K. Trenberth: **Challenges of a sustained climate observing system**

The Earth is observed more completely today than at any other time. In particular, multiple observations are made from space in many different wavelengths via remote sensing and also via active sensors that provide information on many geophysical and meteorological variables. However, a key question is the extent to which these observations are suitable for climate, and especially for long-term climate monitoring?

As the climate system is continuously evolving, there is a need to measure its changes globally and regionally, to understand the system, attribute the causes of the changes by linking the changes in state variables to so-called forcings, and to develop models of the system that can simulate and predict its evolution into the future. The observations must be analyzed, often into globally gridded fields that can be used as an initial state for predictions using climate models. Accordingly, observations are used not only to document the state of the climate and how it is varying and changing over time; but also the external influences on the system such as the sun, the Earth's surface and changes in the atmosphere from human influences.

Because the climate is now changing from human influences (IPCC 2007) there is now an imperative to document what is happening, understand those changes and their causes, sort out the human contribution because it has implications for the future, and make projections and predictions on various time horizons into the future. Many observations pertinent to this information system are made, but many are not climate quality.

This paper discusses the observing system and its suitability for climate purposes. This details fairly recent improvements for cross calibrating space-based observations, for instance, and immediate prospects for the future. The needs are discussed along with the challenges in meeting those needs. Indeed the needs are compelling and enormous, but also feasible with international cooperation.

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Dr Kevin Trenberth, who is from New Zealand, obtained a ScD in meteorology from the Massachusetts Institute of Technology in 1972. He was a coordinating lead author in 1995 and 2007, and a lead author in 2001 of the Scientific Assessment of Climate Change reports of the Intergovernmental Panel on Climate Change (IPCC), and shared the 2007 Nobel Peace Prize, which was awarded to IPCC. He served, from 1996 to

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Dr Trenberth has also served on many national committees. He is a fellow of the American Meteorological Society (AMS), the American Association for Advancement of Science, the American Geophysical Union, and an honorary fellow of the Royal Society of New Zealand. In 2000, he received the Jule G. Charney Award from the AMS and, in 2003, he was given the NCAR Distinguished Achievement Award. He edited a 788-page book *Climate System Modeling*, published in 1992 by Cambridge University Press. He has published over 470 scientific articles or papers, including 47 books or book chapters, and over 210 refereed journal articles, and has given many invited scientific talks. He has also appeared on a number of television and radio programmes and has been quoted in newspaper articles.