A REVIEW OF THE KEY FINDINGS FROM THE IPCC SPECIAL REPORT ON MANAGING THE RISKS OF EXTREME EVENTS

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Abstract

We review some of the key findings from the IPCC's Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. An underlying theme in the report is that disaster risk arises from the complex interaction of exposure and vulnerability. Drawing on historical evidence as well as future projections, the report suggests that mankind's exposure to many forms of extreme climate events has increased in the last 60 years, and may continue to do so in the future. This suggests that appropriate strategies for reducing or managing disaster risk may more appropriately emphasize reducing vulnerability.

Introduction

In March the Intergovernmental Panel on Climate Change (IPCC) has released its *Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (SREX, IPCC; 2012). The SREX synthesizes a vast literature on a wide range of important issues, such as the relationship between climate change and extreme climate events and the implications for such events on social structures and sustainable development. In this brief, we review some of the key findings drawn from this report, as presented in the "Summary for Policymakers" (IPCC; 2011).

Summary of Key Findings and Predictions

An underlying theme in the SREX is that exposure and vulnerability are the key determinants of disaster risk and the resultant impacts when that risk is realized. Exposure involves the presence of social or environmental systems in places that can be adversely affected, while vulnerability involves the predisposition of these systems to adverse impacts resulting from the realization of a certain risk. Neither exposure nor vulnerability are sufficient in and of themselves to result in disastrous impacts, but where there is both a high level of exposure and a high degree of vulnerability, there is an escalated risk of significant adverse impacts. Both exposure and vulnerability are dynamic processes that depend on a wide variety of factors, including economic, social, geographic, demographic, cultural, institutional, and environmental characteristics that are unique to different places at different times. The SREX identifies several important aspects of exposure and vulnerability, including the occurrence of extreme climate events, the resultant impacts of these events, and strategies for actively managing and reducing the disaster risks associated with these events.

- **Extreme Climate Events**
  Identifying changes in the occurrence of various weather outcomes relies on the determination of a trend using historical data. There is some evidence suggesting changes in the occurrence of various climate extremes. On a global scale, for example, data suggest there has been an overall decrease in the number of cold days and nights, while at the same time there has been an overall increase in the number of warm days and nights. These trends have also been observed on a continental scale in North America and Europe. In addition, data suggest an increasing trend of heavy precipitation events in some regions, though there is a great deal of variation both within and across regions. While there does not appear to be a significant change in tropical cyclone activity, there does appear to be a pole-ward shift in the storm tracks for cyclones originating outside the tropics. This analysis may *permit* climate change as a causal factor, but a greater burden of proof is required to attribute these frequency changes to climate change, and even more so to link these to human causes. The SREX finds some evidence that man-made increases in atmospheric greenhouse gas concentrations have contributed to a warming of extreme daily minimum and maximum temperatures, as well as to increased extreme precipitation on a global scale.

  Predictions of future climate conditions are based on complex models that simulate the effect of different atmospheric carbon concentrations affect atmospheric and oceanic cycles. Depending on the emissions scenarios that these simulations are based on, models can result in wildly different predictions. As such, there is often a great deal of uncertainty regarding these predictions, which affects the confidence that can be placed in them. Despite these uncertainties, the SREX suggests that it is virtually certain (99-100% likely) that there will be an increase in the frequency and magnitude of warm temperature extremes and a decrease in cold temperature extremes during the 21st century, and it is very likely that the frequency and/or intensity of heat waves will increase over most areas. The SREX also suggests that the frequency of extreme precipitation events or the proportion of total rainfall attributable to these extreme precipitation events is likely to increase. Some regions are predicted to experience an increase in the frequency of extreme precipitation events despite a decrease in total precipitation. Predicted changes in temperature and precipitation may result in increased

floods on a local scale, though this argument is primarily predicated on "physical reasoning" rather than as the result of model simulations. It is very likely, however, that the mean sea level rise will contribute to upward trends in extreme coastal high water levels in the future. In addition, the predicted increases in the frequency and intensity of heat waves, in conjunction with glacial retreat and the melting of permafrost zones, is likely to increase landslides and mudslides as well as contribute to more frequent lake outburst floods. Tropical cyclone frequency is likely to either remain constant or decrease, though the cyclones that do occur may become be more intense. Droughts are predicted to intensify in the 21st century, due to either decreased precipitation or an increased rate of evaporation of plant and soil moisture.

- **Human Impacts and Disaster Losses**
  Historical evidence suggests that the economic losses arising from climate-related hazards have, on average, increased over time. These estimated economic damages should be interpreted as lower bound estimates, however, since they poorly reflect many losses which cannot easily be expressed in monetary terms (e.g., loss of human lives, ecosystem services, etc.). Absolute economic damages are greater in developed countries, while disaster fatalities and relative damages (as a share of GDP) are larger in developing countries. The major cause of these increasing losses can be attributed to the increased exposure of lives and economic assets to climate hazards, though the report also acknowledges that the role of vulnerability has not been adequately incorporated into causal assessments.

  In the future, extreme events are likely to have a greater impact on those aspects of society that are more closely linked with climate, including agriculture, water, and forestry. Of particular concern—due to its potential for seriously impacting livelihoods—are the potential impacts of climate change on water management systems. Making any firm predictions in this regard, however, is complicated due to the interaction of several different change agents, of which climate change may not even be the most important at a local level. The SREX suggests that socioeconomic factors are likely to be the key drivers of future increases in the economic damages related to climate extremes, specifically the increased exposure of human lives and various forms of capital. The report also suggests that climate-related disasters could have an influence on human migration patterns, since an increasing frequency and/or intensity of extreme climate events may make some locations less desirable places in which to live or work.

- **Disaster Risk Management**
  Given predictions about the impacts of climate change on extreme events, population growth and asset accumulation are likely to increase exposure to disaster risk, so reducing vulnerability is and will continue to be an important component of managing or reducing this risk. Historical evidence suggests that vulnerability and exposure are the result of an uneven and unsustainable development path, consisting of detrimental forces such as environmental degradation and rapid urbanization. These forces place extreme stress on already fragile ecosystems, which increases the exposure to disaster risk. The report finds strong evidence that developed countries are better equipped for dealing with the adverse impacts of disasters, given their financial stability and generally better institutions and infrastructure. These factors enable developed countries to more readily respond to changes in exposure or vulnerability that increase disaster risk. Risk transfer and sharing mechanisms can improve resilience to disasters, but the ability to access such *ex post* strategies may provide disincentives for countries to take adequate *ex ante* measures to reduce their risk.

  The report suggests that effective disaster risk management in the future will require a portfolio of strategies to reduce and/or transfer risk and respond to disasters. These portfolios should be informed and customized by agents at a local level and should be specific to particular circumstances. Generally, however, risk management should incorporate a combination of structure-based responses as well as strategies to increase individual and institutional coping capacity. Disaster risk management strategies that have a dual purpose of both providing benefits under both current climate and a range of future climate scenarios may prove advantageous starting points for managing future climate risk, since many of these strategies

also help countries address other development goals. Ultimately, the SREX argues, the most appropriate disaster risk management strategies will result from an iterative process. Such a process is vital in large part because only over time can many of the uncertainties associated with climate change and resultant disaster impacts be resolved. An iterative risk management process will allow the resolution of these uncertainties to inform policies and adaptive strategies. Monitoring disaster impacts will fuel research into alternative strategies for reducing either exposure or vulnerability, and a process of evaluation and progressive learning will facilitate additional innovation with the end result of reducing mankind's exposure and vulnerability to climate-related disasters.

References

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