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Editorial

Embedding Adaptation to Climate Variability and Change into Actual Decisions, Policies and Development Plans

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Climate change has become a critical challenge for society in both, developed and developing countries. As such it is included in national development plans throughout the world, and special funding mechanisms have been created to assist governments, especially in developing countries, to improve the adaptive capacity of their socioeconomic sectors to a changing climate. However, and in spite of these efforts there is still a generalized lack of implementation of concrete actions that allow to effectively embed adaptation to climate change in the agendas of most of the developing world.

Decision makers, including those responsible for elaborating policy, typically need to respond to problems that require immediate action. Moreover, the effect of such actions must be evident during the usually short terms in which those decision makers operate (typically 2-5 years, sometimes up to 10 years). Consequently, activities and policies targeting impacts that can only be seen in the longer term (e.g., 50 or more years) tend to attract less attention and become a lower priority.

Conversely, the scientific community working in climate change has been producing scenarios for a relatively far future (e.g., 50 to 100 years ahead). For example, the assessment reports that the Intergovernmental Panel on Climate Change (IPCC) has been elaborating since 1990, provide the best available projections of the world's climatology based on the anticipated changes in the composition of the atmosphere and its impact on the Earth's energy balance. The main objective of this research and the communicated results have been crucial to raise the awareness of the general public on the climate change issue in both, developed and developing countries. The research outcomes and the resulting increased public awareness on the need of alternative paths for development including the need for promoting the use of clean energy sources, encourage practices that reduce deforestation, enhance carbon sequestration, and in general to support actions conducive to reduce net greenhouse gas (GHG) emissions.

However, the direct use of these climate projections for assessing the impacts on socioeconomic activities and thus inform decisions and policies present shortcomings. Firstly, they typically project changes in the climate means, while some of the most important climate related challenges to societies are those related to extreme events (floods, hurricanes, drought), and therefore, they provide limited information to assist actual decisions and planning.

Institutions and individuals elaborating policy and acting in the development arena are interested in future climate scenarios because they believe that those scenarios will assist them in assessing the expected impacts of future climate on key socioeconomic sectors (agriculture, health, energy, etc.). It is further believed that the scenarios can help to identify improved adaptive practices, technologies and policies that will assist those sectors to cope with the expected climate.

However, the possible scenarios of future climate produced with the best available scientific methods include uncertainty levels that often impose challenges to be considered in actual decision making and planning. These uncertainties are partially due to limitations in the scientific knowledge included in the climate models that are used to produce the scenarios (this is specially true in rainfall projections). Uncertainties are also the result of assumptions that need to me made about the future socioeconomic scenarios used to estimate the GHG atmospheric concentration that drive the climate models. These socioeconomic scenarios include a wide range of assumptions dealing with trade, energy sources, technology transfer, etc. for the next 50-100 years that inevitably embrace uncertainties.

One analysis that can help to identify the type of information needed to support decisions and policies is an estimation of the relative magnitude of climate variability at different temporal scales (seasonal, decadal, longer-term) observed throughout the last century. Relying on climate models for generating possible scenarios of future climate requires the consideration of this relative magnitude in order to take into account how climate variations at different time scales may combine to produce climate related impacts. For example, subregions with a large observed component of decadal variability will require careful interpretation of climate projections obtained with climate models that do not perform well in simulating the observed variability at that scale.

The IRI[1] developed a web-based tool entitled «Time Scales Map Room» (http://iridl.ldeo.columbia.edu/maproom/.Global/.Time_Scales/) aimed to describe the characteristics of historical temperature and precipitation variability, in order to assist in the understanding of the potential usefulness of different types of climate information. The tool is designed to assess the relative contribution of interannual, decadal and longer-term climate variability on the observed historical climate.

Thus, the IRI's Time Scales maproom can be used to partition the total variability of the observed precipitation in the world over the 20th century into the three components mentioned above: long-term trend or «climate change», decadal, and interannual. That analysis reveals that the long-term trend or «climate change» component explains 5-20 % of the total observed precipitation variance almost anywhere in the world. The decadal component typically explains up to 30 % of the total variance and the remaining 60 % or more of the total precipitation variance is explained by the year-to-year or «interannual» component.

These findings emphasize the importance of the interannual climate variability as compared to any of the other two scales. They also stress the shortcomings of considering only observed or projected long-term trends in subregions with relatively large decadal variability. In short, the results explain the very limited utility of future climate projections exclusively based on climate models.

Early interaction of the climate science community with stakeholders demanding assistance to improve adaptation to climate change encountered important obstacles. Stakeholders found it difficult to act upon the available climate scenarios given the limitations resulting from the uncertainty levels and the lack of consideration of relevant temporal scales discussed above.

In response to these challenges, alternative approaches were developed in institutions that operate in the interface of the scientific and the user communities. These approaches consider the longer-term climate variations («climate change») as part of the continuum of the total climate variability, from seasons through

[1] International Research Institute for Climate and Society, Columbia University, New York

decades to centuries, and aim to generate information at the temporal scale that is most relevant and applicable for the particular time frames or planning horizons of the different decisions. One of the key premises of these approaches is that improving the adaptive capacity of societies to confront current climate variability and its extremes lead to societies that will be better adapted to the longer term climate change.

The approach that we propose to manage the full spectrum of risks and opportunities associated with a changing climate («climate risk management») is sustained on four key pillars:

1. Identifying vulnerabilities and potential opportunities due to climate variability and change for a given system (agriculture, water, public health, natural ecosystems, etc.), in close collaboration with stakeholders.

2. Characterizing and quantifying uncertainties in climate information in order to improve the use of that information. Understanding the climate aspects of vulnerabilities and opportunities requires: (a) *learning from the past*, i.e., understanding the characteristics of climate at different time scales and assessing its socioeconomic impacts, (b) *monitoring the present* conditions of relevant environmental factors (climate, vegetation, streamflow, diseases, etc.), and (c) *providing the best possible information of the future*, at relevant time scales (weeks to decades).

3. Identifying technologies and practices that optimize results in normal or favorable years and/or reduce vulnerabilities to adverse climate. Examples in agriculture include crop diversification, crop rotations, improved tillage systems, increased water soil storage capacity, improved crop water use efficiency, drought-resistant cultivars.

4. Identifying policies and institutional arrangements that reduce exposure to climate hazards and enable to take advantage of favorable climatic conditions. Exposure reduction can be achieved, for example, with improved early warning and response systems, and by transferring portions of the existing risks with different forms of insurance.

Typically, a portfolio of approaches is necessary. For example, insurance covering extreme negative events, diversification covering moderately negative events, and forecast/scenario use to capture opportunities in years with favorable climate conditions given the downside risk is covered by other parts of the portfolio.