Geophysical Research Abstracts
Vol. 17, EGU2015-7288, 2015
EGU General Assembly 2015

Managing the Financial Risks of Water Scarcity

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Environmental uncertainty poses a growing number of financial risks to society, with droughts, floods, extreme temperatures and violent storms imposing costs that approach $500 billion per year. While structural forms of mitigation (i.e. levees, dams) will certainly play a role in limiting financial impacts, these are large investments whose full value is only rarely realized. Furthermore, the value of such long-lived measures becomes increasingly uncertain in a changing climate, raising the issue of whether they will be effective 20-30 years hence. Financial instruments, such as index insurance, can provide increased flexibility by providing compensation for losses only when they occur, and limited contract periods allow terms to be periodically rewritten in response to changing conditions. Financial instruments can also be effectively combined with other economic tools and infrastructure to create integrated solutions in which infrastructure mitigates losses from moderate events, while financial products compensate for more rare, but extreme, events.

There is a long history of environmentally-related insurance and hedging instruments, but to date the actuarial analyses that underlie contract structure and pricing have been based on straightforward observations, such as cumulative rainfall. More recently, simple correlations between two time series have been used to develop index-based contracts. Links between temperature and electricity demand, for example, provide a basis for contracts that are used to limit the financial exposure of power generators to low revenues during unseasonably warm winters or cool summers. Unfortunately, few environmental risks can be so quickly and easily linked to a financial impact. However, with a more advanced understanding of the environmental systems that give rise to financial losses, opportunities exist to develop innovative contracts for a range of new applications. Recent research describes the characterization and mitigation of financial losses experienced by such entities as water utilities, hydropower producers and inland shipping firms as a result of water scarcity, all of which suggest a growing role for financial instruments in managing environmental risk.