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Risk assessment of climate systems for national security

George Backus[†];
[†] Sandia National Laboratories, USA
Leading author: gabacku@sandia.gov

The US Executive branch, many members of Congress, and Defense and Intelligence communities recognize that climate change has considerable potential to create high-consequence security threats. They further recognize the gap between climate science and the engineering risk-based analyses needed to characterize the national security threat. National security issues arising from perceptions of climate change already produce geopolitical tensions within the Arctic, Russia, China, and Africa. From the loss of economic security, to the new access to critical resources, to the disruption of strategic supply chains, climate change produces destabilization hazards across countries. To understand geopolitical issues, we must recognize the dynamics of regional climate change and its concomitant effects on human and state behavior. Moreover, we must comprehend and accommodate the inescapable uncertainty in physical and human-behavioral modeling before we can assign any level of confidence (validation) to the results that analyses produce. This paper describes the extension of our existing climate capabilities to perform regional analyses and a comprehensive characterization of potential security threats. We focus on identifying emergent and signpost phenomena of climate change, along with sensitivity fingerprints. We couple climate change, hydrological and socioeconomic analyses with new Uncertainty Quantification methods for examining the high-consequence tails of the climate probability distributions that dominate the risks and impacts for societies and economies. Our previous work established that a primary path of climate change risk follows a course from local hydrological impacts affecting the ability to maintain local economic activity. Interregional socioeconomic interactions then produce ripple-effect impacts on a global scale with geopolitical ramifications. Decision support systems to quantify and manage the associated risk thereby entails multi-scale and coupled analyses. Informing policy makers of the risk then requires developing metrics for measuring and encapsulating the dynamic uncertainty. This work integrates four disciplines: climate modeling, hydrological modeling, socioeconomic modeling, and uncertainty quantification. This next year, we will extend our hydrological and socioeconomic models, using them to perform regional risk assessments in concert with the global climate models. We use the Arctic and East Asia as our test regions, but incorporate the global consequences of regional risks.. We utilize our newly developed capability in Uncertainty Quantification to determine the probabilistic uncertainty of joint physical and societal climate-change impacts. Our goals for the project are to have developed formal methods for promoting confidence in risk assessment results and our integrated modeling approach will be usable for supporting risk-informed decision making relative to national security issues.