BELMONT FORUM

ICSU
International Council for Science

ISSC
international social science council

Prof. Deliang CHEN, ICSU Executive Director

Visioning: Towards a new initiative on Earth system research for global sustainability research

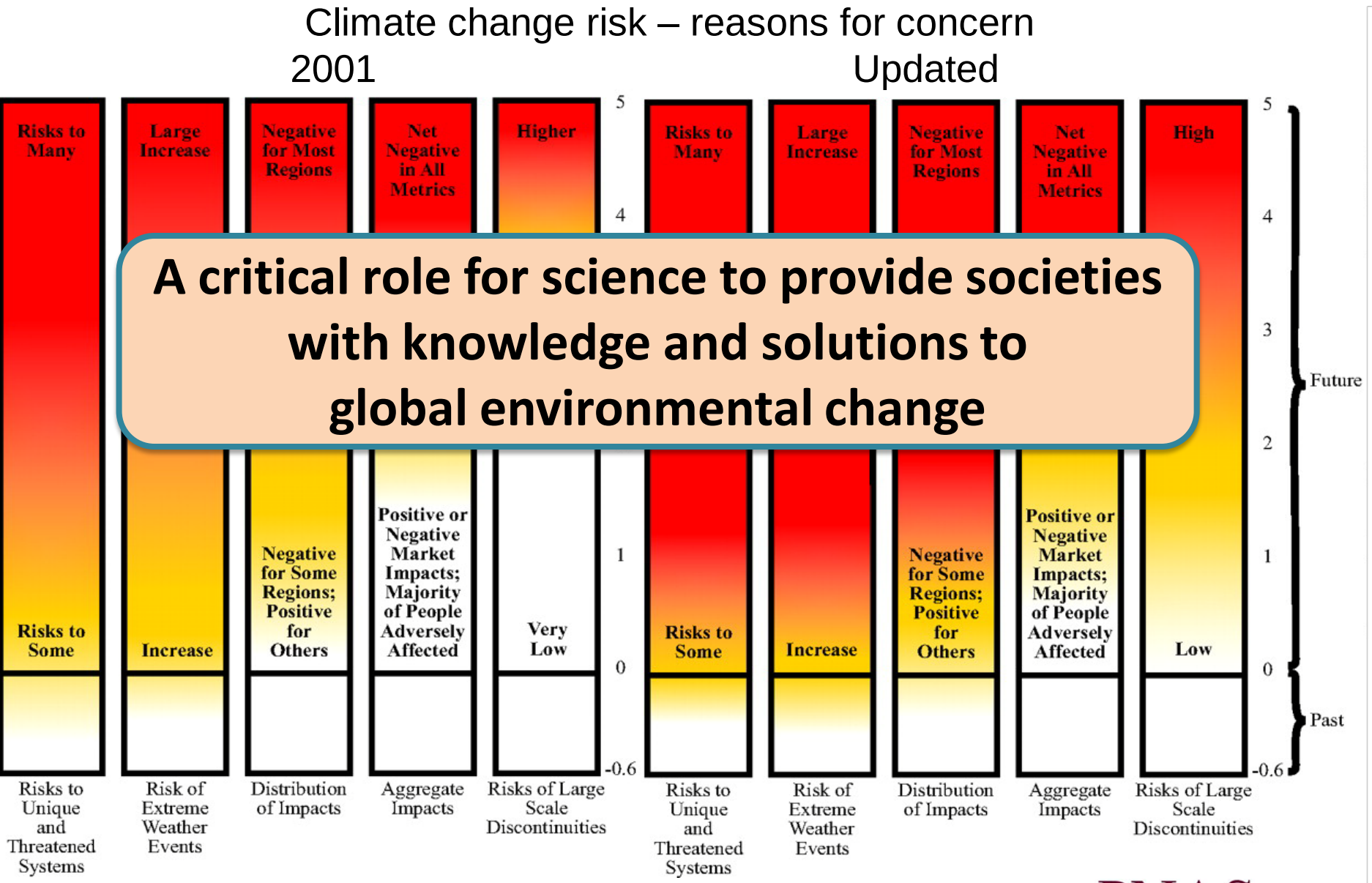
UNEP

UNITED NATIONS UNIVERSITY

UNESCO
United Nations Educational, Scientific and Cultural Organization

IGFA
International Group of Funding Agencies for Global Change Research

Living in a rapidly changing world



A critical role for science to provide societies with knowledge and solutions to global environmental change

Smith J B et al. PNAS 2009;106:4133-4137

PNAS

What happened after that?

All the contrails disappeared!

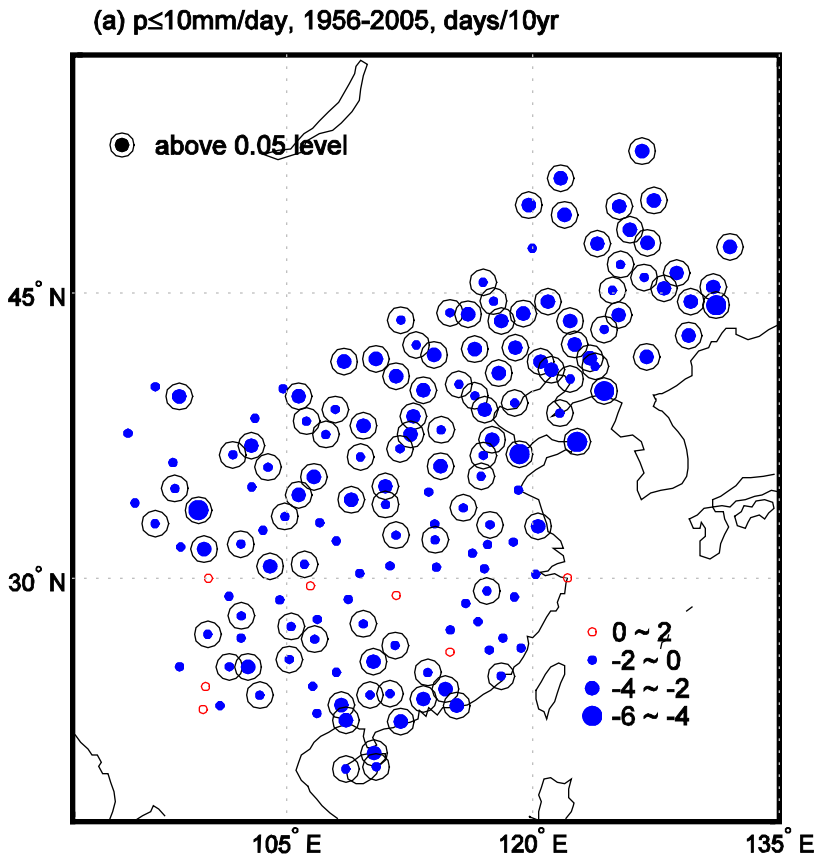
DTR: daily temperature range (the maximum-the minimum)

Travis et al. (2002)

Particulates and air pollution

- **Particulates**, alternatively referred to as **particulate matter (PM), aerosols** or **fine particles**, are tiny particles of solid (a smoke) or liquid (an aerosol) suspended in a gas.

Aerosol pollution over Northern India and Bangladesh - Photo: NASA

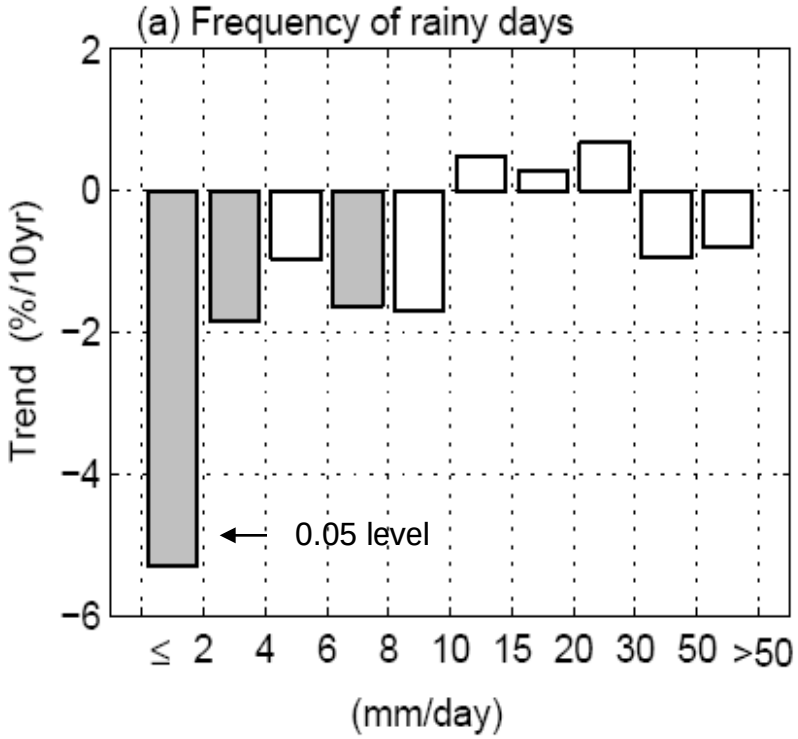


Linear trend of the number of light rain days during the time period 1956-2005. Unit: days/10yr. JJA.

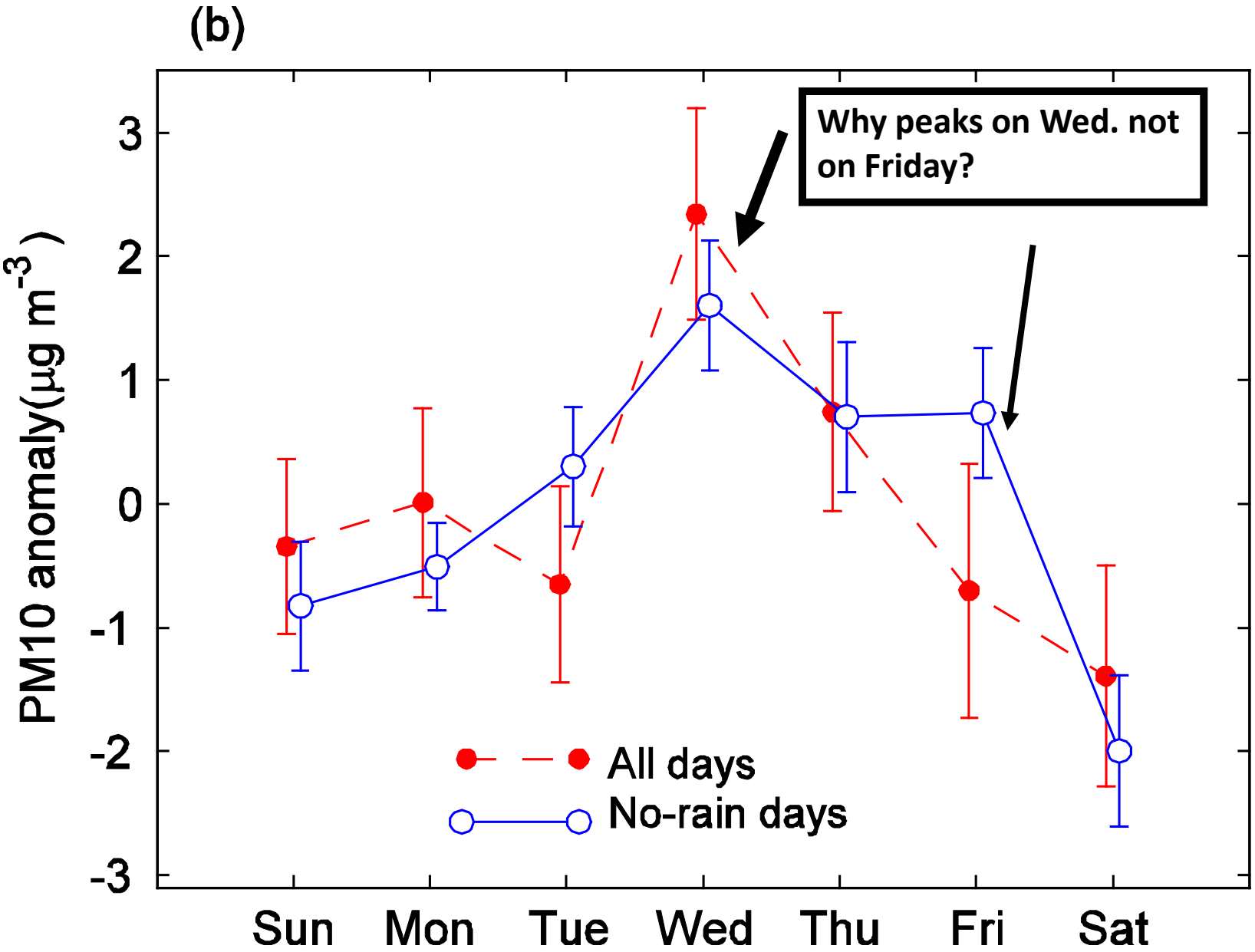
Regional mean trends [10mm/day]:

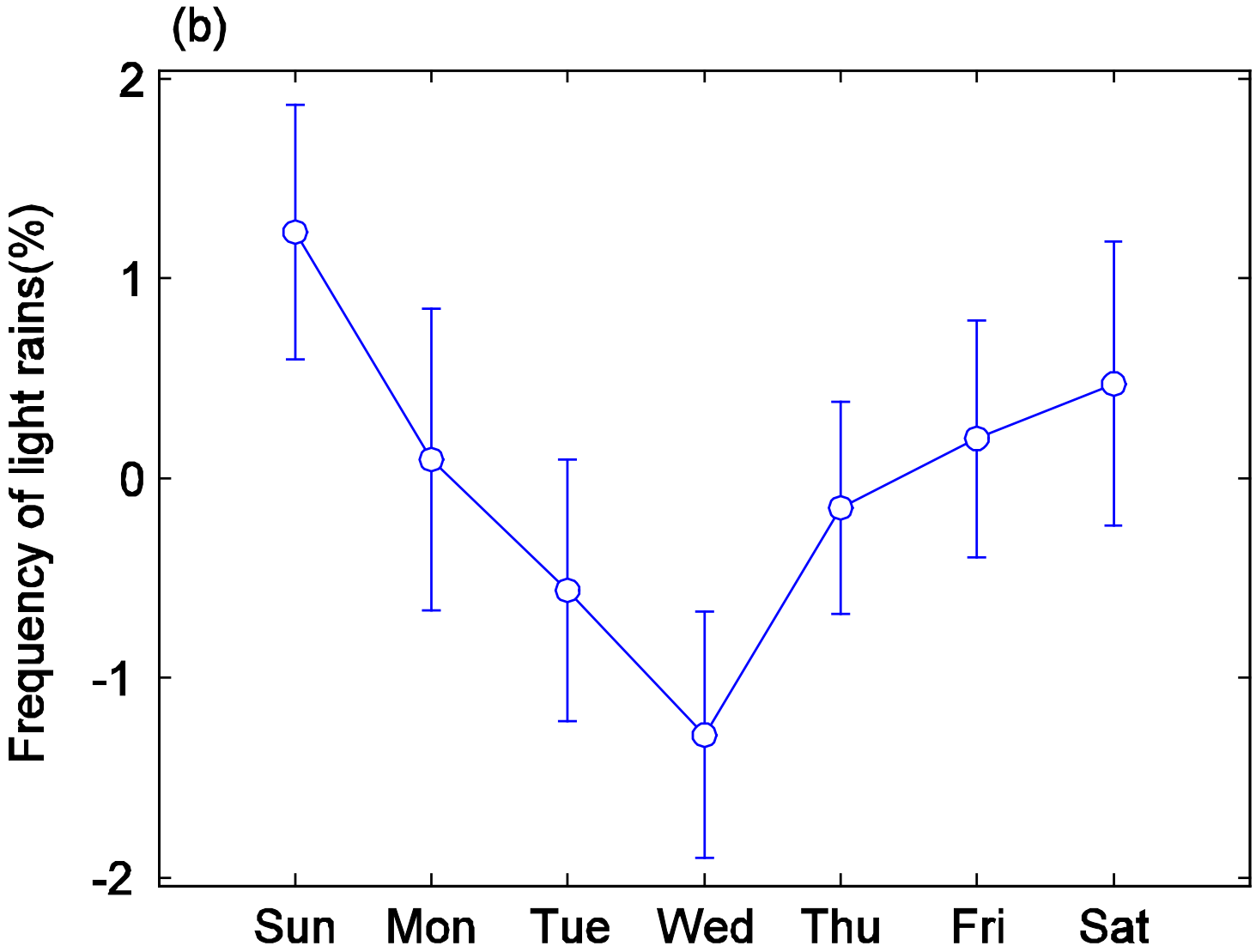
1956-05: -1.7days/10yr [～20%]

1980-05: -2.4days/10yr, 0.01 level



PM10 concentrations from Sunday through Saturday. JJA, 2001-2006. Error bars are ± 1 standard error about the 29-sample mean.





Reducing clouds?!!

Anomalous frequency of light rains from Sunday through Saturday.
P≤ 5mm/day, 29 stations, JJA, 2001-2006
Error bars are ± 1 standard error about the 29-sample mean.

GEC research: a long, successful history

four Global Environmental Change Programmes

WCRP World Climate Research Programme

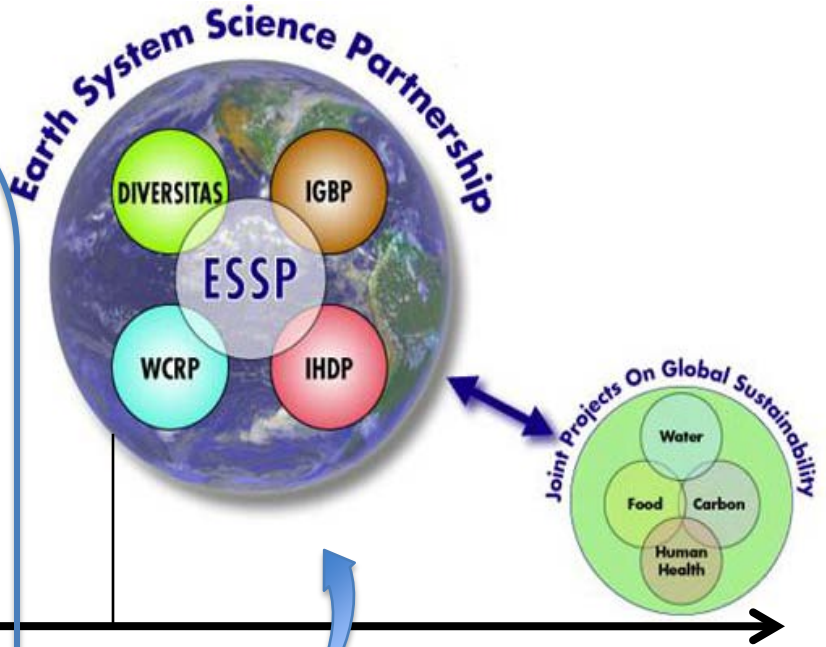
DIVERSITAS an international programme of biodiversity science

1980 1986 1991 1996 2001

GLOBAL IGBP CHANGE International Geosphere-Biosphere Programme

IHDP International Human Dimensions Programme on Global Environmental Change

all co-sponsored by ICSU



and their partnership

The need for an even more coordinated approach

Common recommendations from ICSU/IGFA reviews of GEC Programmes (2006-2009):

- Priority setting
- Effectiveness
- Integrated research framework

"*There is a clear need for an internationally coordinated and holistic approach to Earth system science that integrates natural and social sciences from regional to the global scale*." (ESSP review)

Why a new initiative?

Need for a unified strategic framework to:

- deepen our understanding of the Earth system
- deliver solutions to sustainability challenges, at regional to global scale

An Initiative arising from Visioning and Belmont efforts

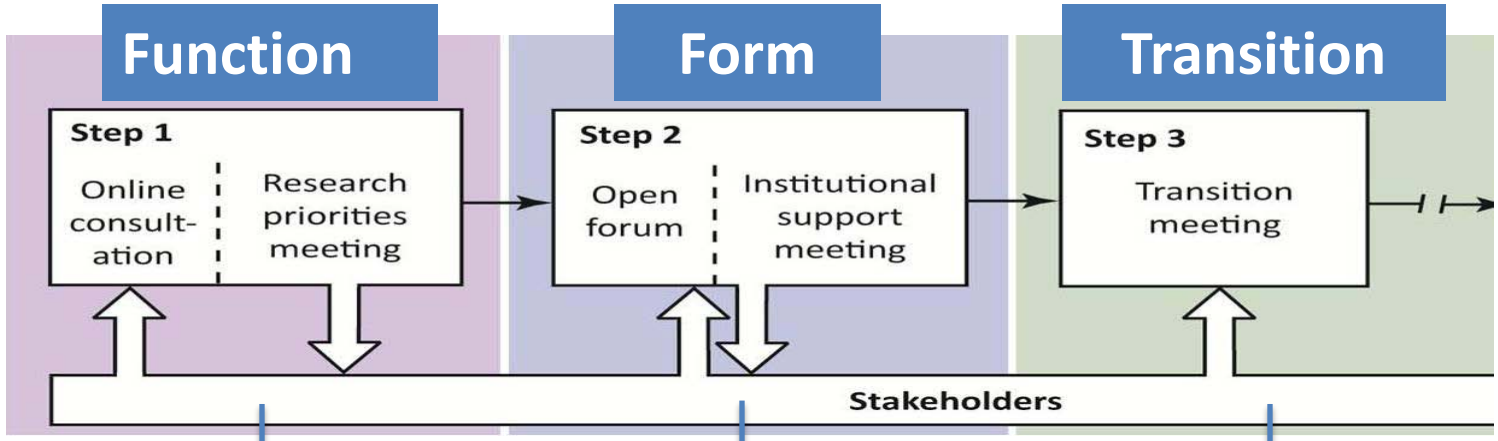
Earth System Visioning
(2009-2011)

- mandated by the ICSU General Assembly in 2008
- to outline options for an **overall framework for global environmental change research**
- established in cooperation with ISSC

Belmont Forum

- a high-level body of main funders of environmental change research
- established in 2009
- to **catalyze delivery of the environmental science-derived solutions that society needs**

Visioning: a three-year consultative process



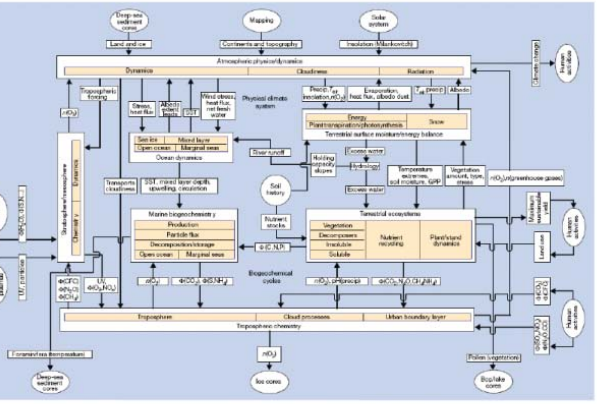
2009 2011

- Five Grand Challenges
- Integration across disciplines
- A new way of doing research

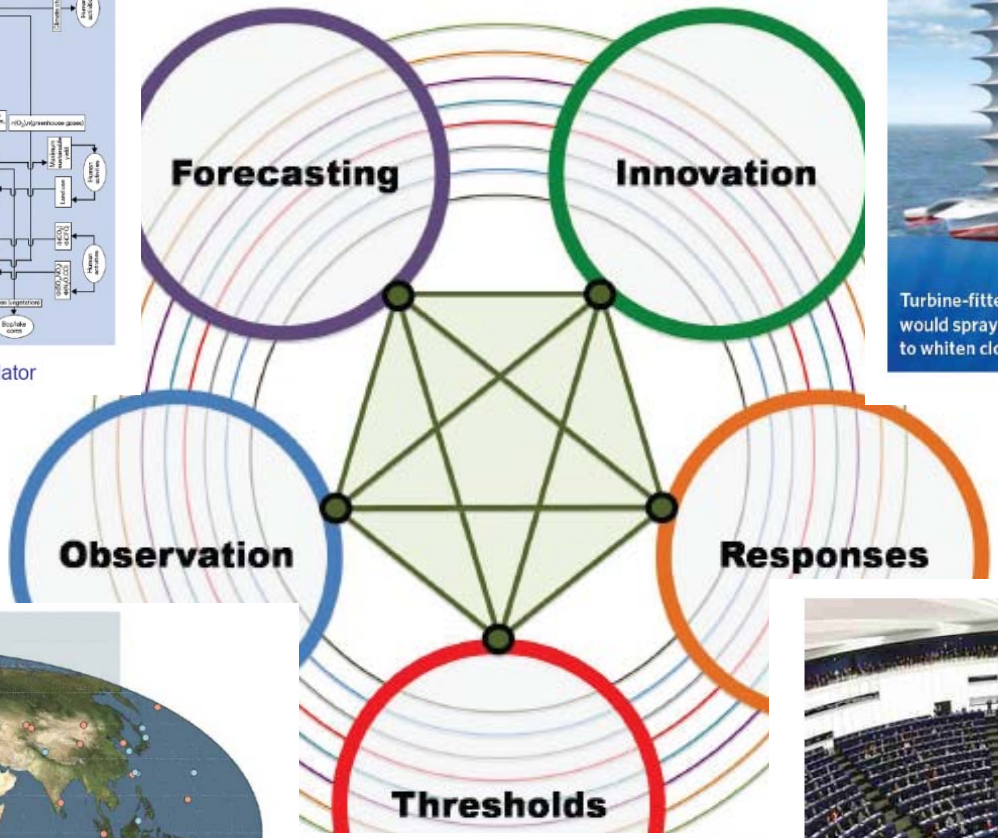
- Business as usual is not an option
- Need an overarching structure

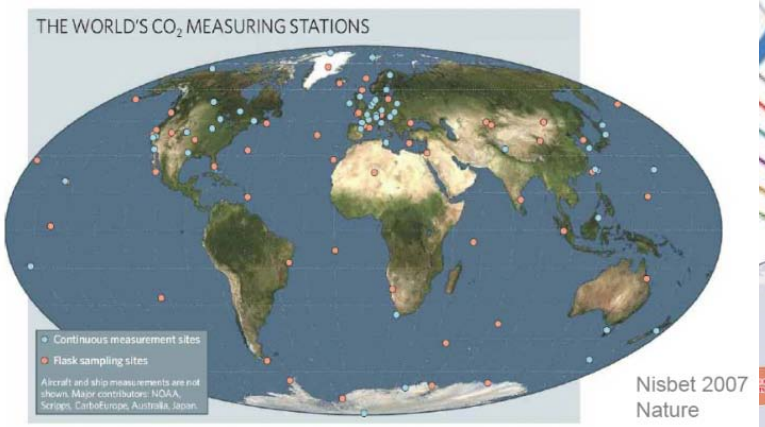
- A Joint Integrated Strategy under unified framework
- Strategically integrating GECs and other structures

Visioning: the five Grand Challenges

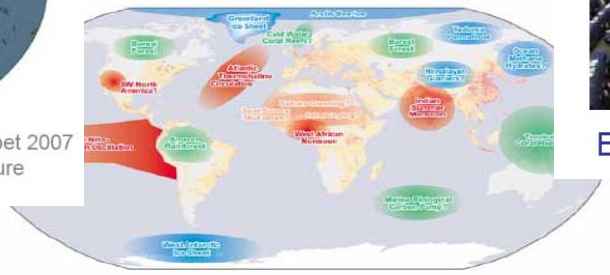


"Wiring diagram" (1985) → Earth System Simulator





Nisbet 2007
Nature



after Lenton et al. 2008

Earth Governance

Grand Challenges: publications

POLICYFORUM

ENVIRONMENT AND DEVELOPMENT

Earth System Science for Global Sustainability: Grand Challenges

W. V. Reid,[1]* D. Chen,[2] L. Goldfarb,[2] H. Hackmann,[3] Y. T. Lee,[2] K. Mokhele,[4] E. Ostrom,[5] K. Raivio,[2] J. Rockström,[6] H. J. Schellnhuber,[7] A. Whyte[8]

improved health and human security, and enhanced energy security? Can this be done while also meeting the United Nations Millennium Development Goals of eradicating extreme poverty and hunger and ensuring ecosystem integrity?

Answering these questions will require reorientation toward new research that better allows science and society to address the needs of decision-makers and citizens at global, regional, national, and local scales (*2*). We will have to meet a twofold challenge: (i) develop strategies to respond to ongoing global change while meeting development goals and (ii) deepen knowledge of the functioning of the Earth system and its critical thresholds (*3*). Promoting sustainable development requires research on a wide range of social, economic, cultural, institutional, and environmental issues (*4*). Given that sustainable development is no longer possible without addressing interactions with global change dynamics (*5*), we focus here on an important dimension of this larger sustainability agenda: the need to broaden and

[1]David and Lucile Packard Foundation, Los Altos, CA 94022, USA. [2]International Council for Science (ICSU), 75116 Paris, France. [3]International Social Science Council (ISSC), 75732 Paris, France. [4]National Research Foundation of South Africa, Pretoria, 0001, South Africa. [5]Indiana University, Bloomington, IN 47408, USA. [6]Stockholm Environment Institute, SE-106 91 Stockholm, Sweden. [7]Potsdam Institute for Climate Impact Research, 14473 Potsdam, Germany. [8]Environment and Natural Resources, International Development Research Centre, Ottawa K1G 3H9, Canada.

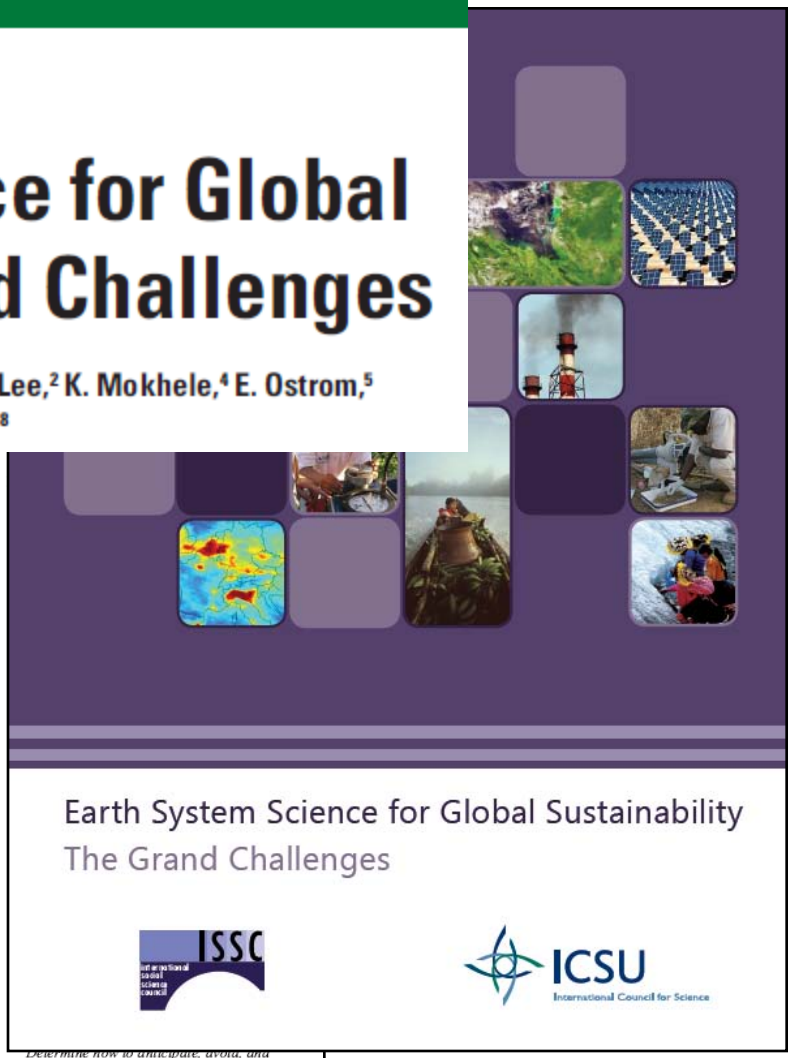
*Author for correspondence: wreid@packard.org

and framework of Earth system research (*7*, *8*). Efforts were made to obtain balanced input from developed and developing country experts, young and senior scientists, social and natural sciences, and both researchers and those using the findings of research. This process resulted in five "Grand Challenges" (listed below in italics), a consensus list of the highest priorities for Earth system science that would remove critical barriers impeding progress toward sustainable development (*9*). The challenges meet four criteria: (i) scientific importance, (ii) need for global coordination, (iii) relevance to decision-makers, and (iv) leverage (i.e., would help address multiple problems). For each grand challenge, several important research questions are identified as answerable within a decade.

Improve the usefulness of forecasts of future environmental conditions and their consequences for people. We need to develop what amounts to an enhanced Earth system simulator to improve our ability to anticipate impacts of a given set of human actions or conditions on global and regional climate and on biological, geochemical, and hydrological systems on seasonal to decadal time scales. Most current efforts to build state-of-the-art whole-Earth system models depart from sophisticated geophysical kernels (coupled atmosphere-ocean models based on exact dynamical equations like Navier-Stokes) that are to be complemented by equally powerful tools (once they become available) representing other parts of the planetary makeup. But,

Determine how to anticipate, avoid, and

Published by AAAS



Reid *et al.* 2010 Science

The Belmont Challenge

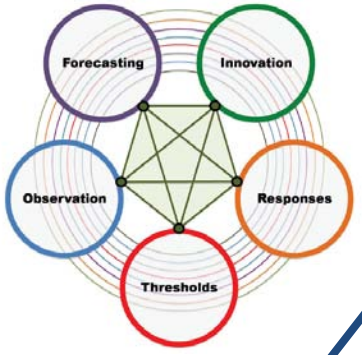
To deliver knowledge needed for action to mitigate and adapt to detrimental environmental change and extreme hazardous events.

This requires:

- Assessments of risks, impacts and vulnerabilities, through regional and decadal analysis and prediction
- Information on the state of the environment, through advanced observing systems
- Interaction of natural and social sciences
- Enhanced environmental information service provision to users
- Effective international coordination mechanisms.

Convergence of strategies for a long-term partnership

ICSU – ISSC
Visioning



Cape Town
meeting
Dec 2010

Seeking stronger
partnership

Belmont
Forum

A global Alliance for a new 10-year initiative

Note: WMO is an observer to ESSI

Earth System for Sustainability Initiative: goals

- Deliver knowledge to respond to global change
- Address the grand challenges
- Engage a new generation of researchers

Earth System Sustainability Initiative: key design criteria

- Focus on research for global sustainability
  - Partnership between researchers, funders, services, users
  - Strong regional nodes
  - A cutting-edge network
  - Active engagement with decision-makers
- Active engagement of full range of disciplines
  - Active engagement of new researchers

Designing the initiative

- A Transition Team oversees the design phase on behalf of the Alliance, until a permanent body is appointed
- An initiative bound in time, with a long-term impact

Transition Team: members



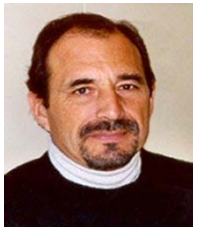





Excellence across disciplines, sectors, regions






for a truly new co-design effort

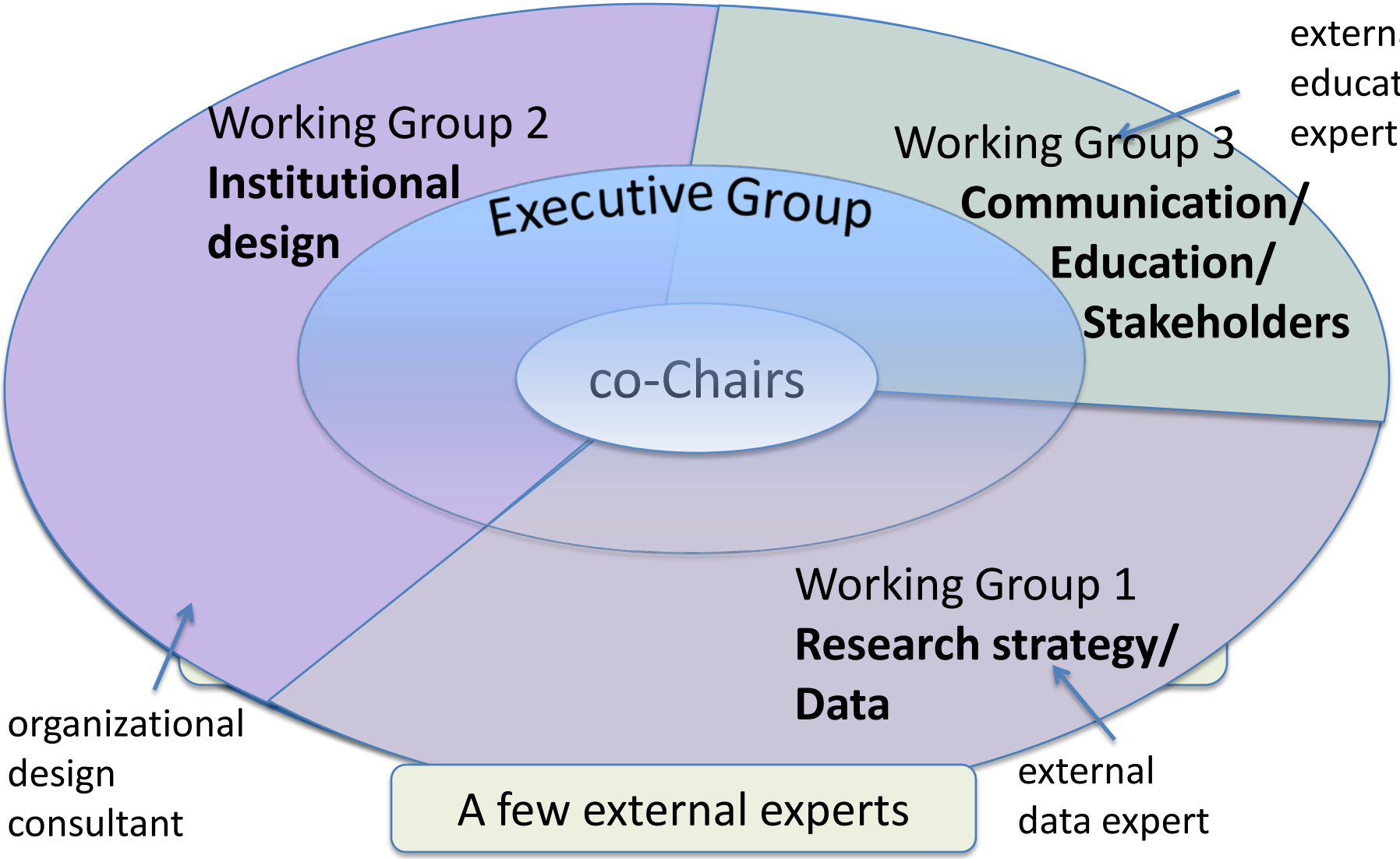






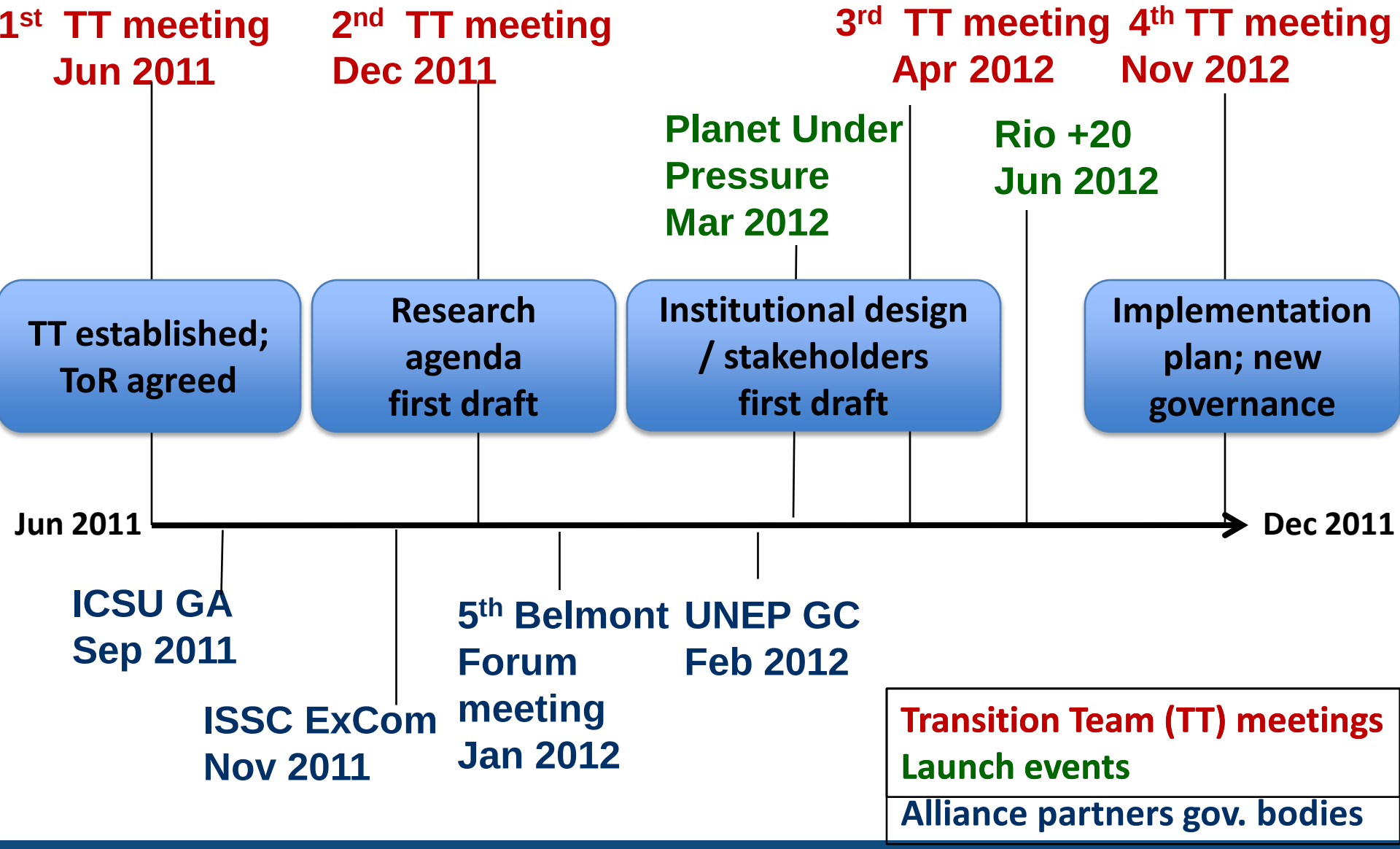

17 individual capacity members and 8 ex-officio (ICSU, ISSC, Belmont Forum, UNESCO, UNU, UNEP)

Transition Team: structure



Co-Chairs: Diana Liverman and Johan Rockström

Transition phase: key events and expected outcomes



Looking ahead: three critical endeavours

- A trans-disciplinary enterprise co-designed in an alliance
- Reorganizing the entire global environmental change research structure, and the way of doing research
- Integrating the “understanding” of how the Earth system works to finding solutions for a transition to global sustainability

For more information: www.icsu.org

ICSU, the International Social Science Council (ISSC), the Belmont Forum, a high level group of major funders of global environmental change research, together with UNEP, UNU and UNESCO, are jointly establishng a new 10-year Earth System Sustainability Initiative. Its goal is to deliver knowledge to enable societies to meet their sustainable development goals in the next decades.

www.icsu.org/what-we-do/projects-activities/earth-system-sustainability-initiative/