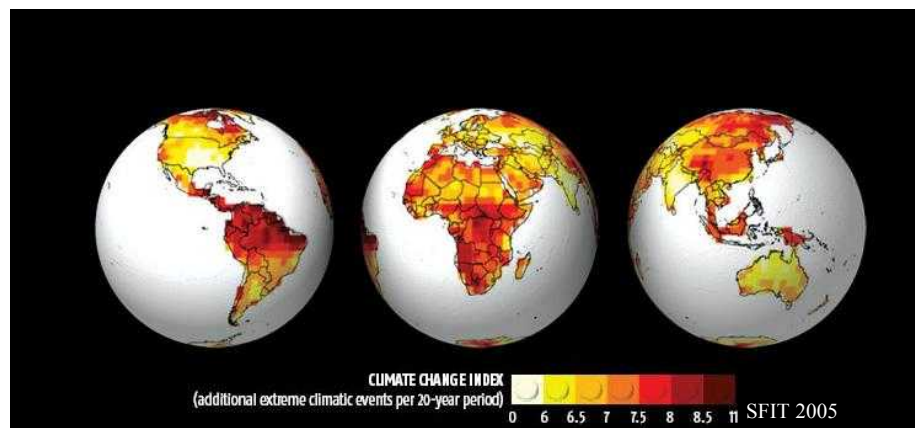


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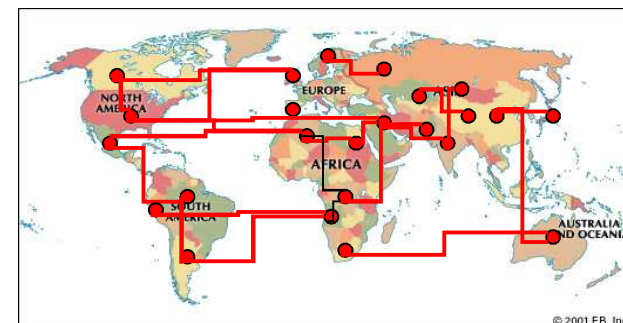


Assessing the Dynamics of Climate and Conflict

Briefing to Dr. John Phillips, Chief Scientist

December 11, 2008

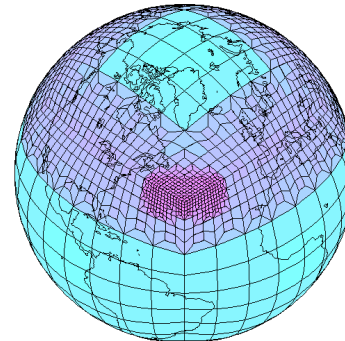
John Mitchiner, jlmitch@sandia.gov
George Backus, gabacku@sandia.gov



Agenda

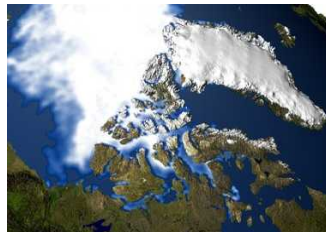


- Climate and National Security
Efforts at SNL
- Climatic Misperceptions
- The Misunderstood Arctic
- Security Preparedness



Climate and Security Preparedness

- Independent of future climate change, new climate-induced agreements and treaties will require government agencies to independently monitor and verify compliance, particularly in regard to:
 - ⊕ Evolving sovereignty claims
 - ⊕ Enforced climate/environmental restrictions on economic activities
 - ⊕ Unilateral geo-engineering and its “down-stream” impacts
- In the Arctic, environmental “incidents” have long-lived impacts that could have severe economic and political implications.
- Real or not, climate-blamed events can cause cascading global geopolitical consequences.



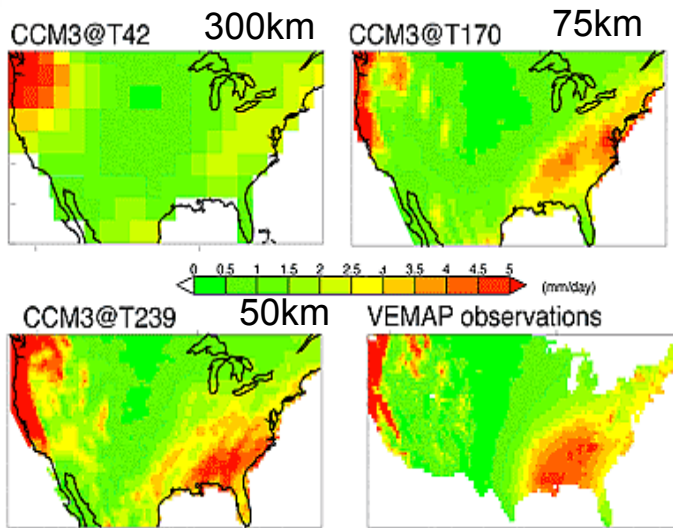
Sandia and Climate Security



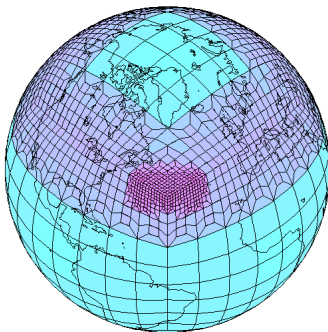
- Sandia has been briefing and preparing to serve with the intelligence and defense community to help in this mission since 2002 (including review of the Climate NIA)
- Our expertise is an integrated engineering perspective with verification and validation to allow high-confidence, risk-informed, decision making under uncertainty.
 - ⊕ Have focused on the impacts of climate-change dynamics on conflict, destabilization, and security.
 - ⊕ Staff have spent decades assessing future conditions, options, policies, and responses using physical, behavioral, societal, economic, and security analyses across many countries and policy domains.



Regional Models For Discovery And Early Warning: Robust, Emergent, Signposts Of Consequences



Wintertime Precipitation



Cubed-Sphere

Emergent phenomena: Trends or effects that cannot be predicted from first-principles reasoning, nor anticipated intuitively. Exploration-mode high performance computing is a laboratory that can lead to discovery of the unpredictable.

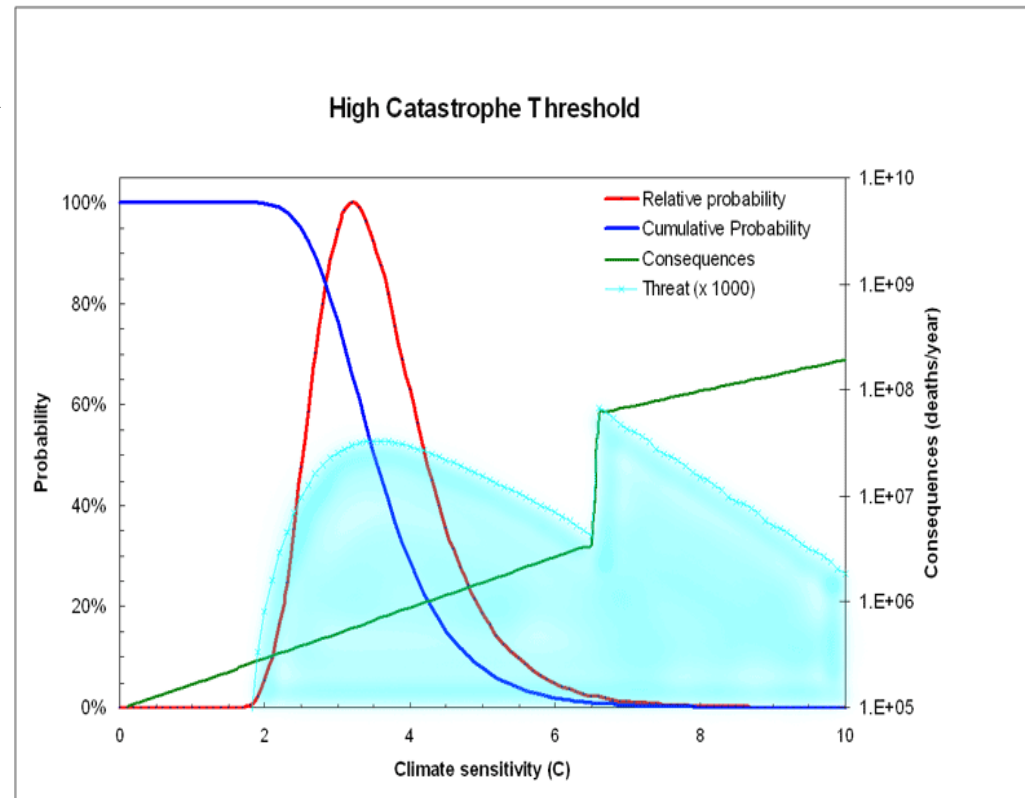
Robust phenomena: Those which emerge from the physics, dynamics, and geometry over a very broad range of assumptions. Regional scale simulations can discover robust emergent phenomena even before they are ready for validated scientific research.

Signpost phenomena: Those which presage future change and provide forecast validation.

Consequential phenomena: Those which have large effects on economies, the environment, security, or other systems on which humans depend. Forecasts of emphasize consequential phenomena, even if probabilities are highly uncertain (Black Swans).

Confusing Scientific with Engineering Risk

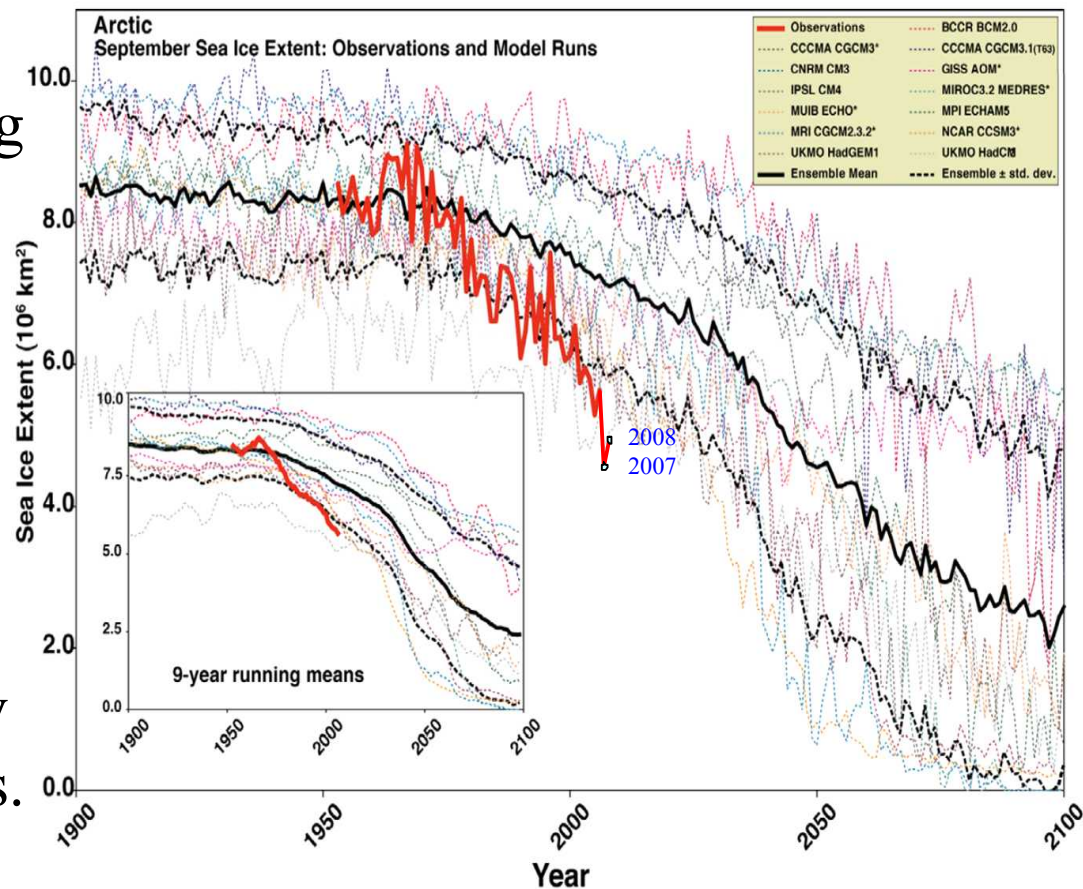
- Science ensures conservative estimate of actual value. This value is the $>50/50$ probability of being worse.
- Engineering ensures functionality under all expected conditions. This value balances chance and consequence tolerance.
- Dominant risk is outlying, right-side of distribution.
- Even with underestimated IPCC results, catastrophic climate is 1000 times more probable than a catastrophic asteroid.



Conservative Science Grossly Misleads Risk Assessment

The Game Changing Arctic

- Reality is already outside the range of any modeling distribution.
- New time constant exceeds the ability to reactively adapt/respond.
- Volume change is more severe and monotonic.
- The Arctic provides early warning of climatic shifts.



Managing Security Risk Dynamics

- No one can ever really know how the future will unfold.
 - ⊕ We need to bound the possibilities and quantify the uncertainty.
 - ⊕ Static perspectives miss the pervasive, dynamically caused interactions.
 - ⊕ Even VERY smart humans cannot mentally contend with delayed feedback phenomena.
- Consequence evaluation requires formal simulation modeling
 - ⊕ Feedback processes define the integrated socioeconomic and physical relationships.
 - ⊕ Workshops and red-teams can only bring up possibilities (hypotheses) to test in verified models, but cannot produce self-consistent scenarios on their own.
- Quantitative assessment using climate and behavioral socioeconomic models
 - ⊕ Conventional socioeconomic simulation tools do not contain the security dynamics.
 - ⊕ Needs to capture critical resiliency and failed expectation dynamics that produce conflict realization.
 - ⊕ Generates early warning/leading indicators for political instability and false-alarms.
 - ⊕ Requires regional socioeconomic and weather detail on a global scale.



Anticipating the Unintended Consequences of Security Dynamics

- Globalization, in the societal sense, will continue to make international security less amenable to military force and more dependent on managing behavioral interactions.
 - ⊕ Keeping intervention and technology options pertinent requires managing the potential unintended consequences of their use.
 - ⊕ Current socioeconomic models do not accommodate conflict-evolution nor the type of validation rigor needed for security missions.
- Sandia is developing a globally applicable system to simulate evolving conflict dynamics and intervention options, while incorporating uncertainty.
 - ⊕ Extends existing socioeconomic behavioral models to include conflict progression within a classified simulation environment.
 - ⊕ Allows the direct coupling of geopolitical models to climate models
 - ⊕ Background efforts of model development already used for two DoD efforts (Africa/SE Asia) on insurgency management for societal stabilization with combined economic and security interventions.



Climatic Interactions and Implications

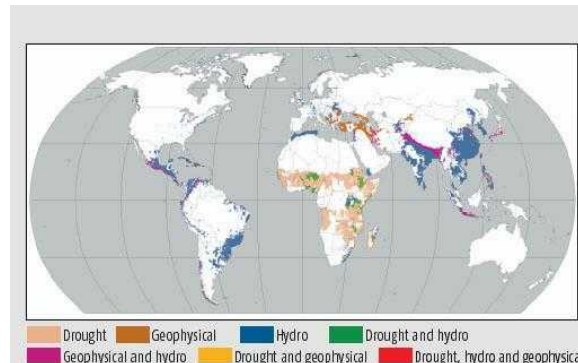


- History repeatedly shows advanced technology and globalization affords no protection from conflict.
 - ⊕ Migration can cause collapse or renaissance on either side of border, or can cause intra-national fracturing or international cascading.
 - ⊕ Disease vectors and rapid-collapse produce power voids where factional entities compete.
 - ⊕ Supply-chain risk causes re-colonization and resource-politicization.
 - ⊕ China, India and Russia sensitivity to climate forces societal changes.
- Climate intensifies resources use and global infrastructure stress.
 - ⊕ Mitigation efforts may be financially and politically destabilizing.
 - ⊕ Inadequate humanitarian efforts create political and security paradoxes.
 - ⊕ Land-use feedback exacerbates local climate and cascading events.
 - ⊕ “Youth Bulge” can affect destabilizing response to climate threat (even in Arctic).
 - ⊕ The Arctic relieves strategic-resource risk through routing diversity



A Changing Security Landscape

- US intervention resources may not be available:
 - ⊕ Dramatic changes in extreme weather and weather variability will change the mission space and strategic implications of interventions.
 - ⊕ The current mix of equipment/resources will be suboptimal for the altered physical conditions of the engagement theater, and will force changes in field tactics/contingences and the cost of interventions. (e.g., open Arctic and tempestuous Tropics).
- Need for monitoring and early warning of cascading/destabilizing conditions
- Alliance partners (and their budgets) are preoccupied with climate-related disasters
- Climate-induced stresses can dictate the location, type, rapidity, and incidence of conflict.



Adapting to the Security Climate



- Assess technological requirements for geographically shifting threats, amid diminished efficacy of existing resources.
- Characterize mission-space transformation of military and political intervention needs.
- Provide tools for intelligence and military logistics in light of climate-change extremes.
- Assist the intelligence community and military in studies for strategic and tactical planning.
- Gauge evolving nation-state societal, political, and financial instability.
- Determine emerging threats and the countermeasures to manage them.
- Enumerate the potential evolution of conflict dynamics across regional boundaries.
- Anticipate conditions to allow countermeasures that redirect the outcome away from catastrophic consequence.



Surprises in Arctic Climate Change

■ The Arctic is the next “new world.”

- ✦ European interests in the New World led to global conflict.
- ✦ Exploitation of and contention over newly accessible polar energy and mineral resources should not be surprising.



■ What is the sense of urgency?

- ✦ The scientific community predicts gradual climate change over decades.
- ✦ Analysis of recent data suggest the Arctic will be ice free for a substantial part of the year by 2013.
- ✦ When viable, up to 80% of world trade would now go over the Pole with destabilizing southern-hemisphere implications.



■ Rapid regional economic development will create new cities, infrastructure and industry in a fragile environment.

- ✦ Russian territory may become the hub of global economic concentration and tension.
- ✦ Destruction of the Arctic environment has unknown human impacts that could lead to violent counter-responses.
- ✦ Extreme weather magnifies politico-economic challenges and the security environment.



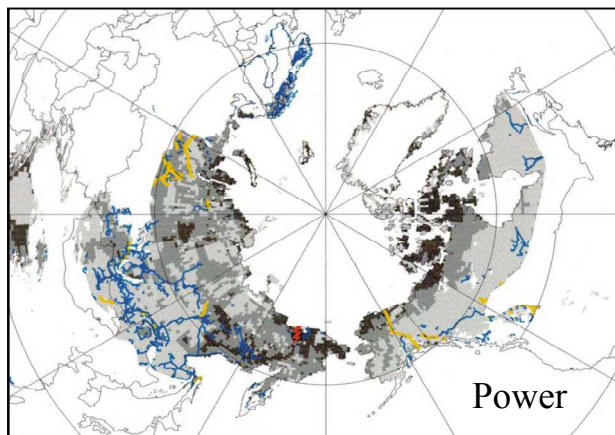
Asset Constraints and Risks

■ Structures

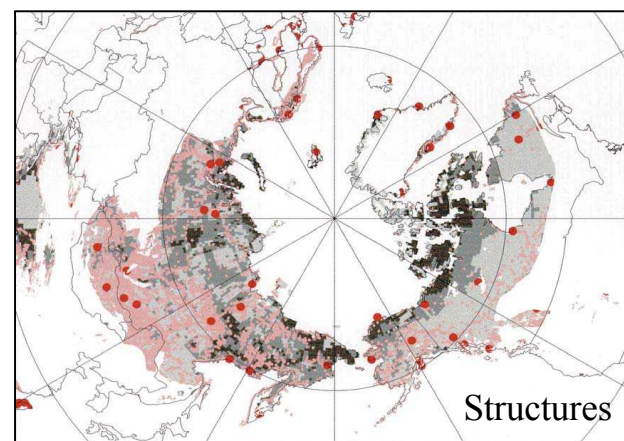
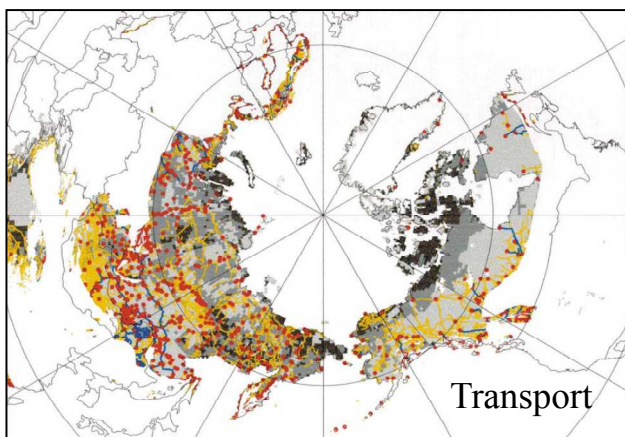
■ Power

■ Transport

Global expansion will be
greatest in Russian territory



Dark grey
implies
high risk



The Security Community needs to Understand, Plan, and Operate in a Shifting Climate

- A capability to address politically disruptive change (globally) at the regional level.
 - ⊕ Climate change can foster US security threats through international instability
 - ⊕ Climate conditions can change the requirements on and the effectiveness of US security activities.
- Increased evaluation capabilities through:
 - ⊕ Large-scale climate, geopolitical, and socioeconomic modeling
 - ⊕ Optimal ocean, ice, atmospheric, and space sensor networks in cooperation with DoD and DHS for Arctic regions.
 - ⊕ System-of-Systems resource/asset assessments
- Leveraging ongoing NNSA (SNL/LANL) missions in verification of international treaties.
- Exploiting (SNL/JPL/LANL) capabilities for global monitoring and systems modeling, including sensitive data on global infrastructure.



Working with the Security Teams



■ Short-Term

- ⊕ Apply our expertise for addressing climate-related security and conflict dynamics.
- ⊕ Incorporate matured (since 1974) staff competence in analyzing global dynamics and climate change impacts.
- ⊕ Use monitoring experience for treaties and agreements
- ⊕ We can work with the community at SCI level, as required.

■ Longer-Term

- ⊕ Integrate and use intelligence, engineering, defense, and international proficiency with climate, behavioral, economics, social network, psychology, and anthropological analysis/modeling capability.
- ⊕ Emphasize Validation & Verification for decision-making under uncertainty.

