

## Towards the Design and Operations of Effective Humanitarian Supply Chains

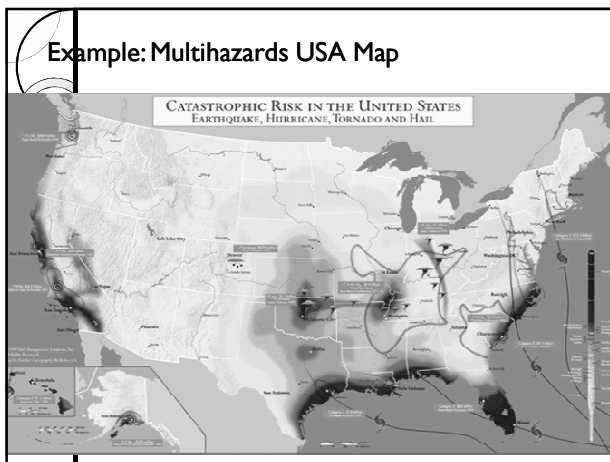
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Lisbon-Portugal, January 2012

### Motivation

- worldwide increasing trend in natural disaster numbers
  - ⇒ the number of disasters resulting in 100,000 to 999,999 victims around the globe doubled during 1987-2006 (CRED)
- Impacts on human lives
  - ⇒ In 2007, 414 natural disasters were reported worldwide affecting 211 million people (CRED)
  - ⇒ Haiti Earthquake: more than 2 million people homeless
- Impacts on global economy.
  - ⇒ Hurricane Katrina in 2005 caused US\$ 129 billion, in damages
  - ⇒ The worldwide economy connectivity helps aggravating the severity of disaster impacts

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### Current Research: Prepositioning Emergency Supplies: A Stochastic Phase-Dependent Approach

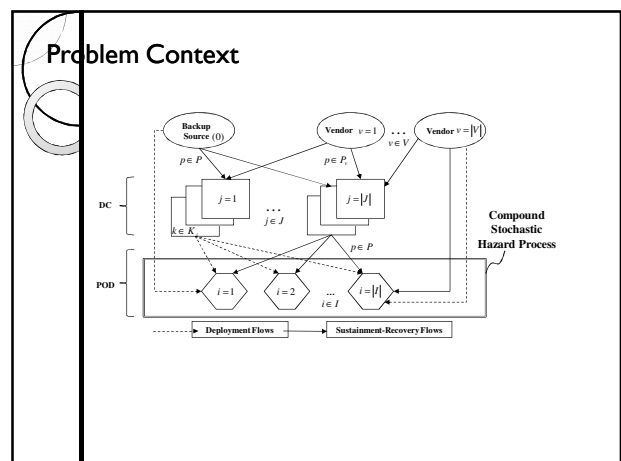
*Soumia Ichoua, Walid Klibi and Alain Martel*

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### Relief Distribution Network: Goal

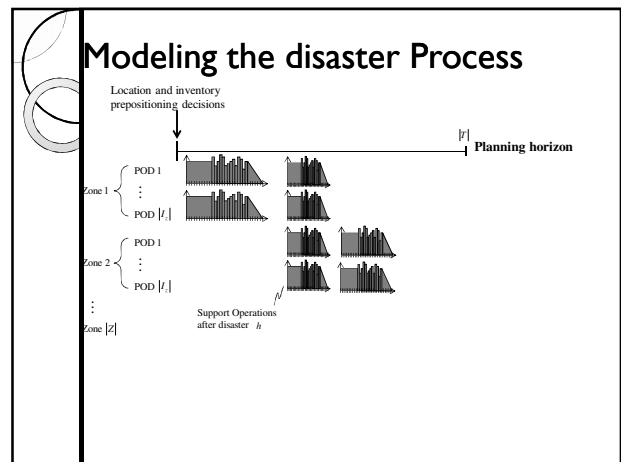
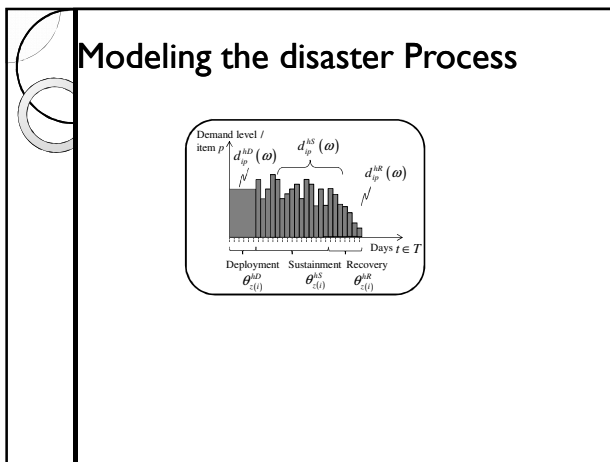
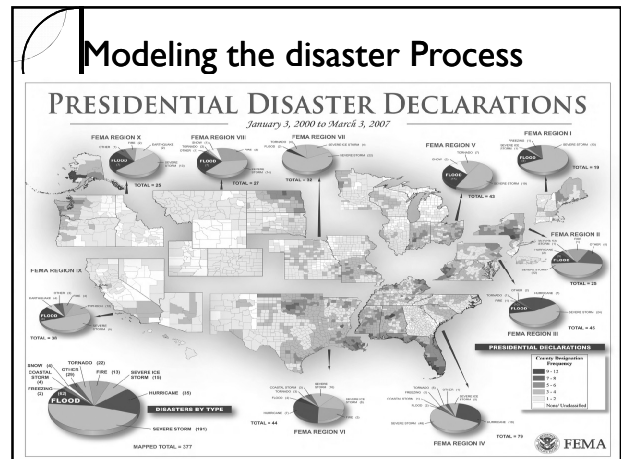
- Mitigate the impacts of disasters on human lives
  - ⇒ an adequate and timely delivery of emergency supplies to affected populations.
  - ⇒ Pre-positioning of emergency supplies prior to the disaster onset
  - ⇒ effective disaster preparedness to insure an effective disaster response

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### Modeling the disaster Process

- What can go wrong?
  - Vulnerability sources identification and filtering
- What are the consequences?
  - Disaster impact on population
- What is the likelihood of that happening?
  - When?
    - Exponential inter-arrival time
  - Where?
    - Attenuation probability ( $\alpha_n$ ): epicentre zone
    - Conditional propagation probability: affected zones



### Modeling the Prepositioning Problem

**Design Decisions:**

1. Number and location of local dist. centers
2. Their inventory levels for each type of emergency supply
3. Allocation of supplies in DCs to PODs

**Objective:**

minimize the expected sum of total transportation costs and total uncovered demand while taking into account all design constraints.

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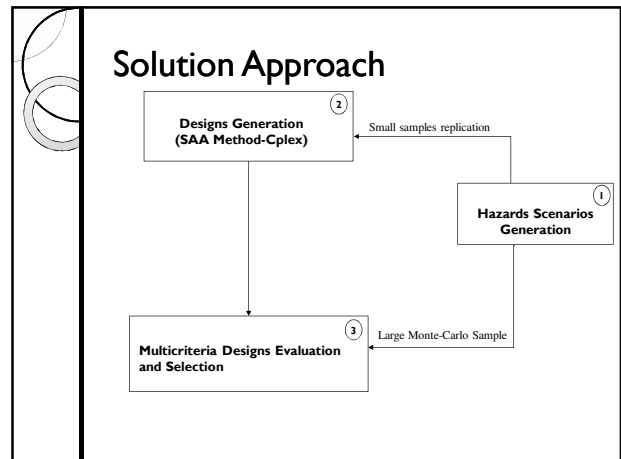
### Effective Design of Humanitarian Distribution Network

⇒ Integration of the two decision processes is essential to enhance the relief network performance

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### Modeling the Prepositioning Problem

- A two-stage stochastic programming model
  - First Stage decisions: Design decisions
  - Second Stage decisions: Operational decisions



### Future Research:

## Collaborative Relief Distribution Networks

### Logistics in large-scale disasters

- multiple parties (NGOs, military, state and federal agencies, etc..)
- chaotic setting where information and resources are scarce

⇒ Need to coordinate the relief distribution network for effective response

⇒ increased interest in collaboration among humanitarian organizations but coordination is still challenging

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### Challenges in Coordinating Humanitarian Relief Networks

- Urgency of Decision Making
- Dynamic-Stochastic environment
- Diversity of participants
- Difficulty to match demand to supply
- A centralized response is typically not realistic
- Difficulty to share information

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### Research Questions

- What to Coordinate?
- existing coordination practices among relief organizations?
- competition/collaboration tradeoff?
- risks , costs versus benefits of coordination?
- Can we learn from coordination in commercial Supply Chains??

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