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EDITORIAL

Complexity and interdisciplinary approaches to environmental research

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The launch of volume 8 of *Environmental Research Letters* (ERL) comes at a critical time in terms of innovations and exciting areas of science, but particularly in the areas linking environmental research and action.

The most recent climate change Conference of the Parties meeting (COP), in Doha in December 2012, has now come and gone. As has been dissected in the press, very little was accomplished. Some will see this as a failure, as I do, and others will reasonably enough note that this meeting, the 18th such COP was[1] never intended to be a milestone moment. The current plan, in fact, is for a 'post-Kyoto' international climate agreement to be adopted only at the COP 20 summit in December 2015.

As we lead up to COP20, and potentially other regional or national approaches to climate protection, innovations in science, innovations in policy tools, and political commitment must come together. The science of climate change only continues to get clearer and clearer, and bleaker [1]. Later this year the IPCC will release its Fifth Assessment Report, AR5. The draft versions are out for review now.

ERL has published a number of papers on climate change science, mitigation and adaptation, but one area where the world needs a particular focus is on the nexus of science and action.

A summary of the Intergovernmental Panel on Climate Change's findings from the first assessment report (FAR; 1990) to the latest report is presented in figure 1. This graphic is specifically not about the scientific record alone. What is most important about this figure is the juxtaposition of the language of science and the language of . . . language.

Note, in particular, that as the physical climate change metrics have progressed, the words—shown on the right—have slowly but surely progressed. In 1990, at the time of the FAR the strongest scientific consensus statement was that another decade of data would likely be needed to clearly observe climate change. Through the second to fourth (SAR, TAR, and AR4) reports, increasing clarity on the science of climate change translated into a consensus of overwhelming blame on human activities. The key statements from each report are not only about the growing evidence for anthropogenically driven climate change, but they have moved into the ecological and social impacts of this change. AR4 critically concluded that climate change would lead to climate injustice as the poor, globally, bear the brunt of the impacts. Despite this 'Rosetta Stone' translating science to language, we have failed to act collectively.

One area where ERL can advance the overall conversation is on this science/action interface. As AR5 emerges, the climate change/climate response interface will need deep, substantive, action that responds rapidly to new ideas

[1] The Kyoto Protocol was adopted on 11 December 1997 in Kyoto, Japan, and entered into force on 16 February 2005. As of September 2011, 191 states have signed and ratified the protocol. The United States signed but did not ratify the Protocol and Canada withdrew from it in 2011.

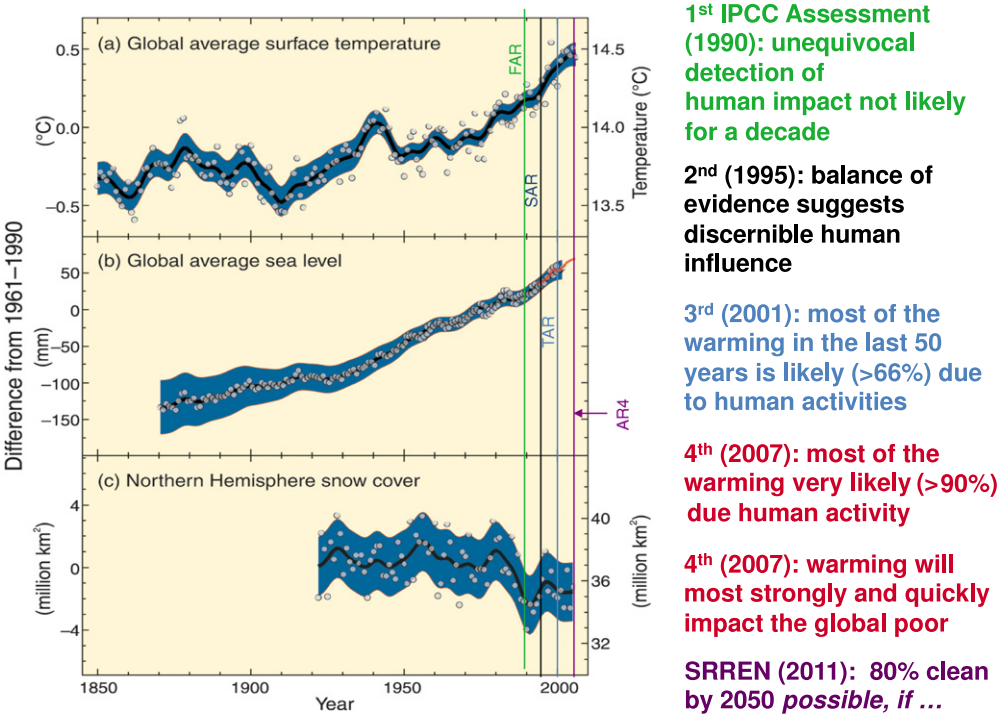

Figure 1. A superposition of the state of climate science in three key data sets, and the dates of the first, second, third and fourth assessment reports (FAR, SAR, TAR, and AR4, respectively) plotted as vertical lines. On the right are the key statements from each of these reports, along with the conclusion of the Special Report on Renewable Energy (SRREN, completed in 2011) which found that up to an 80% decarbonization of the global economy was possible if we can enable and launch a large-scale transition to a clean energy system consistent with what a number of 'leading edge' cities, regions, and nations have already accomplished or started.

and opportunities. The rapid publication and open access features of ERL are particularly critical here as events a such as Hurricane Sandy, economic or political advances in climate response made by cities, regions or nations, all warrant assessment and response. This is one of many areas where ERL has been at the forefront of the conversation, through not only research letters, but also commentary-style Perspective pieces and the conversation that ERL's sister community website *environmentalresearchweb* can facilitate.

This process of translating proposed solutions—innovations—between interest groups, has been in far too short supply recently. One promising example has been the science/action dialog between a leading climate research center and the World Bank [2].

'The Earth system's responses to climate change appear to be non-linear', points out Potsdam Institute for Climate Impact Research (PIK) Director, John Schellnhuber. 'If we venture far beyond the 2° guardrail, towards the 4° line, the risk of crossing tipping points rises sharply. The only way to avoid this is to break the business-as-usual pattern of production and consumption'.

This assessment came in a report on climate science commissioned by the World Bank. Dr Jim Yong Kim, president of the World Bank noted succinctly and critically that:

> '. . . most importantly, a 4 °C world is so different from the current one that it comes with high uncertainty and new risks that threaten our ability to anticipate and plan for future adaptation needs.'

This statement warrants careful discussion. Not only is World Bank President Kim affirming the results of the PIK study, and by direct extension the IPCC (because the same authors at PIK are also central to the work of the IPCC), but he is clearly noting that while many climate analysts rightly talk about the need to

not exceed a 2° temperature increase, the path the world is currently on, namely 4°–6° will be catastrophic. This may come as too soft a statement to many in the scientific community, but it opens the door to an increasingly detailed dialog between climate change science and agencies engaged in action.

Where ERL and other outlets for this conversation can play a critical role is in the many dimensions of climate change and response. The story is far from one only at the global level. As http://climatehotmap.org and many other location specific assessments detail, the environmental change story is playing out in millions of critical cases. Each warrants reporting and action, as well as integration with assessments of current data gathering and 'big data' needs, and with wider socioeconomic questions of effective political, and policy response. Through that, dialog papers in ERL will be critically important to advancing not only climate science, but the interactive dialog between knowledge and action.

References

[1] Hansen J, Sato M and Ruedy R 2012 Perception of climate change *Proc. Natl Acad. Sci. USA* **109** E2415–23

[2] Potsdam Institute for Climate Impact 2013 *Turn Down the Heat: Why a 4 °C Warmer World must be Avoided* (Washington, DC: The World Bank)