

Natural, Technological, and Intentional Public Health Emergencies

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Outline

- 1 Natural hazards
 - Meteorological hazards
 - Hydrological hazards
 - Geophysical hazards
- 2 Technological hazards
- 3 Intentional hazards

Learning objectives

At the end of this presentation, attendees will be able to:

- Describe natural hazardous threats;
- Describe technological hazardous threats;
- Describe intentional hazardous threats;

Some definitions

- Hazard
- Emergency
- Disaster
- Catastrophe

What is a hazard?

Hazard

To the extent that people co-exist with powerful natural and man-made processes, there is a non-zero probability that the natural, accidental, or intentional variation in these processes will produce extreme events having very negative consequences

What is an emergency?

Emergency (1)

An event involving a minor consequences for a community — perhaps a few casualties and a limited amount of property damage. These events that are frequently experienced, relatively well understood, and can be managed successfully with local resources — sometimes with the resources of a single local government agency

Emergency (2)

A situation in which there is a higher than normal probability of an extreme event occurring. The urgency of the situation requires attention and, at some point, action to minimize the impacts.

What is a disaster? catastrophe?:

Disaster

The occurrence of events that threaten human or animal health, damage property and/or the environment, and exceed a community's ability to cope

Catastrophe

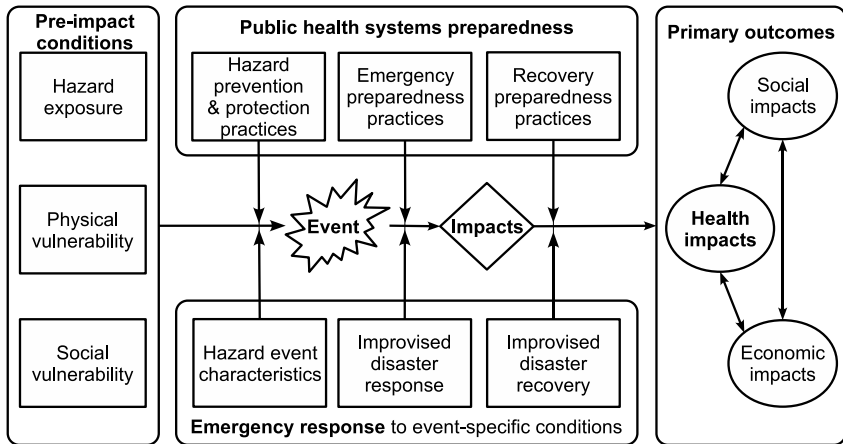
An event that exceeds the resources of many local jurisdictions — in some cases crippling those jurisdictions' emergency response capacity and disrupting the continuity of other local government operations

What is a public health emergency?

Public health emergency preparedness

The capability of public health systems, communities, and individuals to prevent, protect against, quickly respond to, and recover from health emergencies, particularly those whose scale, timing, or unpredictability threatens to overwhelm routine capabilities.

Public health disaster impact model



Principal hazards in the United States

Natural hazards

Extreme events that originate in nature. The hazards are commonly categorized as meteorological, hydrological, or geophysical.

Technological hazards

Originate in human-controlled processes but are released into the environment.

Intentional hazards

Originate in human-controlled processes but are intentionally released into the environment to cause terror or to cause harm to human, animal, or plant populations.

Meteorological hazards

- Thunderstorms
- Tornadoes
- Hurricanes
- Extreme cold
- Extreme heat
- Wildfires

Thunderstorms

What is it?

A thunderstorm is a rain shower during which you hear thunder. Since thunder comes from lightning, all thunderstorms have lightning. A thunderstorm is classified as “severe” when it contains one or more of the following:

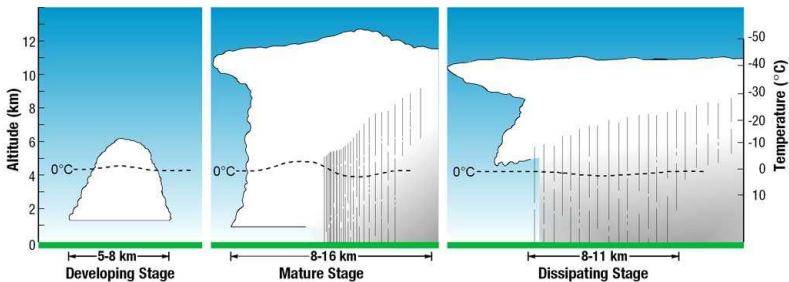
- hail three-quarter inch or greater,
- winds gusting in excess of 50 knots (57.5 mph), or
- tornado.

How does a thunderstorm form?

Three basic ingredients are required for a thunderstorm to form: moisture, rising unstable air (air that keeps rising when given a nudge), and a lifting mechanism to provide the “nudge.”

Source: http://www.nssl.noaa.gov/primer/tstorm/tst_basics.html

Thunderstorm life cycle



The sun heats the surface of the earth, which warms the air above it. If this warm surface air is forced to rise it transfers heat from the surface of the earth to the upper levels of the atmosphere. The water vapor cools, releasing heat, and condensing into a cloud. The cloud grows upward where temperature is freezing, turning water into ice and droplets. Both have opposite electrical charges. When the built up charges discharge, we get lightning (and thunder).

Thunderstorm types

- Single cell storm
- Multi-cell cluster storm
- Multi-cell (squall) line storm
- Supercell storm (mesocyclone, giant hail, strong downbursts, violent tornadoes)

Source: http://www.nssl.noaa.gov/primer/tstorm/tst_basics.html

Thunderstorm threats

- Lighting (start wildfires)
- Hail
- Heavy rains (flash floods)
- Strong winds
 - downbursts (up to 125 mph)
 - microbursts (up to 150 mph)
- Tornadoes

Tornadoes

What is it?

A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground. Because wind is invisible, you can't always see a tornado. A visible sign of the tornado, a condensation funnel made up of water droplets, sometimes forms and may or may not touch the ground during the tornado lifecycle. Dust and debris in the rotating column also make a tornado visible and confirm its presence.

http://www.nssl.noaa.gov/primer/tornado/tor_basics.html

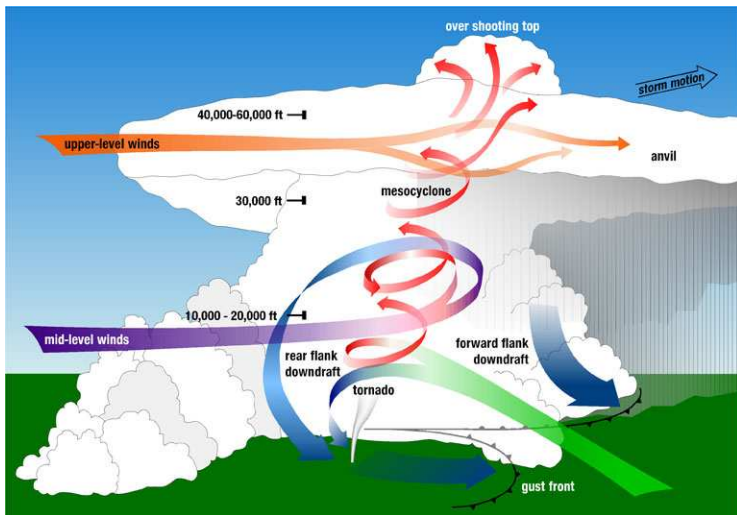
Tornadoes

What is known?

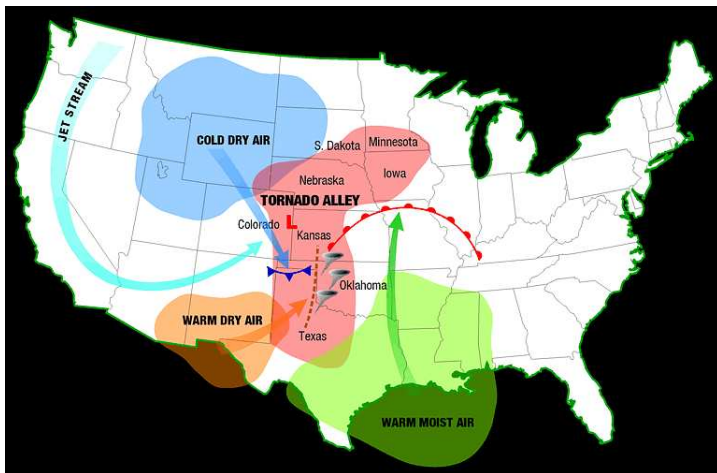
Tornadoes are the most violent of all atmospheric storms. Those that form from a supercell thunderstorm are the most common, and often the most dangerous. A supercell is a long-lived (greater than 1 hour) and highly organized storm feeding off an updraft (a rising current of air) that is tilted and rotating. This rotating updraft — as large as 10 miles in diameter and up to 50,000 feet tall — can be present as much as 20 to 60 minutes before a tornado forms. This rotation is called a mesocyclone. The tornado is a very small extension of this larger rotation.

http://www.nssl.noaa.gov/primer/tornado/tor_basics.html

Supercell tornadogenesis



United States "Tornado Alley"



http://www.nssl.noaa.gov/primer/tornado/tor_climatology.html

Fujita scale

Scale	Wind Speed (MPH)	Expected damage
F0	40–72	Light damage
F1	73–112	Moderate damage
F2	113–157	Considerable damage
F3	158–206	Severe damage
F4	207–260	Devastating damage
F5	261–318	Incredible damage

The F-scale, or Fujita Scale, is a damage scale developed by T. Theodore Fujita to relate the degree of damage to the intensity of the wind. It is not an absolute scale. Many factors need to be taken into consideration including wind direction, wind duration, flying debris, and the strength of the structure.

Source: http://www.nssl.noaa.gov/primer/tornado/tor_damage.html

Tornado damage



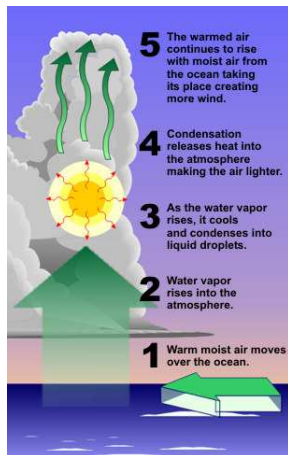
Date: 5/4/99

Location: Eastlake (south
Oklahoma City)

View: Looking northeast at house
on the north side of the street
(just east-southeast of the center
of the damage track. A board
was driven through the door of
the car with one end protruding
through to the driver's seat area.

Source: <http://www.srh.noaa.gov/oun/storms/19990503/>

Tropical cyclones



A tropical cyclone is a warm-core, low pressure system that develops over the tropical or subtropical waters, and has an organized circulation. Depending upon location, tropical cyclones have different names:

- Hurricanes (Atlantic/Eastern Pacific Oceans)
- Typhoons (Western Pacific)
- Cyclones (Indian Ocean)

Source: <http://www.srh.noaa.gov/srh/jetstream/tropics/tc.htm>

Tropical cyclones

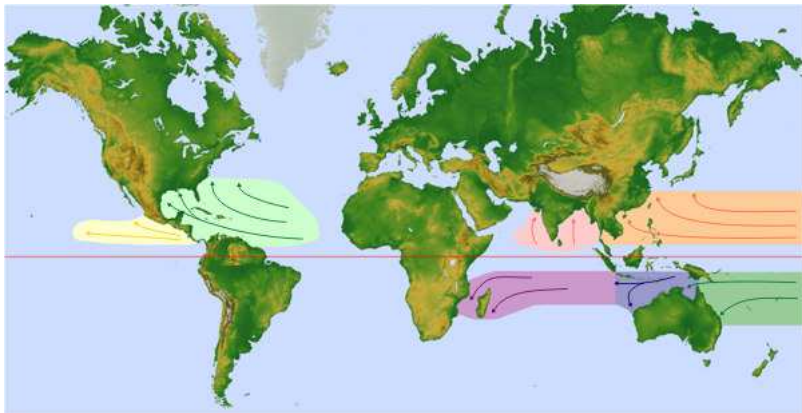


Favorable environmental conditions that must be in place before a tropical cyclone can form:

- Warm ocean waters (at least 80°F / 27°C);
- An atmosphere which cools fast enough with height;
- Minimum distance of at least 300 miles from equator.
- A pre-existing near-surface disturbance.

Source: <http://www.srh.noaa.gov/srh/jetstream/tropics/tc.htm>

Tropical cyclone formation regions



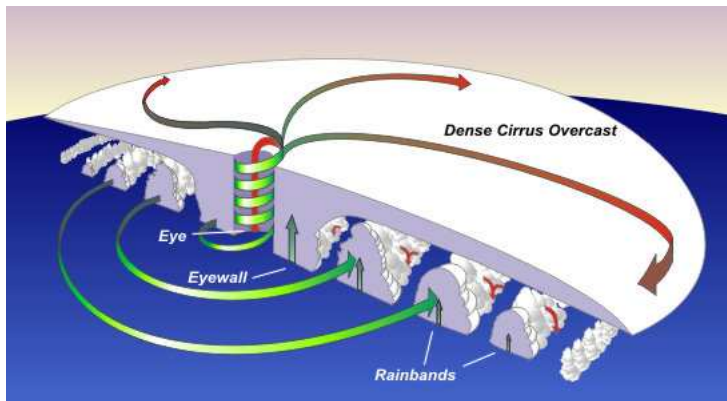
Source: http://www.srh.noaa.gov/srh/jetstream/tropics/tc_basins.htm

Tropical cyclone classification

Table: Saffir-Simpson Hurricane Scale

Category	Wind speed (MPH)	Name	Storm surge (ft)
n/a	<39	Tropical depression	n/a
n/a	39–73	Tropical storm	n/a
1	74–95	Minimal hurricane	4–5
2	96–110	Moderate hurricane	6–8
3	111–130	Extensive hurricane	9–12
4	131–155	Extreme hurricane	13–18
5	>155	Catastrophic hurricane	>18

Tropical cyclone structure

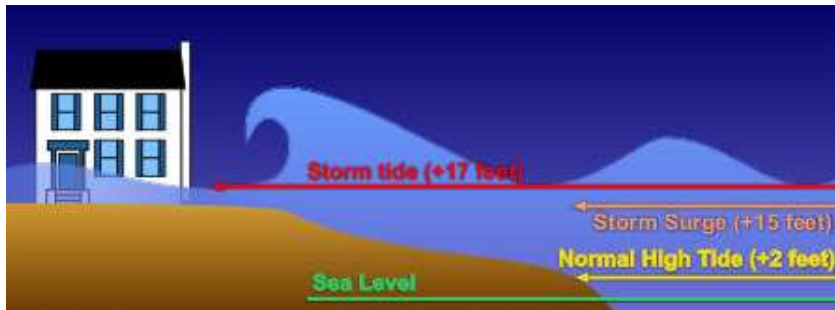


Source: http://www.srh.noaa.gov/srh/jetstream/tropics/tc_structure.htm

Tropical cyclone hazards

- Storm surge
- Wind and squalls
- Inland flooding
- Tornadoes

Tropical cyclone storm surge



Source: http://www.srh.noaa.gov/srh/jetstream/tropics/tc_hazards.htm

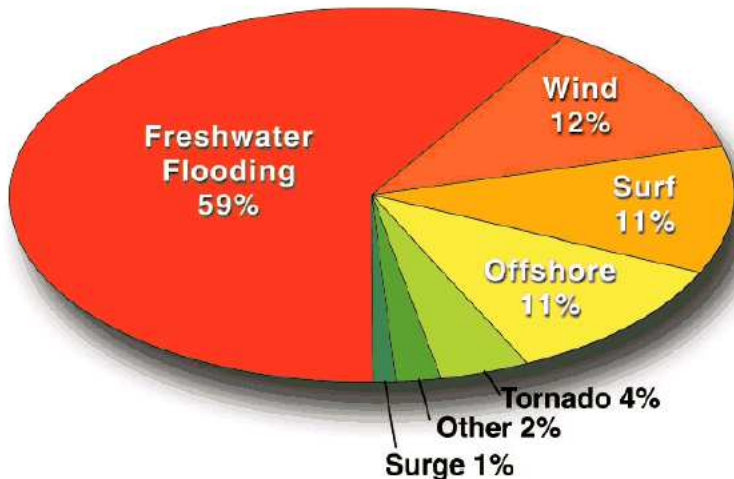
Most lethal U.S. hurricanes

Rank	Year	Name/Location	Deaths	Category
1	1900	Unnamed/Galveston, TX	8,000	4
2	1928	Unnamed/SE Florida	1,836	4
3	2005	Katrina/FL, LA, MS, AL	1,300	4
4	1919	Unnamed/FL Keys/S Texas	600	4
5	1938	Unnamed/New England	600	3

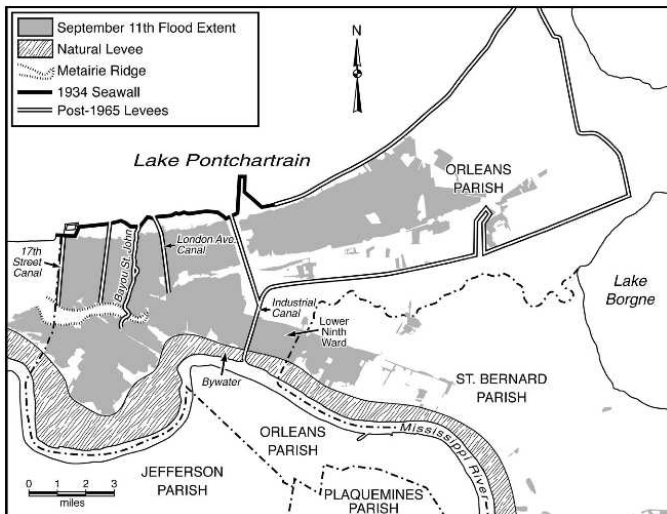
Clements BW. Disasters and Public Health: Planning and Response.
 Butterworth-Heinemann, 2009, 1st Edition

Tropical cyclone deaths in U.S.

Leading Causes of Tropical Cyclone Deaths in the U.S 1970-1999



Hurricane Katrina Catastrophe: Social construction?



Hurricane Katrina Catastrophe: Social construction?



Heat wave

What is it?

Prolonged period of excessively hot weather, which may be accompanied by high humidity.

Heat index

Recalibrated temperature that includes the contribution of relative humidity.

Complications

- Heat cramps
- Heat exhaustion
- Heat stroke

Risk factor for heat illness and injury

- Very young and very old
- Physically or mentally disabled
- Engaged in outdoor exercise or work
- Users of alcohol or selected drugs
- Social factors
 - Low income
 - Homeless
 - Socially isolated
 - Urban residence
 - Poor access to health care or cooling shelters

Hydrological hazards

- Floods
- Storm surge
- Tsunamis

Floods

- River flood
- Coastal flooding
- Inland flooding
- Flash flooding

Tsunamis

What is it?

A tsunami is a series of ocean waves generated by sudden displacements in the sea floor, landslides, or volcanic activity. In the deep ocean, the tsunami wave may only be a few inches high. The tsunami wave may come gently ashore or may increase in height to become a fast moving wall of turbulent water several meters high

Geophysical hazards

- Volcanic eruptions
- Earthquakes
- Landslides

Technological hazards

- Toxic chemicals
- Radiological and nuclear materials
- Flammable materials
- Explosives

Intentional hazards (CBRNE)

- Chemical
- Biological
- Nuclear
- Radiological
- Explosives

Summary

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