



# GLOBAL PATTERNS IN TERRORISM

Lecture 10

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CSCI 7000-001

Inference, Models and Simulation for Complex Systems

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## **ter•ror•ism (noun)**

*a violent act*

*by non-governmental actors*

*to create fear*

*for political purposes*

*“terrorism from below”      vs.      “terrorism from above”*

# **a brief history of modern terrorism**



## **wave I: anarchist**

**c.1880 - c.1920**

examples:

- 1881 Narodnaya Volya assassinates Tsar Alexander II
- 1901 Leon Czolgosz assassinates US President McKinley
- 1905 Terrorist Brigade operates in Switzerland and Finland
- 1914 Archduke Ferdinand's assassination starts World War I



**wave 1: anarchist**

**c.1880 - c.1920**

**wave 2: anti-colonial**

**c.1910 - c.1960**

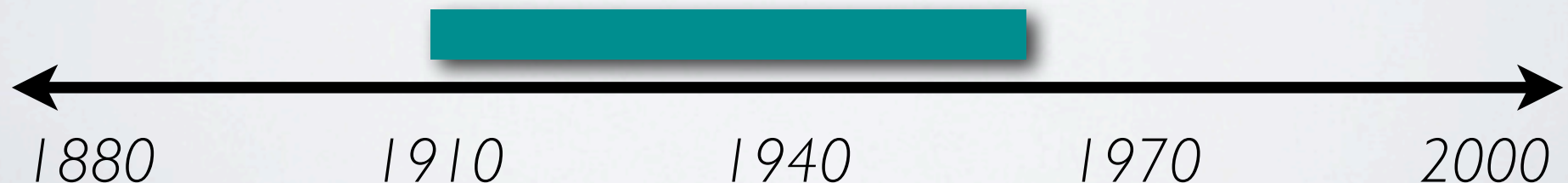
examples:

1928-66 Muslim Brotherhood's Secret Apparatus in British Egypt

1931-48 Irgun fights to create Israel out of British Palestine

1955-59 EOKA fights for Cyprus' independence from Britain

1954-62 FLN fights for Algerian independence from France



**wave 1: anarchist**                      **c.1880 - c.1920**

**wave 2: anti-colonial**                **c.1910 - c.1960**

**wave 3: revolutionary**              **c.1960 - c.2000**

examples:

1964+      PLO in Palestinian territories

1970-90    “Contras” in Nicaragua

1970-93    Red Army Faction in West Germany

1980-92    Shining Path in Peru

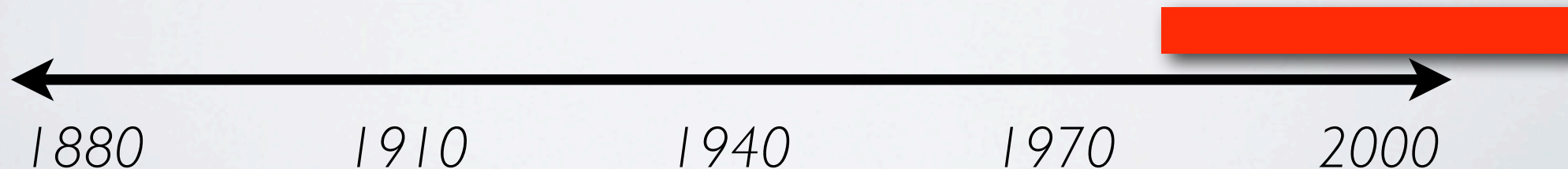
tacit encouragement from USSR and USA



<b>wave 1: anarchist</b>	<b>c.1880 - c.1920</b>
<b>wave 2: anti-colonial</b>	<b>c.1910 - c.1960</b>
<b>wave 3: revolutionary</b>	<b>c.1960 - c.2000</b>
<b>wave 4: religious</b>	<b>c.1980 - present</b>

examples:

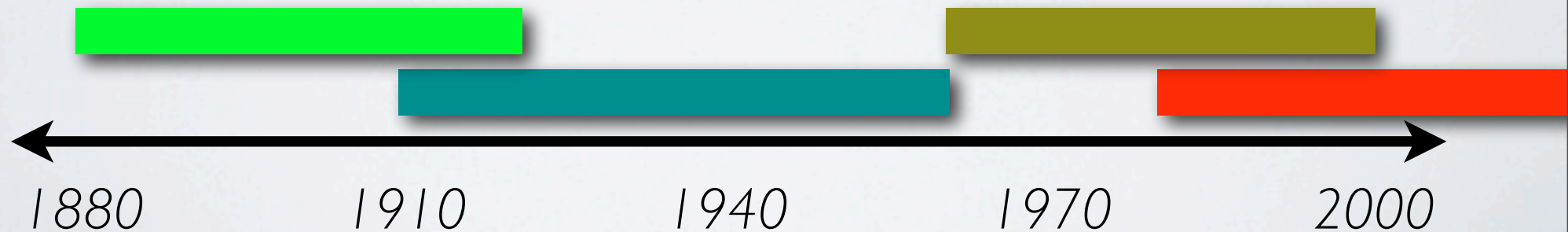
- 1976-09 Tamil Tigers in Sri Lanka (Hindu)
- 1984-00 Aum Shinrikyo in Japan (Cult)
- 1987+ Hamas in Palestinian territories (Islamic)
- 1991+ Lord's Resistance Army in Uganda (Christian)
- 1994+ Taliban in Afghanistan, Pakistan (Islamic)



## tactics

## targets

wave 1	assassinations, dynamite, suicide missions	government, heads of business
wave 2	assassinations, firearms, guerrilla attacks	government, military
wave 3	hostages, firearms, high explosives, guerrilla attacks, assassinations	mainly military, some civilians
wave 4	suicide bombs, improvised explosives, firearms, unconventional methods	mainly civilians, some military





## conventional studies of terrorism

- **historical, descriptive, policy-oriented**
- **focused on incidence and strategy**  
(spoiler effects, substitution, public support)
- **correlations**  
(democracies, political motivation, strategic opportunities, alliances, material support)
- **mainly use aggregate measures**  
(totals, binary variables)
- **general linear model**  
(regressions)

thus

- theories of rational behavior, context and strategic issues  
(*a la* economics)
- severity of events typically ignored
- theories rarely mechanistic  
(but often psychological)
- few general “laws”
- little hope of forecasting  
(context, context, context)

**where is terrorism today?**

# MIPT **TERRORISM**

## KNOWLEDGE BASE <sup>SM</sup>

### incident profile

**ABU HAFS AL-MASRI BRIGADE AND SECRET ORGANIZATION OF AL-QAEDA IN EUROPE ATTACKED TRANSPORTATION TARGET (JULY 7, 2005, UNITED KINGDOM)**

**Incident Date:** July 7, 2005

**Terrorist Organization(s):** Abu Hafs al-Masri Brigade , Secret Organization of al-Qaeda in Europe

**Target:** Transportation

**City:** London

**Country:** United Kingdom

**Region:** Western Europe

**Tactic:** Bombing

**Weapon:** Explosives

**Fatalities:** 27

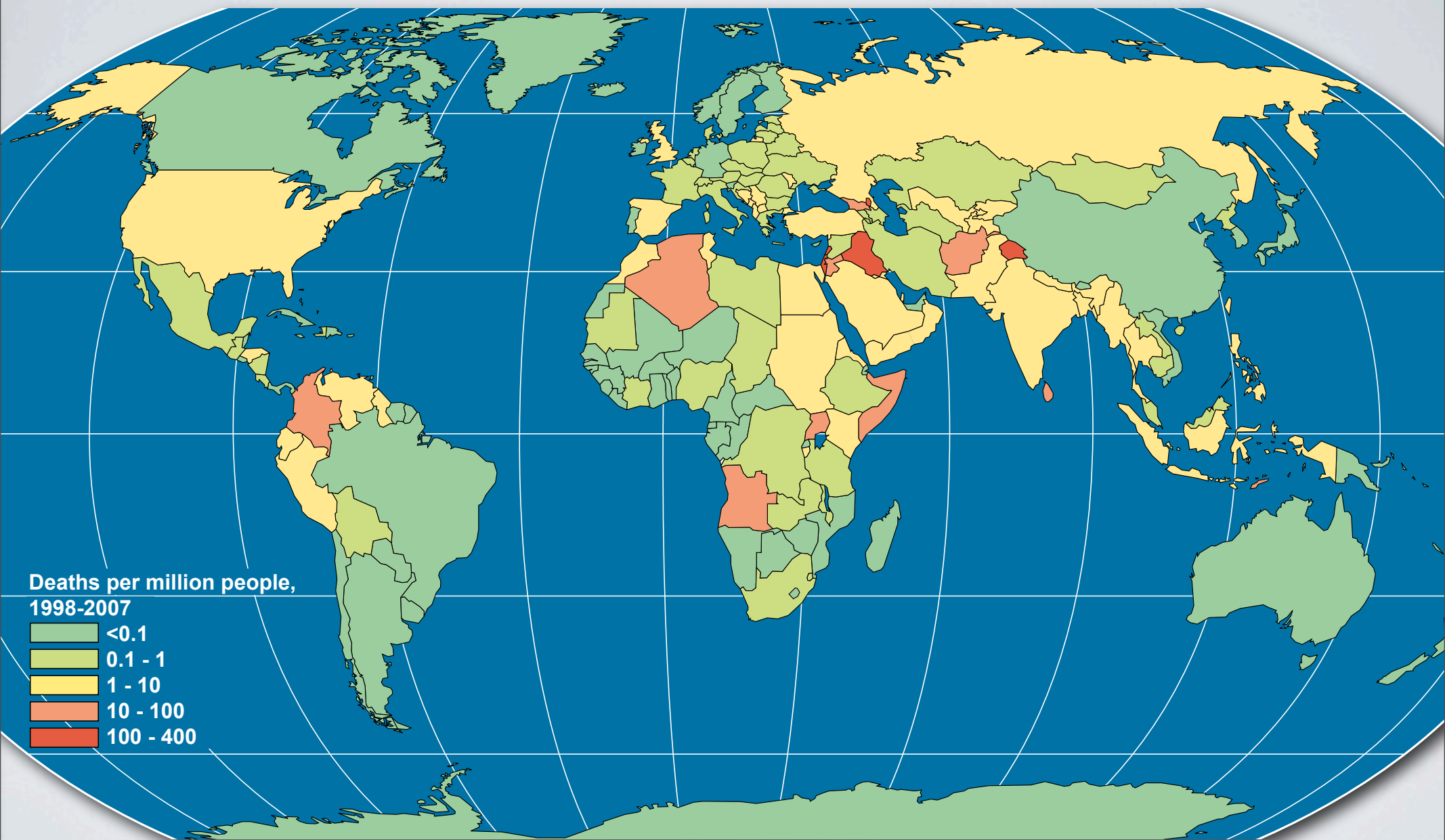
**Injuries:** 0



## **RAND-MIPT data**

- 40 years (1968-2008)
- domestic + international
- 5000+ cities, 187 countries
- 36,018 events (37% deadly)



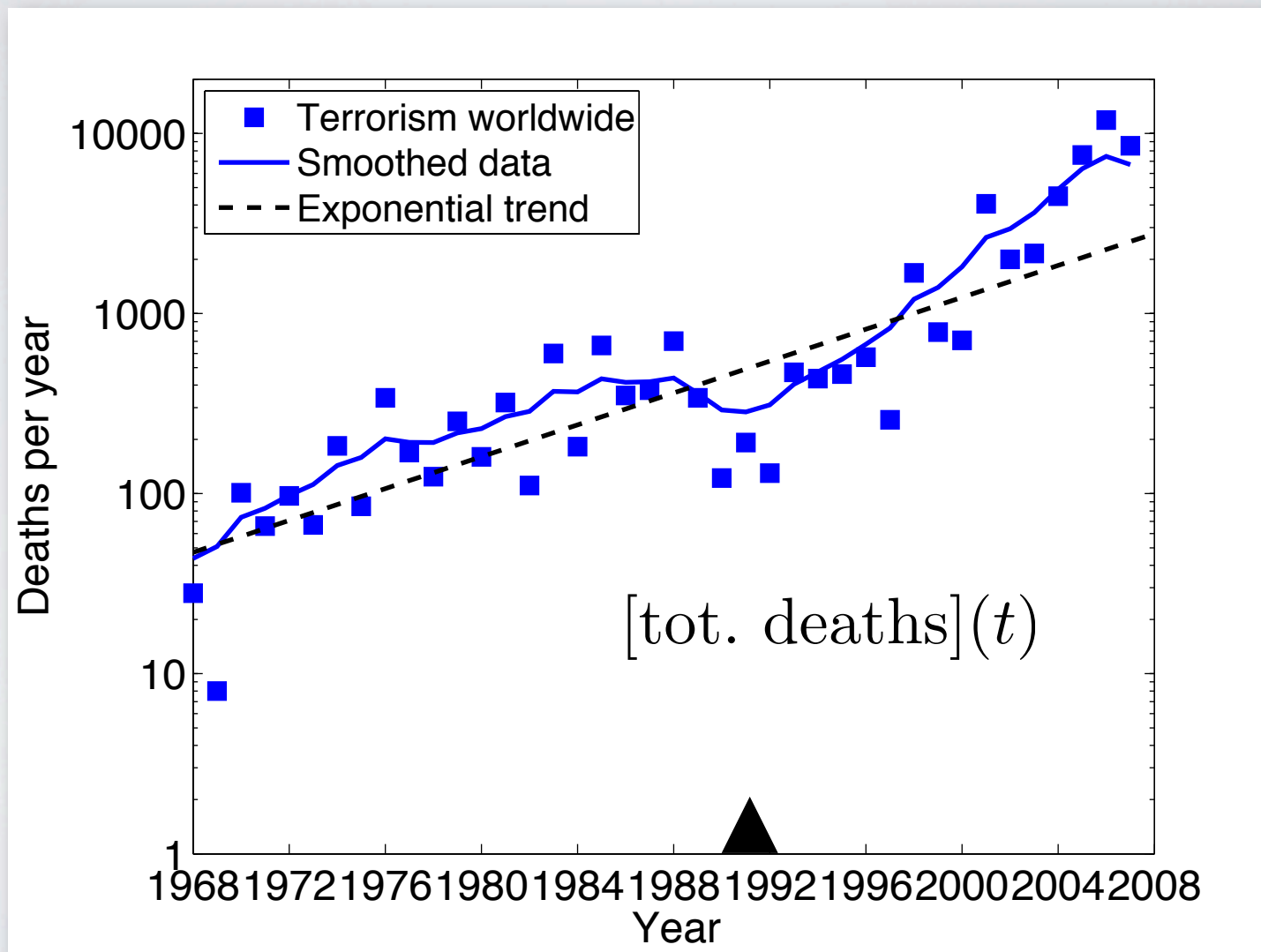


## deaths per million people, USA 2007

terrorism	0	--
lightning	0.15	1
bee sting	0.18	x1.2
airplane crash	0.23 <sup>*</sup>	x1.5
homicide	61.74 <sup>*</sup>	x408.3
car crash	124.43	x829.5

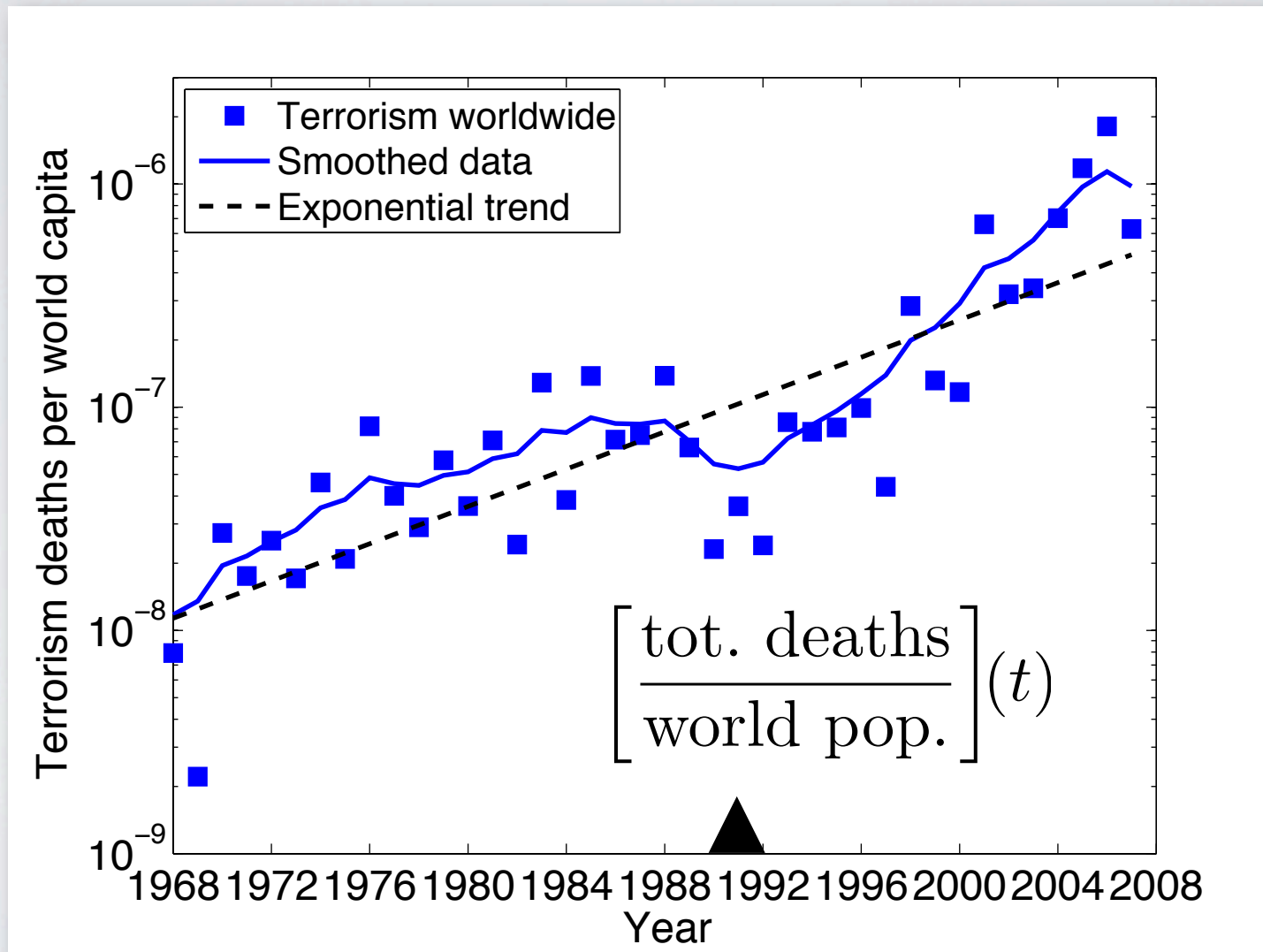
**is terrorism getting worse?**

# is terrorism getting worse?

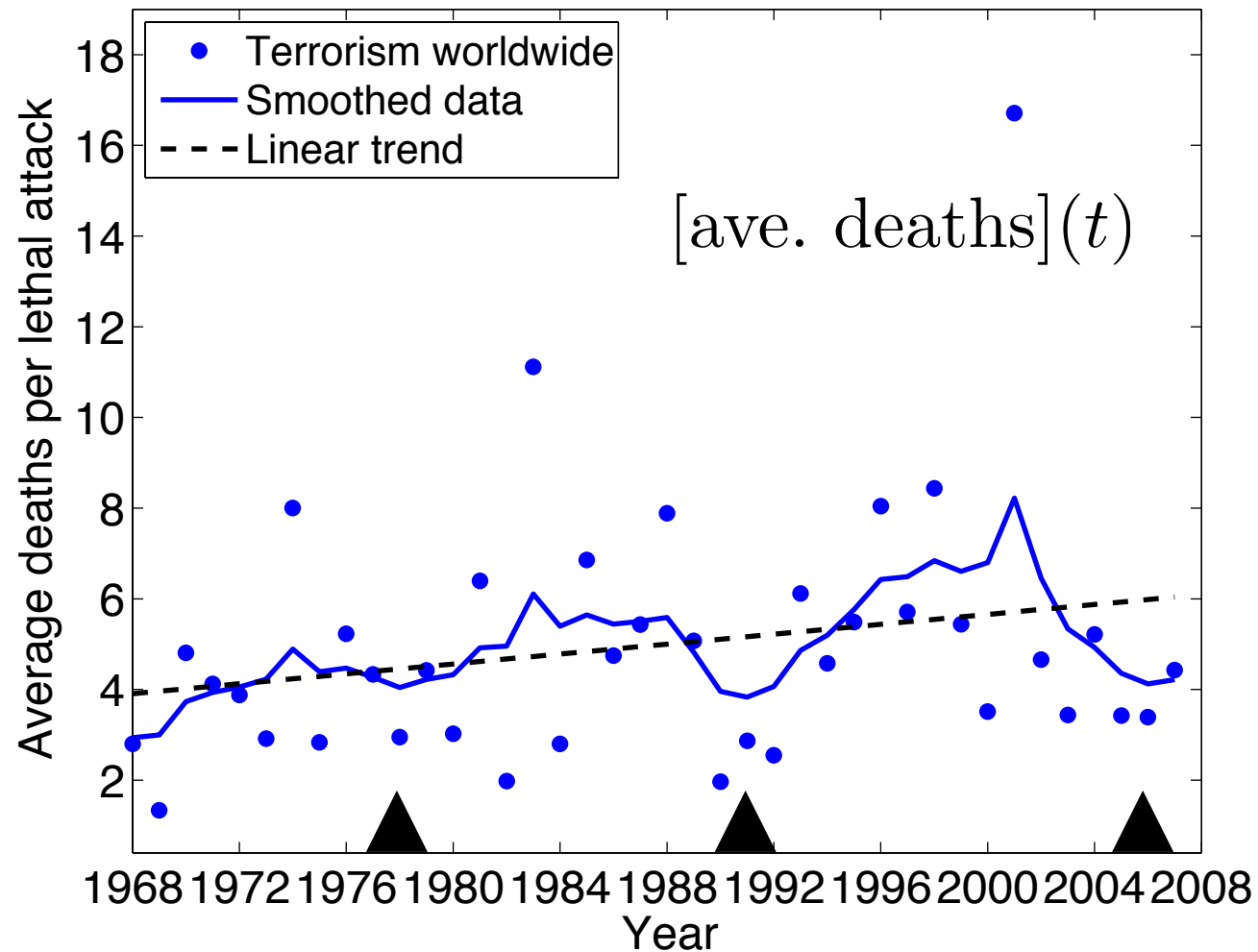




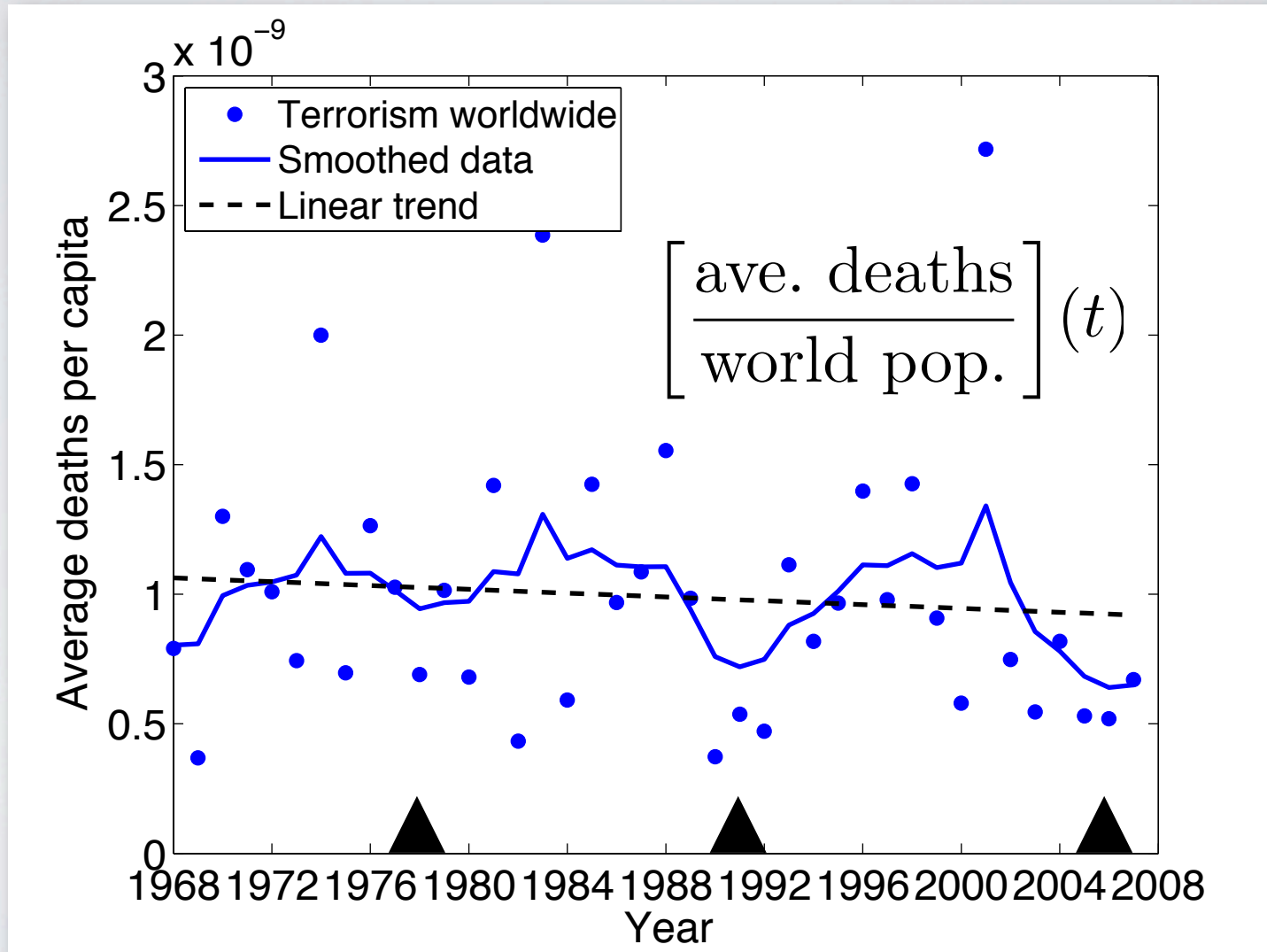
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# is terrorism getting worse?



# is terrorism getting worse?



## **comments**

- individual events no worse, on average
- number of fatal events increased exponentially
- odd lulls in 1992, 2006



## **severe events (“outlier” events)**

- relatively few casualties (automobiles > terrorism)
- very infrequent
- disproportionate economic, political effects

For example: major re-organization of US/UK national security apparatus after 9.11.2001

21 Dec. 1988: Pan Am Flight 103, Lockerbie Scotland (270 deaths)

19 Apr. 1995: Oklahoma City bombing (168 deaths)

11 Sept. 2001: World Trade Center (2749 deaths)

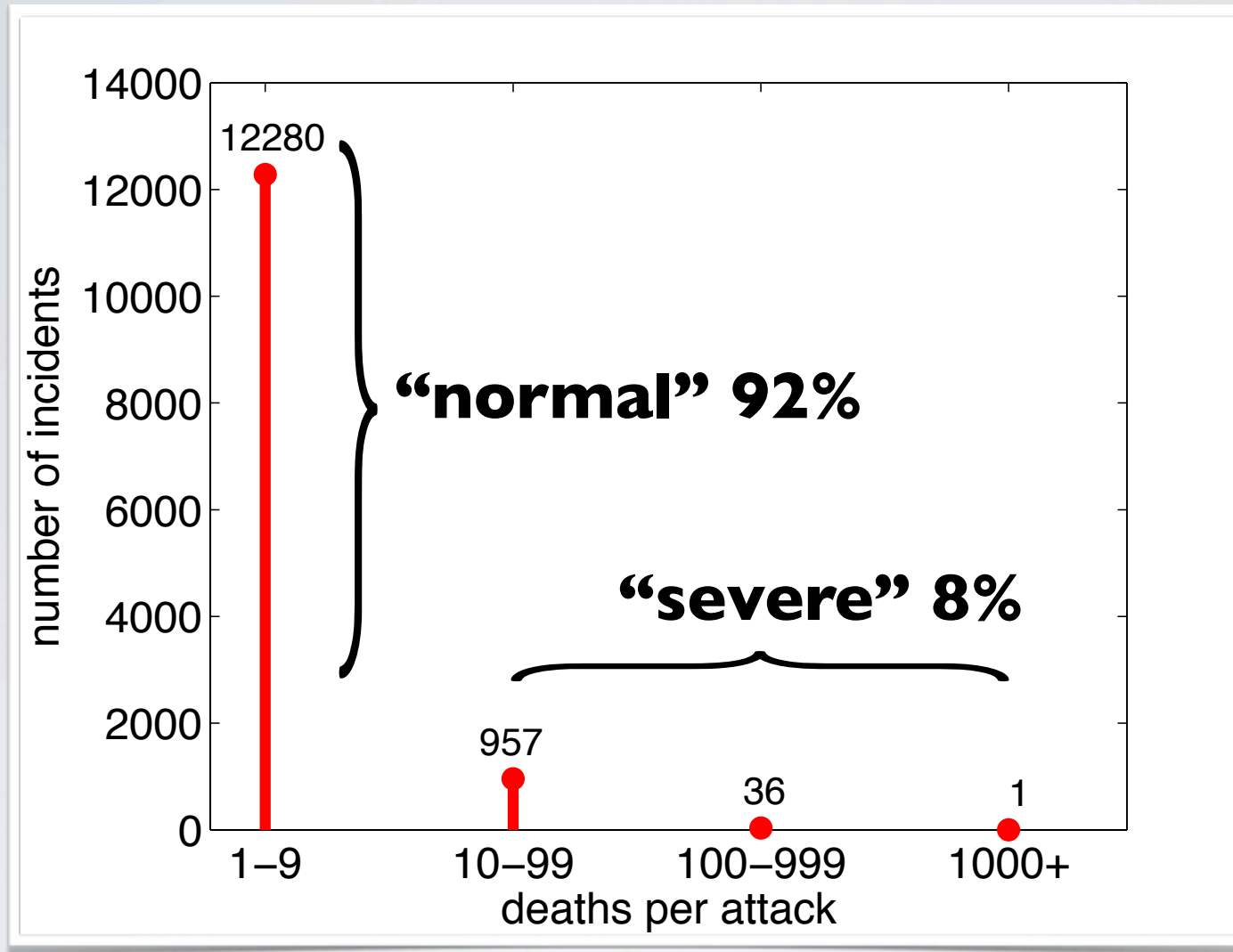
12 Oct. 2002: Bali nightclub bombing (202 deaths)

26 Nov. 2008: Lashkar-e-Taiba attack in South Mumbai (173 deaths)

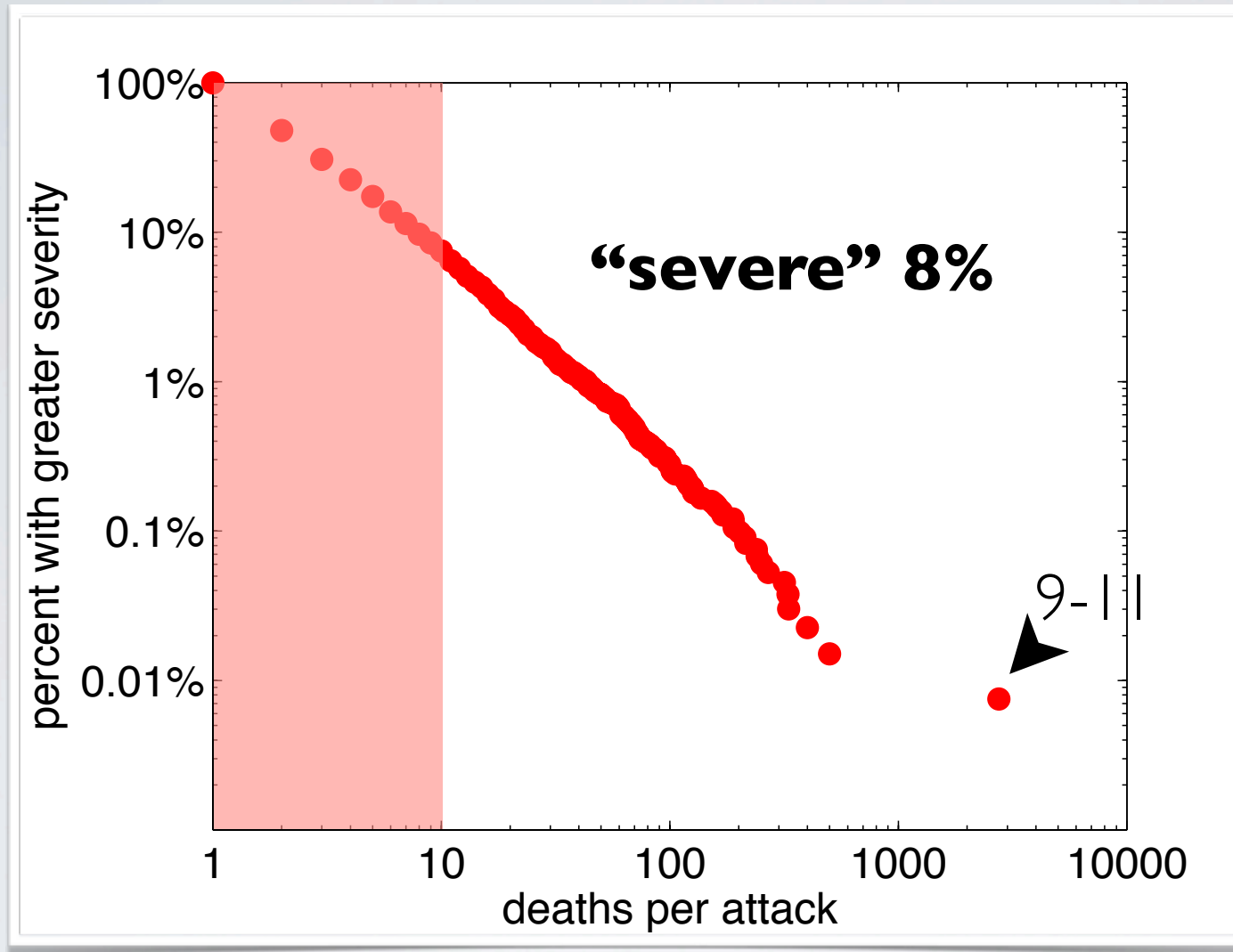


image credits: wikipedia, BBC news

# 13,274 deadly attacks, 1968-2008

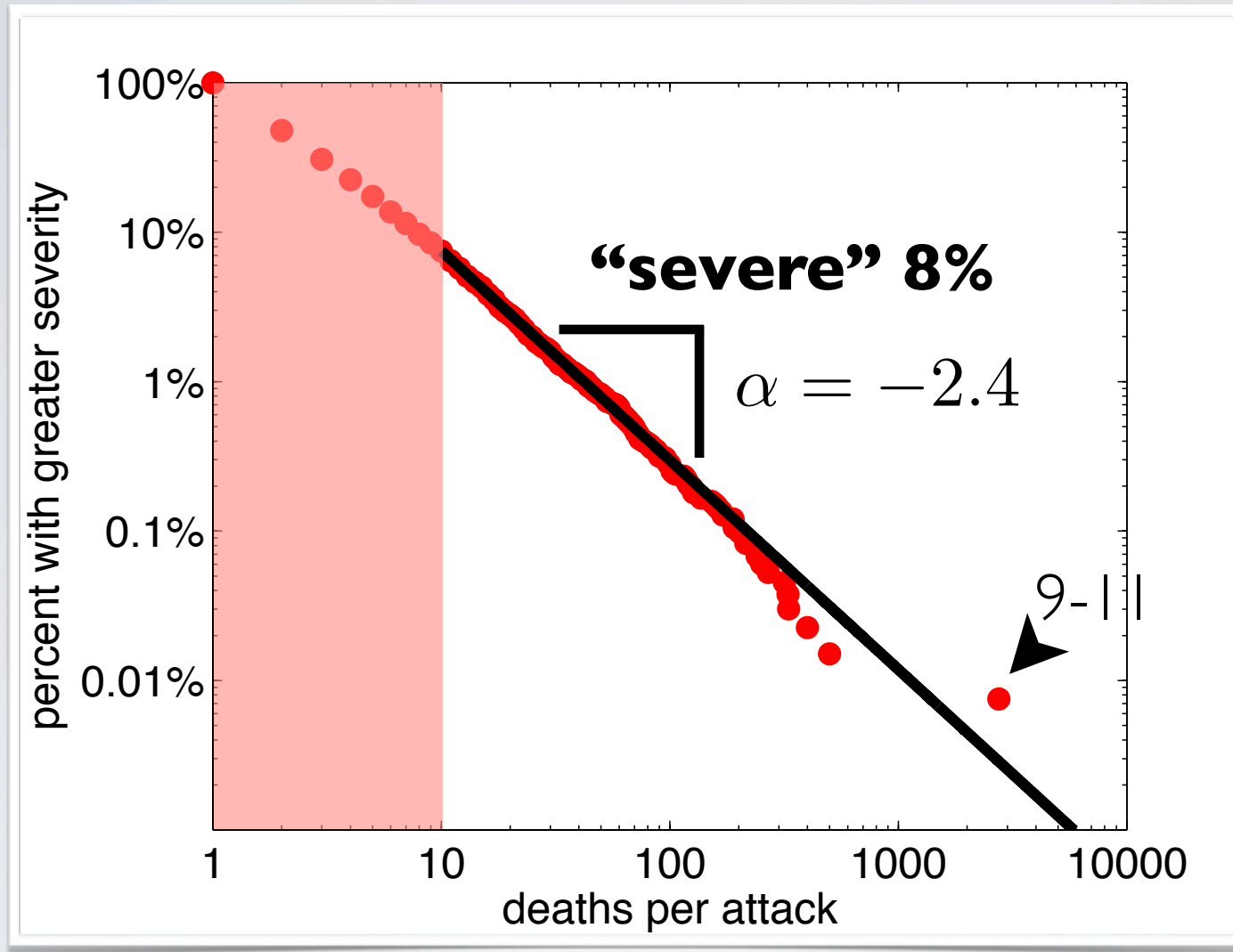


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## testing the power law

	$\hat{x}_{\min}$	$\hat{\alpha}$	$\hat{n}_{\text{tail}}$	$p$
deaths	10	$2.4 \pm 0.2$	1024	0.44 ←

### power-law is *plausible* model for deaths

- no fundamental difference, big vs. small
- $\hat{x}_{\min}$  marks “severe event” range
- could estimate risk of future severe events  
(additional validation needed for this)
- can use power-law model for additional analysis

## **variations**


how does frequency-severity distribution vary with

- time
- weapon type
- economic development

## variation with time

study events in each  
24 month interval

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KNOWLEDGE BASE <sup>SM</sup>

 **incident profile**

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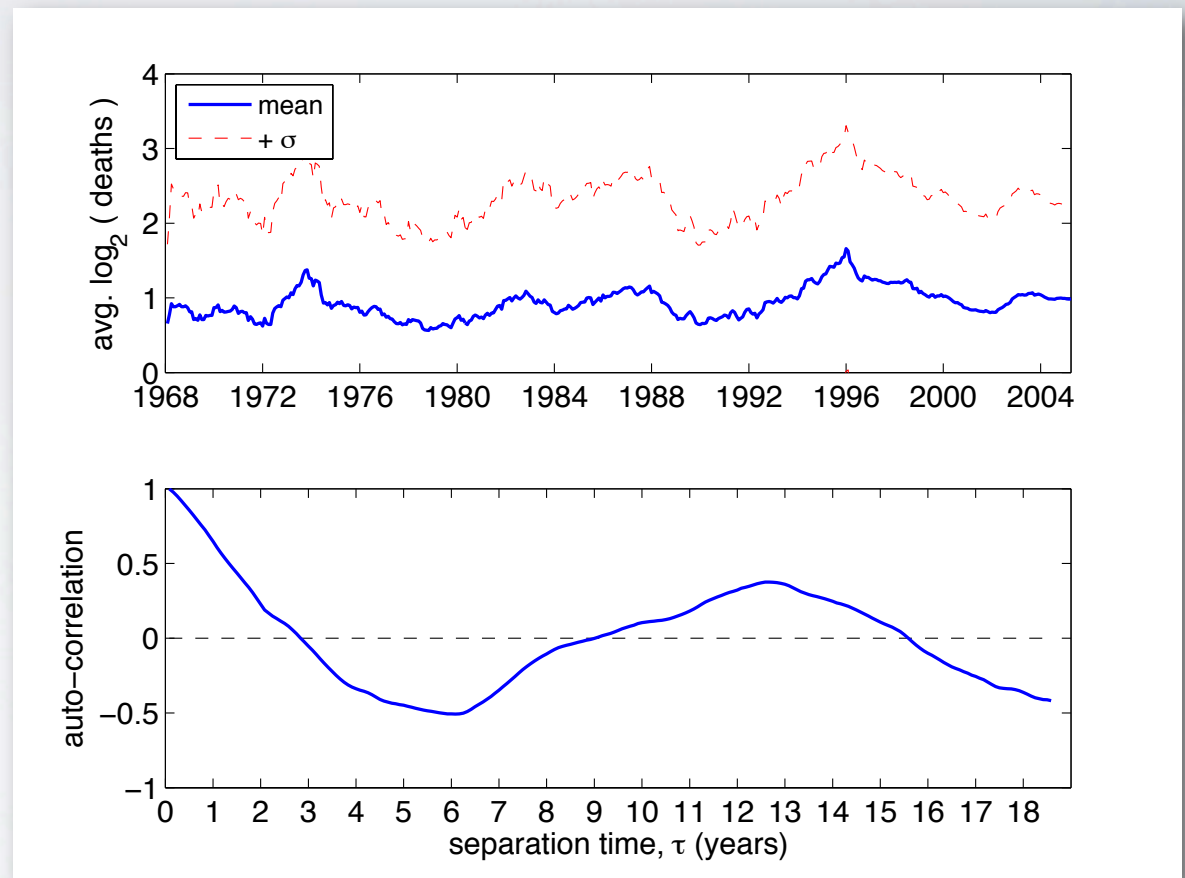
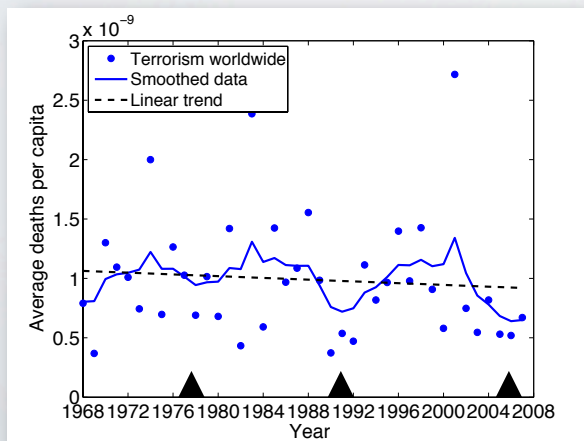
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## variation with time

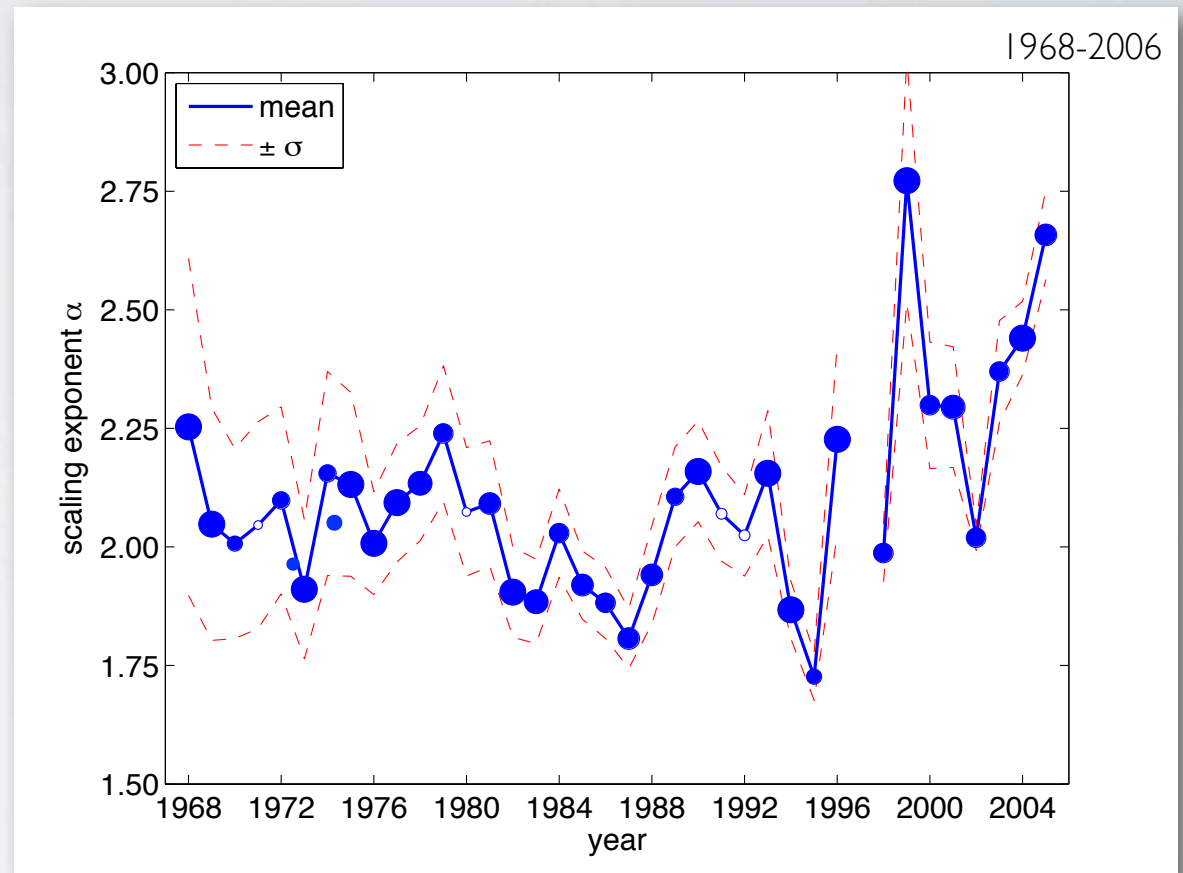
- ave. log-severity largely stable over 40 years
- apparent periodicity in ave. log-severity at years  $\tau \approx 13$





## variation with time

- scaling exponent largely stable over 40 years
- suggests severity distribution largely stable
- main difference today: many more events



## variation by weapon

- chem/bio
- explosives
- fire/arson
- firearms
- knives
- other/unconventional

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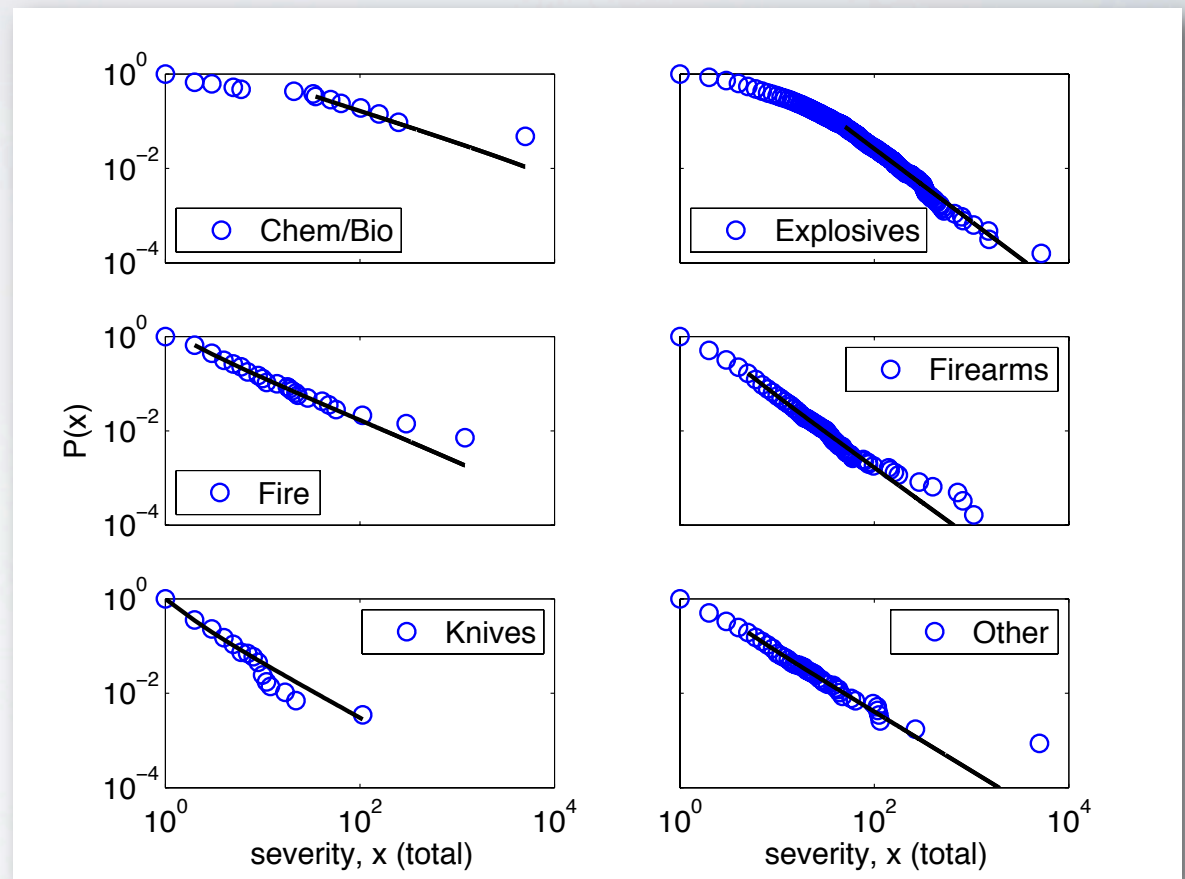
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## variation by weapon

- more apparent power-law behavior
- but different  $\hat{\alpha}$ ,  $\hat{x}_{\min}$
- not ubiquitous: no power laws by region
- explosives most deadly, overall




## variation by economy



- 30 countries (USA, Japan, France, UK, Turkey...)
- tracks economic statistics and data for these 30 + 70 others

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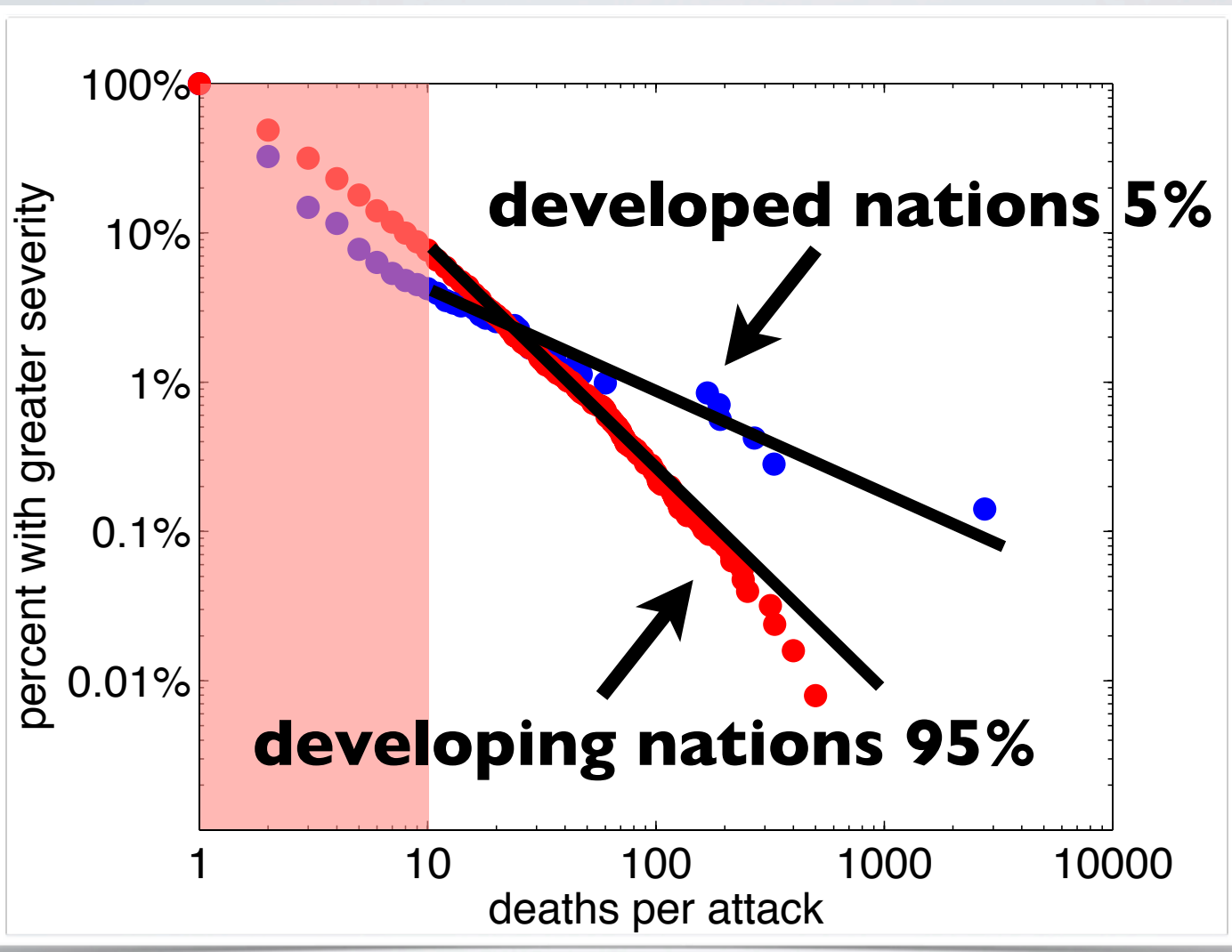
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## economy alone?

severe events	$x \geq x_{\min}$	of total
Turkey	335	26.9%
France	201	16.2%
Spain	109	8.8%
Germany	98	7.9%
USA	93	7.5%
Greece	76	6.1%
Italy	73	5.9%
UK	62	5.0%
total	1047	84.2%

other factors must be  
involved



## comments

power-law pattern holds for

- different decades (70s, 80s, 90s, 00s)
- different types of weapon (guns, fire, bombs, etc.)
- different levels of economic development (OECD)
- but not for “regions” or suicide attacks

open questions

- what creates this simple and robust pattern?\*
- what does this mean for long-term planning?  
(can we make accurate statistical forecasts?)

# generating the power law

model 1:

- competition between states and terrorists leads to exponential sampling (a la Reeds & Hughes)  
[Clauset, Young & Gleditsch (2007)]

model 2:

- population density fluctuations + density-dependent targeting (a la Reed & Huges)  
[Clauset, Young & Gleditsch (2010)]

model 3:

- self-organized critical, fission-fusion model of group dynamics leads to power-law in cell sizes  
[Johnson et al. (2009), Clauset & Weigel (2010)]



**tuesday:**

terrorist organizations **or** civil wars

