# The 2nd International Young Scientists' Global Change Conference, AND The 2nd Earth System Science Partnership's Open Science Conference

## Global Environmental Change: Regional Challenges November 2006 Beijing China

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In November 2006, I had the privilege of representing Australian palaeoscience at two international meetings on global change research held in Beijing, China. They profoundly challenged my views on the threat posed by global warming. Climate change is very real, happening now, and the rate of change is accelerating. I was struck by the urgency for direct and immediate action needed - at every level, in every nation.

The first conference I attended was the International Young Scientists' Global Change Conference (YSC) (Figure 1). The YSC took place November 5–8, 2006 the China Meteorological Administration campus in Beijing, China. The conference was sponsored by the Earth System Science Partnership (ESSP) and was organised by the global change SysTem for Analysis, Research and Training (START) and the China Meteorological Administration. START is a capacity building initiative for global change researchers funded by the ESSP program (detailed below). It targets developing countries and collaborations that conduct research on regional environmental change, the assessment of impacts and vulnerabilities to such changes, and information to policy-makers.

It brought together 100 young scientists from 35 countries to discuss some of the key challenges facing our scientific discipline, and the implications they hold for the future of global sustainability. Four people attended the meeting from our region, including three Australians (Ben Preston (CSIRO), Anna Richards (University of Queensland) and myself) and one New Zealander (Olivia Warrick (Victoria University)). I was the only Australian (and palaeoclimatologist) to address the congress.

The conference was an excellent platform for young scientists to present their research findings to both peers and leading scientists in the environmental change field. Keynote speakers included distinguished climatologist and numerical modeller Prof. Congbin Fu (China) and Prof. Paul Crutzen (USA), who received the Nobel Prize in 1995 for his research on atmospheric ozone. The meeting was organised into six themes:

- Earth system variability and modelling
- Ocean, freshwater and coastal systems
- Land ecosystem and biodiversity
- Biogeochemical cycles; cryospheric studies
- Human vulnerability and risk management
- Global change and agricultural systems

My talk addressed uncertainties surrounding late 20th century El Niño-Southern Oscillation (ENSO) extremes (Gergis and Fowler, 2005). This involved reconstructing the long-term history of ENSO using high-resolution palaeoarchives including tree-rings, corals, ice-cores and documentary records (Gergis et al., 2006). Previous ENSO reconstructions have been geographically biased toward East Pacific teleconnection regions, with little representation of sites influenced by the Western Pacific warm pool. I presented the first large-scale Southern Hemisphere effort to reconstruct ENSO using an expanded network of recently developed Western Pacific palaeoarchives.

Of the total number of extreme El Niño/La Niña event years reconstructed since A.D. 1525, 43% occur in the 20th century. Strikingly, 30% of all reconstructed ENSO event years occur post-1940 alone, suggesting that recent ENSO variability appears anomalous in the context of the past five centuries (Gergis and Fowler, 2005). These results suggest it is likely that ENSO operates differently under natural (pre-industrial) and human-influenced background states. Given the large-scale socio-economic impacts of ENSO events, investigations into how continued global warming will influence future ENSO behaviour are vital.

Over the course of the conference, we were encouraged to informally discuss the question "What are the big questions in global change science?" This lead to some very interesting conversations, as it is not often you get physical and social scientists from 35 countries in the same room! Collectively, we identified three main areas:

- Detection and attribution of physical climate cycles and their forcing mechanisms;
- Improved inter-disciplinary communication of science within and beyond the scientific communities;


Figure 1. Participants of the *2nd International Young Scientists' Conference on Global Change*, 5–8 November 2006, Beijing, China. Photograph courtesy Sandra Stowe, International START Secretariat.

• Adaptation and mitigation strategies to minimise socio-economic impacts.

The key concern was how we can effectively apply our science to confront environmental challenges and create a sustainable future. Scientists from developing nations were quick to comment that basic development issues identified by the 2005 *Millennium Ecosystem Assessment,* such as public health, food production, habitat fragmentation, coastal management and urbanisation, should not be dealt with in isolation. Vulnerability to climate-related impacts on society are compounded by factors unrelated to climate change, such as rapid popu-lation growth, unsustainable patterns of development and socio-economic inequity. Adaptation policy must aim to make societies more robust to developmental issues including, but not confined to, the issue of climate change.

Improved dialogue between science and policy-makers was also identified as another key priority area. As scientists, we need to be attuned to the interests of policy makers and need to improve on communicating our work to non-specialists. The group agreed that there is an important and practical need to continue inter-disciplinary meetings, such as this one, to cultivate an understanding of the complexity of global environmental change research and its practical application.

After negotiating the tangle of inner-city Beijing for a field trip to the awe-inspiring Forbidden City, all YSC participants then took part in the Earth System Science Partnership's Open Science Conference, "Global Environmental Change: Regional Challenges", at the Beijing International Conference Center. The ESSP is a collaboration between the four major international global change research programmes:

**DIVERSITAS**: an International programme of biodiversity science
**IGBP**: the International Geosphere-Biosphere Programme
**IHDP**: the International Human Dimensions Programme on Global Environmental Change
**WCRP**: the World Climate Research Programme

The meeting was attended by more than 1,000 global environmental change scientists, policy makers, members of the private sector and journalists. Issues discussed ranged from state-of-the-art advances in climate science, global food security, human health, sustainable development and biodiversity loss. The concept of a new form of "Earth System Science" was proposed as a cross-disciplinary integration of environmental and developmental sustainability in the natural and social sciences.

The term *Anthropocene,* first suggested by Paul Crutzen in 2000, is now being used to describe the most recent period in the Earth's history. The period begins during the 18th century when the activities of humans first began to have a significant impact on the Earth's climate and ecosystems. Crutzen explained how the influence of humankind on the Earth in recent centuries as so significant as to constitute a new geological era.

In a radical attempt to sequester atmospheric carbon, he discussed a controversial "geoengineering solution" currently being investigated by NASA (Crutzen, 2006). It is proposed that one million tonnes/year of sulphate aerosols are injected 16km into the upper atmosphere to increase the albedo of the earth's atmosphere, reducing global warming. This essentially simulates the radiative

effect of a large volcanic eruption, with models predicting a substantial warming of winter temperatures in the Northern Hemisphere. There is also lot of uncertainty about acid rain fallout and the impact on precipitation and temperatures in the stratosphere. This seems a desperate attempt to initiate a 3°C cooling to offset 2°C of global warming. Having sat through days of talks describing practical adaptation and mitigation solutions to a shifting climate, I found the whole concept a little hard to swallow.

But drastic times call for drastic measures. We learned that the planet is currently in a "non-analogue" state when the environmental conditions experienced today have no historical counterpart any time in our geologic past. According to evidence from ice-core records drilled from Dome Concordia (Dome C) in Antarctica, the closest we get to finding global temperatures somewhat similar to present is close to 800,000 years ago (EPICA, 2004). During that period, there were nowhere near the 6.6 billion people with the technology to alter the ecological systems the Earth houses today.

CSIRO's Michael Raupauch, from the Global Carbon Project, explained that global growth in carbon dioxide emissions from fossil fuels was four times greater in the 2000–2005 period than in the preceding ten years. Despite efforts to reduce carbon emissions, the global growth rate in $CO_2$ was 3.2% in the five years to 2005 compared to 0.8% in the 1990 to 1999 period. Recent efforts to reduce emissions have had virtually no impact on emissions growth and that effective caps are urgently needed. Raupauch stated that on our current path, we will find it extremely difficult to rein in carbon emissions sufficiently to stabilise the atmospheric $CO_2$ concentration at 450 ppm; even 550 ppm will be a challenge.

Currently, we are on track for the Intergovernmental Panel on Climate Change (IPCC) A1B "worst case" scenario trajectory. As outlined in the recently released *Climate Change 2007: The Physical Science Basis: Summary for Policy Makers*, this is likely to be shaped by an increasingly frequent series of extreme climate episodes in a rapidly unstable and unpredictable climate system. Due to environmental inertia, even when anthropogenic emissions do begin to decrease, atmospheric $CO_2$ will continue to rise for up to a century.

This concept is often referred to as our "commitment" to climate change. During this period, global temperatures will continue to increase, locking the world into continuous feedbacks of unforeseen climatic change. Effective management of the Earth system under such conditions will depend on early and consistent actions. Action is needed now, not in some vague, distant future. This had me (and many others) squirming in my seat: what to do?

At the close of the meeting, Conference Co-Chair Gordon McBean (Canada) presented the *Statement of the Beijing Conference on Global Environmental Change,* formulated as an urgent call by the scientists to society and policy makers to collaborate in the face of an ever faster changing environment. They noted: *In this era of human activities modifying the planet on a global scale, we are concerned for the continuing adverse affects on the global environment and the resulting serious threats to sustainable development of human society.*

The urgent need for improving communication between scientists with the broader public was identified, stating it was our role to: *Take responsibility to mobilise knowledge for action, and provide society with the scientific information to better meet present and future needs within the context of sustainable development.*

This left me with mixed feelings. I was concerned at the distinct lack of Australian and New Zealand scientists at these meetings. More importantly, I was concerned about the lack of research opportunities available in global change in Australasia. On a positive note, it gave me the final motivation to begin engaging in science communication work.

I strongly encourage young scientists to keep an eye out for these inter-disciplinary conferences. They provide an outstanding opportunity to expand knowledge of global change, to educate others about your field and learn how your work fits into the "bigger picture".

We have a responsibility as scientists to get involved in communicating to the broader community and across disciplines if the breakthroughs needed to face climate change are to be realised. Global environmental change is an immense social and technological call-to-action that will require collaboration on every scale. As is clear from the latest IPCC report, it is one we cannot afford not to heed.

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