Field Informatics in Disaster/Disease Situational Analysis and Intervention

(1st Field-Based Design Symposium, Kyoto U., 2013)

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Special Thanks

- Special thanks to **Professor Toru Ishida, colleagues, and friends** of Collaborative Graduate Program in Design, Design School, Kyoto University for kind invitation, hosting and arrangement!
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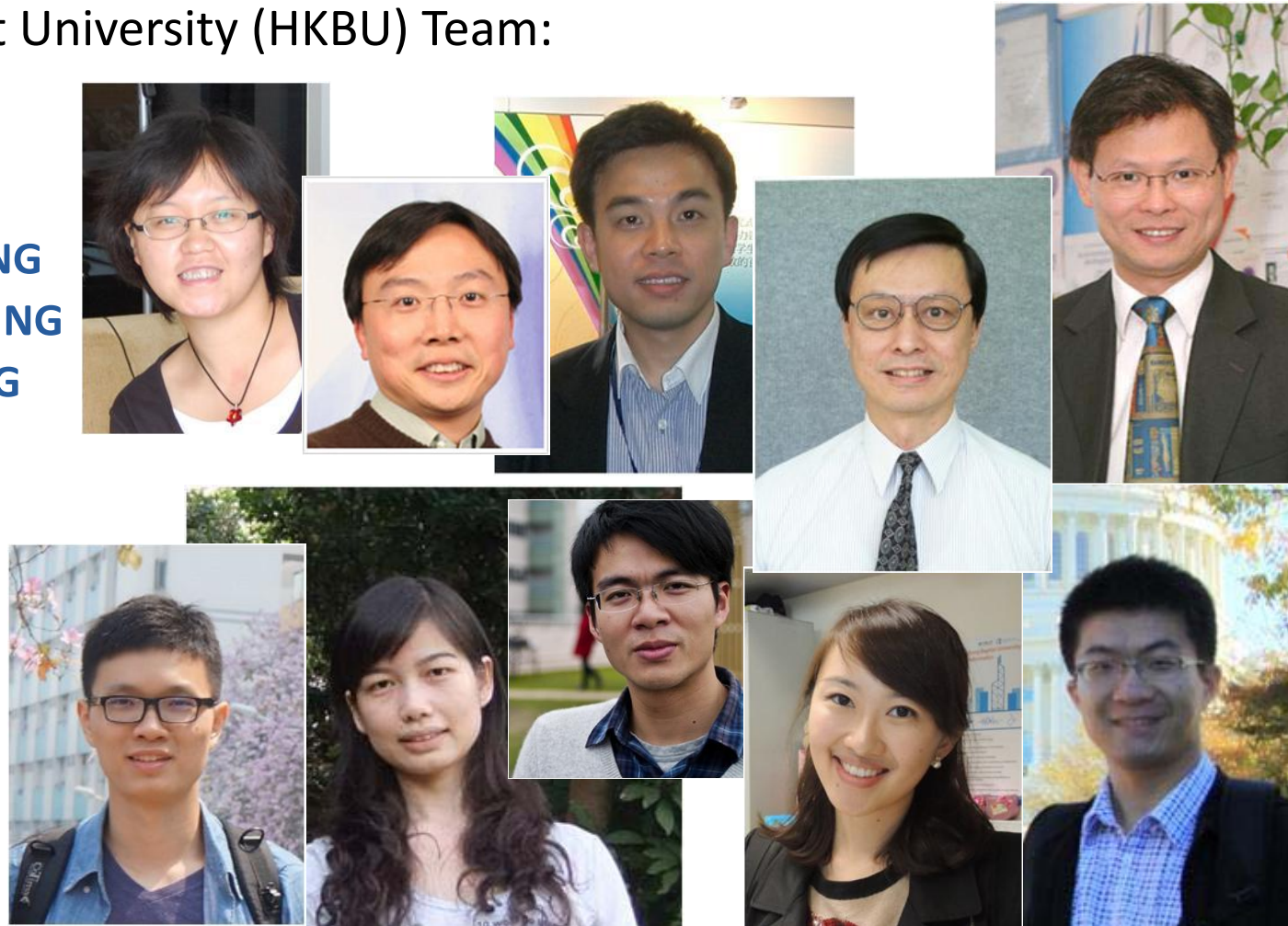

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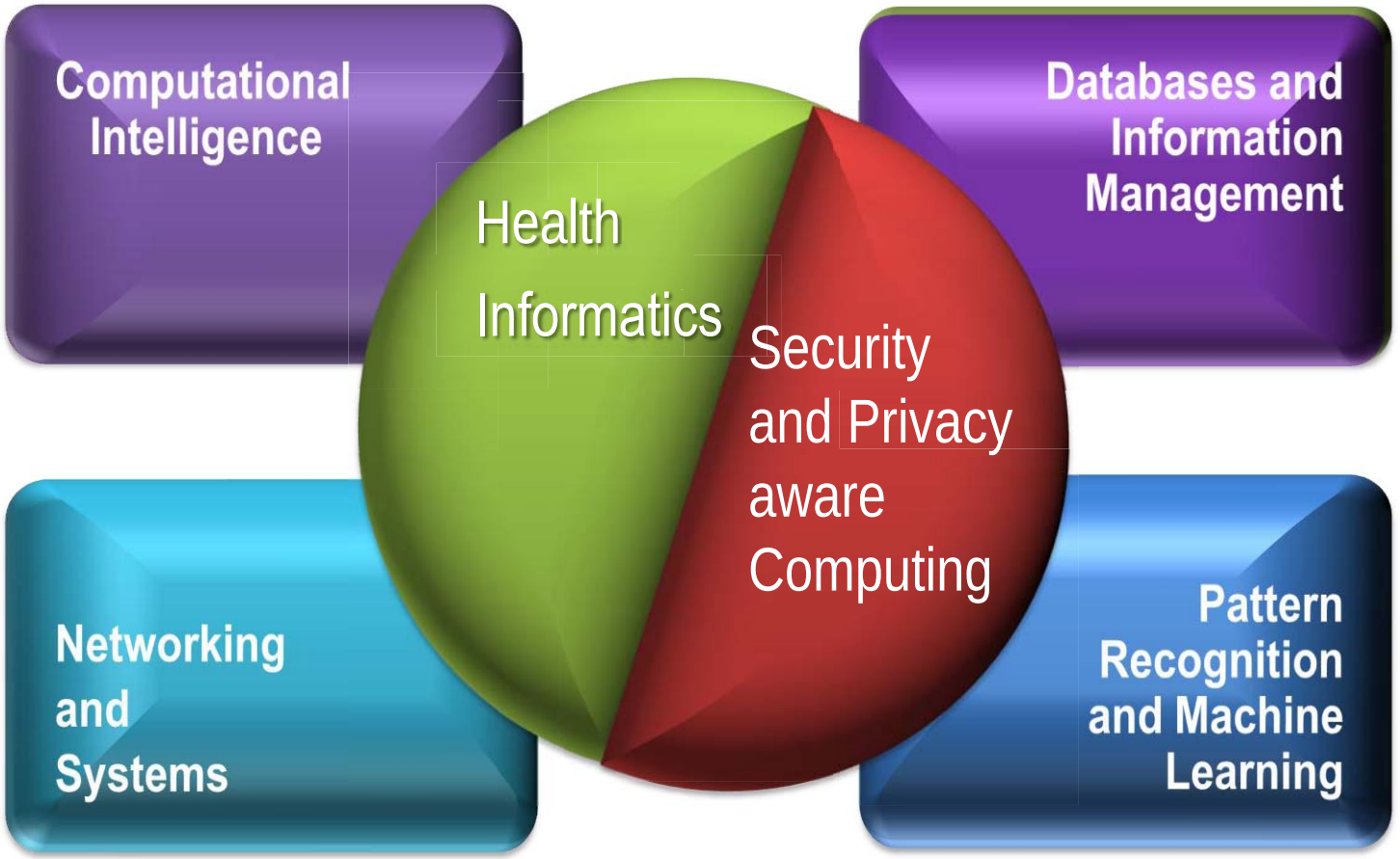
HKBU-CS Key Research Areas



Field Informatics

京都大学
フィールド情報学研究会

Field is defined here as **"a spatio-temporal area that is difficult to grasp via any analytical and/or engineering approach due to the co-existence of various individuals and entities, which results in the unexpected occurrence of seemingly accidental events thus necessitating our continuing commitment and caring. (Osamu Katai)"**

Field based design **aims to discover problems arising in various fields, and to provide solutions to those problems.**

…the study of the **patterns, causes, and effects** of health and disease conditions in defined populations. - Wikipedia

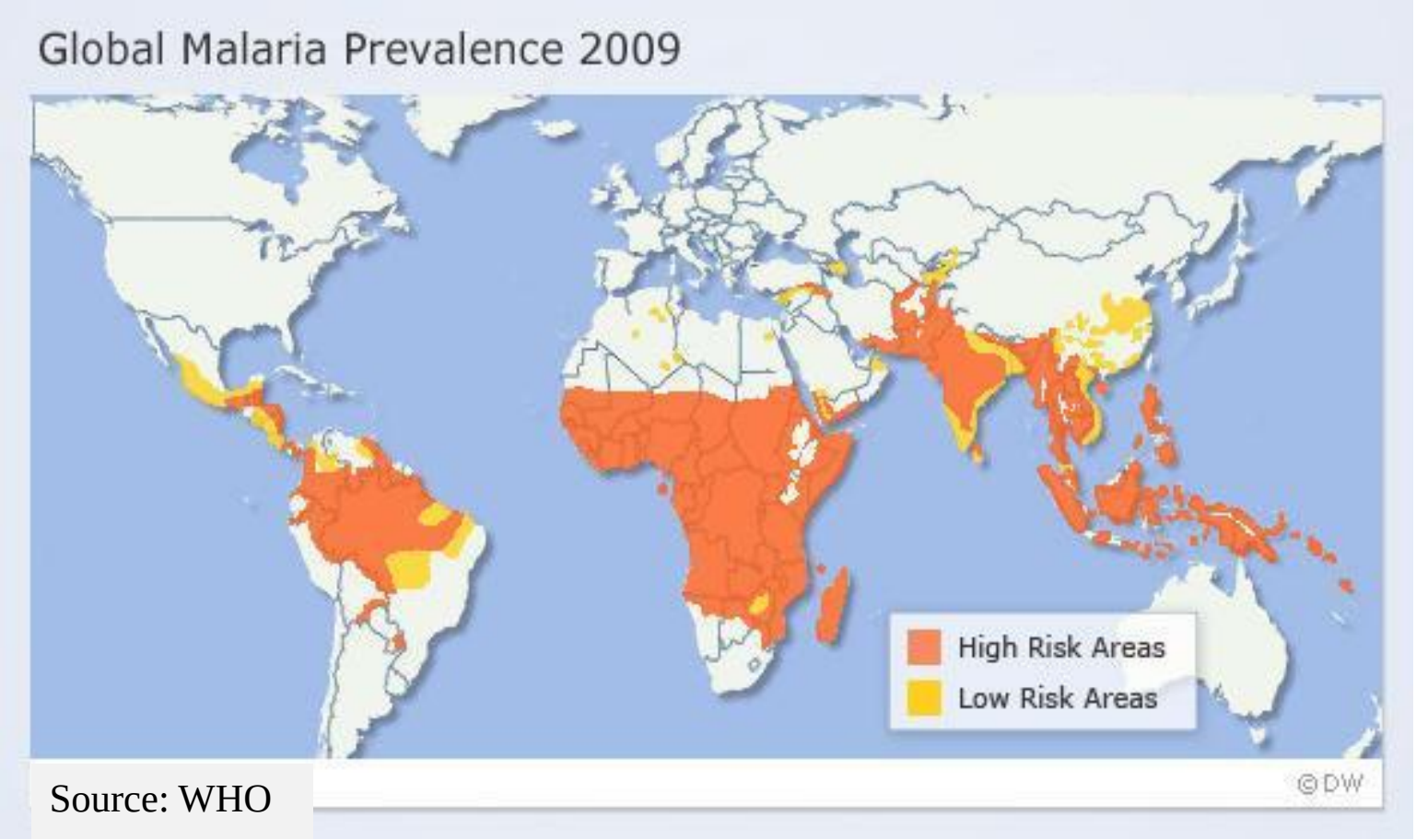
EPIDEMIOLOGY OF DISEASES

EPIDEMIOLOGY OF EXTREME EVENTS

EPIDEMIOLOGY OF DISEASES

Malaria

- **Malaria** is one of the world‘s most deadly diseases
- As of 2008, nearly 250 million people worldwide were infected with the disease, and 1 million people died from it (WHO)



Source: WHO

United Nations Millennium Development Goals

- Eight goals be achieved by 2015, agreed by all 191 UN member states:
  1. Eradicate extreme poverty and hunger
  2. Achieve universal primary education
  3. Promote gender equality and empower women
  4. Reduce child mortality rates
  5. Improve maternal health
  6. Combat HIV/AIDS, malaria, and other diseases
  7. Ensure environmental sustainability
  8. Develop a global partnership for development

6. Combat HIV/AIDS, **malaria**, and other diseases

The *Field* – An Illustration

Possible Impact

（1） Imported ca

（2） Temperatur

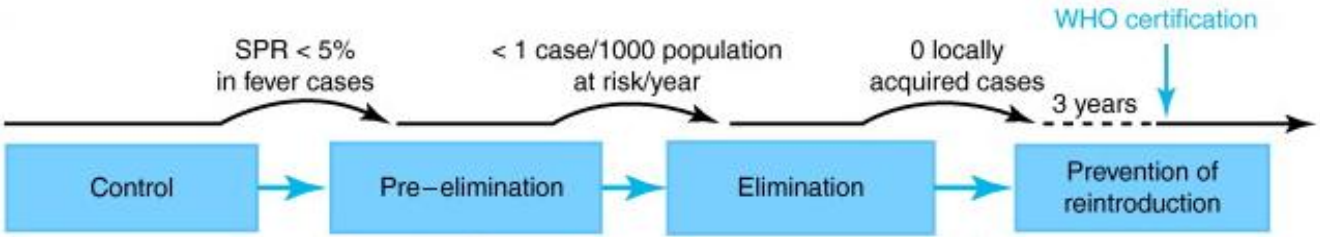
（3） Human mob

（4） Socio-econc

The *P.vivax* cases and populations in Teng Chong, 2005.

Public Health Indicators

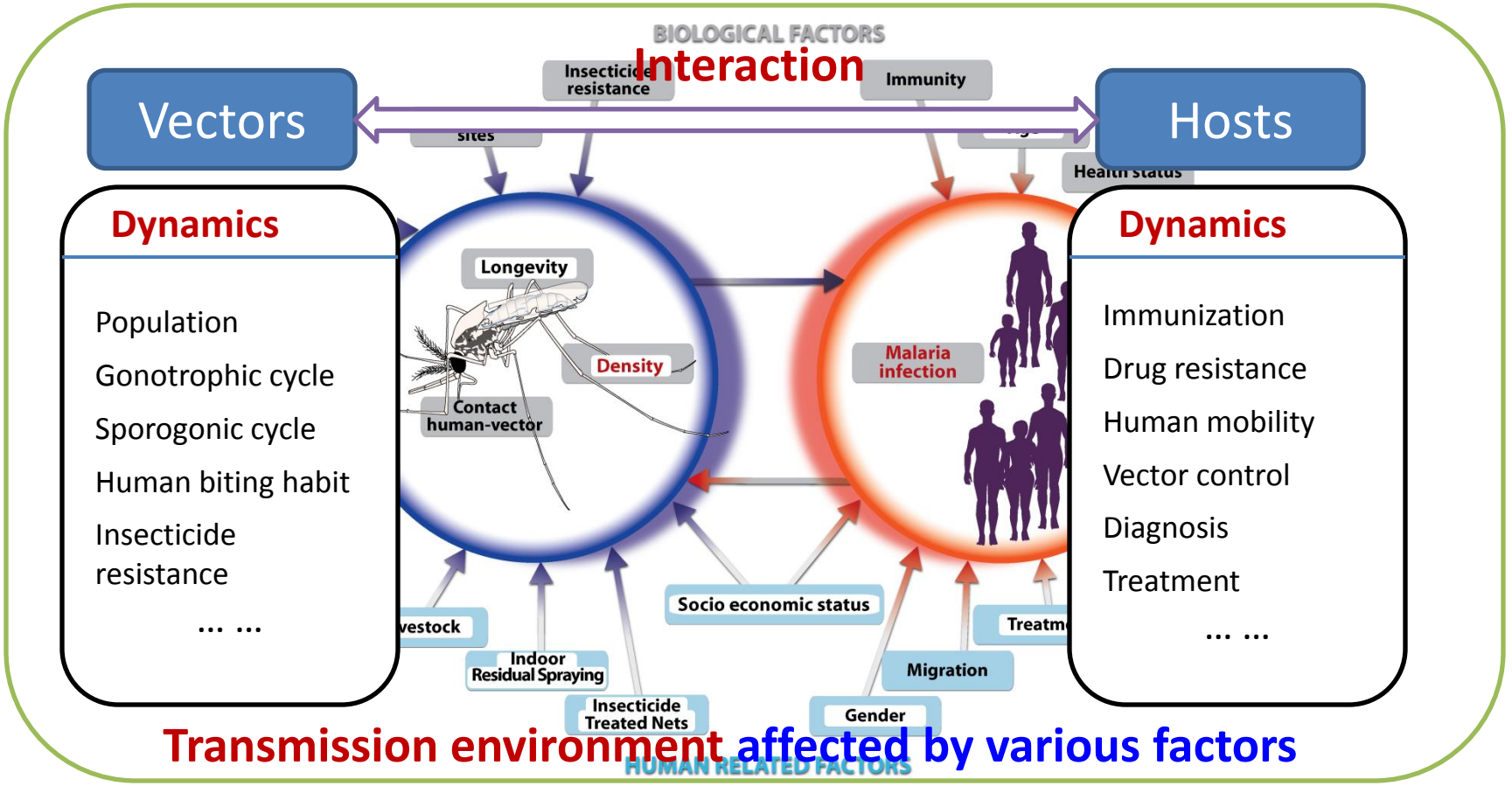
- Situational Analysis: **Transmission Patterns?**
  - Temporal and spatial distribution of malaria cases (When & where)
  - Demographical distribution (Who)
- **Risk Measures**
  - Under control
  - Elimination
  - Eradication



- **Research Problems**
  - To **discover**/predict malaria transmission patterns
  - To **design**/assess policy-level decisions

Multi-Scale Impact Factors

- Malaria transmission between human beings and vectors may be impacted by various factors at multiple temporal and spatial scales.



[1] Protopopoff N, Van Bortel W, Speybroeck N, Van Geertruyden J-P, Baza D, D'Alessandro U, Coosemans M, "Ranking malaria risk factors to guide malaria control efforts in African highlands", *PLoS ONE*, vol. 4, p. e8022, 2009.

Multi-Level Transmission Dynamics

Macroscopic

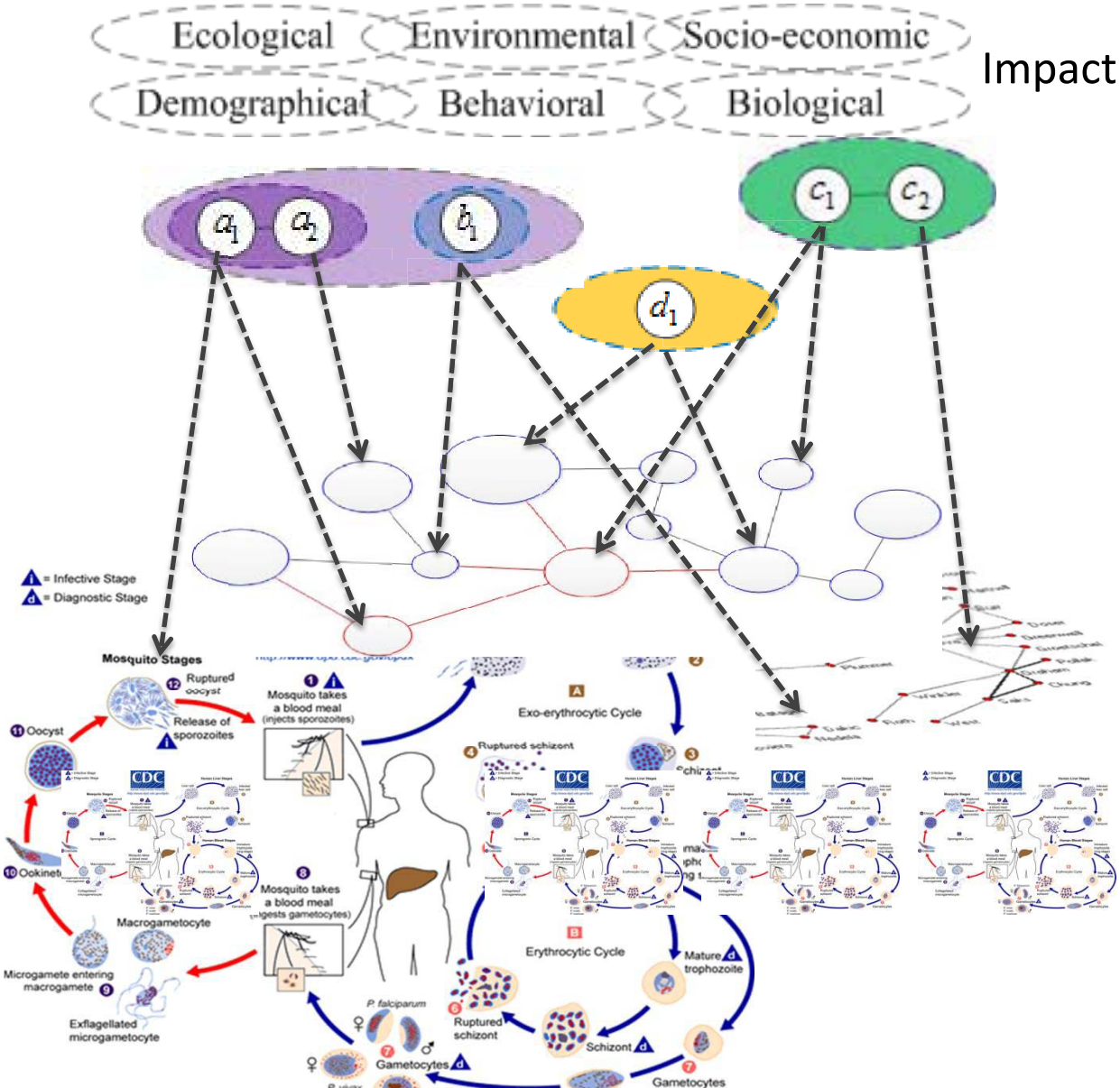
Multi-scale

Microscopic

Metapopulation

Multi-level

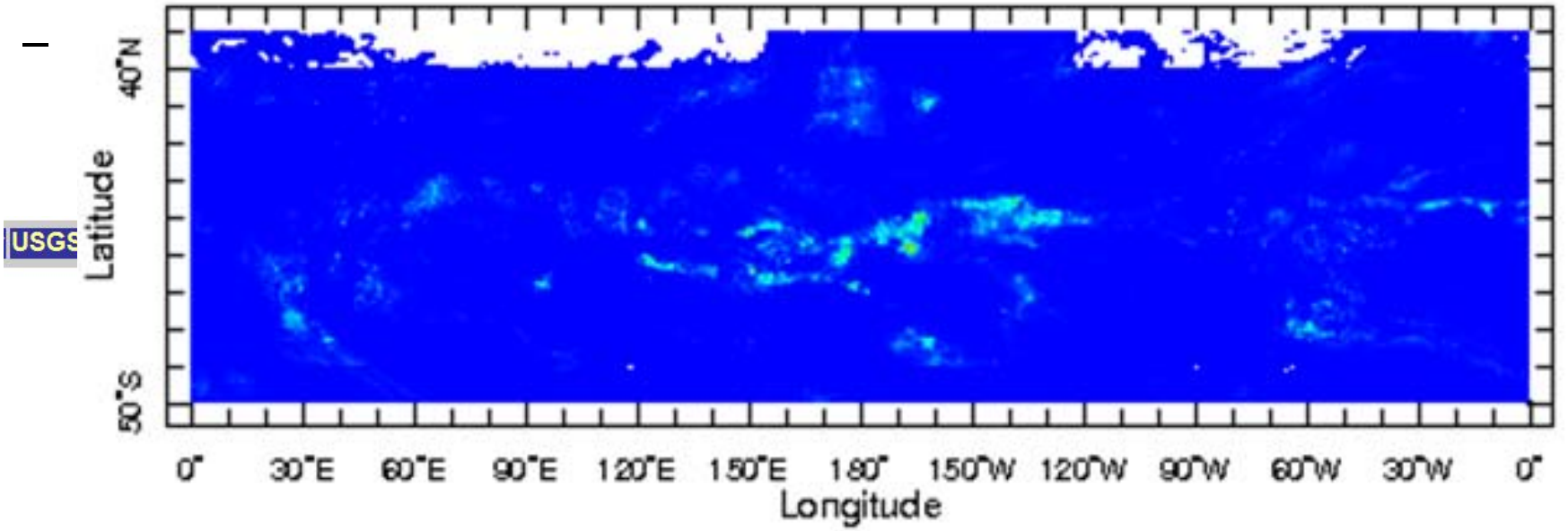
Individual

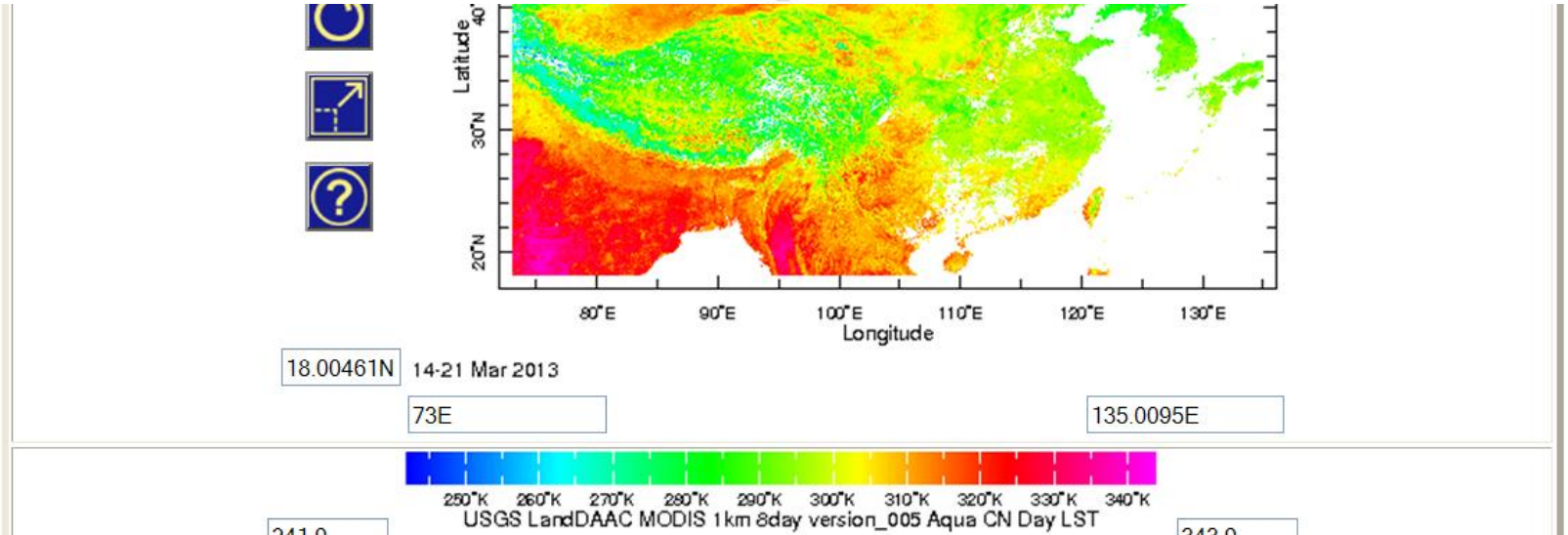


Environmental Data from the Field

(obtained via *International Research Institute for Climate and Society*, part of Columbia University's *Earth Institute*)

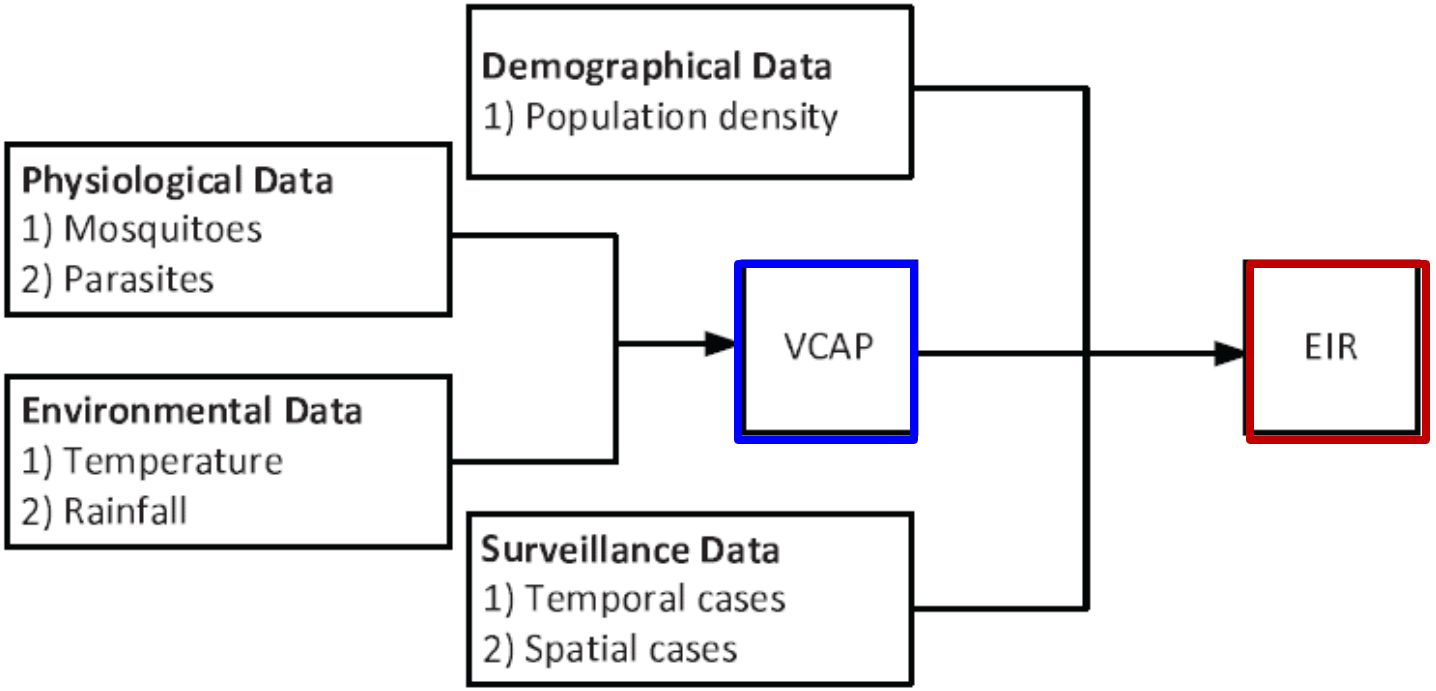
–





A Spatial Malaria Transmission Model **(with B.Y. Shi)**

- **Evaluate malaria risk for each individual location**



VCAP: number of potentially infective contacts an individual person makes, through vector population, per unit time.

EIR: number of infectious bites received per day by a person.

[2] P. Ceccato, C. Vancutsem, R. Klaver, J. Rowland, and S. J. Connor, "A vectorial capacity product to monitor changing malaria transmission potential in epidemic regions of Africa," *Journal of Tropical Medicine*, p. e595948, October 2012.

VCAP and *EIR*

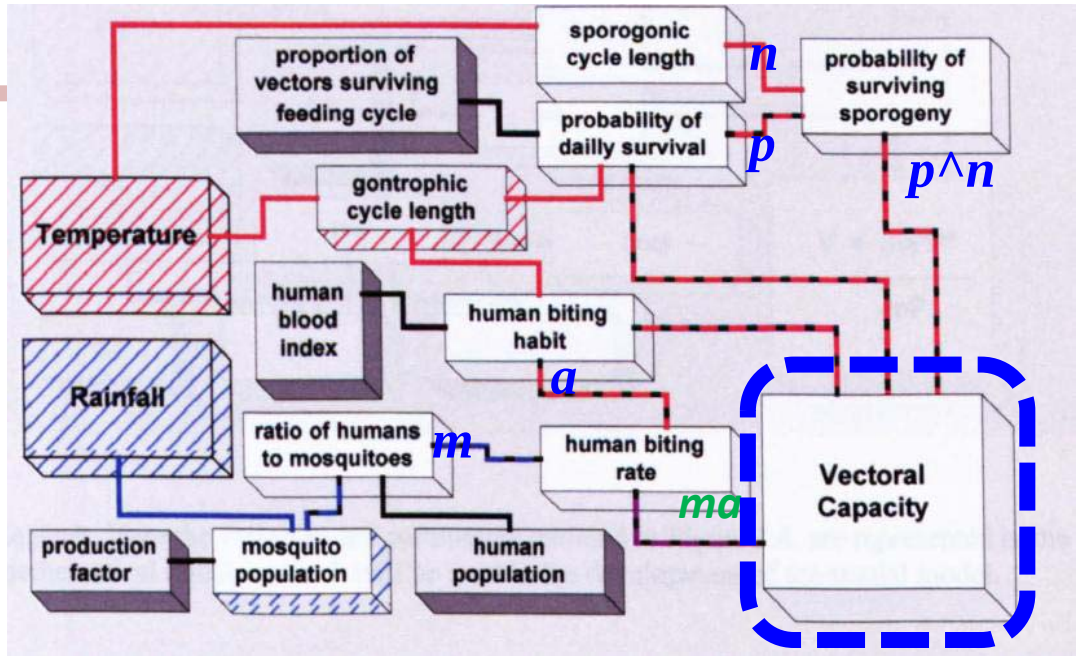
- $VCAP = \frac{ma^2p^n}{-ln(p)}$

a – human biting habit

m – ratio of humans to mosquitoes

n – sporogonic cycle length

p – probability of daily survival



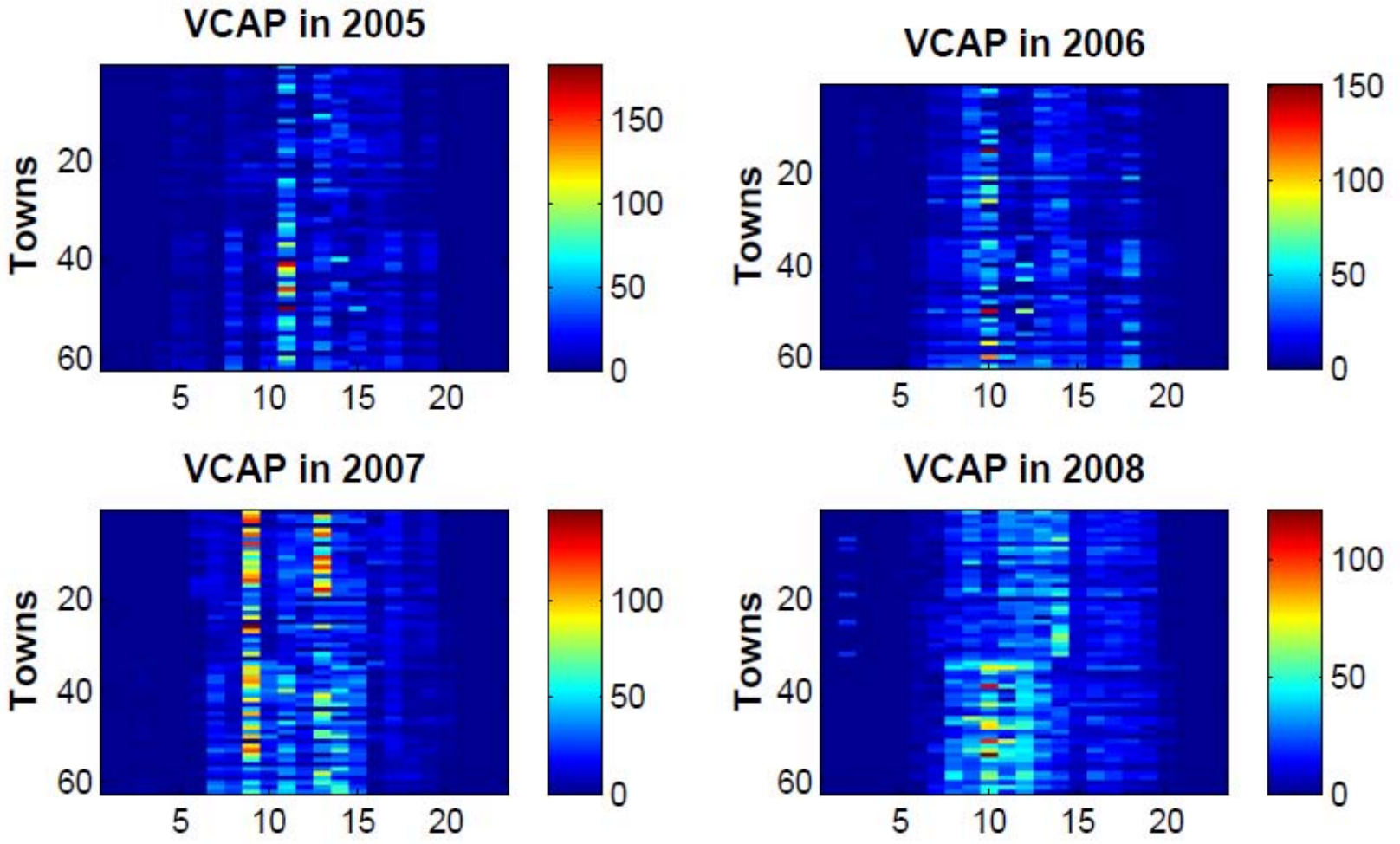
- $EIR(t) = \frac{c \cdot VCAP \cdot x(t)}{1 - ca \cdot x(t)/ln(p)}$

$x(t)$ – proportion of infectious person at time t

c – transmission efficiency from an infectious person to an uninfected mosquito

[2] P. Ceccato, C. Vancutsem, R. Klaver, J. Rowland, and S. J. Connor, "A vectorial capacity product to monitor changing malaria transmission potential in epidemic regions of Africa," *Journal of Tropical Medicine*, p. e595948, October 2012.

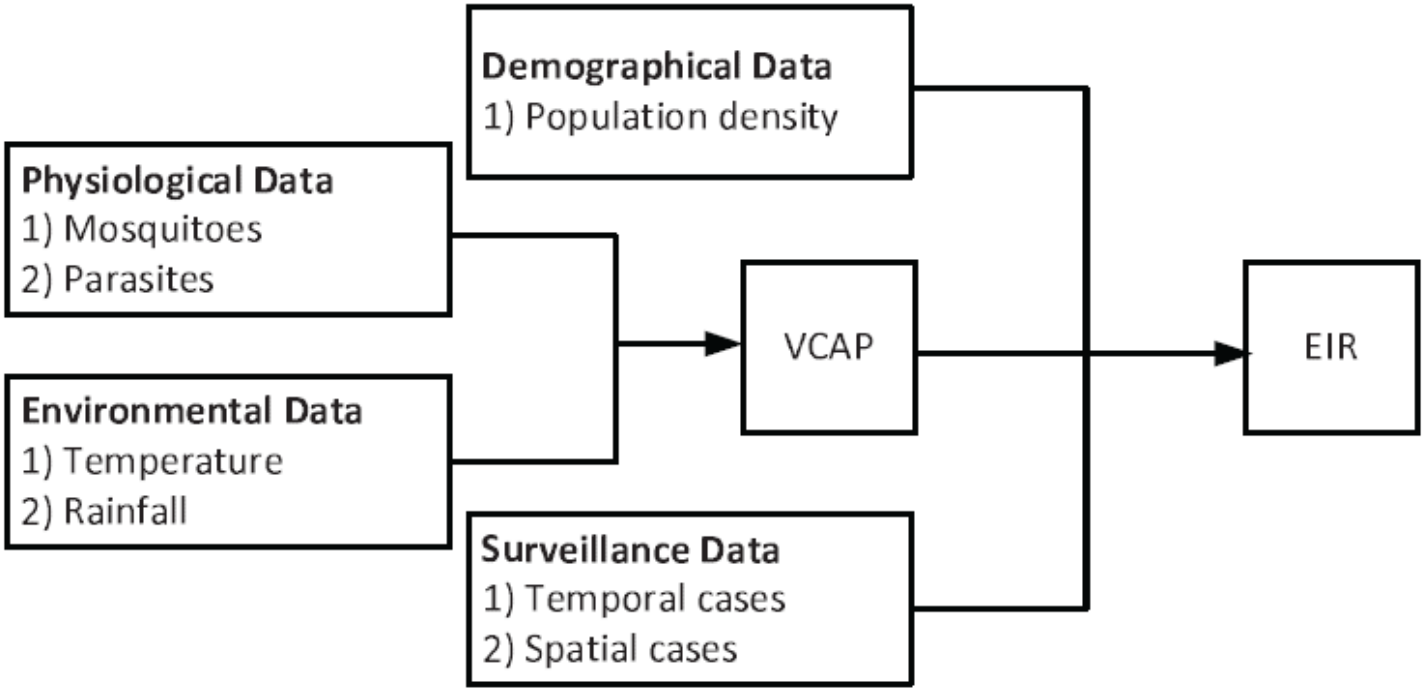
VCAP of 62 Malaria-Endemic Towns in Yunnan



The values of vectorial capacity of the 62 towns in Yunnan province in 2005, 2006, 2007, and 2008, respectively. The values are calculated based on the MODIS and TRMM data using time window size 16 days.

A Spatial Malaria Transmission Model

- **Evaluate malaria risk for each individual location**



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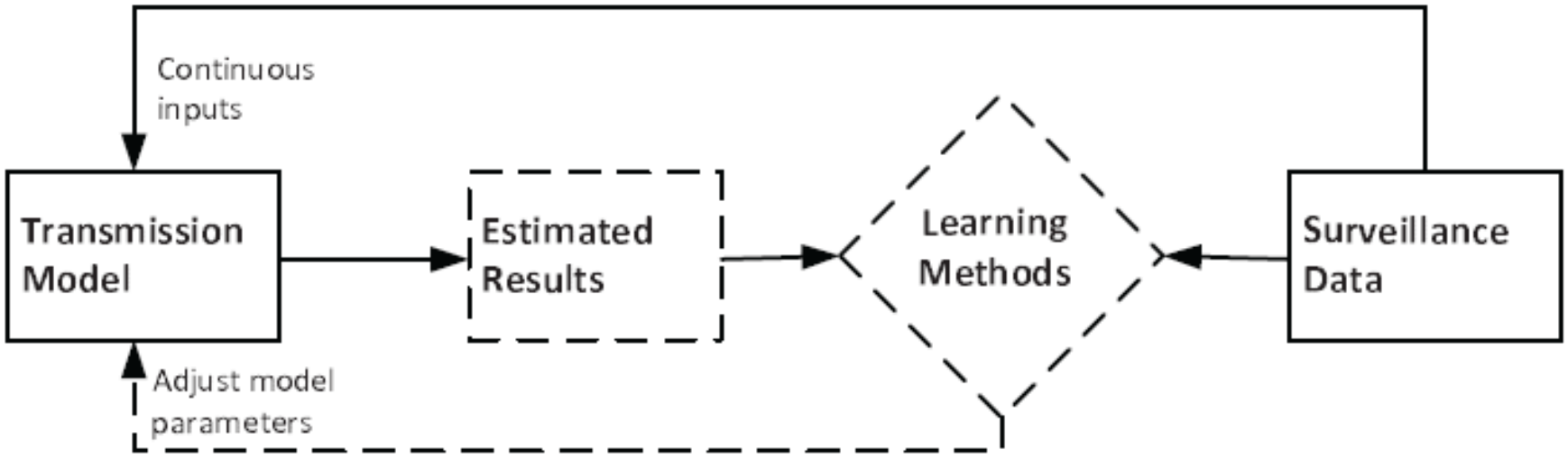
[2] P. Ceccato, C. Vancutsem, R. Klaver, J. Rowland, and S. J. Connor, "A vectorial capacity product to monitor changing malaria transmission potential in epidemic regions of Africa," *Journal of Tropical Medicine*, p. e595948, October 2012.

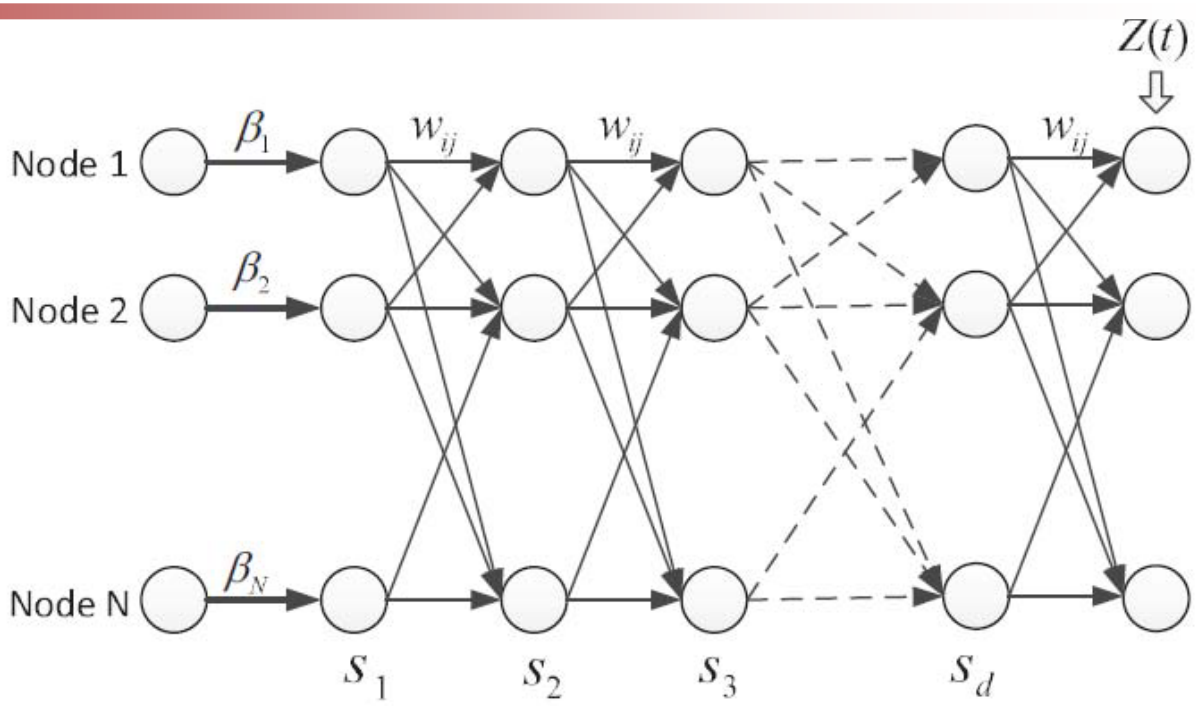
Malaria Transmission Patterns: A Learning Approach



- Surveillance data (continuous inputs) → *malaria transmission model*
- The model outputs (*estimated results*) → *learning methods*

- Surveillance data (*training set*) → learning methods
- Learning methods (results) → *parameters in the malaria transmission model*

An Example of Learning Method: Recurrent Neural Network



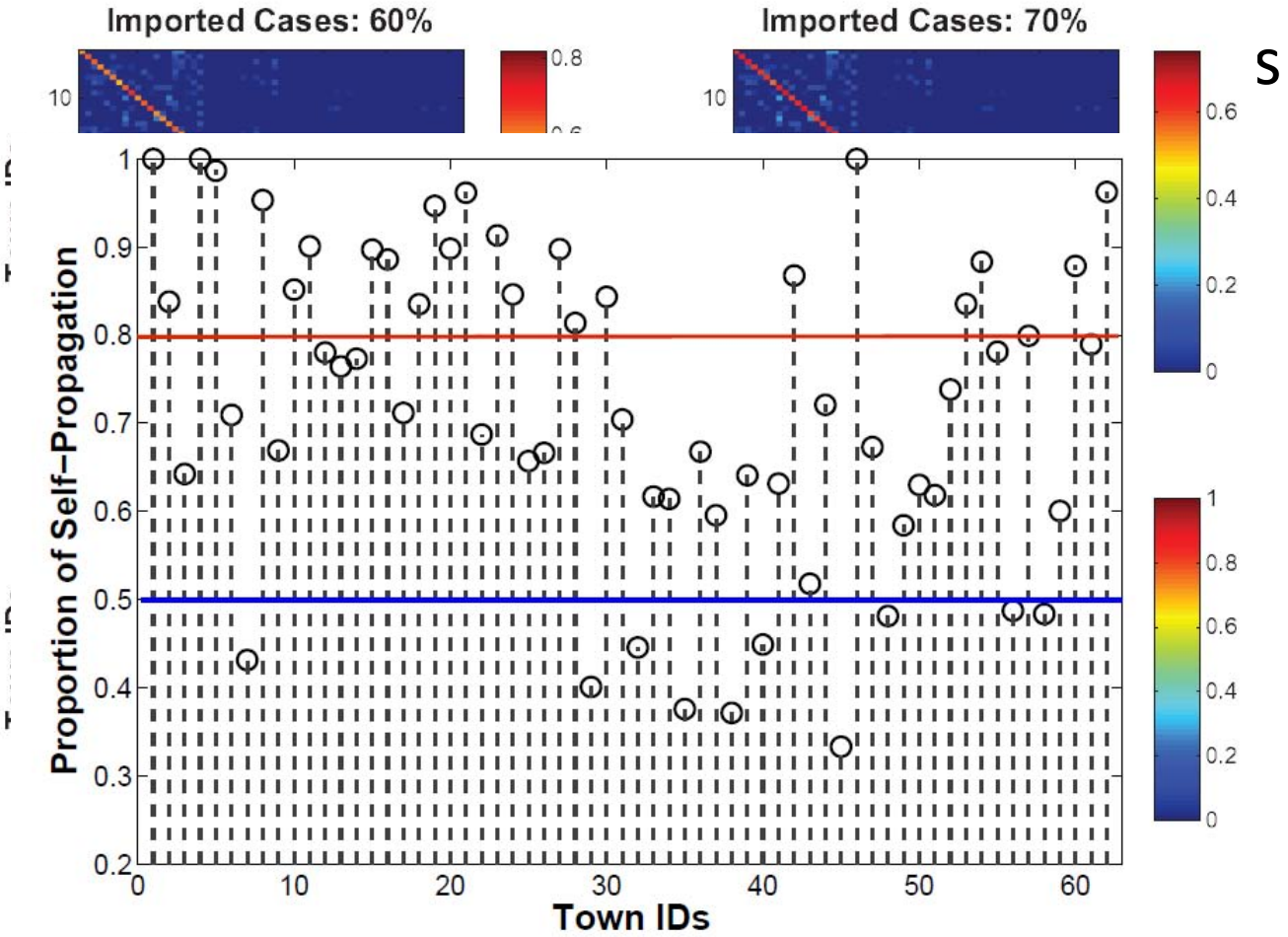
- Each node represents a town.
- β_i represents the control effort of each node.
- Z represents imported cases.
- d is the diameter of the transportation network among 62 towns.

Objective: Inferring malaria transmission networks, i.e., w_{ij}.

Method: The backpropagation algorithm.

Learning Results

- Using *a recurrent neural network method* to infer underlying malaria transmission networks under different scenarios
- Class



A Complex Systems Perspective

I. Public Health Policies

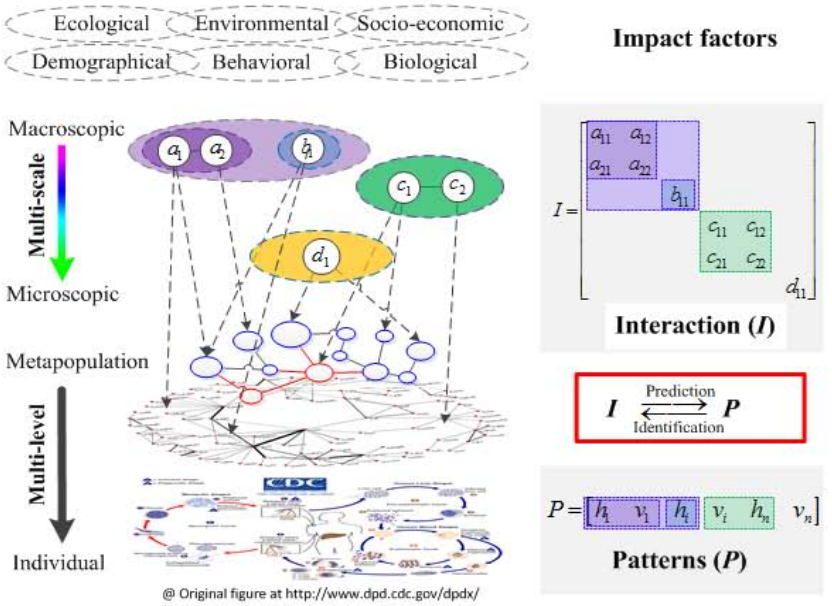
Goals and targets
- Death reduction
- Case reduction

Intervention strategies
- Diagnosis
- Treatment
- Vector control
- Vaccination

Monitoring & evaluation
- Disease surveillance
- Anti-drug resistance
- Effectiveness & efficiency

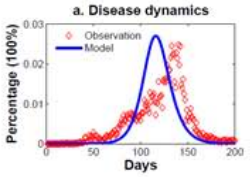
Cooperation
- Financial support
- Political commitment
- Organizational management

II. Disease Transmission: A Complex Systems Perspective

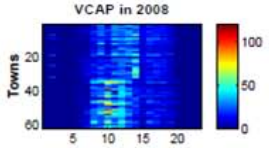


III. Public Health Indicators

Transmission patterns
- Temporal (when)
- Spatial (where)
- Demographical (who)



Risk measurements
- Under control
- Elimination
- Eradication



IV. Data-Driven Computational Intelligence

Requirements

System modeling
- Predicting tempo-spatial patterns (*Real-world study* I)
- Identifying underlying interactions (*Real-world study* II)

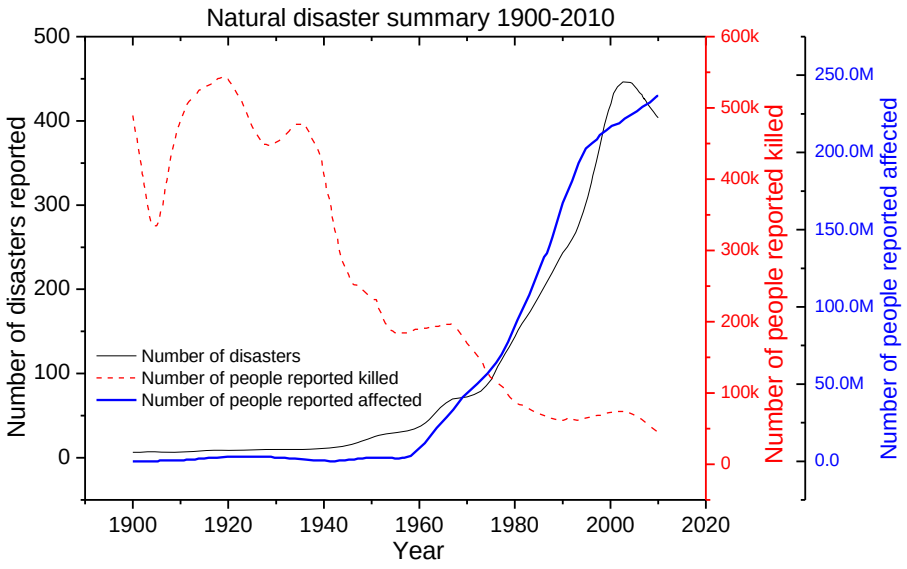
Policy-level decision making
- Active surveillance
- Strategic planning
- Deployment
- Assessment

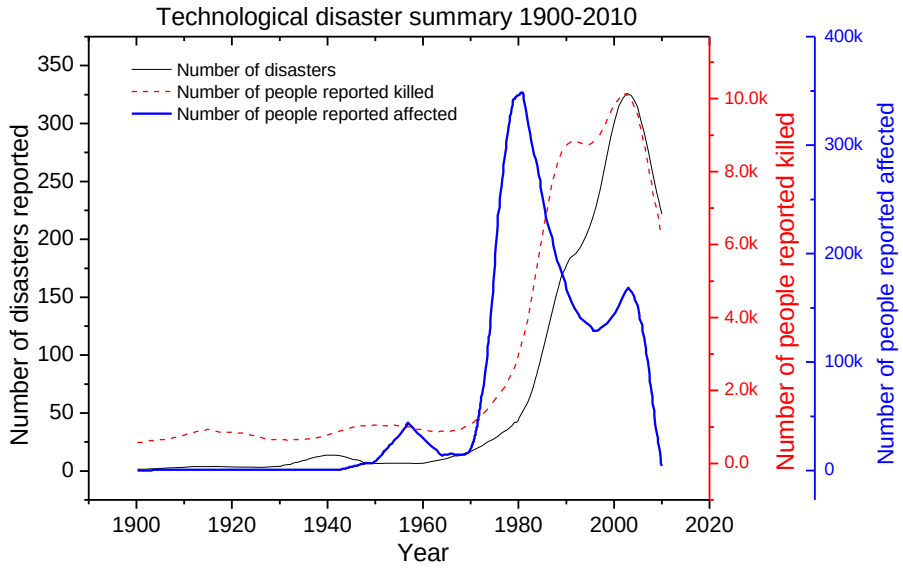
Predictions

EPIDEMIOLOGY OF EXTREME EVENTS

Disasters

- **Natural and technological disasters** [1]
  - earthquake, flood, tsunami, hurricane, extreme temperature...
  - industrial accident (e.g., nuclear leak, gas explosion), transport accident (e.g., air crash)...
- **Causing social and economic damages**





[1] The International Disaster Database, http://www.emdat.be/

Situational Analysis: Emotional Responses?

- Different emotional reactions [3]
  - Sadness, anxiety and anger
  - **Emotions may affect behaviors** (psychological findings [4][7])
  - **Irrational crowd behaviors** caused [4][6]:
    - Anxious person may be easily influenced by rumors [5]
    - Spontaneous evacuation (e.g., at three Mile Island) because of fear [4]

- **Research Problem**
  - To **characterize**/understand human emotional reactions (for more effective relief)

[3] Y.R. Tausczik et al., The psychological meaning of words: LIWC and computerized text analysis methods, Journal of Language and Social Psychology, 29(1): 24-54 (2010).
[4] M.K. Lindell et al., Fundamentals of Emergency Management. Federal Emergency Management Agency Emergency Management Institute, Emmitsburg, MD (2006)
[5] O. Oh, et al., An exploration of social media in extreme events: Rumor theory and twitter during the Haiti earthquake 2010. Proceedings of 31st International Conference on Information Systems (ICIS10), p 231 (2010)
[7] L.A., Camras et. al., An event-emotion or event-expression hypothesis? A comment on the commentaries on Bennett, Bendersky, and Lewis (2002). Infancy 6(3), 431--433 (2004)

BBC News

Categories

- All Results (7,107)
- News (511)
- Sport (4,229)
- Blogs (656)
- TV & Radio Programmes (551)
- TV & Radio Sites (436)
- More Categories...

Media

- All
- Video
- Audio
- Text & Images

Date

From: 01 03 2011

To: 30 04 2011

GO

News

Results from 01 Mar to 30 April 2011 | Text & Images Only

11 March 2011

Quake was big even for Japan
Science & Environment / 11 March 2011
Another day, another earthquake. Except the Magnitude 8.9 tremor off the Honshu, **Japan**, will be a standout event for 2011 - if not in...

Japan earthquake: UK offers assistance and resc teams

UK / 11 March 2011
Britain has offered assistance to **Japan** after it a massive earthquake which triggered a tsunam Secretary William Hague said...

Japanese earthquake: Eyewitness accounts

Asia-Pacific / 11 March 2011
A massive earthquake has hit the north-east of triggering a tsunami that has caused extensive Japanese television showed cars,...

Google aids Japan quake victims

Technology / 11 March 2011
... useful after other disasters that have stopped getting in direct touch. Victim log In its first few **Japan** quake Person Finder...

Profile: Sendai City

Asia-Pacific / 11 March 2011
A powerful earthquake has struck the north-east coast of **Japan**, triggering a devastating tsunami. The BBC profiles the northern city of Sendai,...

Japan earthquake: UK offers assistance and rescue teams

Britain has offered assistance to Japan after it was hit by a massive earthquake which triggered a tsunami.

Some 17,000 British nationals live in Japan, which has experienced its biggest earthquake on record

Foreign Secretary William Hague said the UK could help with humanitarian assistance or search and rescue teams. There were no known British casualties, he said.

The Foreign Office has advised against all non-essential travel to Tokyo and the north-east of the country.

The Queen has sent a message of sympathy to the people of Japan.

Buckingham Palace said she had expressed her sadness at the "tragic loss of life" to Emperor Akihito. Prince Charles also wrote to the emperor to say the news had come as a great shock.

Prime Minister David Cameron also offered the Japanese people his condolences and said "we stand ready to help in any way that we can".

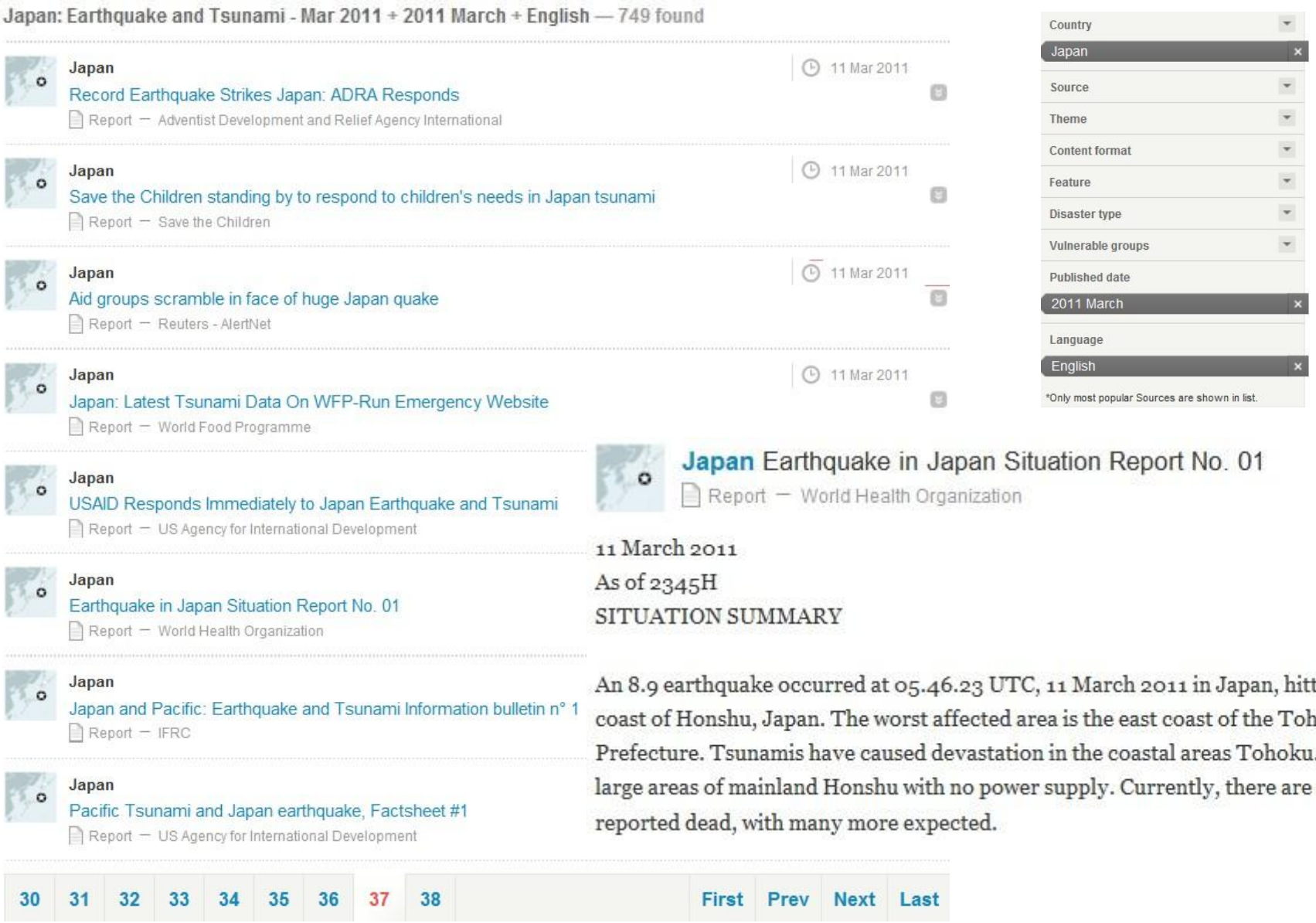
The earthquake hit the north-east of Japan at 1446 local time (0546 GMT) on Friday, triggering a tsunami. Hundreds are known to have died so far but the death toll is expected to rise significantly.

It has emerged that BBC Philharmonic Orchestra members are safe after they were caught up in the 8.9-magnitude earthquake as they travelled from Tokyo to Yokohama.

Related Stories

- Tsunami after massive Japan quake
- In pictures: Japan earthquake
- Earthquake 'terror' of scientist

ReliefWeb


Japan: Earthquake and Tsunami - Mar 2011 + 2011 March + English — 749 found
Japan
Record Earthquake Strikes Japan: ADRA Responds
Report — Adventist Development and Relief Agency International
11 Mar 2011
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Save the Children standing by to respond to children's needs in Japan tsunami
Report — Save the Children
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Japan
Aid groups scramble in face of huge Japan quake
Report — Reuters - AlertNet
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Japan
Japan: Latest Tsunami Data On WFP-Run Emergency Website
Report — World Food Programme
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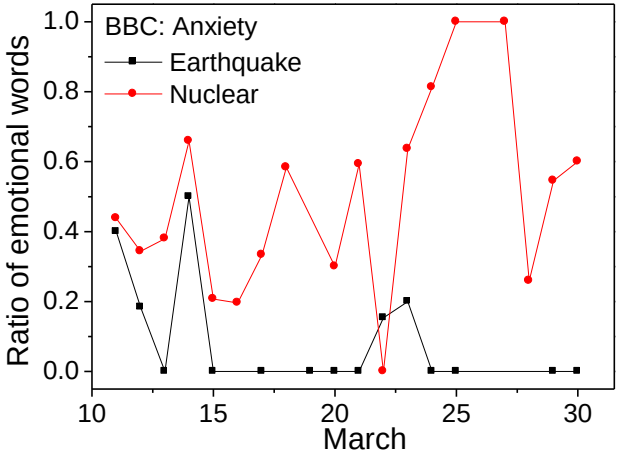
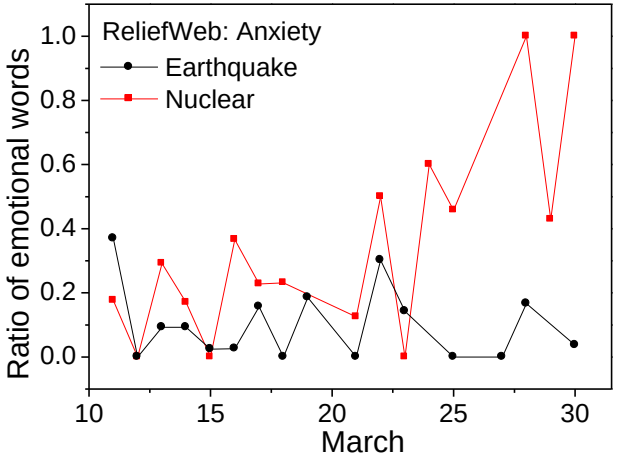
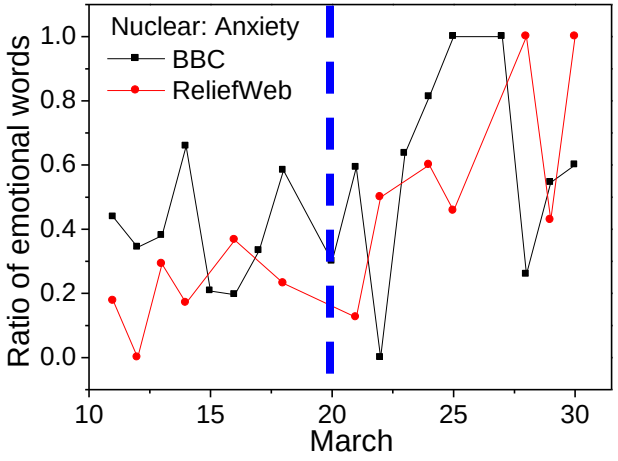
Japan
USAID Responds Immediately to Japan Earthquake and Tsunami
Report — US Agency for International Development
Japan
Earthquake in Japan Situation Report No. 01
Report — World Health Organization
Japan
Japan and Pacific: Earthquake and Tsunami Information bulletin n° 1
Report — IFRC
Japan
Pacific Tsunami and Japan earthquake, Factsheet #1
Report — US Agency for International Development
30 31 32 33 34 35 36 37 38 First Prev Next Last
Country
Japan
Source
Theme
Content format
Feature
Disaster type
Vulnerable groups
Published date
2011 March
Language
English
*Only most popular Sources are shown in list.
Japan Earthquake in Japan Situation Report No. 01
Report — World Health Organization
11 March 2011
As of 2345H
SITUATION SUMMARY
An 8.9 earthquake occurred at 05.46.23 UTC, 11 March 2011 in Japan, hitting the east coast of Honshu, Japan. The worst affected area is the east coast of the Tohoku Prefecture. Tsunamis have caused devastation in the coastal areas Tohoku. There are large areas of mainland Honshu with no power supply. Currently, there are 90 people reported dead, with many more expected.

Analysis of Emotional Responses **(with C. Gao)**

- **Clustering-based analysis**
  - People feel more anxious about the nuclear crisis and sad about the earthquake
    - Rumors could fast spread, resulting in irrational behaviors
      - Panic buying of iodide in USA and salt in China
  - ReliefWeb exhibited a relatively calm and professional attitude about the nuclear crisis (before more evidence about radiation leakage was confirmed on Mar. 20)







[1] C. Gao, J.M. Liu, Clustering-based Media Analysis for Understanding Human Emotional Reactions in an Extreme Event. ISMIS2012

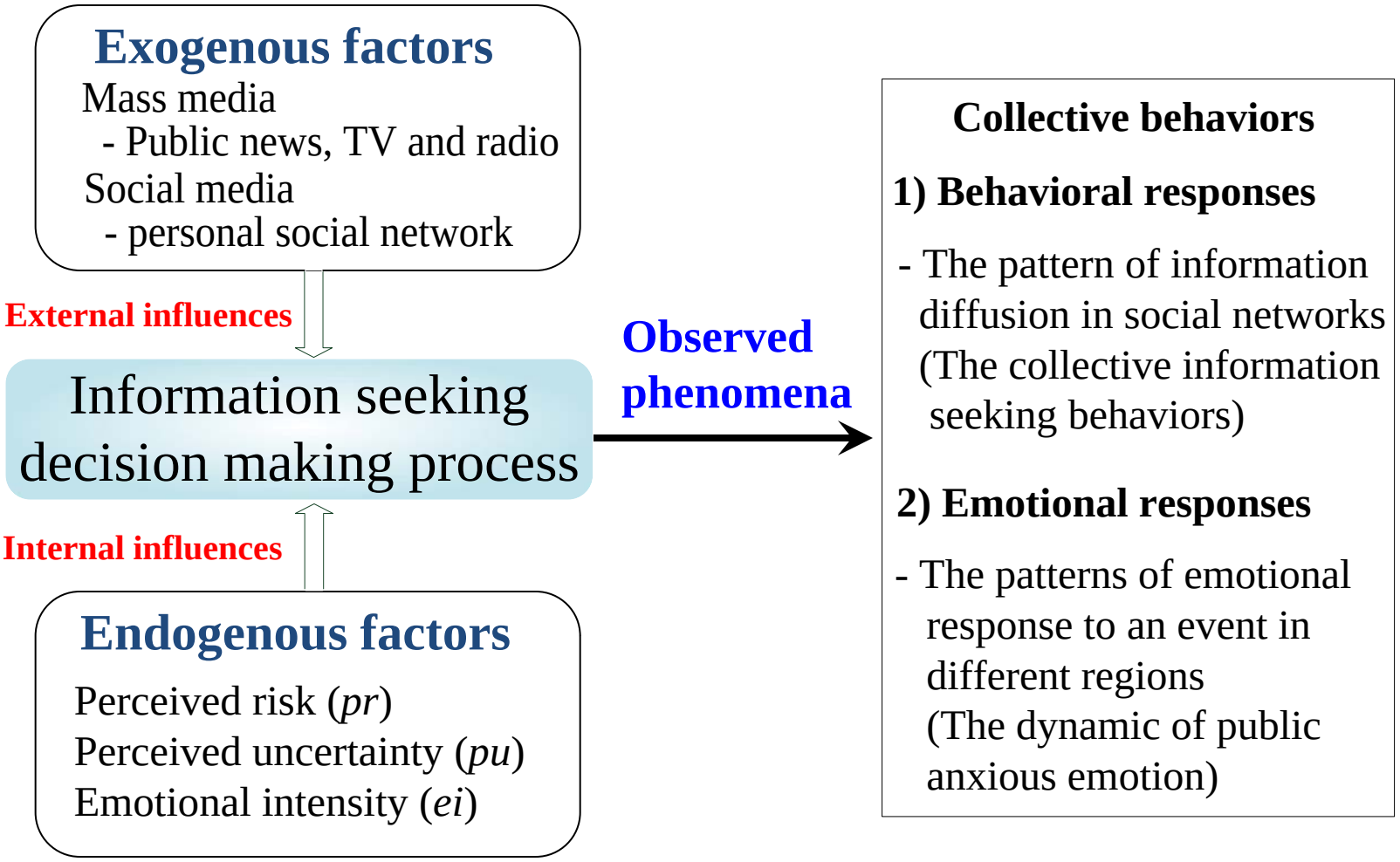
Situational Analysis: Human Behaviors?

- **Observed collective behaviors**
  - Information burst [4][5]
    - Seeking event-related information → to reduce the *uncertainty*
  - Spontaneous evaluation [6]
    - Evacuating from a disaster zone → to avoid *perceived risk*
  - Panic buying
    - Buying unusually large amount of a product → to offset a *potential shortage*

- **Research Problem**
  - To **predict** human behaviors, so as to reduce the damages and improve the efficiency of relief

[4] E.Adar et al., Why we search: Visualizing and predicting user behavior, WWW07: 599-608.
[5] Z. Xu et al., Modeling user posting behavior on social media, SIGIR12" 545-554.
[6] X. Lu et al., Predictability of population displacement after the 2010 Haiti earthquake, PNAS, 2012, 109(29):11576-11581.

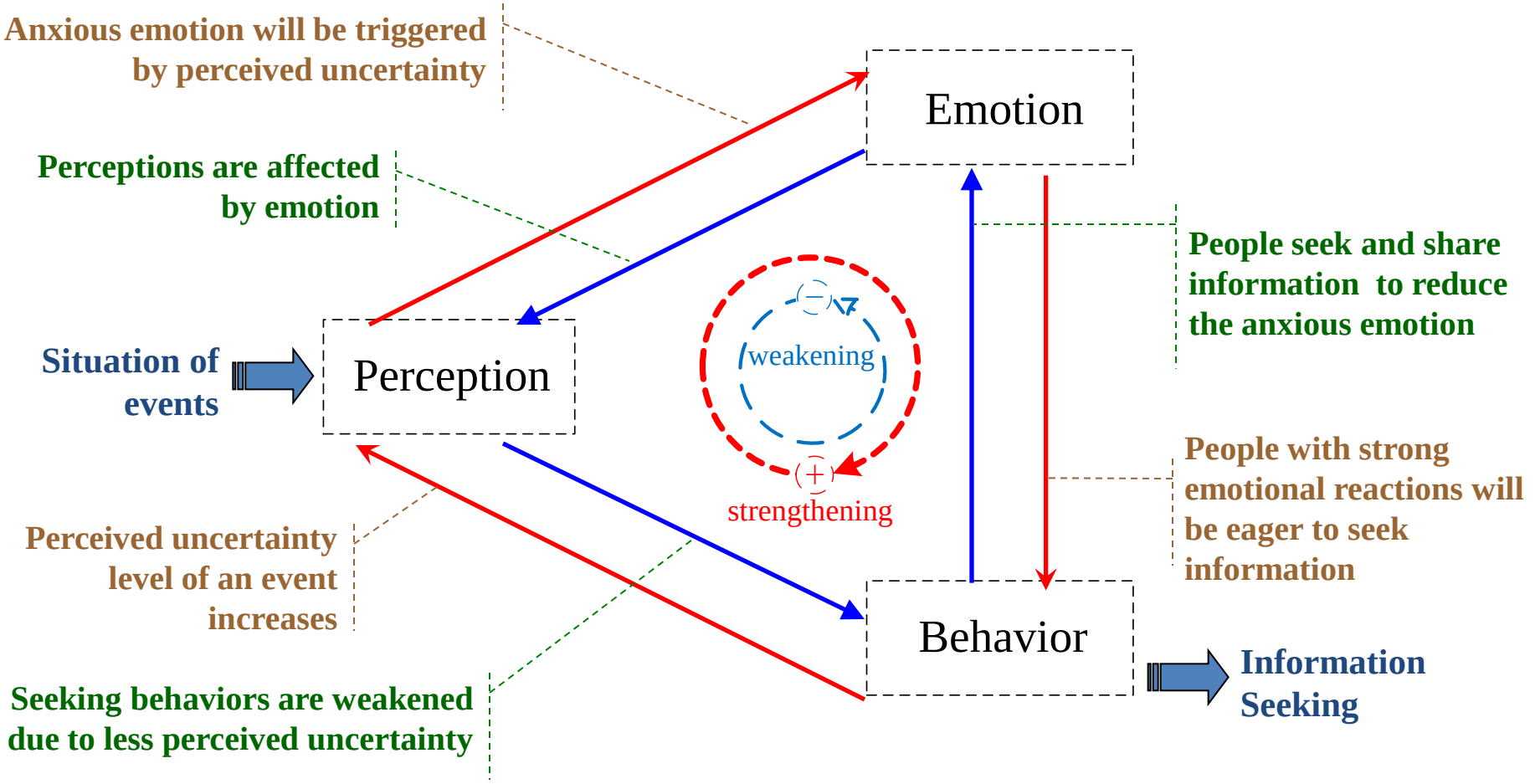
Impact Factors on Human Decision-Making



Autonomy-Oriented Computing (AOC) Based Model Design

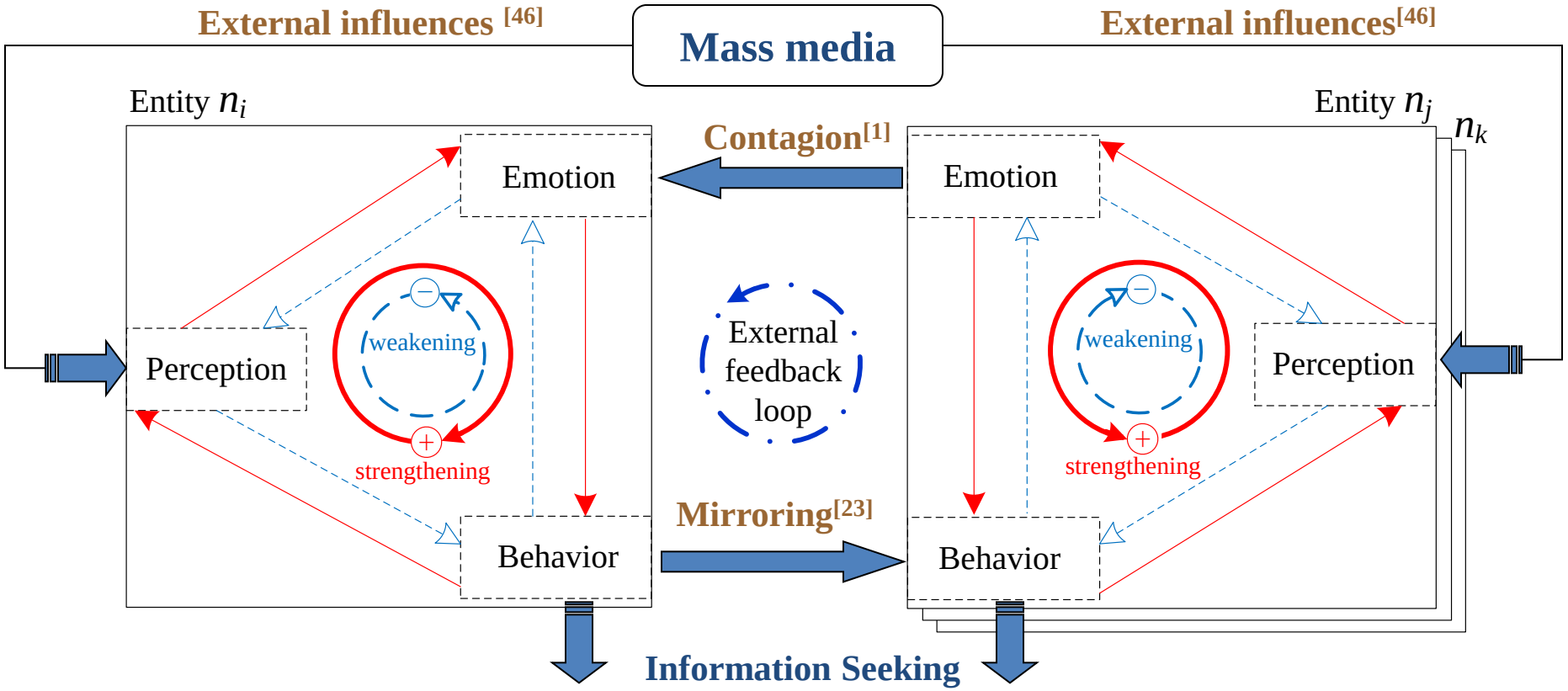
(with C. Gao)

- **Psychological profiles**
  - The **interplay** of perception, emotion, and behaviors



AOC-Based Model Design

- **The effects of external influences**
  - Two sources: Mass and social media



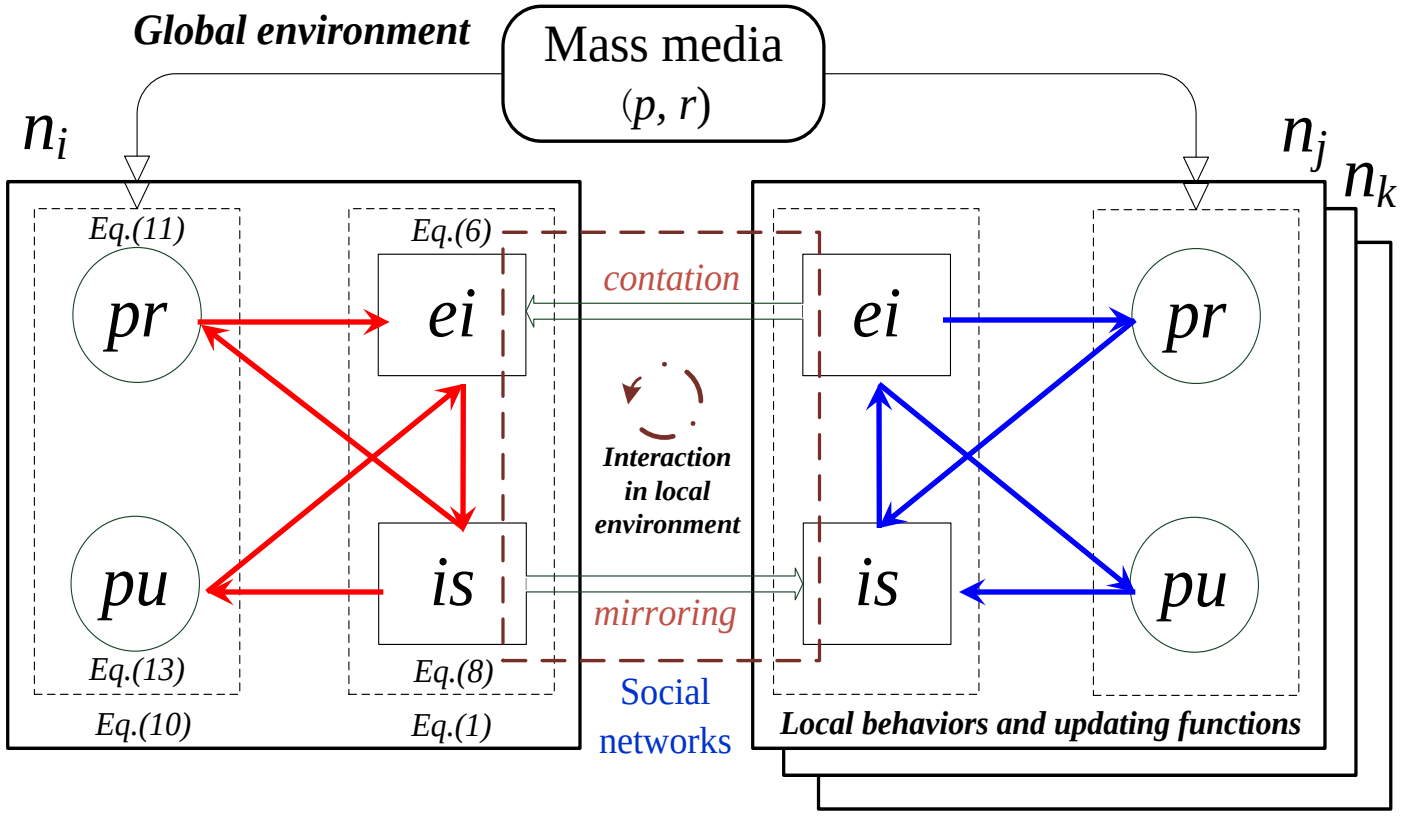
[1] T. Bosse et al., Modeling collective decision making in groups and crowds: Integrating social contagion and interacting emotions, Autonomous Agent and Multi-Agent Systems, 2013, 27: 52-84

[23] J. Treur, A cognitive agent model displaying and regulating different social response patterns, IJCAI11: 1735-1742

[46] K.A. Lachlan, et al., Disaster news and subsequent information seeking: Exploring the role of spatial presence and perceptual realism, Electronic News, 2010, 4(4): 203-217

AOC-Based Model Design

- Interplay among emotional intensity (*ei*), information seeking behavior (*is*), perceived risk (*pr*), and perceived uncertainty (*pu*) in an entity



Formulation

- **Emotional intensity (*ei*)**
  - The larger *ei* is, the higher anxiety level an entity has
  - If *ei* is larger than an threshold (τ), some irrational behaviors will be triggered.

$$\Delta q(ei) = \mu F_{SN}(ei) + (1 - \mu F_{PM}(ei)) \quad (6)$$

- F_{SN} is based on previous Eq. (2-5)
- F_{PM} is defined as an extending traditional cognitive model through incorporating URT [10] in order to overcome the shortcomings of overestimating the effect of diffusion in [1]

$$F_{PM}(ei) = (r(t) \cdot q(is) - q(ei)) \quad (7)$$

- *r(t)* denotes the dynamic changes of event-related information. People reduce their emotional intensity through active information seeking behaviors

[1] T. Bosse et al., Modeling collective decision making in groups and crowds: Integrating social contagion and interacting emotions, Autonomous Agent and Multi-Agent Systems, 2013, 27: 52-84

[10] C.R. Berger et al., Some exploration in initial interaction and beyond: Toward a developmental theory of communication, Human Communication Research, 1: 99-112 (1975).

Formulation

- **Information seeking behaviors (*is*)**
  - The larger *is* is, the more seeking behaviors an entity has
  - Human behaviors is affected by two parts as shown in Eq.(1)

$$\Delta q(is) = \mu F_{SN}(is) + (1 - \mu F_{PM}(is)) \quad (8)$$

  - F_{SN} is based on previous Eq. (2-5)
  - F_{PM} is the effect of emotional intensity on *is* of an entity. The higher emotional intensity will trigger some irrational behavior. Specially, the emotional intensity is a mediator between perceptions and behaviors (i.e., *pu/pr* → *ei* → *is*).

$$F_{PM}(is) = pu \cdot [\, pr \cdot r(t) \cdot q(ei) + (1 - pr) \cdot (1 - (1 - r(t)) \cdot (1 - q(ei)))] + (1 - pu) \cdot r(t) - q(is) \quad (9)$$

[1] T. Bosse et al., Modeling collective decision making in groups and crowds: Integrating social contagion and interacting emotions, Autonomous Agent and Multi-Agent Systems, 2013, 27: 52-84

[10] C.R. Berger et al., Some exploration in initial interaction and beyond: Toward a developmental theory of communication, Human Communication Research, 1: 99-112 (1975).

Formulation

- **Perception**
  - People will perceive different risk[28] and uncertainty[2] according to the characteristics of an event, such as death toll, (un)controllable
  - Two factors that may affect human perceptions
    - Emotional intensity of anxiety[31]
    - The relevance and polarity of event-related information [9] that people seek

$$\Delta P = (1-v)\cdot F_{HP} + v\cdot\left(\frac{1}{1+e^{-\sigma(q(ei)-\tau)}}\right)\cdot F_{HP} \quad (10)$$

- The first part denotes the effects of external information on human perceptions
- The second part denotes the some irrational behaviors if the emotional intensity is larger than a threshold

[2] W.J. Burns, et al., The diffusion of fear: Modeling community response to a terrorist strike, Journal of Defense Modeling and Simulation, 2007, 4(4): 298-317

[9] M.M.Turner et al., The role of anxiety in seeking and retaining risk information: Testing the risk perception attitude framework in two studies, Human Communication Research, 32: 130-136 (2006).

[28] P. Slovic et al., Perception of risk posed by extreme events, Risk Management Strategies in an Uncertain World, 2002

[31] M. Rosenboim, et al., Emotions, risk perceptions, and precautionary behavior under the threat of terror attacks: A field study among israeli college students, Journal of Behavioral Decision Making, 2012, 25(3): 248-256

Formulation

- **Perceived risk**
  - People perceives different risk for an event based on own experiences in memory [35].
  - People often lower the risk of frequent event (pr → 0) and increase the risk of rare event (pr → 1)

$$\Delta pr = (1-v)\cdot F_{HP} + v\cdot\left(\frac{1}{1+e^{-\sigma(q(ei)-\tau)}}\right)\cdot F_{HP} \quad (11)$$

$$F_{HP}(pr) = (1-q(is))\cdot(\varsigma\cdot p + (1-\varsigma)\cdot(1-p)) - q(pr) \quad (12)$$

- *p* denotes the polar of event-related information (pos. or neg.)
- Optimistic people ($\varsigma \Rightarrow 1$) will strengthen the positive information and weaken the negative information, and vice versa [1]

[1] T. Bosse et al., Modeling collective decision making in groups and crowds: Integrating social contagion and interacting emotions, Autonomous Agent and Multi-Agent Systems, 2013, 27: 52-84

[35] A. Ding, Modeling the psychosocial effects of terror or natural disaster for response preparation, Journal of Defense Modeling and Simulation, 2007, 4(4): 318-342

Formulation

- **Perceived uncertainty**
  - People perceives the uncertainty level of an event. The larger *pu* (*pu*→1) will amplify the seeking behaviors based on URT
  - The coupling relationship of psychological impacts based on [1]

$$\Delta pu = (1-v)\cdot F_{HP} + v\cdot\left(\frac{1}{1+e^{-\sigma(q(ei)-\tau)}}\right)\cdot F_{HP} \quad (13)$$

$$F_{HP}(pu) = r\cdot(1-p)\cdot q(is) - q(pu) \quad (14)$$

  - The second parts of Eq.13 will not contribute to the change of uncertainty level is emotional intensity is lower than a threshold
  - The quick and positive event-related information can reduce the perceived uncertainty level about an event [47]
  - The slow and ambiguous information may increase the uncertainty level and lead to rumors spreading [7]

[1] T. Bosse et al., Modeling collective decision making in groups and crowds: Integrating social contagion and interacting emotions, Autonomous Agent and Multi-Agent Systems, 2013, 27: 52-84

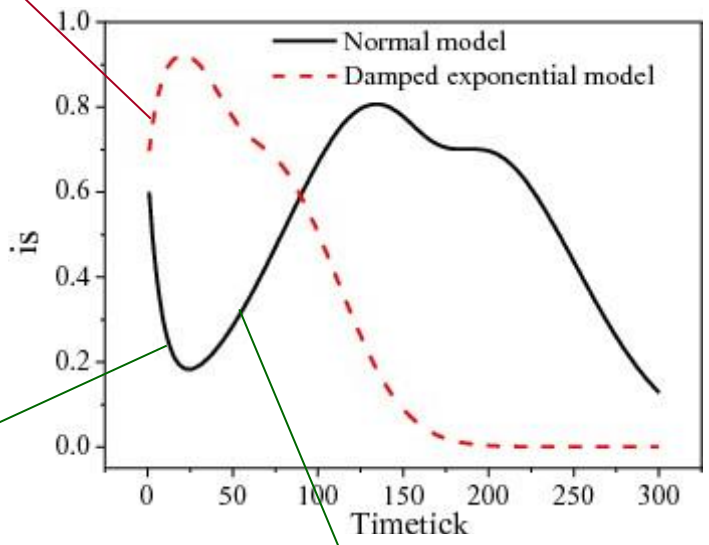
[7] O. Oh, et al., An exploration of social media in extreme events: Rumor theory and twitter during the haiti earthquake 2010, ICIS10: Article No.231

[47] P.R. Spence, et al., Proxemic effects on information seeking after the September 11 attacks, Communication Research Reports, 2005, 22(1): 39-46

Simulation Results

- **The effect of disaster types on information seeking**

Sudden events
The initial increase is caused by the social influences (i.e., behavior mirroring). After that, the seeking behavior is reduced.

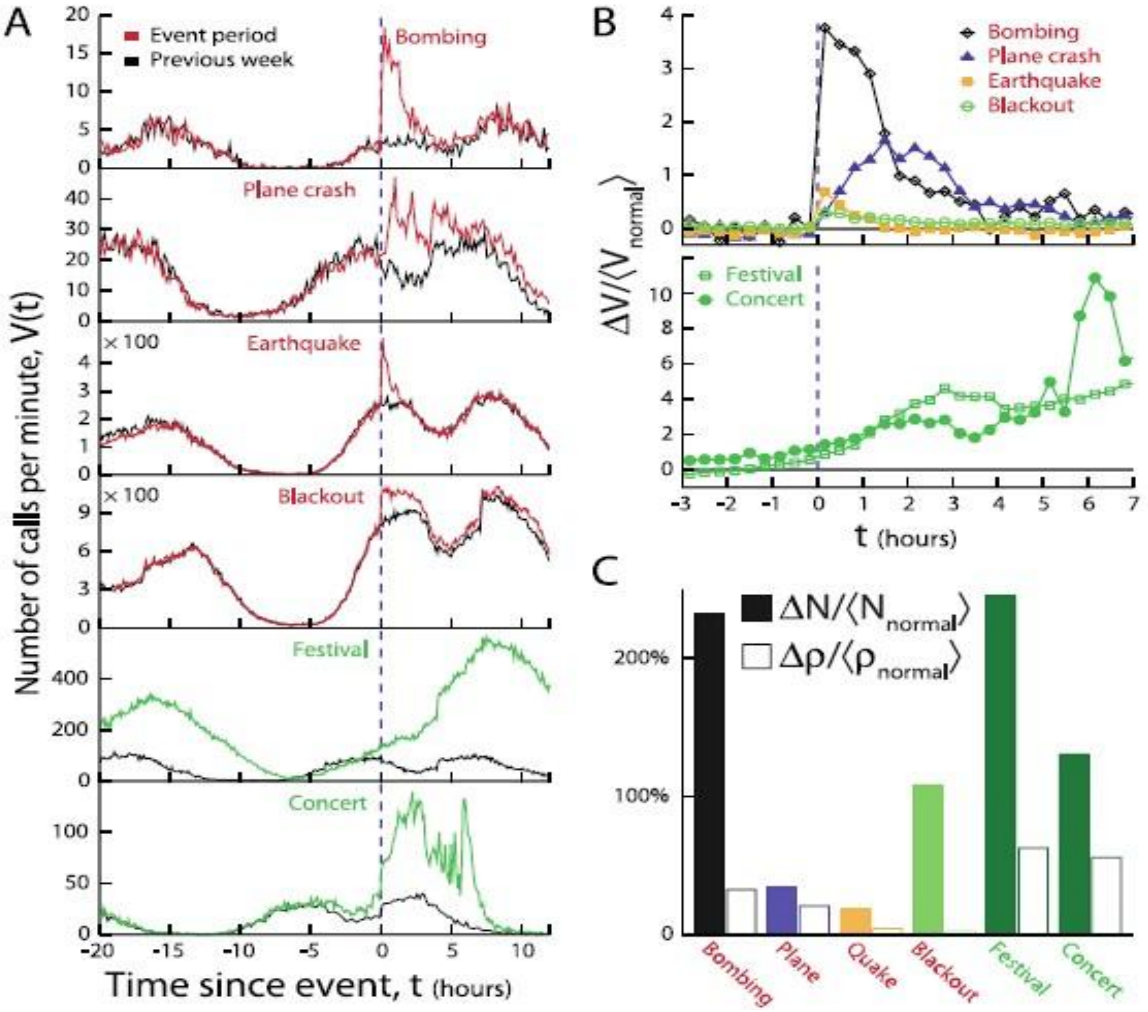


Gradual events
When facing with a forthcoming event, only those entities with more anxious emotions will actively search certain event-related information.

Gradual events
When the event is more closer, more and more entities perceive the risk and will engage in seeking certain event-related information

Human Responses to a Crisis (via Phones)

- **Activity patterns when encountering "extreme events"**

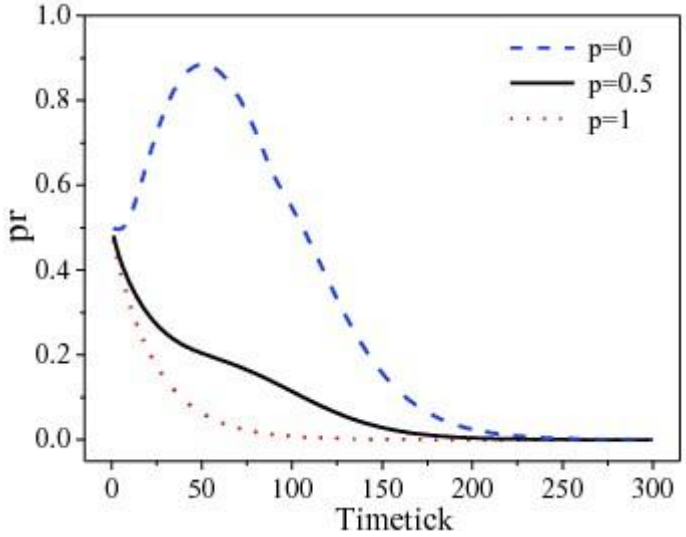


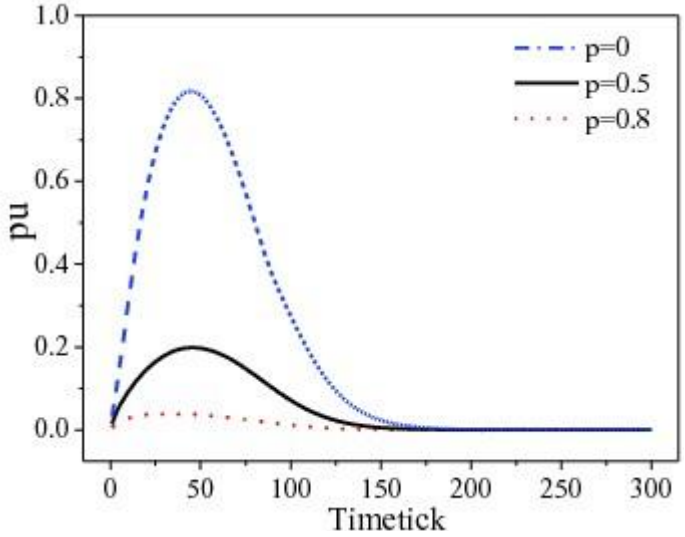
Call anomalies during emergencies

[1] J.P. Bagrow et al., Collective response of human populations to large-scale emergencies, PLoS ONE, 6(3): e17680 (2011).

Simulation Results

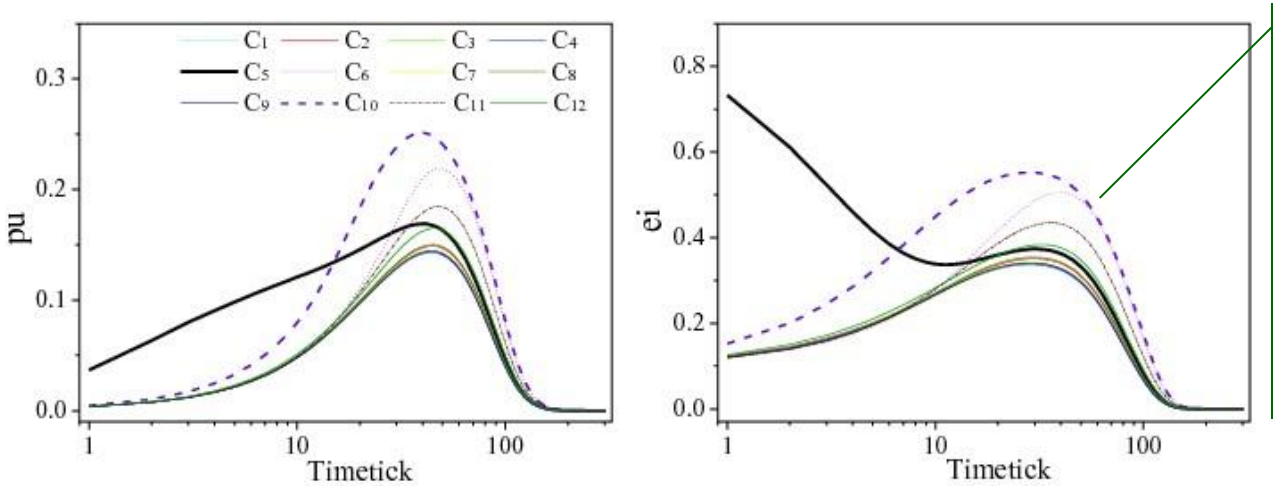
- **The effect of the polarity of event-related information on human perceptions**
  - The relevance of event-related information (*r(t)*) follows a damped exponential model
  - The more negative information ($p \rightarrow 0$) an event has, the more perceived uncertainty and risk for the event will be evoked





Simulation Results

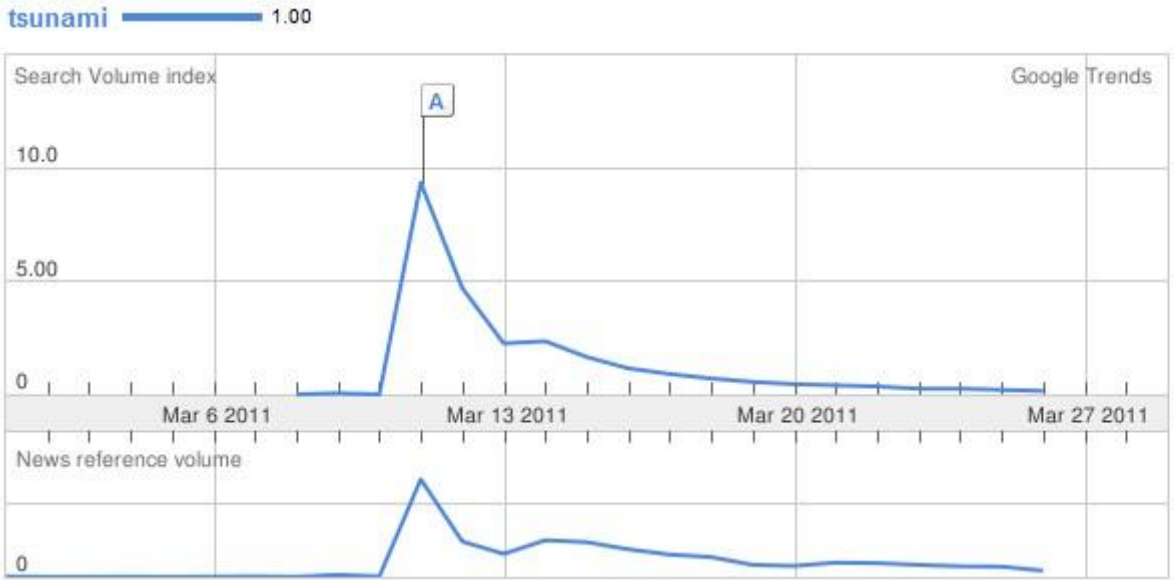
- **The effect of spatial characteristics on human responses**
  - To estimate the effect of the past experience on human response, we assume that the perceived risk of people in C_{10} is more higher than that of people in other communities, because C_{10} has more closer relationships with other communities than C_5
  - C_{10}.pr=1, C_i.pr=0.5 (i≠10)



- C_5 will trigger C_{10} with more uncertainty level and emotional intensity even if C_{10} has not been close relationship with C_5
- The historical experience (especially miserable experience) will play more impact on human normal responses to certain extreme events

Human Responses to a Crisis (on Google)

Term: Tsunami



A Japan earthquake and tsunami
Stuff.co.nz - Mar 11 2011

More news results »

Regions		Cities	
1.	Malaysia	1.	Makati, Philippines
2.	Philippines	2.	Jakarta, Indonesia
3.	Indonesia	3.	San Francisco, CA, USA
4.	Peru	4.	Lima, Peru
5.	Chile	5.	Santiago, Chile
6.	India	6.	Los Angeles, CA, USA
7.	Singapore	7.	Delhi, India
8.	Argentina	8.	Buenos Aires, Argentina
9.	Canada	9.	New York, NY, USA
10.	Mexico	10.	Toronto, Canada

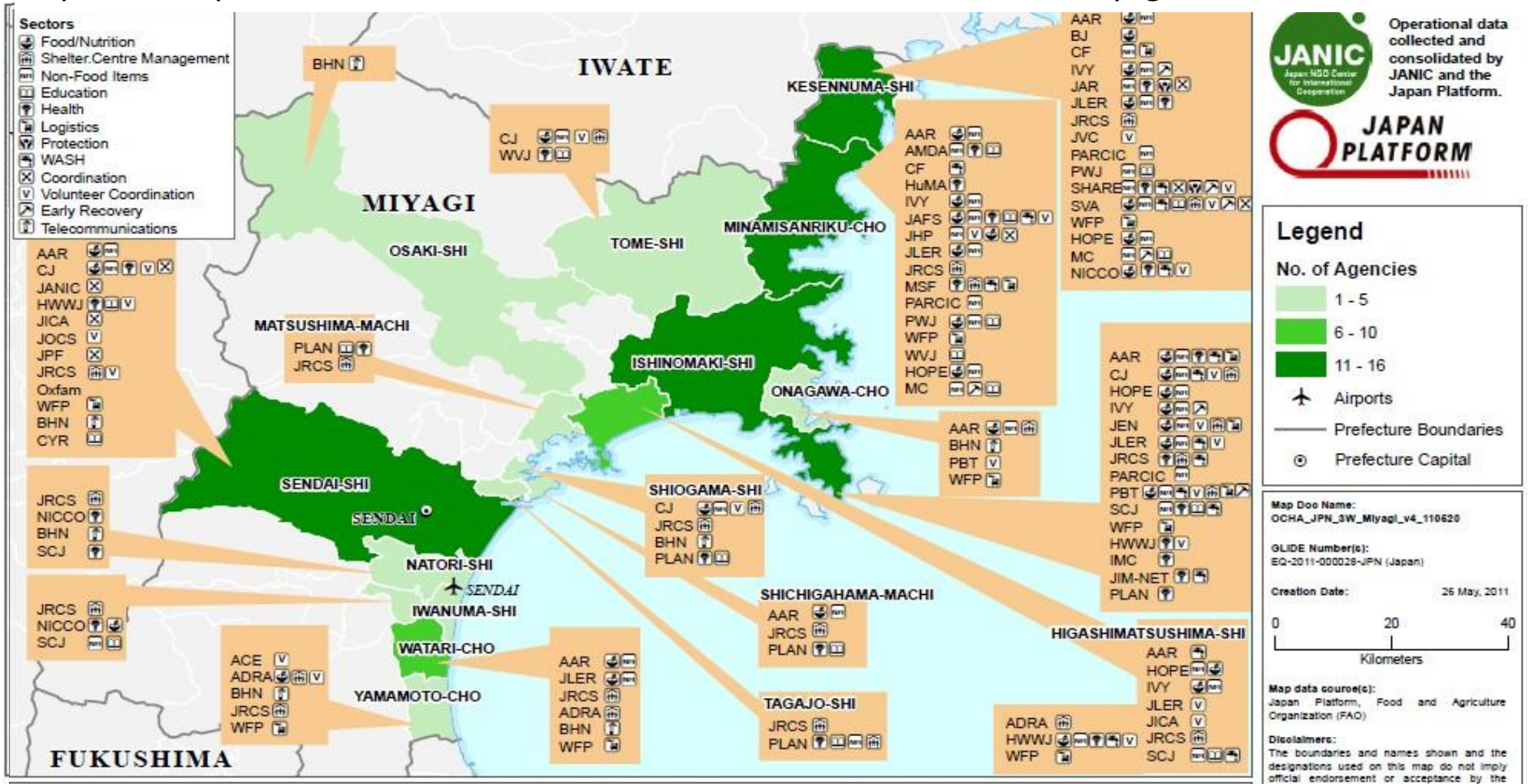
A Future Step: Intervention?

- **Understanding human response behaviors to extreme events**
  - The relationship between individuals' information seeking need *vs*. public rumor/uncertainty spreading
  - Modeling collective decision-making
  - Data analysis for understanding social emotion/mood
    - As an indicator of response phases
  - Collective emotion diffusion/analysis

- **Improving cooperation and relief efficiency of agencies**
  - **To identify social needs at different times, and plan effective relief missions** (e.g. releasing specific information about an episode), through analyzing human responses to extreme events

NGOs in Japan

Japan Earthquake and Tsunami: Who What Where as of 20/05/2011, Miyagi Prefecture



AAR: Association for Aid and Relief
ACE: Action against Child Exploitation
ADRA: ADRA Japan
AMDA: Association of Medical Doctors of Asia
BHN: BHN Telecom Association
BJ: Bond and Justice
CF: Civic Force
CJ: Caritas Japan
CYR: Caring for Young Refugees
HOPE: HOPE International Development Agency Japan
HuMA: Humanitarian Medical Assistance
HWWJ: Hope Worldwide Japan
IMC: International Medical Corps
IVY: International Volunteer Center of Yamagata
JAFS: Japan Asian Association and Friendship Soc.
JANIC: Japan NGO Center for International Cooperation
JAR: Japan Association for Refugees
JEN: JEN
JHP: Japan Team of Young Human Power
JICA: Japan International Cooperation Agency
JIM-NET: Japan Iraq Medical Network
JLER: Japan Lutheran Emergency Relief
JOCS: Japan Overseas Medical Cooperation Service
JPF: Japan Platform
JRCS: Japan Red Cross Society
JVC: Japan International Volunteer Center
MC: Mercy Corps
MSF: Medecins sans Frontiers Japan
NICCO: Nippon Int'l Coop. for Community Dev.
Oxfam: Oxfam
PARCIC: Pacific Asia Resource Ctr Interpeoples' Coop.
PBT: Peace Boat
PLAN: Plan Japan
PWJ: Peace Winds Japan
SCJ: Save the Children Japan
SHARE: Services for Health in Asian and African Regions
SVA: Shanti Volunteer Association
WFP: World Food Programme
WVJ: World Vision Japan

A Complex Systems Perspective, *Revisited*

I. Public Health Policies

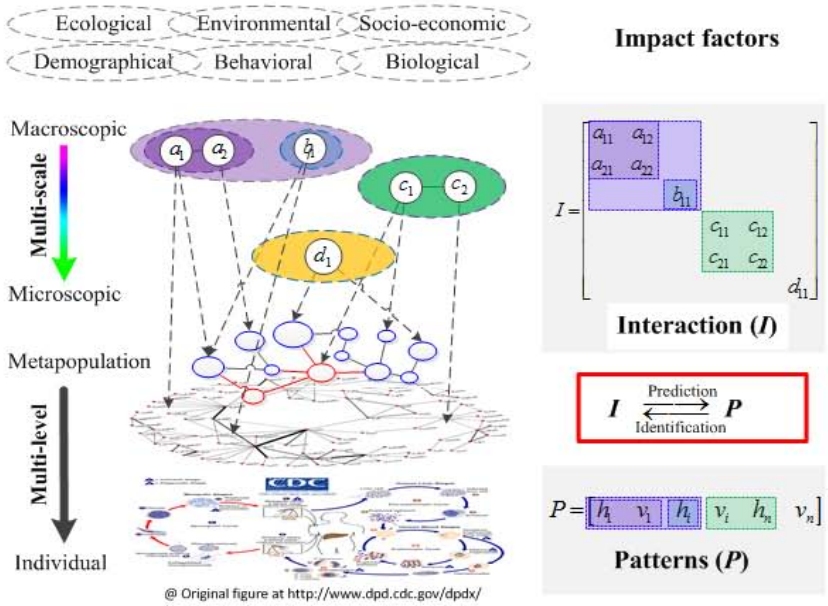
Goals and targets
- Death reduction
- Case reduction

Intervention strategies
- Diagnosis
- Treatment
- Vector control
- Vaccination

Monitoring & evaluation
- Disease surveillance
- Anti-drug resistance
- Effectiveness & efficiency

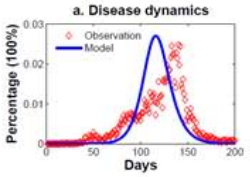
Cooperation
- Financial support
- Political commitment
- Organizational management

II. Disease Transmission: A Complex Systems Perspective

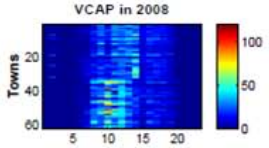


III. Public Health Indicators

Transmission patterns
- Temporal (when)
- Spatial (where)
- Demographical (who)



Risk measurements
- Under control
- Elimination
- Eradication



IV. Data-Driven Computational Intelligence

Requirements

System modeling
- Predicting tempo-spatial patterns (*Real-world study* I)
- Identifying underlying interactions (*Real-world study* II)

Policy-level decision making
- Active surveillance
- Strategic planning
- Deployment
- Assessment

Predictions

THANK YOU

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