Inundation, Infections, and the Internet:

Applying System Perspectives to Climate Change

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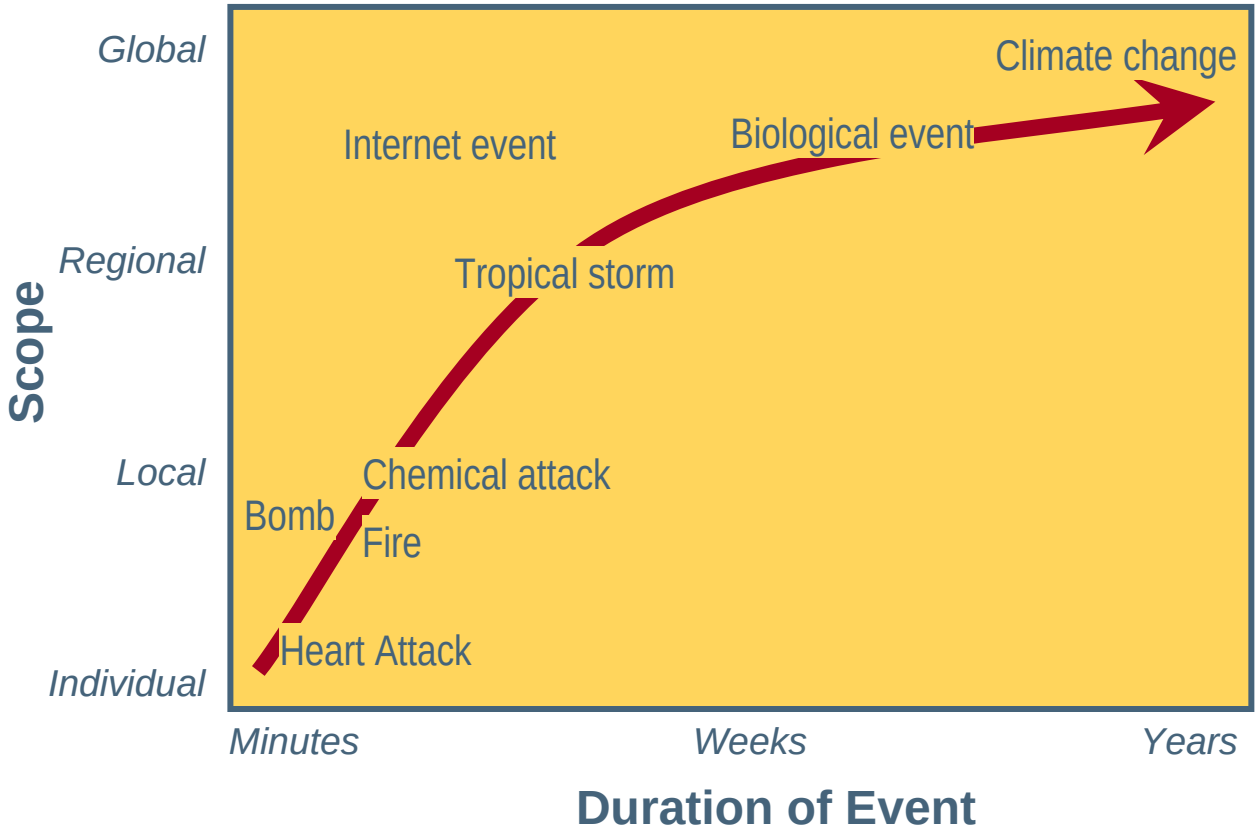
Response to Hazards and Threats –
"What Does It Take To Get Attention?"



Complications:

- ***Uncertainty of event and prediction***
- ***Cost of decision and response***

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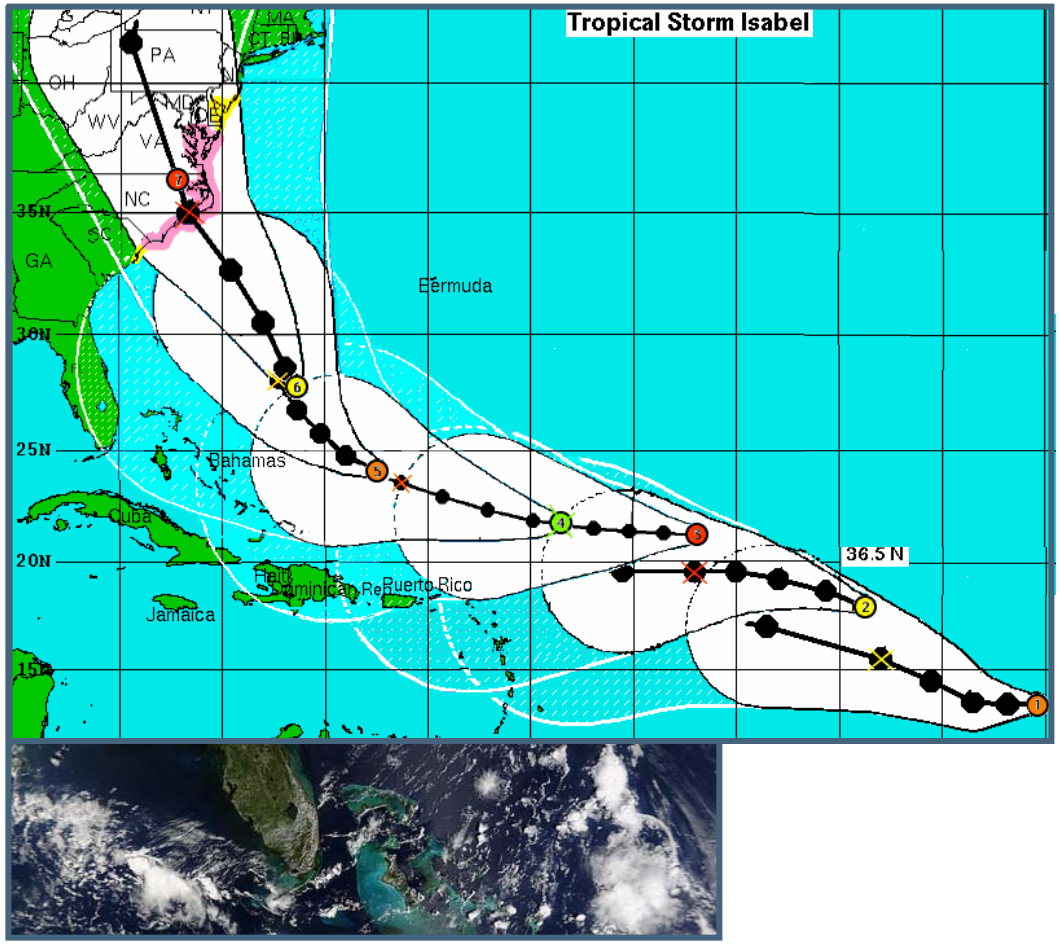
Response to Hazards and Threats –
"Seeing Around Corners?"

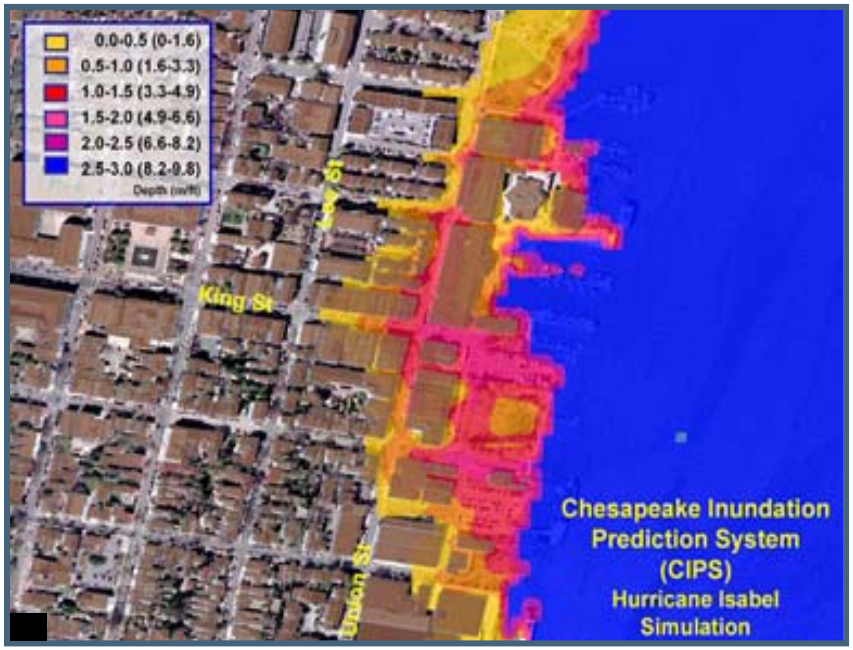


Complications:

- **Uncertainty of event and prediction**
- **Cost of decision and response**
- **Difficulty of Response**

Services Industry → Heavy Industry

Flood Inundation –
Combined Impact of Surge and Downriver Events



Context

- Single and multiple contributing threats
- Local to regional economic and human impact

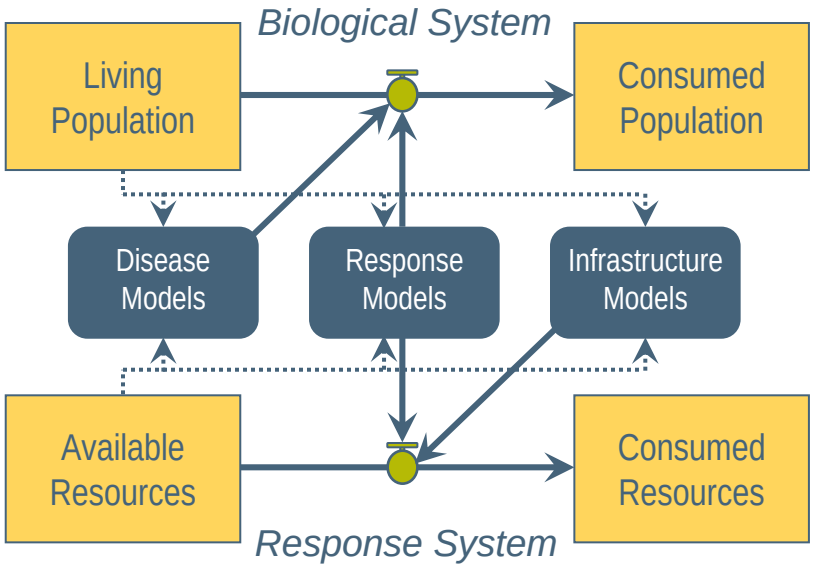
Lessons Learned

- Need for actionable information
- Identify user needs and engage users end to end in prototype development
- Current data and forecast is not sufficient
- Bridge research, modeling and technology to achieve operational prototype
- Better response with better prediction and understanding of uncertainty

Practices and Realities

- Business Continuity Plans include weather and flood related events
- Business relationships need to be in-place

Infections –
Natural and Terrorist Based Biological Events



Context

- Large number of unknowns/uncertainties
- Detection is difficult
- Regional, national, global impact

Lessons Learned

- Early action saves lives; flatten the response
  - Make decisions and take action locally
  - Maximize resource pool
  - Local inaction has global consequences
- Critical infrastructure essential
  - Private sector owned,inter-dependent
  - Humans are key resource
- Need to model disease & response systems

Practices and Realities

- Business Continuity Plans now include flu
- Long lead times requires pre-positioned polices and agreements

Internet –
Performance of IP-based Systems

Context

- Dynamic technology environment
- Limited centralized control or governance
- Problems cascade in minutes

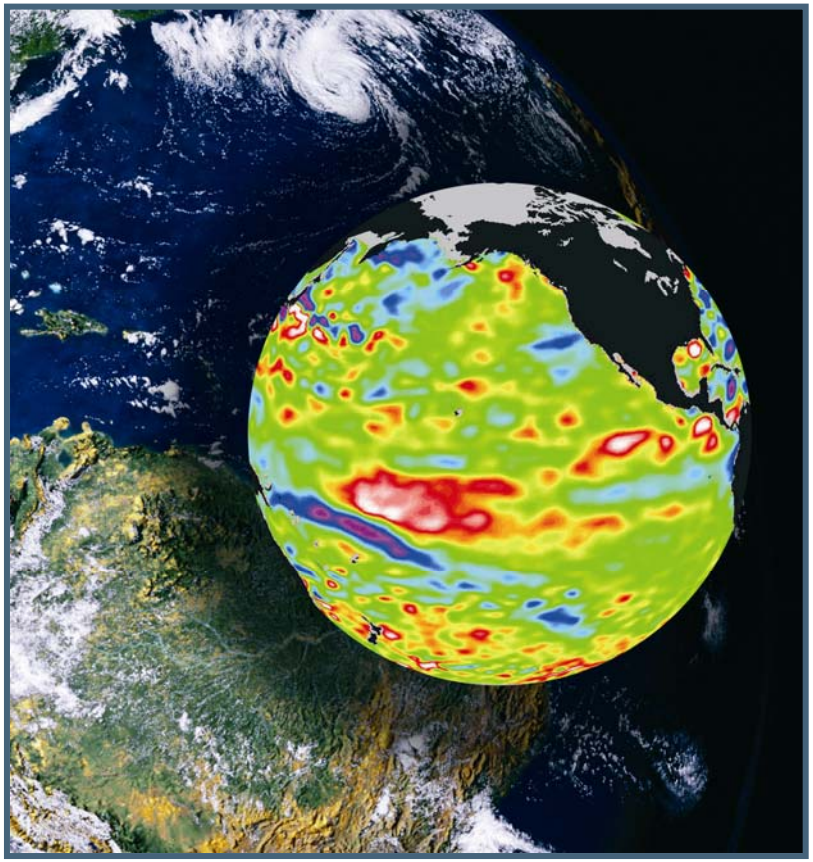
Lessons Learned

- Emergent behaviors negate fundamental design assumptions
- Resilience not guaranteed by multiple systems

Practices and Realities

- Business Continuity Plans address loss of information and network services
- Corporate infrastructure redundancy not realized

Climate Change –
Industry Needs



Context

- Complex, global problem
- Long time constants – Delayed consequences
- Problems potentially cascade

Lessons to be Learned

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-

Best Business Practice

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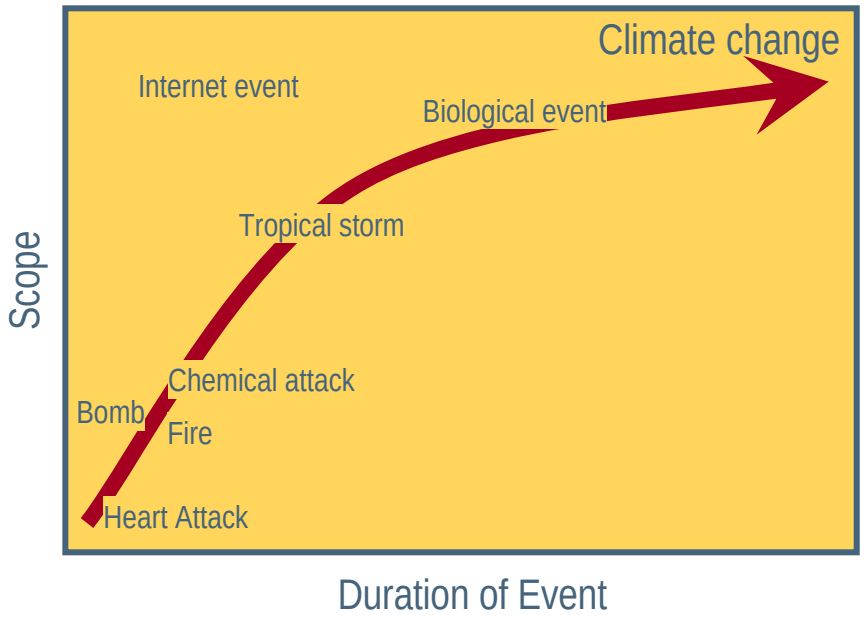
Extrapolation to Climate Change –
System Implications – Putting things together



What We Know…

- Uncertainty of event and prediction
- Risk of decision and response
- Difficulty of model validation

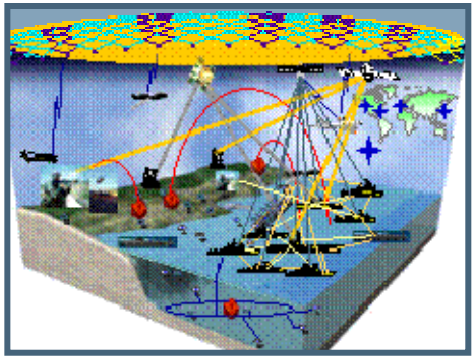
What We Have To Do…

- Understand failure scenarios and critical dependencies
- Use flexible, agile, sense and respond approaches
- Exploit information and networking technologies
- Assume and guide technology advancements

Understanding Failure Scenarios… Using Sense-and-Respond Strategies

*Mass Based**

Just-in-Time



*Sense-and-Respond**

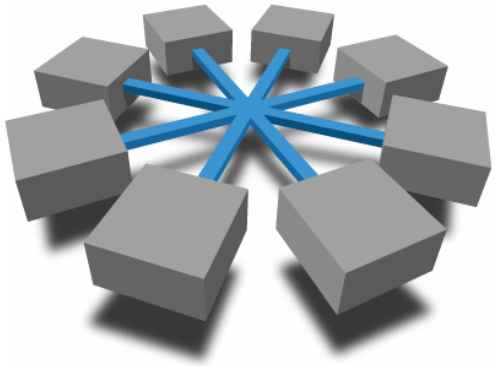
- **Dynamic environment and response evolution** over stable environment and fixed response
- **Constant sensing, analyzing, and action** over application of fixed response plan
  - Rapidly (re-)organize to respond to a changed situation, mission, or goal
- **Resilience** over efficiency
- **Roles, accountabilities, and capabilities** over strategic plan
  - Improves decision time and speed of action
- **Collaborative network of capabilities** over functional hierarchy
  - Control via arbitrators replaces fixed organizational structures
- **Scalable and evolvable** over predetermined transition and expansion plans
- **Requires technological support** to realize sense-and-respond

**"Sense and Respond Logistics: Co-Evolution of an Adaptive Enterprise Capability," DOD Office of Force Transformation*

Exploit Information & Network Technologies
Within Sense-and-Respond Approach

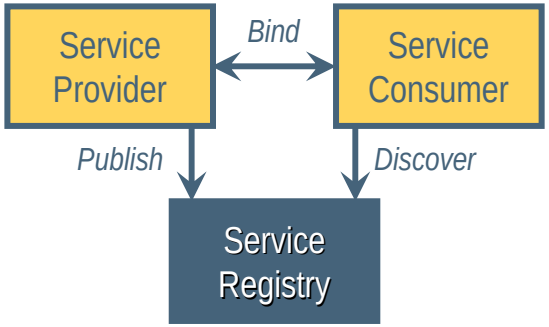
Network-Centric

- High-speed reliable Intra-/Inter-net
- Information sharing
- Gradations of access based on role in current operations



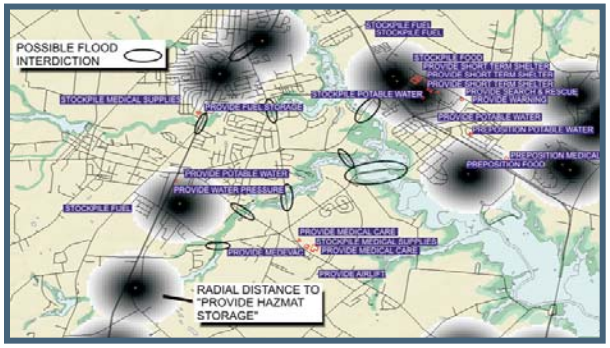
Service Oriented Architecture

- Decentralized and open approaches to delivering services and resources
- Maximizes the resource pool



Situational Awareness GIS

- Use GIS to overlay available capabilities onto the community
  - See effects of events and current options
  - Determine needed capabilities

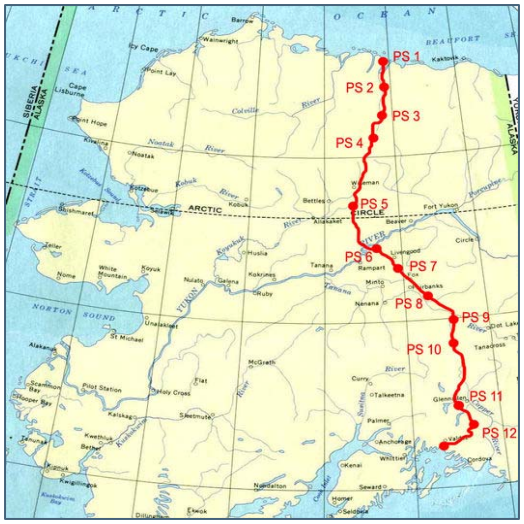


Source: Eveleigh, et al,, Systems Engineering, Vol. 10, No. 3

Assume and Direct Technology Advancements Build Roadmaps and Benchmarks for Action

- Climate models indicate clear impacts for industry
  - Need to establish requirements for response and action
- Need to understand a highly dynamic technology options:
  - Minimize the magnitude of climate change
  - Address causes of climate change
  - Minimize climate change impact
- Establish roadmaps and benchmarks for action
- Build the relationships and put policies in place early.
- Invest with a long term perspective

Scoping the Climate Information Need:
Impacts on Industry



The Trans-Alaska Pipeline is half underground and half above ground (where permafrost is present).
Will industry move more pipeline underground as permafrost retreats or build a port facility instead to avoid dealing with the changing permafrost?

Grass-Fed? Not Without Grass. In 2003, David Simpkins made a bet on the future… start feeding grass to his Angus cattle.
But this summer's drought resulted in little grass for cows to graze, and he had to sell many to a feedlot.
"It's at least a two-year setback."
Jane Black, Washington Post October 17, 2007

Cave Spring in Lynchburg, Tennessee slows to a trickle.
Major drought – water flow is already down a third to a half of normal. This has been the source for over 140 years for Jack Daniel's Whiskey.
They are conserving as much water as they can and finding ways to use less water in the whiskey recipe – and praying for rain. Bob Swanson/Doyle Rice, USA Today

Thank You

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