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ENHANCING VALUE OF SPACE-BORNE SYSTEMS FOR DISASTER RISK REDUCTION RESEARCH AND DISASTER RISK MANAGEMENT

Abstract

Purpose: Using the 2010 flood event in Pakistan as a case study, the paper highlights the political, socio-economic, and environmental context in which information from space-borne systems is used to coordinate international disaster response. The purpose is to enable the space-technology community to gain a more holistic understanding of stakeholders and their information needs. We simulate the 2010 flood event using a coupled land-atmosphere modeling system. The results illustrate how data from space-borne systems can enhance the reliability and predictive ability of models and facilitate decision making during natural disasters through more effective knowledge management.

Methodology: In July and August of 2010, six major pulses of torrential rain occurred over northern Pakistan plunging approximately one fifth of the country under water. The floods affected over 20 million people, killing over 1,985 people, destroying or damaging over 1.6 million homes and killing more than an estimated 300,000 livestock. The World Bank estimated the cost of reconstruction at USD 10 billion, which was approximately two percent of Pakistan's Gross National Product, and almost 30 percent of its annual tax revenue. According to the International Monetary Fund, the total economic impact of flooding to rural livelihoods, agricultural output, industrial input and infrastructure, including lost economic productivity was expected to total USD 43 billion. We assess the magnitude and extent of deforestation over the study region using data from Landsat Thematic Mapper (TM) and Moderate Resolution Imaging Spectroradiometer (MODIS). We conduct modeling simulations of the flood event using the Weather Research Forecast (WRF) modeling system using two different Land use/Land cover datasets, and compare the results against in situ observations. Sensitivity simulations are conducted to explore the effectiveness of reforestation initiatives aimed at reducing flood damage.

Results: The analysis provides a first-order assessment of the impact that deforestation has had on flood damage. Space-borne systems enhance the reliability and predictive ability of earth system models, which are not only capable of informing decisions related to flood response and relief operations, but also provide pre-event vulnerability assessment of population and infrastructure to extreme events.

Conclusion: With technology-enabled connectedness increasing the possibility that local disasters will have regional or global implications, the need for timely and reliable information from a variety of sources, including space-borne observations and earth system models has grown significantly. The full benefits of such systems will not be realized without a persistent and well-organized communication effort between receivers and suppliers of information.