

Humanitarian Operations

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Promoting Human Welfare

“Doing Good with OR”

- Disasters; Natural and Manmade
- Ongoing Problems





Humanitarian Logistics

Relief logistics

Development logistics

Type

Complex emergencies
(Man-made disaster)

Natural disaster

Slow onset
-Famine
-Drought

Sudden onset

Unpredictable Location
-Tsunami

Predictable Location

Predictable Timing
-Hurricane
-Flood

Unpredictable Timing
-Earthquake
-Volcanic eruption

Timeline

Pre-disaster
(mitigation & preparedness)

- * assessment
- * planning
- * training/education

Disaster
(response)

- * relief operations
- * second phase
- * logistics stages

Post-disaster
(recovery)

- * debris cleaning
- * measure the effect of
 - infrastructure
 - planning
 - response
- * short & long term
- * lessons learned

OR/MS Research in Public Sector



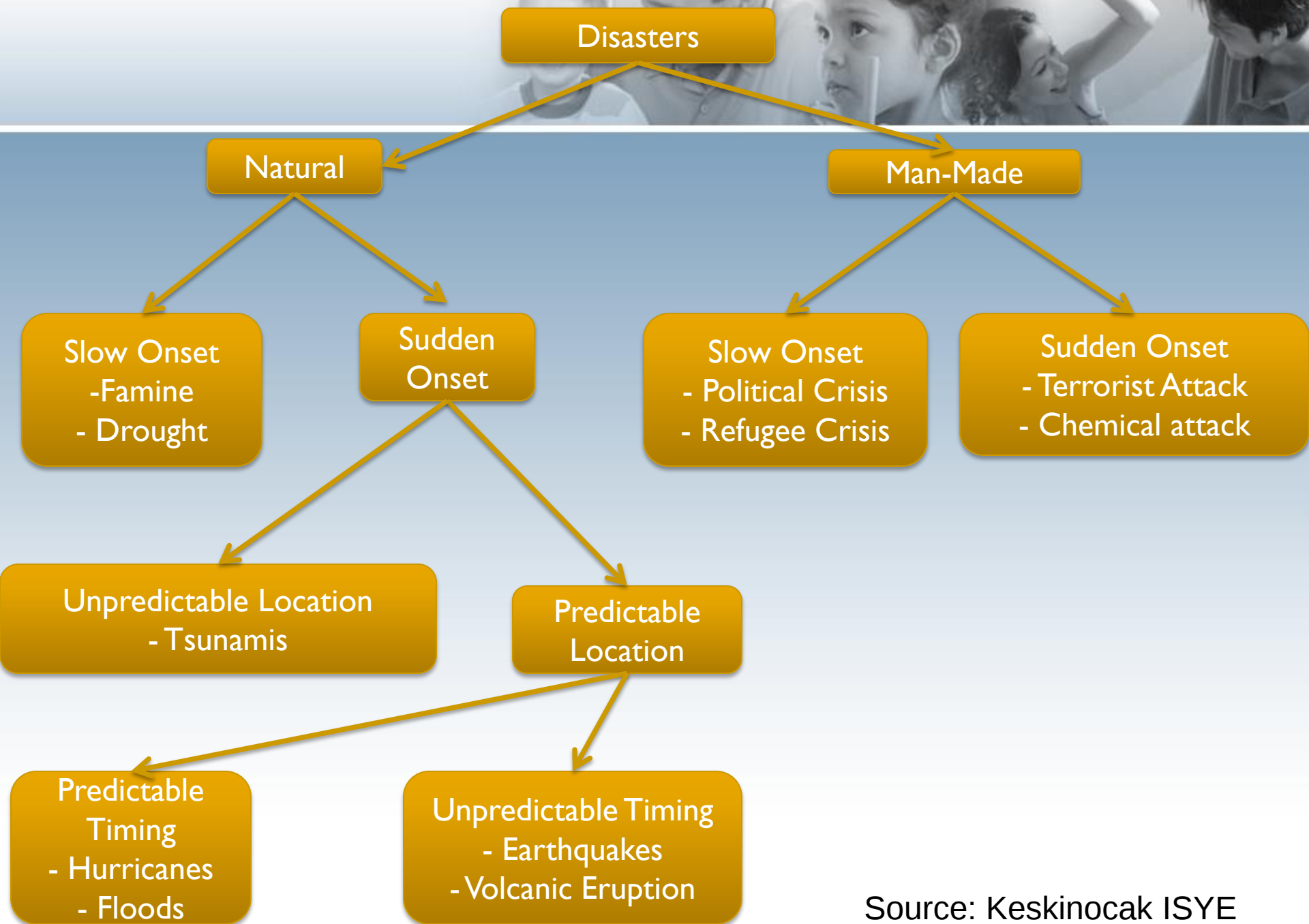
- Chaiken and Larson (1972), Methods for Allocating Urban Emergency Units: A Survey
- Larson (1972) Urban Police Patrol Analysis
- Larson and Odoni (1981) Urban Operations Research
- Jones and Eden (1981), OR in the Community
- Pollock, Rothkopf, Barnett (1994) eds., Operations Research in the Public Sector
- Ritchie (1994), ed., Community Works: 26 Case Studies Showing Community Operational Research in Action
- Johnson and Smilowitz (2007), Tutorial on Community Based Operations Research
- Kaplan (2008), Adventures in Policy Modeling! Operations Research in the Community and Beyond

Public Sector Examples



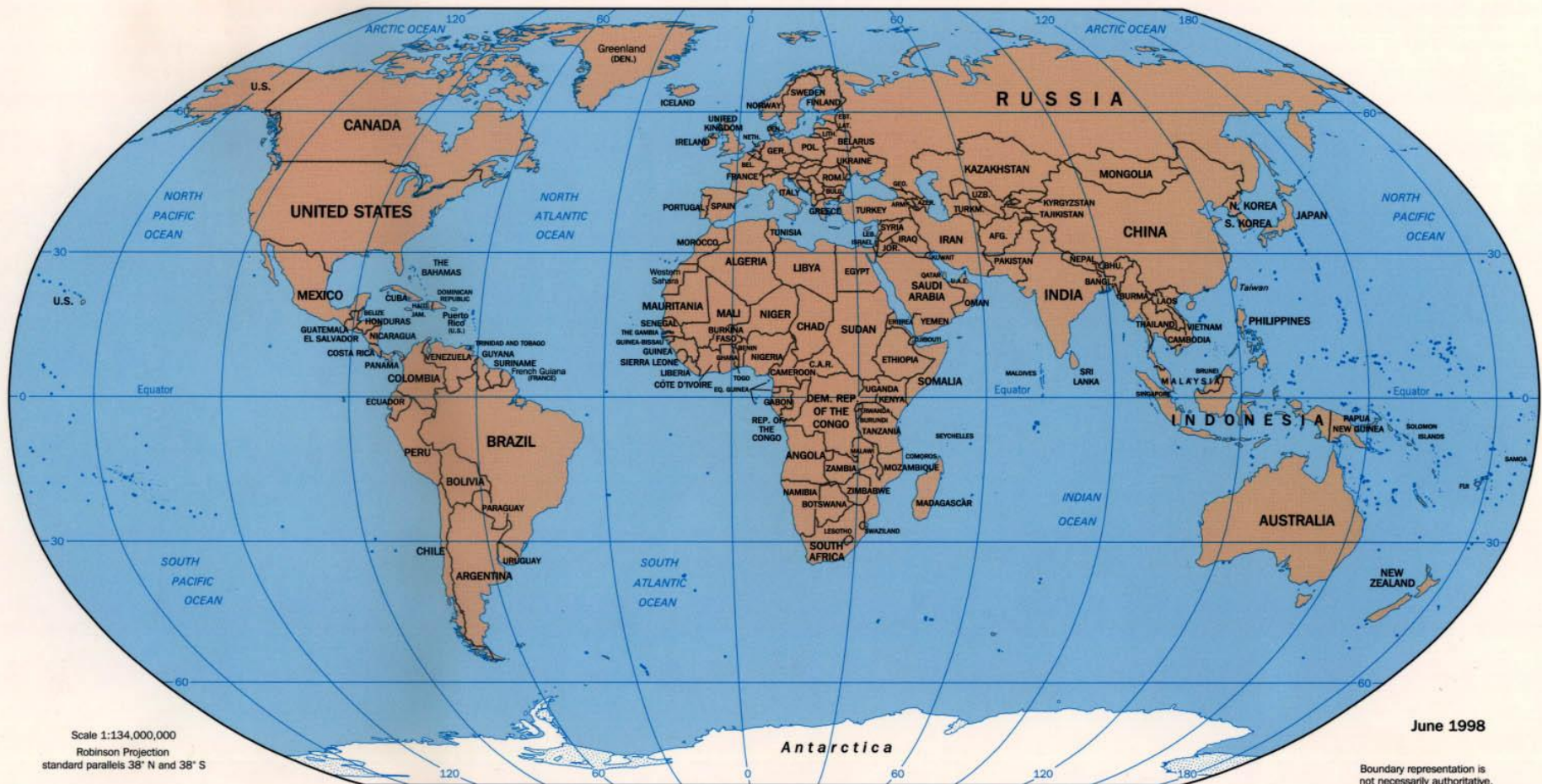
- Improving the performance of fire and police departments
- Delivery of meals to senior citizens (Meals-on-Wheels)
- Delivery of blood to hospitals
- Housing
- Drug Policy – Enforcement vs Treatment?
- Guns and violence
- Public transportation

Routine events vs Disasters

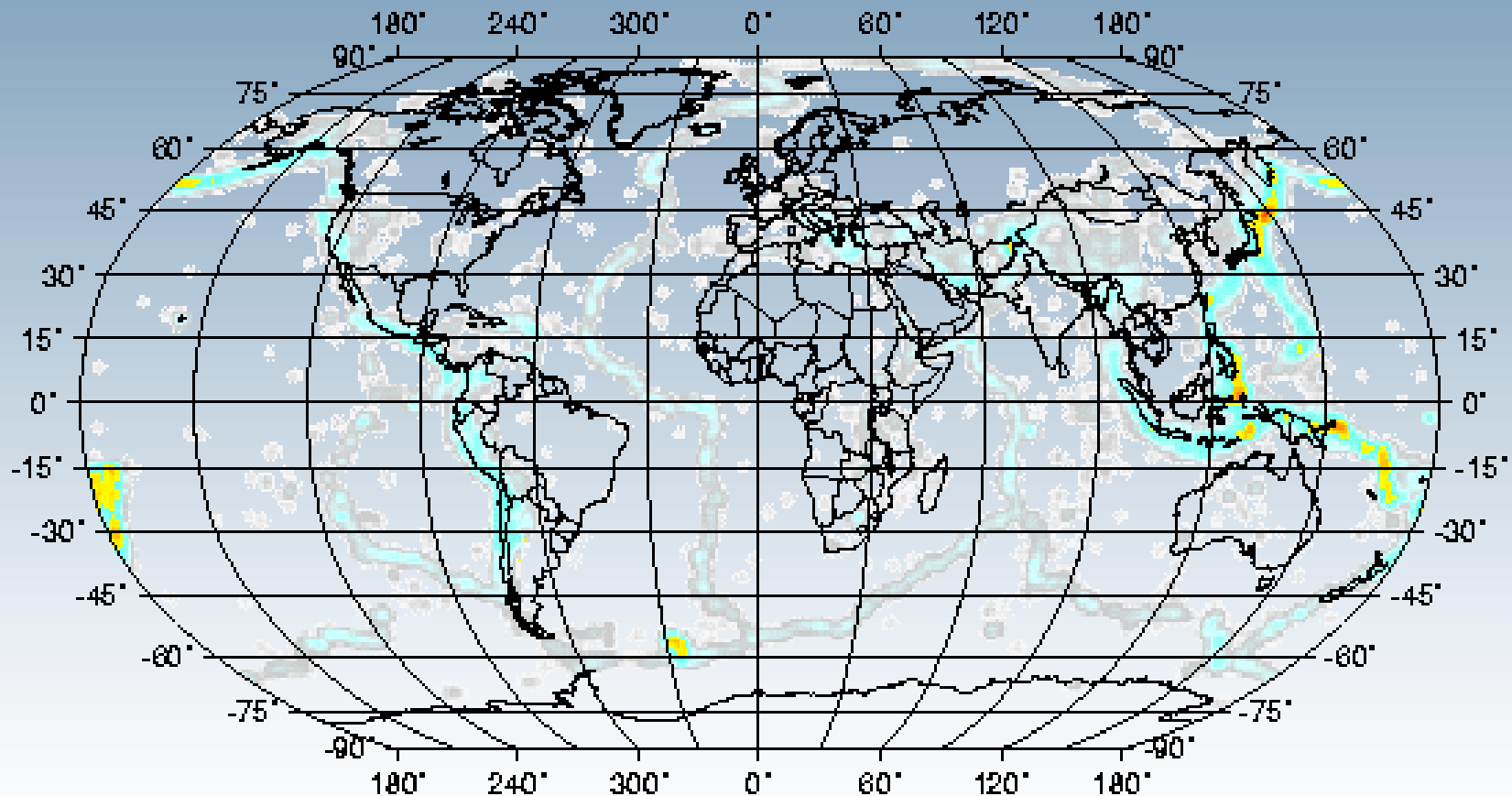


Source: Keskinocak ISYE

Disasters Around the World

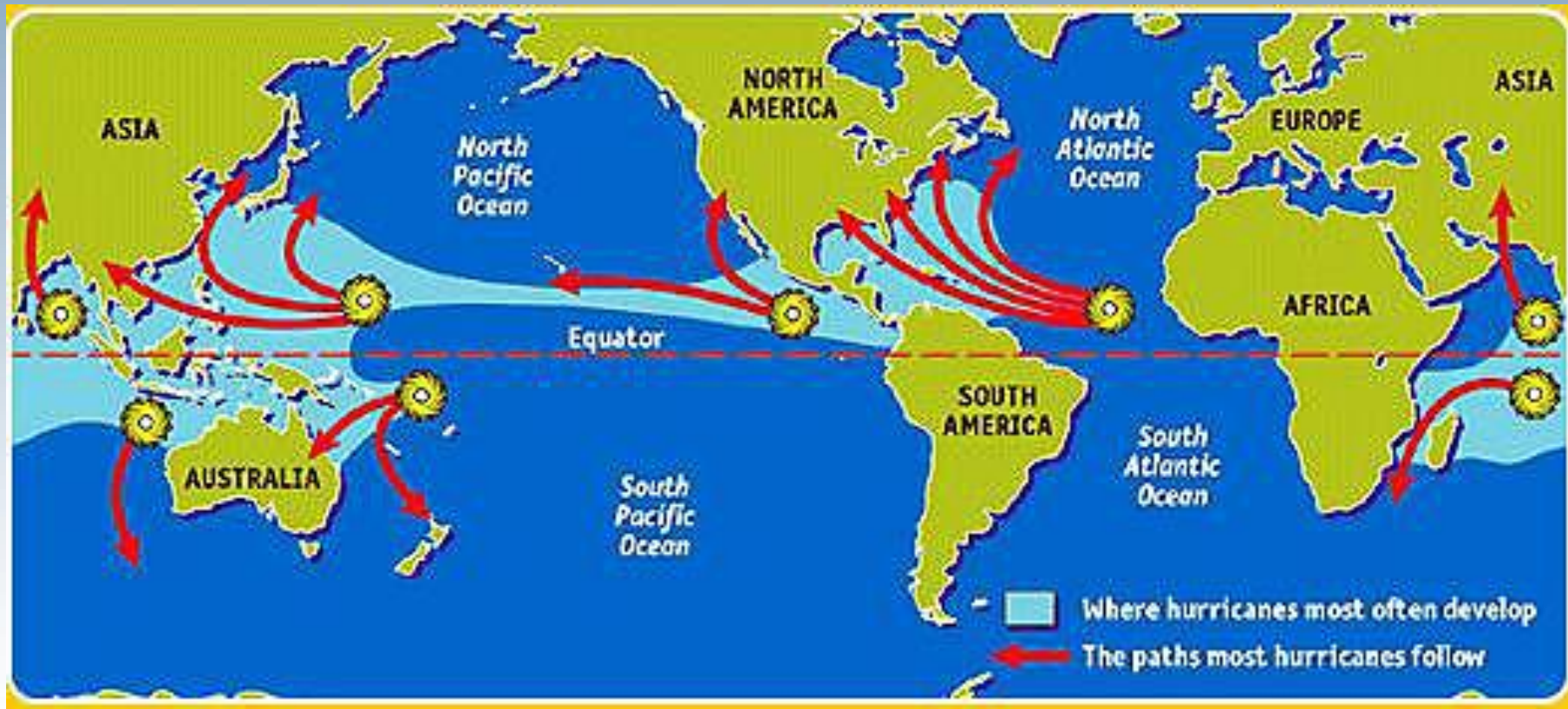


Earthquake



Average Number of Earthquakes per Year, Magnitude 5 and Greater, All Depths

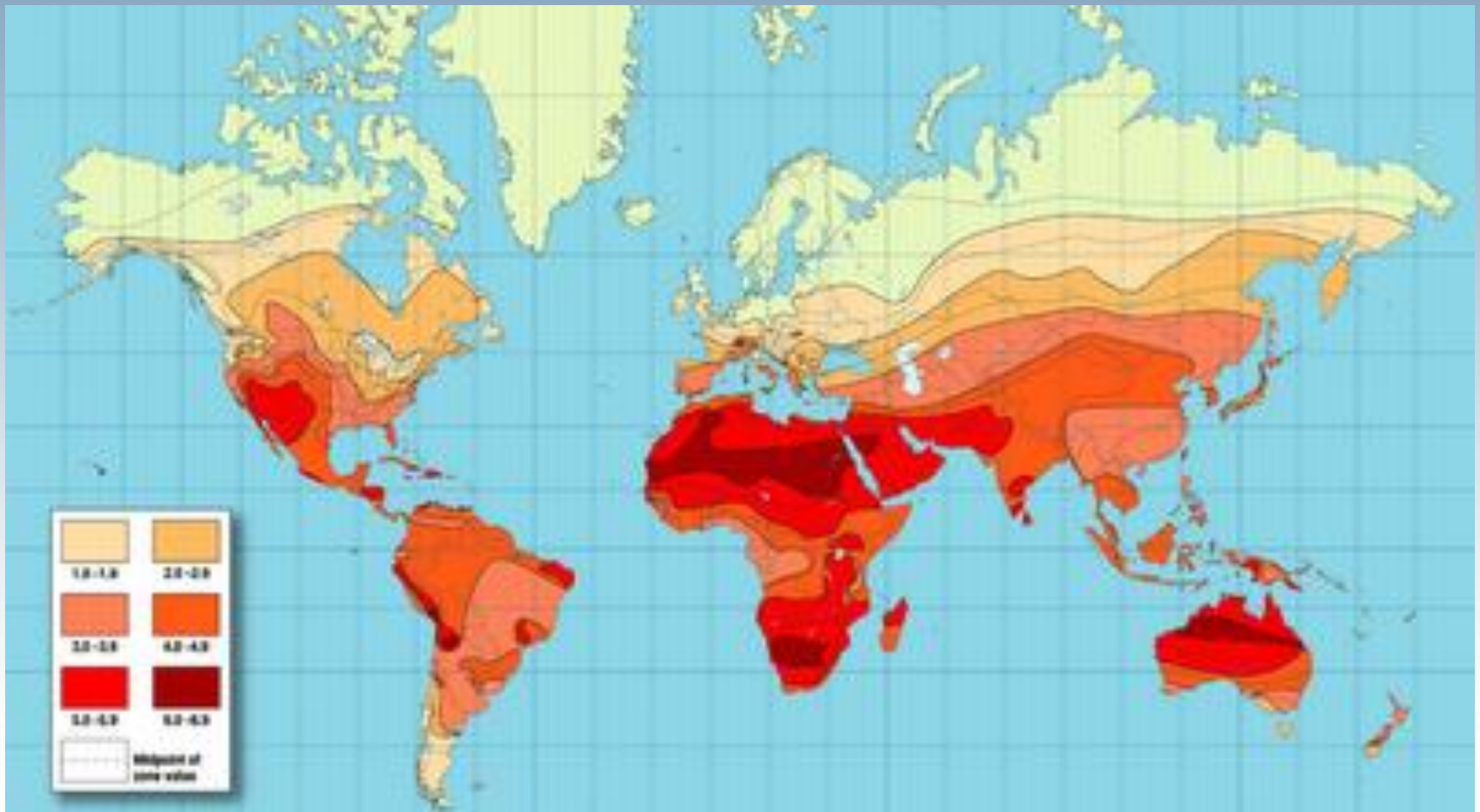
Hurricane



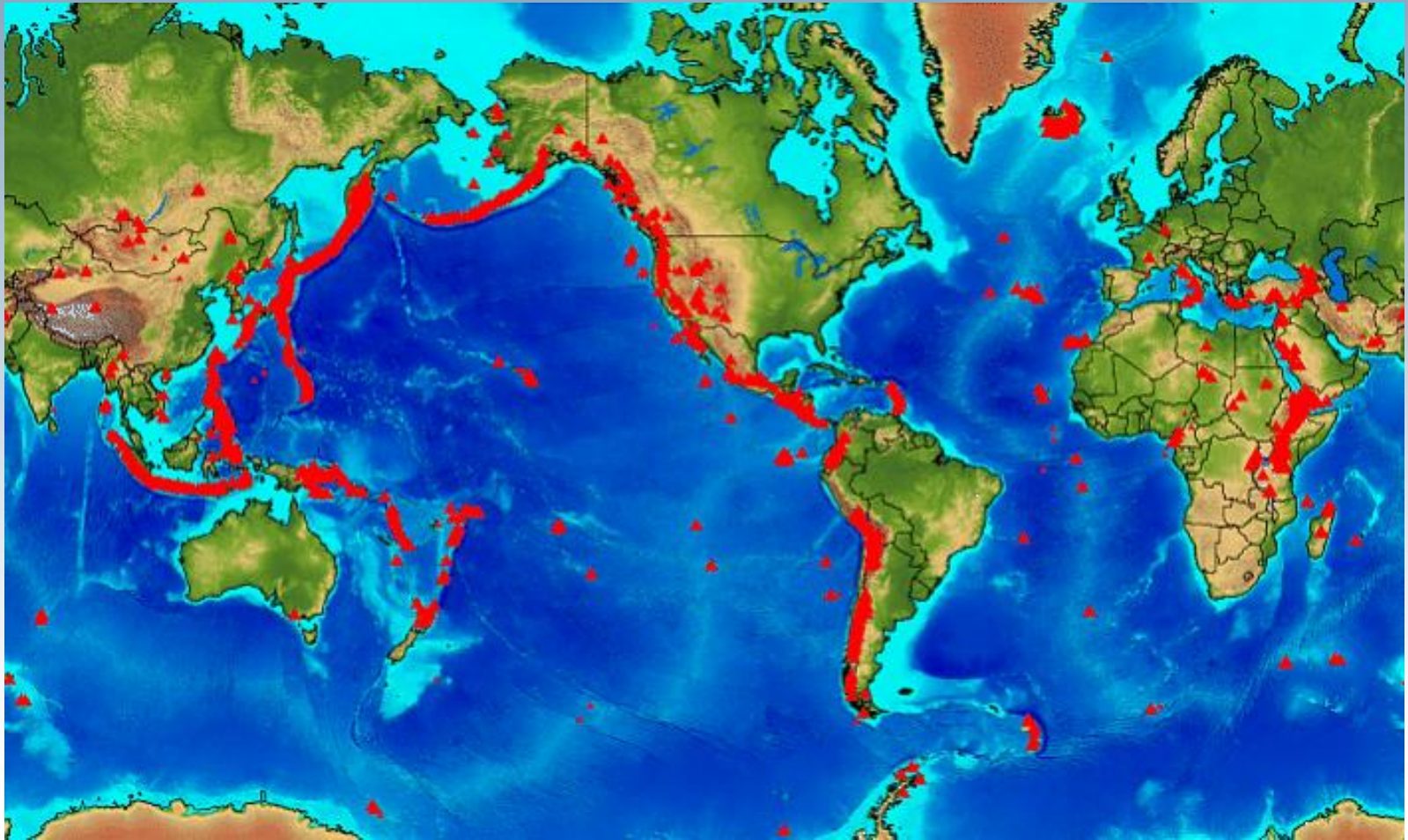
Tsunami



Heat



Volcano



Disaster Stories

- Hurricane Katrina (2005)
- Hurricane Harvey (2017)
- 2010 Haiti Earthquake
- 2004 Indian Ocean Earthquake and Tsunami
- 1970 Bhola cyclone
- September 11 Attacks
- Japan Earthquake (later)



Hurricane Katrina (2005)

- Between 23-30 August 2005.
- Hit southeast US, specifically greater New Orleans
- 1836 confirmed fatalities
- \$81.2Billion recorded damage





Hurricane Katrina (2005)

- Preparedness
 - Federal Government
 - On the morning of Friday, August 26, Katrina had strengthened to a Category 3 storm.
 - The United States Coast Guard began prepositioning resources in a ring around the expected impact zone
 - On August 27, it moved its personnel out of the New Orleans region prior to the mandatory evacuation.
 - On August 28, Louisiana coast and West Florida are marked as “inhabitable”



Hurricane Katrina (2005)

- Preparedness
 - State and Local Level
 - On August 26, local governments began evacuating
 - 41 counties and 61 cities were evacuated
 - Plan was sufficient but not enough resources and infrastructure
 - False assumption of path and strength caused this

Hurricane Katrina (2005)

- Impact
 - Total death toll is 1836, with 1577 from LA and 238 from MS.
 - Coastal area of LA, MS and some of West FL is was flooded because of the heavy rain
 - Buildings became damaged and unused. People left homeless





Hurricane Katrina (2005)

- Aftermath
 - Military
 - 10000 guard troops were deployed
 - Coast Guards flew around for search and rescue
 - Navy sent ships for search and rescue
 - Air force sent relief supplies, search and rescue teams, aeromedical evacuation and medical care



Hurricane Katrina (2005)

- Aftermath
 - Government (Non-Military)
 - FEMA deployed all their S&R teams and Medical Assistance teams
 - Kids were transferred to other schools
 - 10000 temporary jobs became eligible to help recovery
 - 11500 lives saved
 - 25000 citizens evacuated
 - FEMA distributed 6.7M Liters water and 1.9M meals
 - Around 30000 government staff were employed

Hurricane Katrina (2005)



- Aftermath
 - State and Local
 - Sent aid, S&F teams and ambulances
 - Provided shelter and bungalow areas
 - Provided schooling for children





Hurricane Katrina (2005)

- Aftermath
 - Red Cross
 - 74000 volunteers, provided shelter to 160000 evacuees and more than 7.5 million hot meals
 - More than 250 Emergency Response Vehicles to provide food and water
 - Criticised because they mostly interested in disaster aid, not recovery

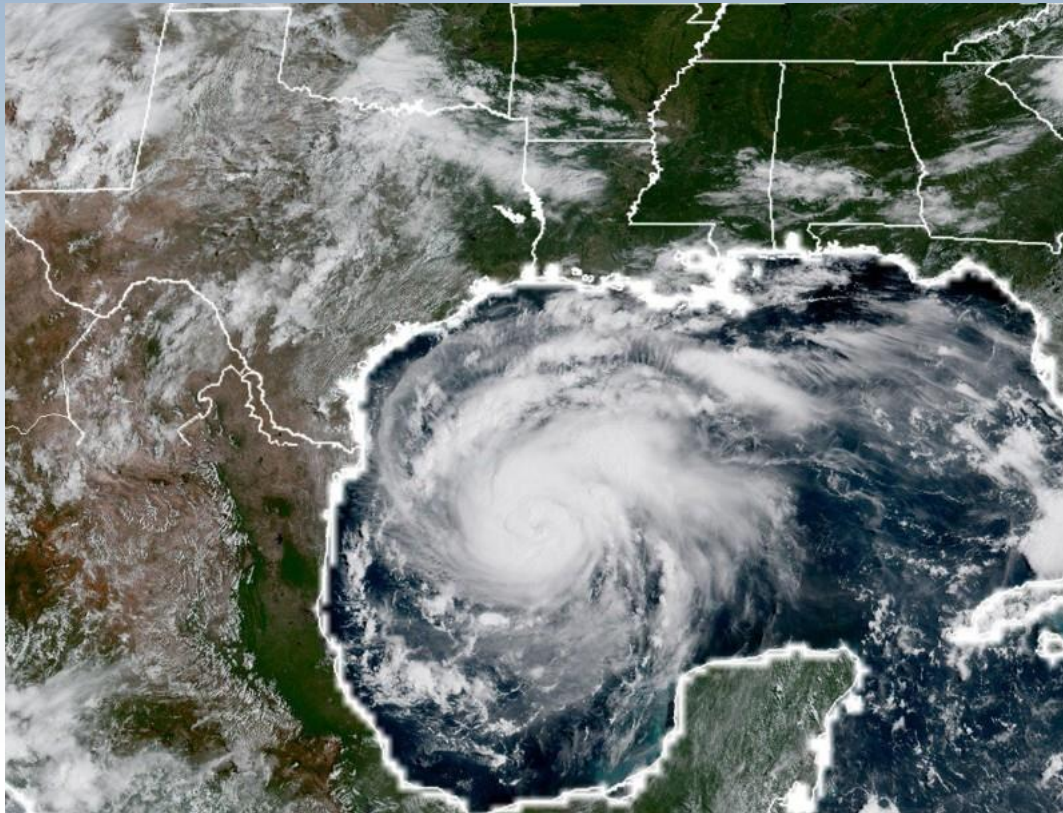


Hurricane Katrina (2005)

- Aftermath
 - Amateur radio operators
 - Gave disaster and weather reports to staff
 - Camp Hope
 - Volunteer camp originated in Violet, LA
 - Provided housing for evacuees

Hurricane Harvey (2017)

- Between August 25-September 2
- Hit Texas and Louisiana



Hurricane Harvey (2017)



27 trillion

*Gallons of rain Harvey dumped
on Texas (and Louisiana) in 6 days*



51

*Inches of rain — a record
from a tropical cyclone
in the continental US*

Hurricane Harvey (2017)



75 billion

*Amount, in dollars,
of estimated losses from Harvey*



72,000

*Number of people rescued
(as of Friday)*

Hurricane Harvey (2017)



450,000

*Estimated number of victims
who will ask FEMA for
disaster assistance*



30,000

*Estimated number
of people who will
need temporary shelter*

Hurricane Harvey (2017)



215,000

*Students out of school
after Houston, the 7th largest
school district in the US,
canceled classes*



14,000

*Number of National Guard
members activated to help*

Hurricane Harvey (2017)



56,000

*Number of calls to
Houston 911 in the first 15 hours.
(Average for a typical
day is 8,000)*



33

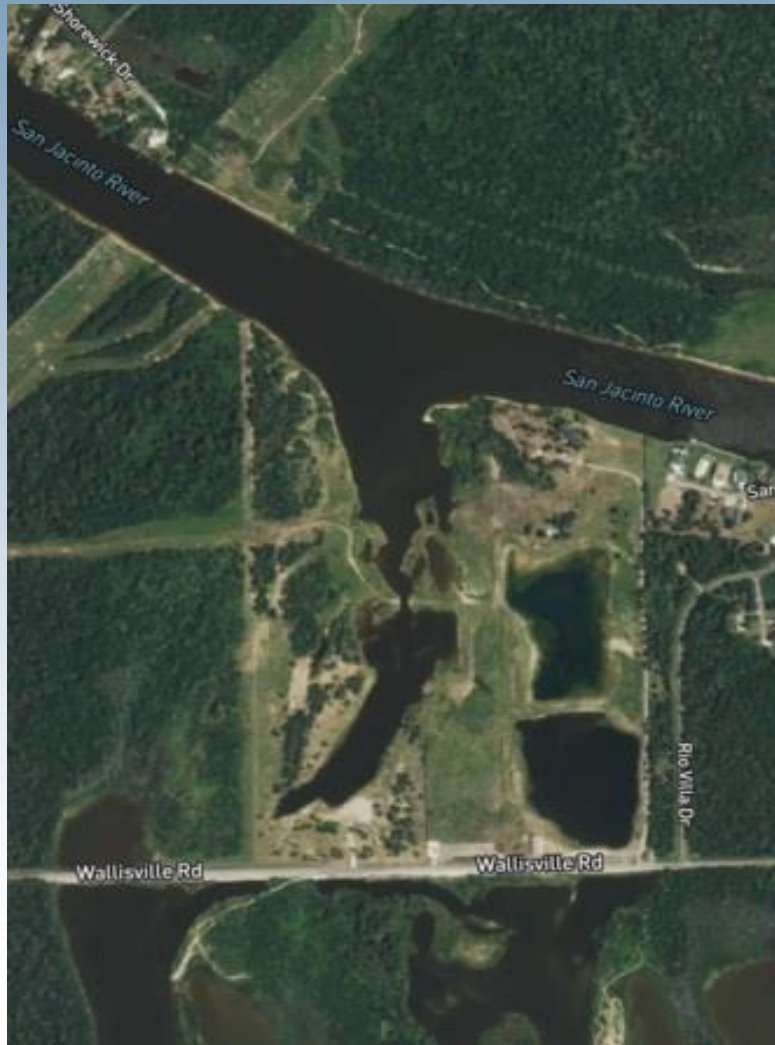
*Number of Texas counties under
federal disaster declaration*

Sources: Weatherbell; Texas Governor's Office; Houston Office of Emergency Management; National Weather Service, FEMA

Hurricane Harvey (2017)



Hurricane Harvey (2017)



Hurricane Harvey (2017)



Hurricane Harvey (2017)



2010 Haiti Earthquake

- On Tuesday, 12 January 2010 at 16.53 local time (21.53 UTC)
- A catastrophic magnitude of 7.0Mw
- Nenter near town Leogane, 25 km west of the capital
- By 24 January at least 52 aftershock measuring 4.5 or more





2010 Haiti Earthquake

- 230000 people died
- 300000 people injured
- 1000000 people made homeless
- No damaging tsunami reported



2010 Haiti Earthquake

- Damage to infrastructure
 - All hospitals in the capital; air, sea, and land transport facilities; and communication systems were destroyed
 - 3 “Doctors Without Borders” facilities were destroyed



2010 Haiti Earthquake

- Early Response
 - Many countries sent S&R teams
 - Dominican Republic sent water, food, machinery, made their airport and hospitals available and provided telecommunications
 - Following days, most countries sent relief supports



2010 Haiti Earthquake

- Relief and rescue
 - Rescue operations were intensified after the arrival of staff from other countries (two days after the disaster)
 - As of 18 January, over 3000 people were cured
 - Medical ship



RELIEF AND RESCUE EFFORTS

- Problematic delivery of aid!
- Canadian government
 - Air traffic control
 - Radar
 - Runway lightening
- Individual and corporate donations
- In 23 January Haitian Government ended rescue efforts.



RELIEF AND RESCUE EFFORTS

- Violence during distribution of food
- US Military to prevent chaos
- WFP handed out food only to women with vouchers.
- Cash for Work of UNDP!
- Refugee camps
- Military Engineering team from Japan and S. Korea
- 300+ protestors for lack of aid and food
- Lawyers without borders for justice system
- G7 canceled all debts of Haiti



LATER?

- In July 2010, CNN returned to Port-au-Prince and reported, "It looks like the quake just happened yesterday“.
- More than 1 million people in shelters
- 15% house built
- Cholera epidemic broke out
- Sexual, domestic, and gang violence
- Black marketing for vouchers



2004 Indian Ocean Earthquake

- December 26, 2004. Near the west coast of Sumatra, Indonesia.
- Magnitude was between 9.1 and 9.3
- Tsunamis occurred afterwards
- Killed over 130000 people in different countries.

2004 Indian Ocean Earthquake



2004 Indian Ocean Earthquake





2004 Indian Ocean Earthquake

- Humanitarian aid is needed because of the damage in infrastructure, shortage in food, water and medical supplies.
- Epidemics was a concern
- Response was quick, so there was no hunger and therefore less deaths.
- Over 1.3 million people were effected from the tsunami. Food provided by WFP.
- Over \$7B donated by other countries.

2004 Indian Ocean Earthquake

- Countries provided infrastructure, medical support, staff and relief supports.
- NGOs started fund-raising activities
- Moreover, several companies donated financial support.



1970 Bhola Cyclone

- Hit West India and East Pakistan (Bangladesh)
- 12 November 1970
- Category 3 Hurricane
- Political crisis
- 167000 was killed by the storm





1970 Bhola Cyclone

- Aftermath
 - Government sent hospital ships and staff to the area
 - Army arrived to the area after two days
 - Relief is blocked because of the political crisis
 - East Pakistani political leaders criticised central government because of the slow response
 - Lead to Bangladesh Liberation War

1970 Bhola Cyclone

- Aftermath
 - Since the government was ineffective, Pakistan Red Crescent started to take over response activities.
 - NGOs and foreign governments sent financial aid and relief support.
 - After this disaster, Red Crescent began to form a complete disaster plan and awareness campaign for the cyclone season.

September 11 Attacks





September 11 Attacks

- Series of coordinated suicide attack organized by al-Qaeda in 2001.
- 4 aircraft
 - Two crashed into WTC
 - One crashed into Pentagon
 - One crashed into field in PA
- Total death toll was 2995, including 19 terrorists.



September 11 Attacks

- Many police officers took leaves of absence to travel to NYC to assist recovering bodies.
- People donated blood for the wounded.
- Many relief funds were immediately set up to assist victims of the attacks, with the task of providing financial assistance to the survivors and to the families of victims

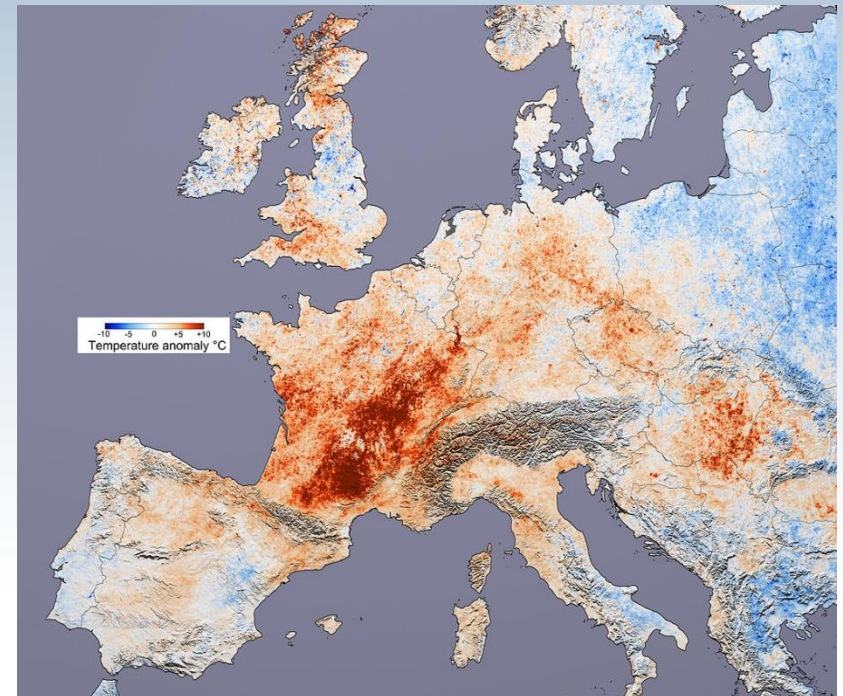


September 11 Attacks

- Within the United States, Congress passed and President Bush signed the Homeland Security Act of 2002, creating the Department of Homeland Security, representing the largest restructuring of the U.S. government in contemporary history.

2003 European Heat Wave

- Between June-August of 2003
- Hit Western Europe
 - France, Portugal, Spain, Netherlands, Germany, Switzerland, United Kingdom
- Caused health crisis, drought and crop shortfall
- Around 70.000 deaths
- Recorded as the hottest summer since 1540
- EU's total wheat production was down by 10 million tons (10%)



2003 European Heat Wave



Country	Maximum Temperature	Number of deaths*
France	40°C	14.802
Portugal	48°C	2039
Spain	45°C	12.963
Netherlands	38°C	1500
Germany	40°C	9000
Switzerland	42°C	in Alps melting glaciers caused avalanches and floods
United Kingdom	39°C	2000

* Recorded deaths occurred mostly among the elderly people

2008 Afghanistan Blizzard

- In February 2008 in Afghanistan
- Below -30°C and 180 cm snow
- At least 926 people died
- 100.000 sheep and 315.000 cattle deaths



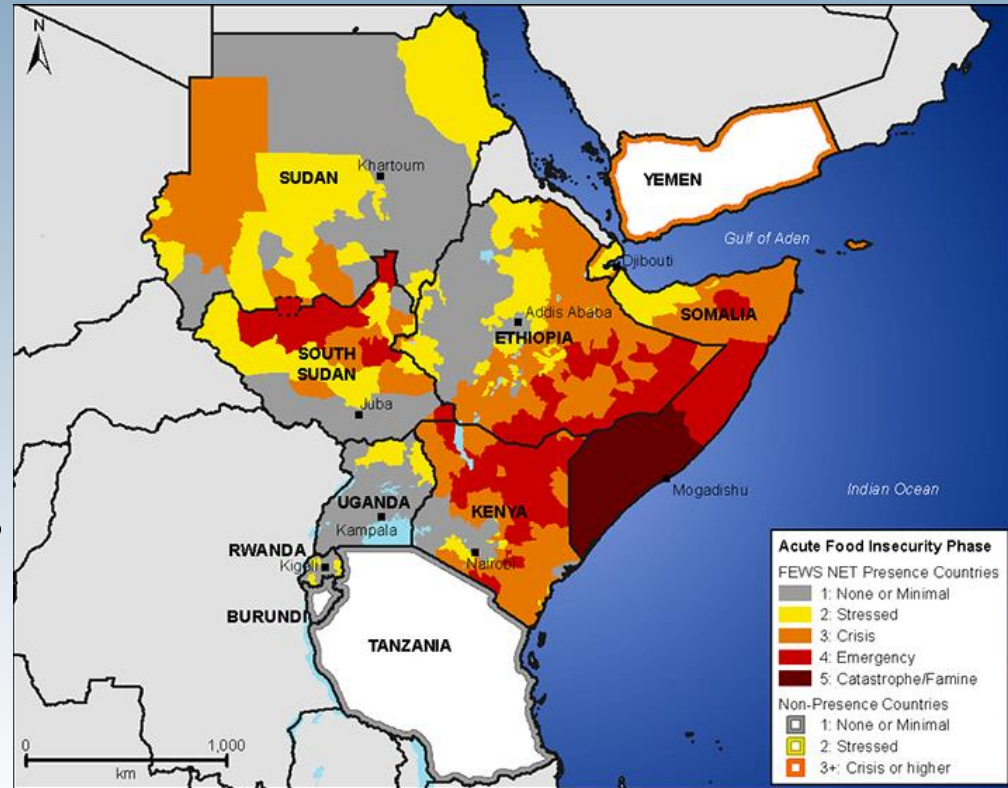
2008 Afghanistan Blizzard

- More than 100 amputations performed
- Several tons of clothing, blanket, food and fuel provided by aid organizations and foreign troops



2011 East Africa Drought

- Between July-September of 2011
- Somali, Djibouti, Ethiopia, Kenya, Uganda are affected mostly
- Only 30% of the average rainfall of the last 15 years
- Estimated death rate: 50.000 – 260.000 people
- 9.5 million people in need of relief



2011 East Africa Drought

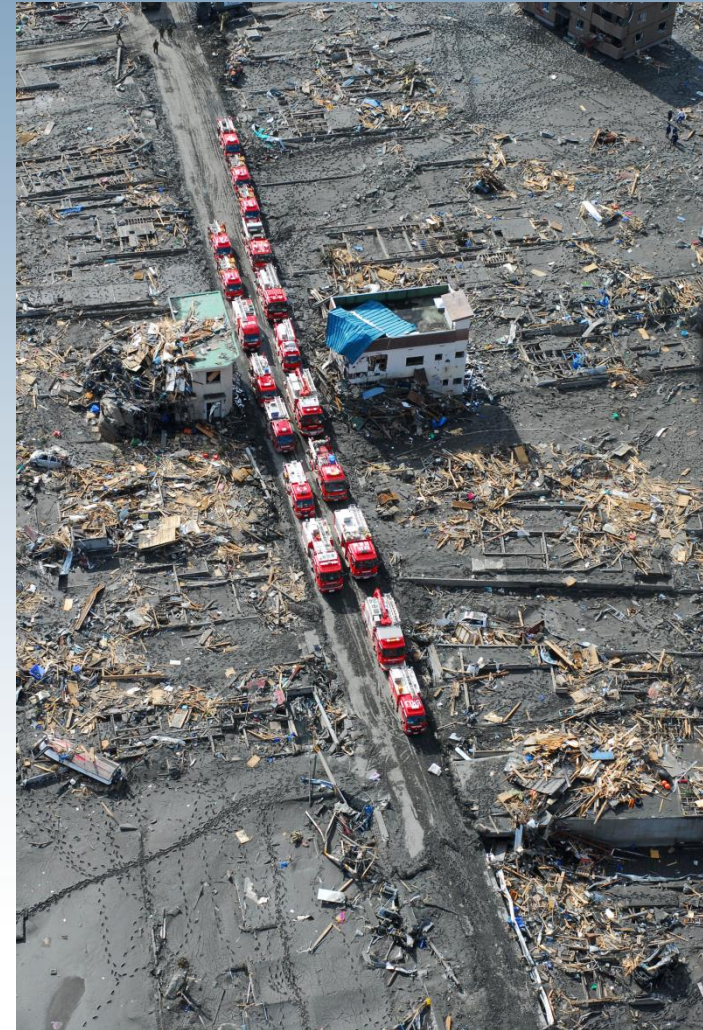
Funding Status Horn of Africa Crisis (as of 24 September 2011)

	Requirements (million US\$)	Committed (million US\$)	% met
Kenya	741	480	65%
Djibouti	33	19	56%
Somalia	983	732	74%
Ethiopia (non-refugees)	398	291	73%
Ethiopia (refugees)	246	112	45%
Miscellaneous funding		76	
Total	2402	1710	71%

Source: UN Office for the Coordination of Humanitarian Affairs (OCHA)^[87]

2011 Tōhoku Earthquake and Tsunami

- Hit Japan in 11 March 2011
- 9.0 magnitude earthquake
- Followed by tsunami with wave height up to 39 meters
- 160,000 deaths
6000 injured
2500 lost people
- Spent \$122 billion for recovery



2011 Tōhoku Earthquake and Tsunami



- Around 1000 aftershocks in the following 5 days
- 80 of them larger than 6.0 magnitude
- \$25 million worth debris
- 340.000 people displaced from their homes
- Food, water, shelter, medicine shortages

2011 Tōhoku Earthquake and Tsunami

- Aftermath
 - Government mobilized Self-Defense Forces
 - Japanese Red Cross spent \$1 billion
 - Aid from 116 countries and 28 international organizations





Impact of Disasters on people

- Disasters are not “rare” events:
- 6637 natural disasters between 1974-2003 worldwide
 - More than 2 million deaths
 - 5.1 billion cumulatively affected people
 - 182 million homeless people
- Only in 2005, over 180000 deaths and over US\$ 200 billion economic loss