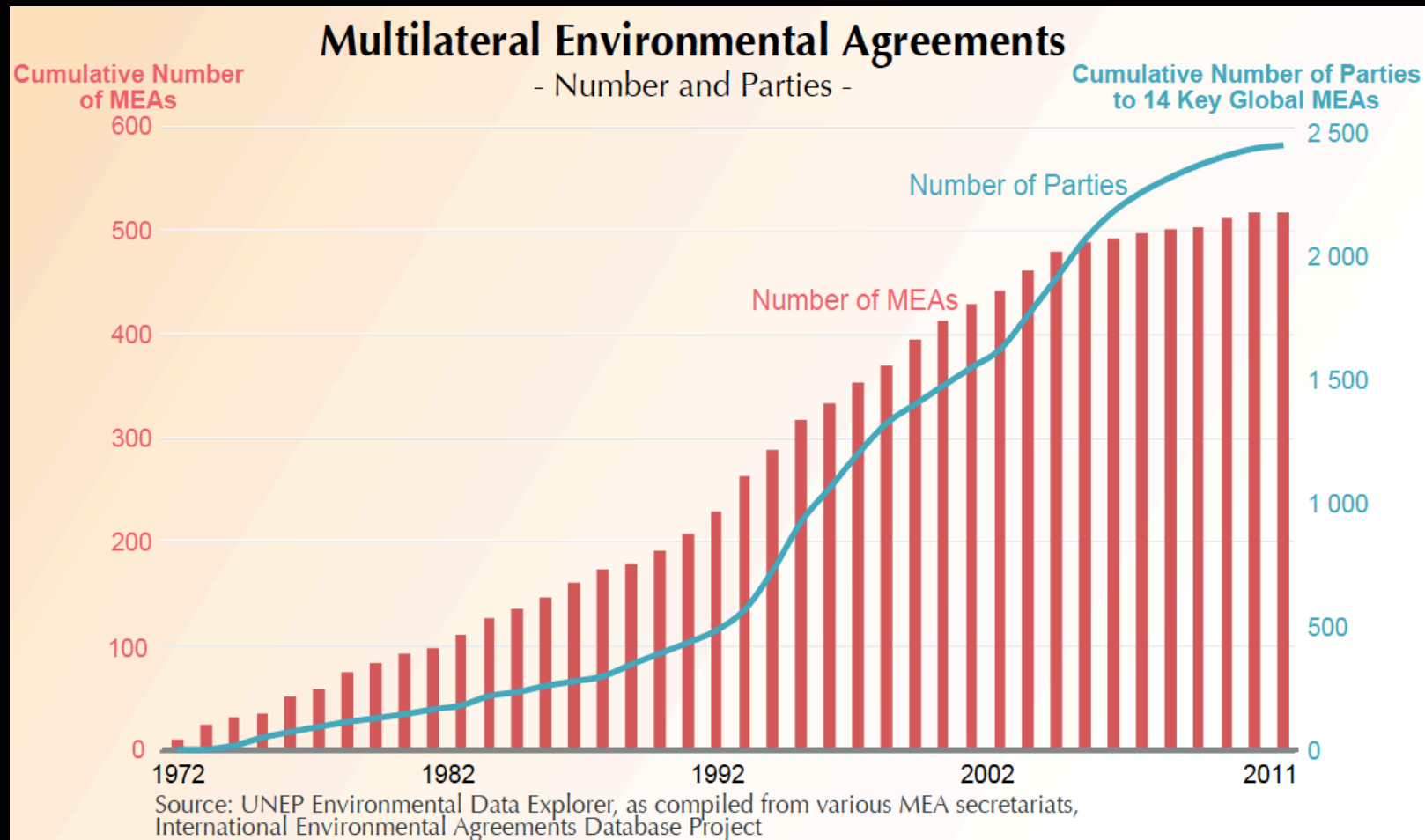
- Understand **interactions and feedbacks** in the entire Earth System
- Develop **integrated regional studies** to assess the two-way coupling between the **biophysical** and **social** systems
- Improve existing **climate tools**
- Integrate **new approaches**, priorities, capabilities
- Cooperate with **new partners**

# **Addressing Global (integrated) Earth System Problems**



# 500 Multilateral Environmental Agreements

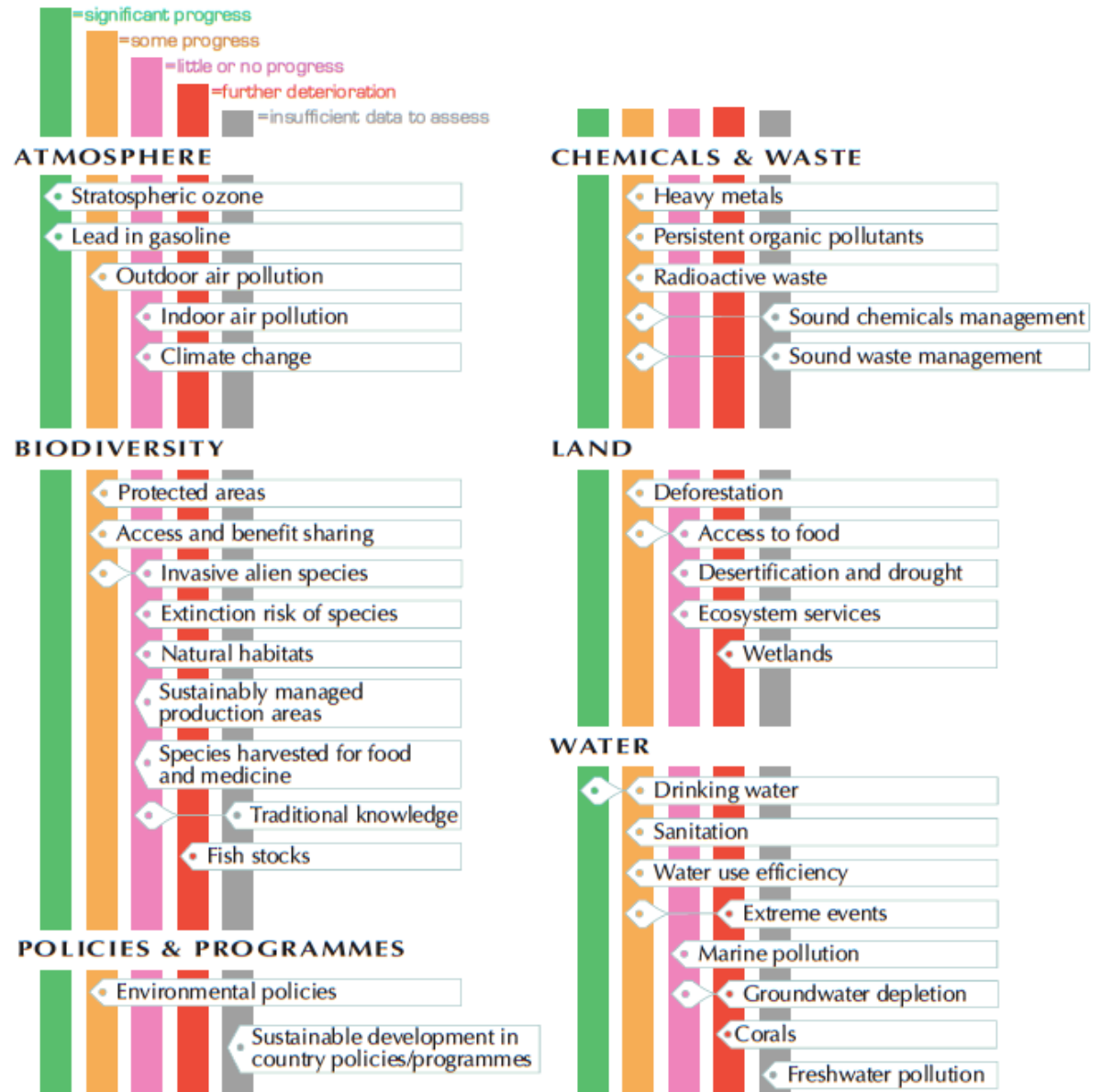
The number of multilateral environmental Agreements is very high, but with which effects?



# Environmental Policies

## Successes and Failures of Environmental Policies

### Environment Scorecard 2012



This Scorecard's rating of progress on each issue (including ratings split between two categories) is explained in the text of this report.



# A global Mobilisation of the Scientific Community

- *There has been realization that the key **scientific progress** made over the last decades has not sufficiently **helped society to cope** with expected climate change and variations.*
- *In particular, society needs to better assess its **vulnerability** to climate change and to develop **mitigation** and **adaptation** strategies to increase its resilience.*

## Vulnerability assessment

Situation analysis

Scientific  
analyses

Participatory  
assessment

Current vulnerability

Future scenarios

Future vulnerability

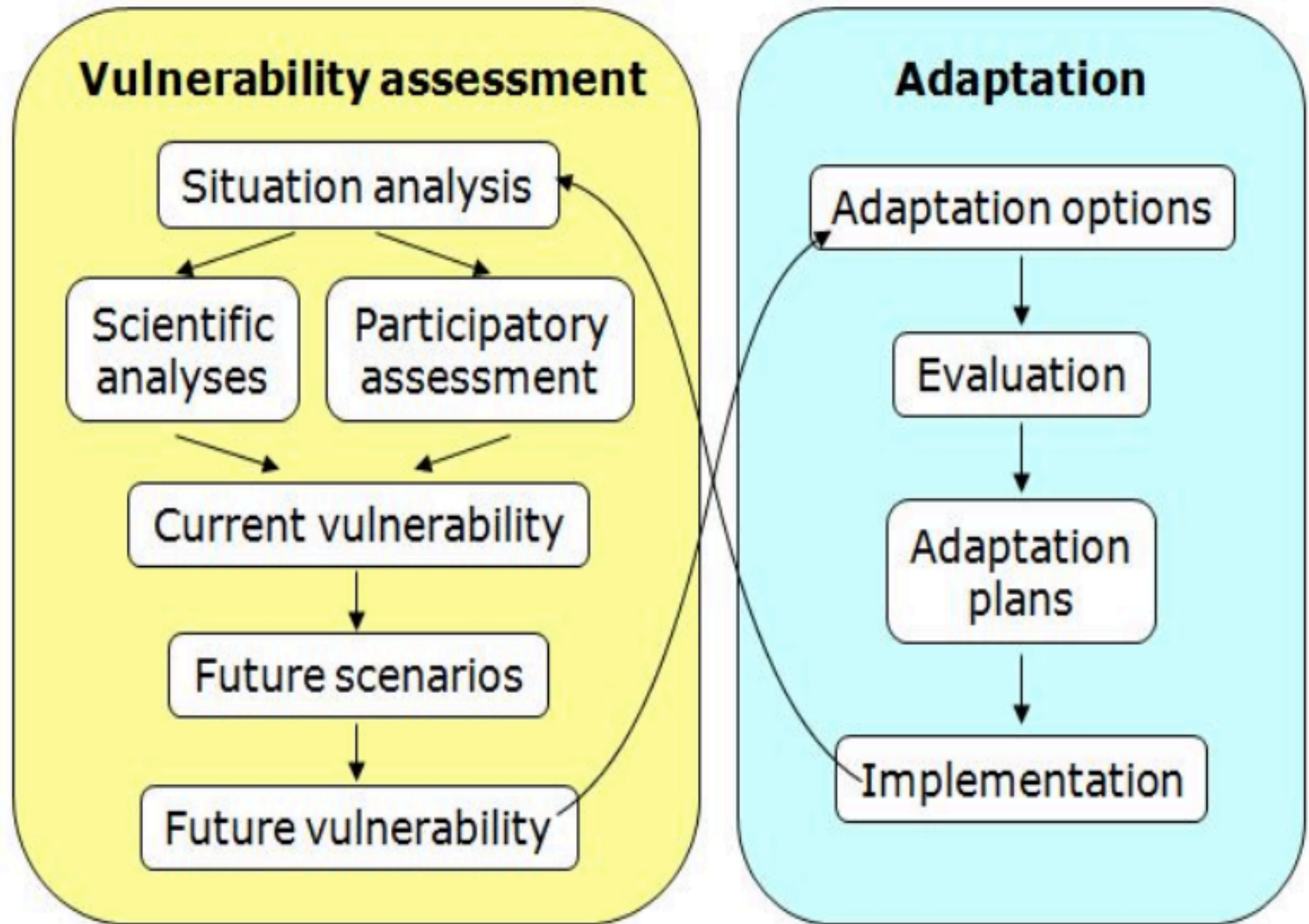
## Adaptation

Adaptation options

Evaluation

Adaptation  
plans

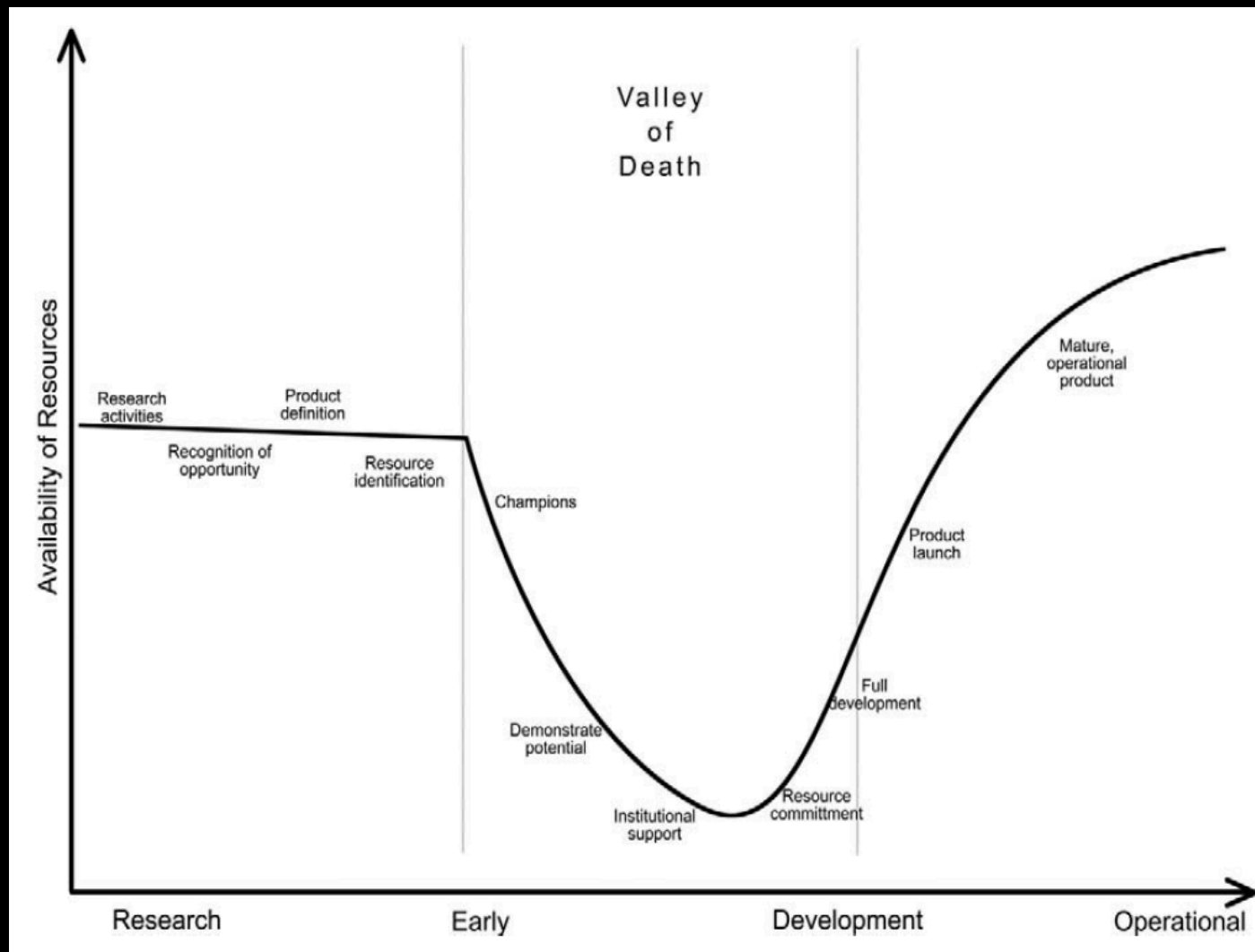
Implementation







# “The Valley of Death”



Source:  
Barr et al.,  
2009

# Scientists forced to face communication into value-conflicting contexts

Data generation:

**Adequate?**

Integration,  
analysis, and  
interpretation:

**Problematic**

Delivery, translation  
for application,  
including non-  
climate context:  
**Emergent & Weak**

Appropriately  
informed  
adoption

Mixed

Choices

choices

Choices

**Scientists** – Producers – Analyzers – Translators – Providers – Communicators - **Users**



# International Development of Climate Services

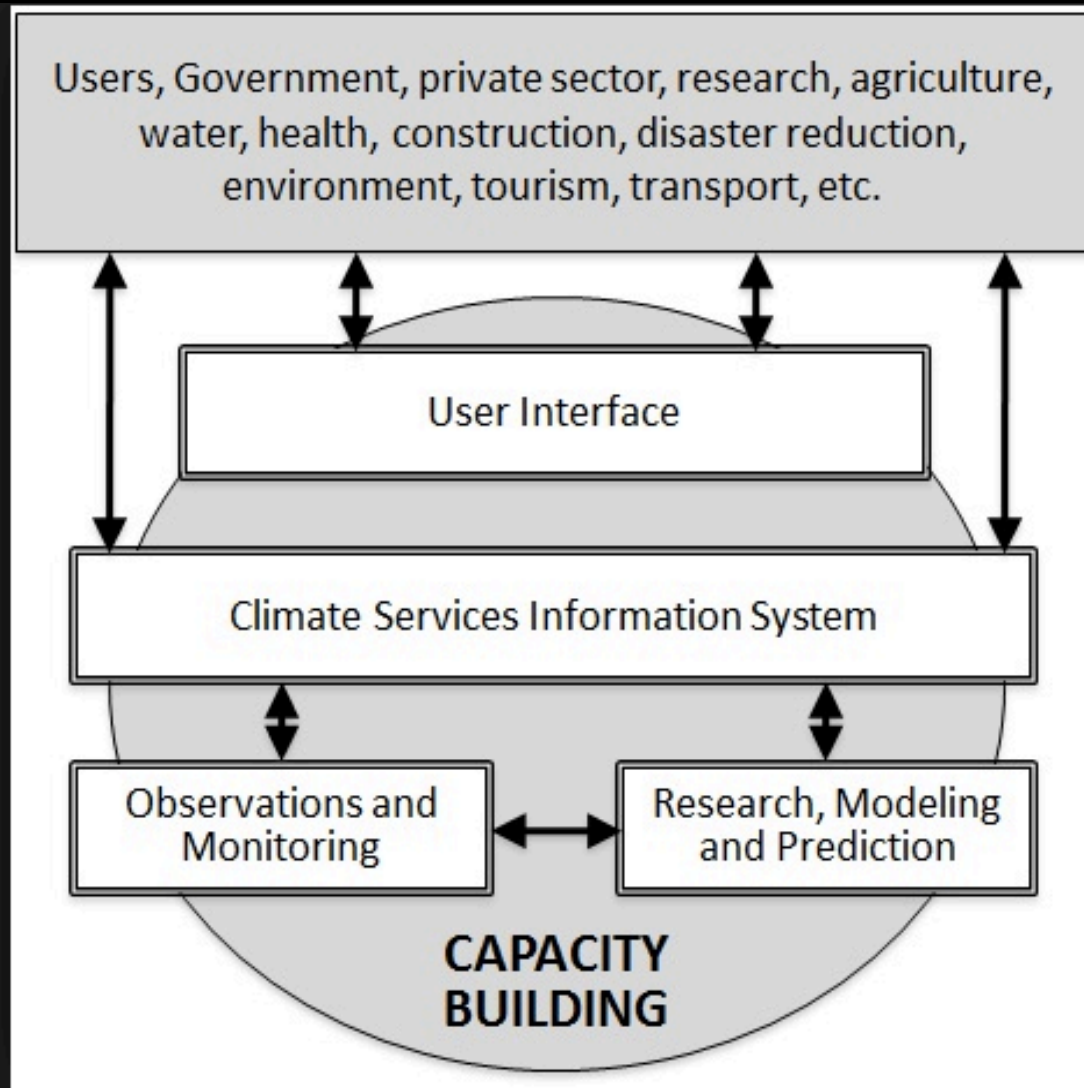
## Bridge between science and society

- **Climate services** involve the production, translation, transfer, and use of climate knowledge and information in climate-informed decision making and climate-smart policy and planning.
- **Climate services** ensure that the best available climate science is effectively communicated with agriculture, water, health, and other sectors, to develop and evaluate mitigation and adaptation strategies





# Global Framework for Climate Services



## World Climate Conference-3

Better climate information for  
a better future



WCC · 3

[www.wmo.int/wcc3](http://www.wmo.int/wcc3)

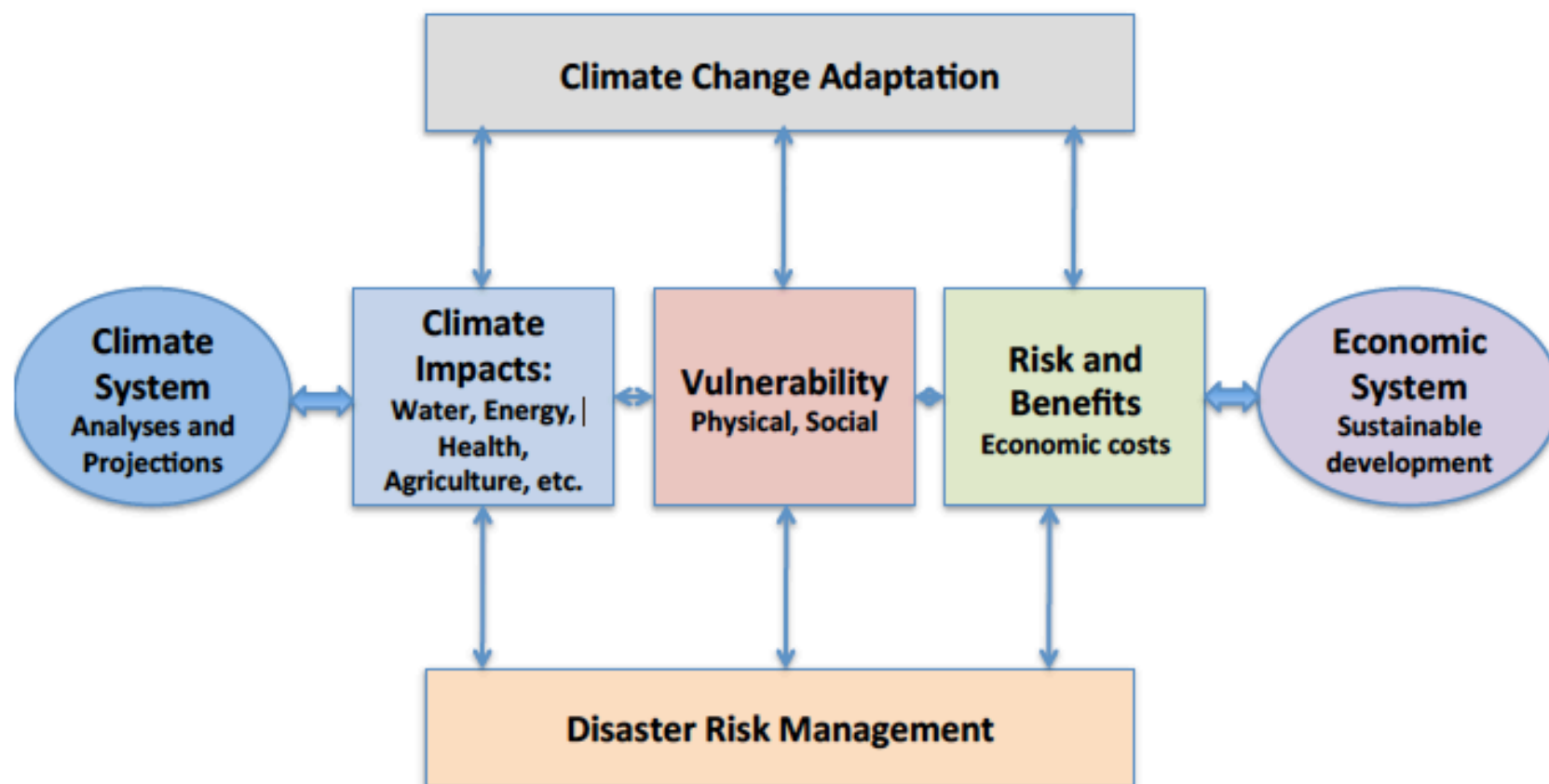


Geneva, Switzerland, 31 August – 4 September 2009

Geneva International Conference Centre



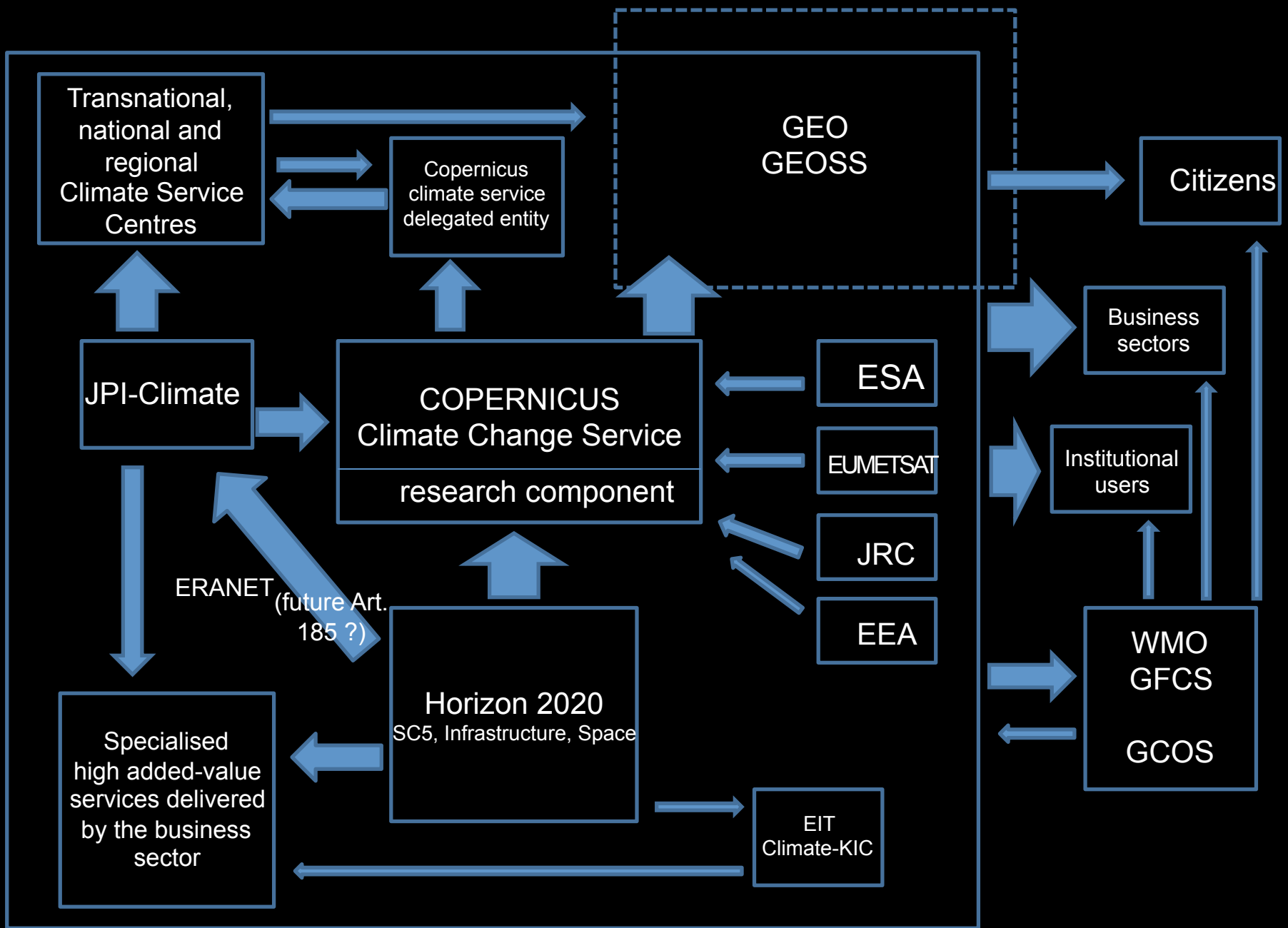
# A Framework for Climate Services



**The Framework for Climate Services**

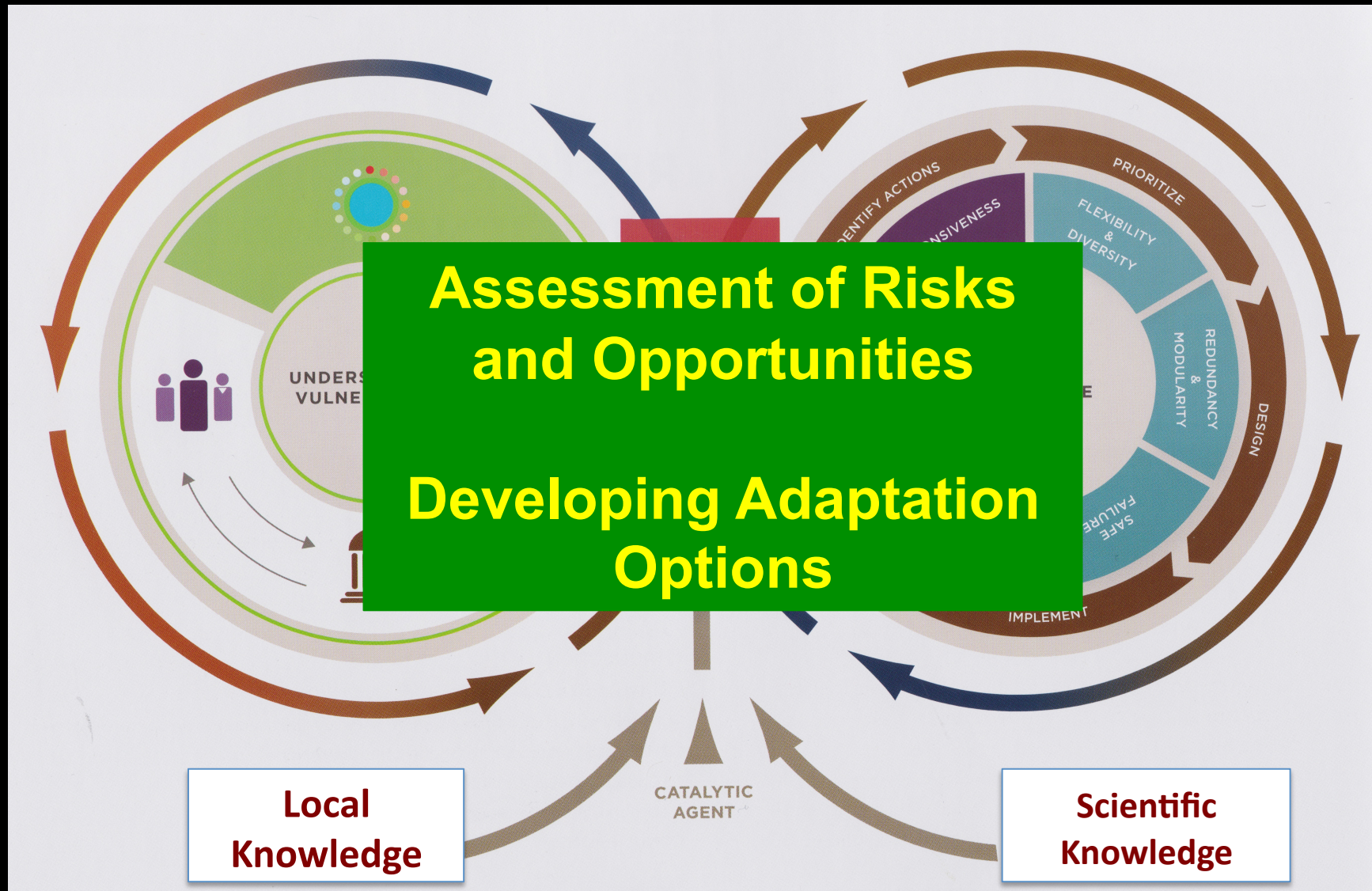
## Essentially two different approaches for Climate Services

1. **Top-down approach:** Development of large data bases and dissemination of data available to users. Extension of Meteorological Services.
2. **Bottom-up approach:** Initiation of dialogue with stakeholders and identification their specific needs. Towards solutions to their problems. Extension of research groups involved in adaptation science.





# Understanding Vulnerability and Building Resilience



# Climate Costs Awaken Industry



Coca Cola recognizes that climate change is an **economically disruptive force**.

It reflects a view growing among American **business leaders** and mainstream economists who see global warming as a **force to lower gross domestic products**

4 Feb. 2014



## More Companies see global warming's impacts on profits

Michael Bloomberg, former New York Mayor, Henry Paulson, Jr, former Treasury Secretary in the Bush Administration are commissioning an economic study called “Risky Business” on the financial risks associated with climate change.

“There is no question that, if we get substantial changes in atmospheric temperatures, as all the evidence suggests, that it is going to contribute to sea-level rise. There will be agriculture and economic effects – it’s inescapable.”

*Douglas Holtz-Eakin, Head of the American Action Forum*

# **Getting Prepared for a Major Transformation of our Society**



## Where Do we Stand Today?

- The **fundamental climate science** has made tremendous progress, but many problems (of societal relevance) remain to be addressed. It has demonstrated that climate change is a consequence of the human enterprise.
- The **IAV community has become more prominent** and receives increasing support because it focuses on solution to the climate change challenge.
- Both communities **remain separated** and are rarely collocated in research institutions.
- Funding agencies **shift money** from the first to the second group, which creates tensions.

There is a need to maintain a strong program on  
fundamental climate research:

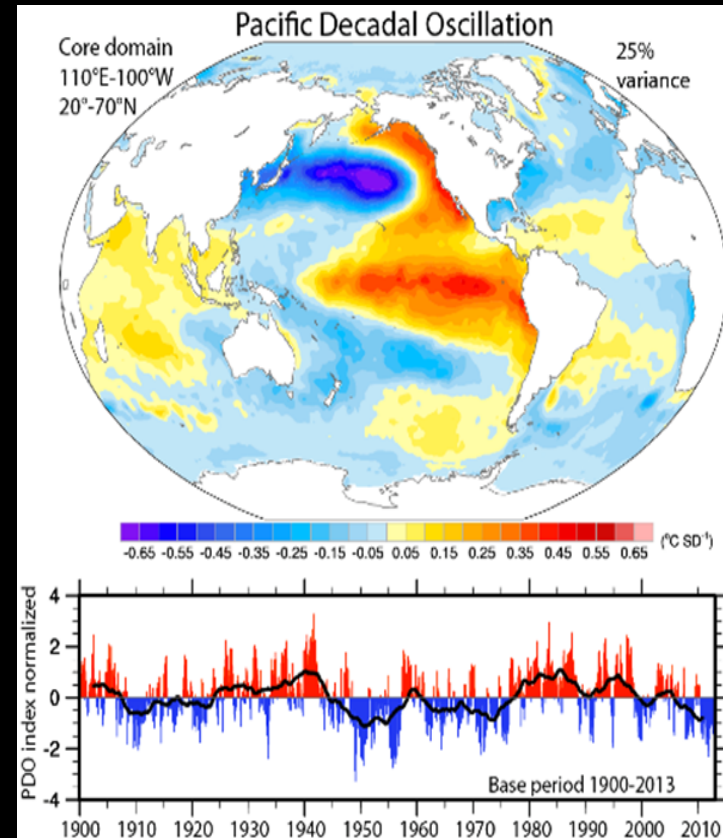
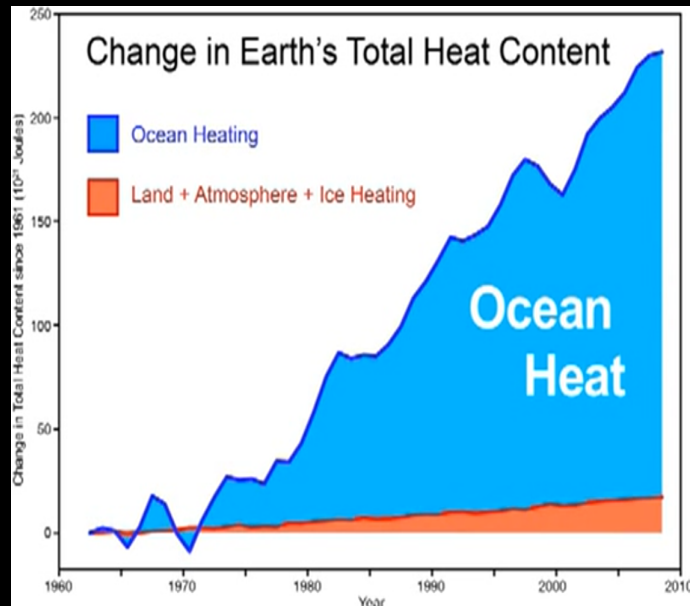
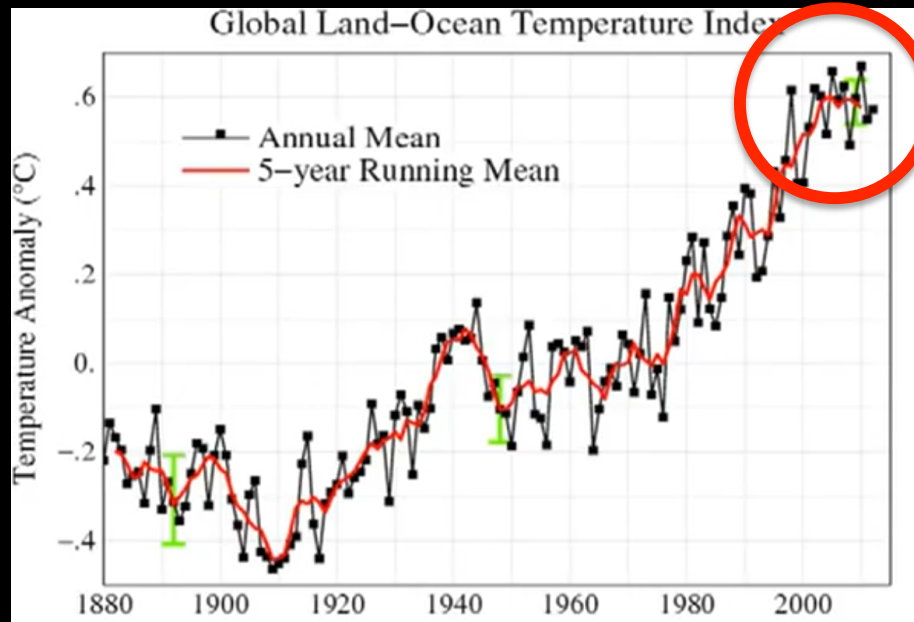
### The 6 WCRP Grand Challenges 2014

- Clouds, Circulation and Climate Sensitivity
- Changes in the Cryosphere
- Climate Extremes
- Regional Climate Information
- Regional Sea-level Rise
- Water Availability

### But also....

- Seasonal to decadal climate prediction
- Coupling between climate and the biogeochemical cycles

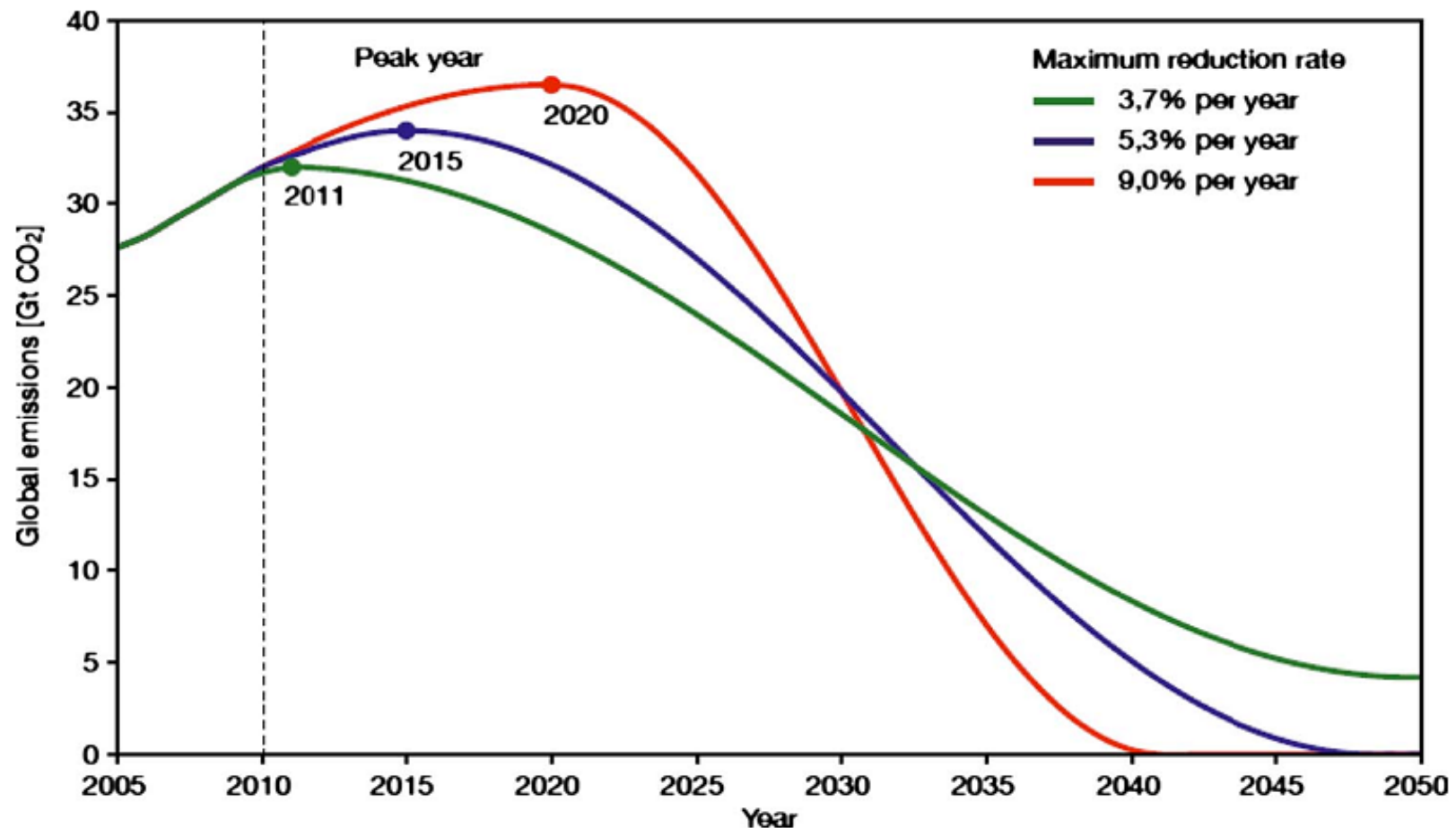
# The Climate Hiatus



## Pacific Decadal Oscillation (PDO)

- There are ocean oscillations with longer periods such as the Pacific Decadal Oscillation **PDO** in the Pacific (Period of about 10 years)
- There is evidence that the **PDO** plays a key role in the observed slowdown of the global warming over the last 15 years.

At the same time, scientific research should provide the basis for the **grand transformation** of the socio-ecological system





# The missing piece: a distillery

	GCM 1 data	GCM 2 data	GCM 3 data	GCM 4 data	GCM 5 data	GCM-n data
RCM 1	data	data	data	data	data	data
RCM 2	data	data	data	data	data	data
RCM 3	data	data	data	data	data	data
RCM 4	data	data	data	data	data	data
RCM 5	data	data	data	data	data	data
SD 1	data	data	data	data	data	data
SD 2	data	data	data	data	data	data
SD 3	data	data	data	data	data	data
SD 4	data	data	data	data	data	data

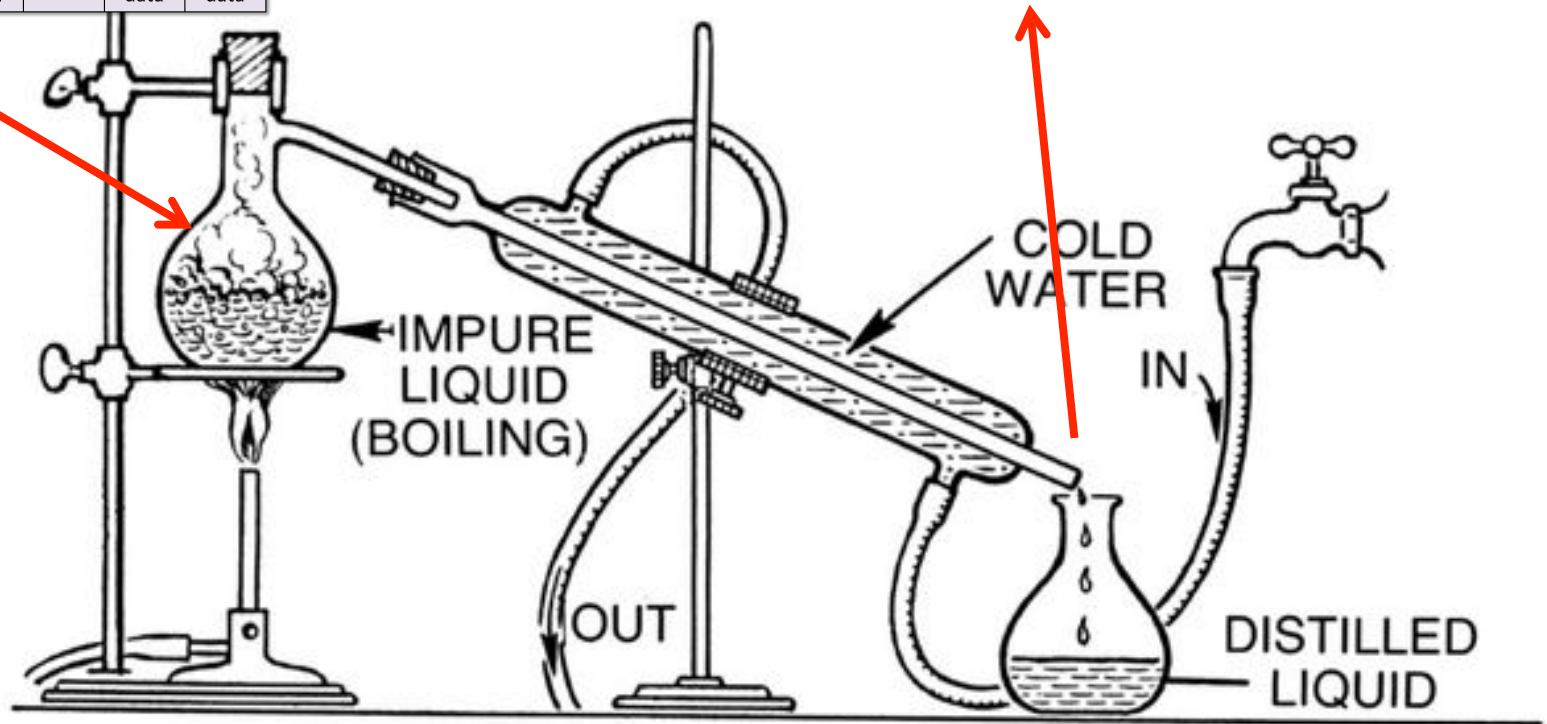
Climate  
Data



**Water:** tasteless and life-essence

**Vodka:** odourless and liver damaging

**Witblitz:** (problematic) Transformational



# Future Earth



## DYNAMIC PLANET

How is the planet changing due to human activity and natural phenomena? What are the environmental and societal trends, drivers and processes affecting change and how do they interact? What are the global thresholds and risks surrounding these trends?

[MORE](#)



## GLOBAL DEVELOPMENT

How can we address humanity's most pressing needs including fair and sustainable stewardship of food, water, biodiversity, energy and other materials that make life viable and valued?

[MORE](#)



## TRANSFORMATIONS TOWARDS SUSTAINABILITY

What are the options and opportunities for change towards sustainability? How do they relate to human values, emerging technologies and economic development pathways? How should the global environment be governed and managed sustainably?

### Future Earth will be a global platform to deliver:

- **Solution-orientated** research for sustainability, linking environmental change and development challenges to satisfy human needs for food, water, energy, health;
- **Effective interdisciplinary collaboration** across natural and social sciences, humanities, economics, and technology development, to find the best scientific solutions to multi-faceted problems;
- **Timely information for policy-makers** by generating the knowledge that will support existing and new global and regional integrated assessments;
- **Participation** of policy-makers, funders, academics, business and industry, and other sectors of civil society in co-designing and co-producing research agendas and knowledge;
- **Increased capacity building** in science, technology and innovation, especially in developing countries and engagement of a new generation of scientists.



# The Earth League

‘A self-organised network of scientific entities spanning both hemispheres, working to respond to some of the most pressing issues facing humankind today’

15<sup>th</sup> July 2014

Earth League climate statement on the implications for climate policy of the 5<sup>th</sup> IPCC Assessment, emerging from the Earth League scientific workshop at the Santa Fe Institute 23-25 April 2014

## Climate change: the necessary, the possible and the desirable

Rockström, Johan<sup>1</sup>; Brasseur, Guy<sup>2</sup>; Hoskins, Brian<sup>3</sup>; Lucht, Wolfgang<sup>4</sup>; Schellnhuber, John<sup>4</sup>; Kabat, Pavel<sup>5</sup>; Nakicenovic, Nebojsa<sup>5</sup>; Gong, Peng<sup>6</sup>; Schlosser, Peter<sup>7</sup>; Manez, Maria<sup>8</sup>; Humble, April<sup>8</sup>; Eyre, Nick<sup>9</sup>; Gleick, Peter<sup>10</sup>; James, Rachel<sup>9</sup>; Lucena, Andre<sup>11</sup>; Masera, Omar<sup>12</sup>; Moench, Marcus<sup>13</sup>; Schaeffer, Roberto<sup>11</sup>; Seitzinger, Sybil<sup>14</sup>; van der Leeuw, Sander<sup>15</sup>; Ward, Bob<sup>16</sup>; Stern, Nicholas<sup>16</sup>; Hurrell, James<sup>17</sup>; Srivastava, Leena<sup>18</sup>; Morgan, Jennifer<sup>19</sup>; Nobre, Carlos<sup>20</sup>; Sokona, Youba<sup>21</sup>

# Capacity Development: The Earth Academy



- An international network of research institutions promoting **education and capacity building** for decision-makers and future leaders on the major planetary challenges facing humanity
- *To develop research and educational partnerships that integrate knowledge and build capacity on questions related to the Earth System, specifically human-driven environmental and climate changes, their impacts on the socio-ecological systems, and the societal transformations required to address these changes.*



# A Unique Think Tank

ASPEN GLOBAL CHANGE INSTITUTE

Furthering the Understanding of Earth Systems & Global Environmental Change

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solutions

The Aspen Global Change Institute is dedicated to furthering the scientific understanding of Earth systems and global environmental change through interdisciplinary scientific workshops, educational programs, and publications & videos about global change science.

## Dialogue with Stakeholders

- Every case study/user/potential user is different
- The decision-making context is key *i.e., Need to know the*
- So a sectoral focus is important *'who' and the 'what'*
- Can't assume that users know their needs *a priori*
- Sending out questionnaires is not optimal (interviews and focus groups work better but more time consuming)
- These steps are complex and time consuming but are very important

# Key to Success for Interdisciplinary Programs

- Shared concepts and languages
- Collaboration between those who excel in their own field
- Joint proposal development
- Sub-projects to allow individuals to succeed in their own field
- Intellectual mutual respect
- Long-term commitment
- Good communication, joint location
- Stakeholder participation





# Thank You

*“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*