Examining Risks, Extreme Events, and Abrupt Changes

Uncertainty, Instability and Irreversibility in the Earth System; Yokohama, Japan, 11–13 March 2013

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Climate change research in Japan has shifted focus significantly in the past 2 years, with a greater emphasis on risks, extreme events, and abrupt changes. Two new national government-funded 5-year projects, Integrated Climate Assessment—Risks, Uncertainty and Society (ICA-RUS) and Program for Risk Information on Climate Change (SOUSEI) will focus on climate-induced risks and hazards and the possibility of fast climate changes. In light of the devastating Tohoku earthquake, tsunami, and consequent nuclear accident that occurred 2 years ago in Japan, there is also an increased interest in looking again at risks previously thought to be highly unlikely and in searching for potential risks that have not been considered.

Scientists in Europe and the United States have been investigating abrupt climate changes and "tipping points" for well over a decade. To benefit from this experience, a symposium funded by the ICA-RUS project was held at the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) in Yokohama. Researchers from Europe and the United States were invited, along with scientists from a number of institutes and universities in Japan, with around 40 attendees in total. Sessions focused on assessing risks, learning from the past, and predicting the future. Debates were held on three topics: abrupt climate changes, ensemble approaches, and future directions.

Participants concluded that one avenue to increase the utility of climate information is to strengthen the two-way interaction between stakeholders and scientists. The "linear model," or one-way approach, in which scientific results are provided to government, business, and the public, can be a very ineffective approach to the generation and use of information.

The group also agreed that the time scale of the climate change is an important factor in evaluating risks. From a societal point of view, assessment of the time scale and size of a climate change or risk from the climate change, and indeed the time scale required to avert the risk, can be more important than the dynamical characteristics of the underlying process (i.e., whether the process is linear, nonlinear, or even a threshold-induced bifurcation).

Another conclusion was that the main evidence for rapid and substantial climate changes comes from the past. The paleoclimate record can thus potentially provide a key to assessing the potential for future rapid climate changes. Many challenges remain for both the paleomodels and the paleodata, but evidence points to the current climate models as having limitations in reproducing such rapid changes. One consequence is that purely model-based projections may underpredict the likelihood of future abrupt changes.

In addition, participants agreed that when researchers generate probabilistic predictions, it is important that they try to realistically represent their uncertainty and to characterize as much as possible the effects of simplifying assumptions. Probabilistic ensembles derived from single models appear to be limited in terms of their qualitative range of behaviors, compared with those from the multimodel ensembles. However, multimodel ensembles still potentially have common biases and limitations, the consideration of which should be included when making probabilistic statements.

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