

SIO15: Natural Disasters – Forces&Energy

<https://geowiki.ucsd.edu/sio15>

- all lectures will be recorded



SIO15-SS1 2020 Topics 01/02: Nat. Disasters/Forces and Energy

SS 1 2020

<https://geowiki.ucsd.edu/sio15>

Watch all videos!

Look out for new tab to get these lecture slides!

- these are difficult times
- pros and cons about online classes
- pros and cons about summer sessions
- privacy issues vs classroom
- email: glaske@ucsd.edu
- use chat box (there is a privacy option!)

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Homework

<https://geowiki.ucsd.edu/sio15>

- assignment ready for download later today
- homework video ready tomorrow
- submit your pdf through Gradescope! 1 document/student
- hand-written assignments should be scanned on a scanner/printer, or using a proper scanning app e.g. Turboscan (please upload no phone camera photos!)
- poorly scanned assignments will not be graded!

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Tests

<https://geowiki.ucsd.edu/sio15>

Class website quizzes are not-for-credit

Friday quizzes on Canvas for credit! 10 pts each

No midterms, no final exam

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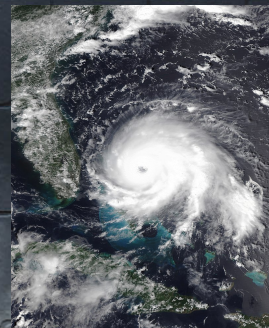
Obvious Types of Natural Disasters

- earthquakes
- hurricanes
- volcanoes
- landslides
- floods
- tornadoes
- storms
- wildfires
- impacts of space objects

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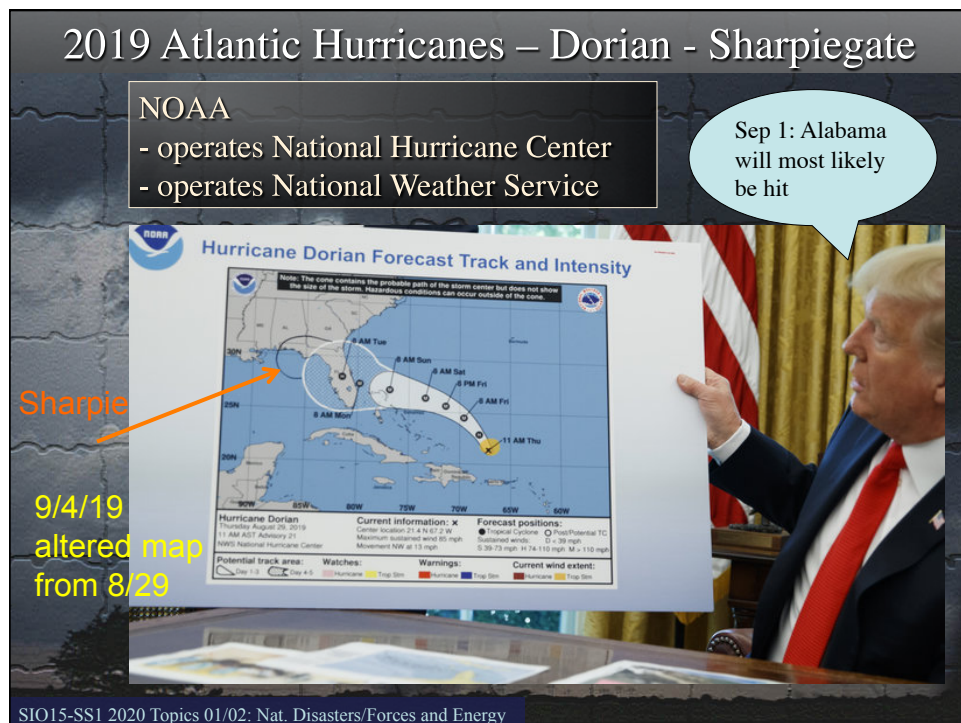
2019 Atlantic Hurricanes – Dorian

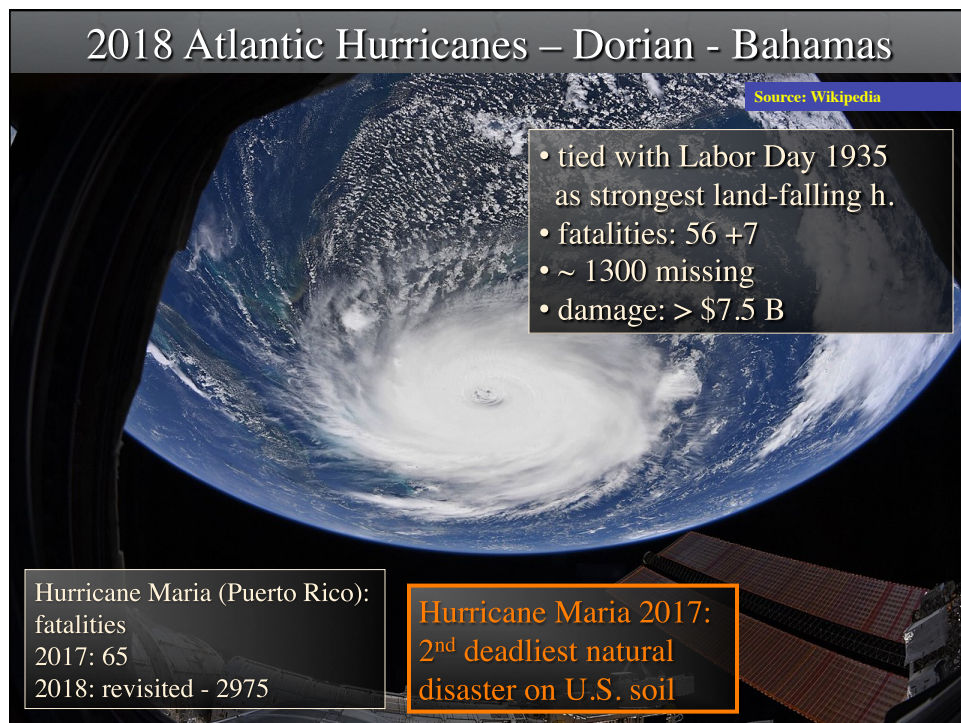
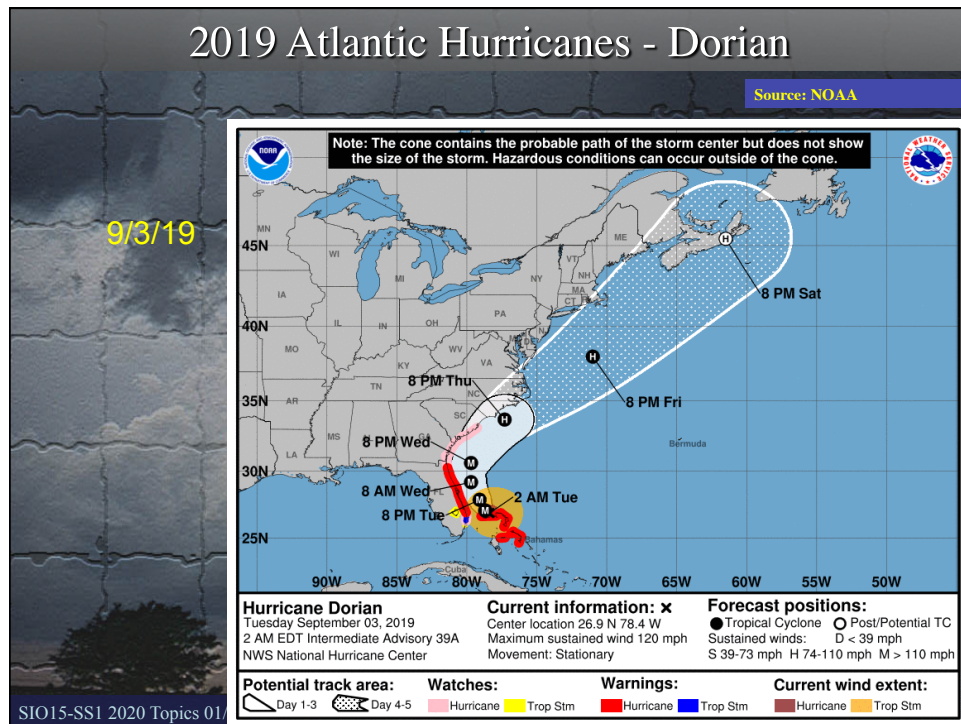
Source: Wikipedia

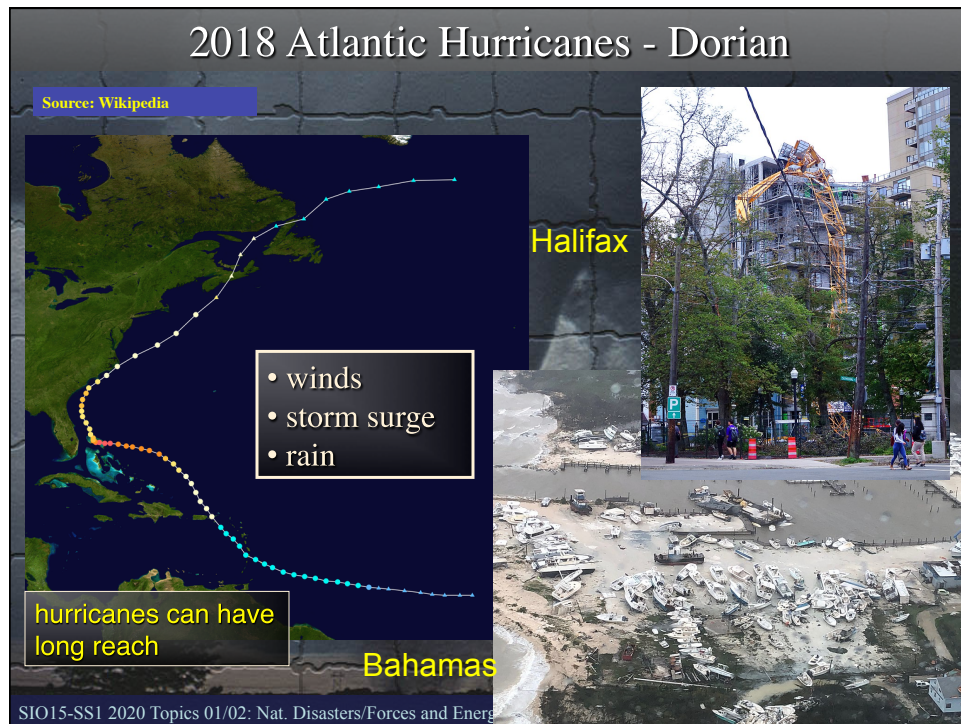


- Category 5
- Aug 24 – Sep 10
- scale: 1000 km
- winds tied for 2nd strongest
- Bahamas
- track difficult to predict

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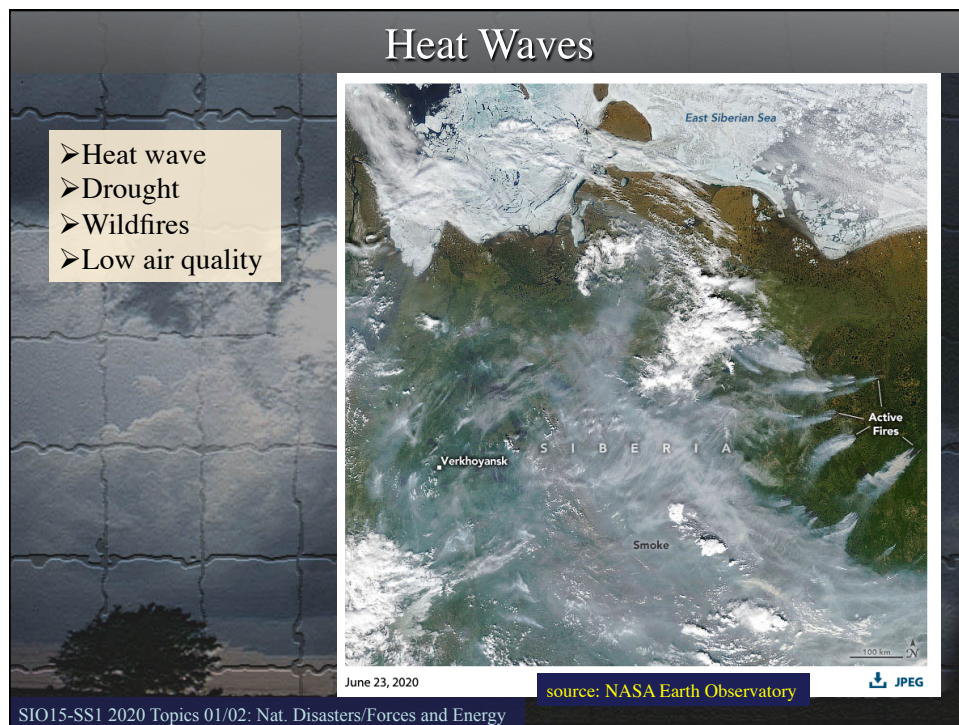
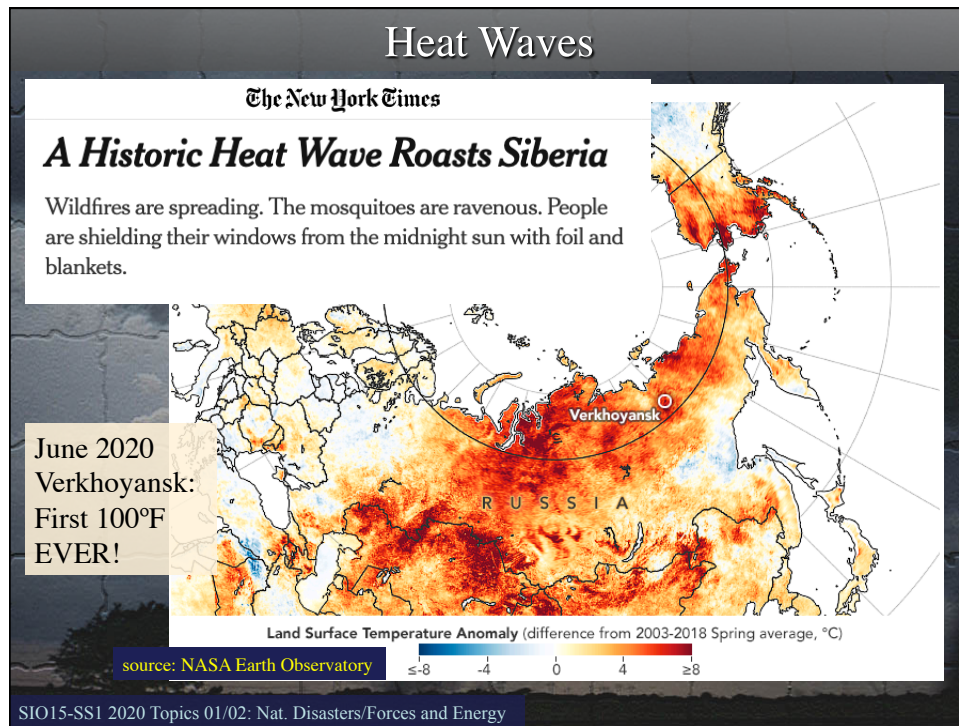


Some Not so Obvious Natural Disasters

- cold snaps
- heat waves
- droughts
- global climate change
- solar storm
- pandemics

- humans are increasingly affected
- humans have an increasing impact

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2019 Wildfires: Indonesian Rainforest



source: Wikipedia

2007 WWF:
"Borneo has unique species"

Borneo: deforestation increasing since 2010 despite 2011 moratorium

Borneo
Feb – at least Oct
cause:
'illegal' slash-and-burn
for oil palms/timber/paper pulp
-> industrialized nations

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2019 Wildfires: Indonesian Rainforest

[link to YaleE360](#)

Malaysia

Borneo (Kalimantan)

source: yaleE360 global forest watch



Indonesia deforestation: world's 3rd-worst contributor to CO₂ after China, US

Sumatra lost 1/3 of its forest between 1990 and 2010

Sumatra and Kalimantan forests sit on peat
-> more CO₂ released

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2019 Wildfires: Indonesian Rainforest

tropical rainforests have most biodiversity on Earth source: Wikipedia

Burning rainforest

- ✧ extinction of unique species
- ✧ displacement of indigenous people -> conflicts



Oil Palm nursery - source: Greenpeace

orangutans live only in Borneo and Sumatra



Borneo orangutan critically endangered

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2019 Wildfires: Indonesian Rainforest

tropical rainforests have most biodiversity on Earth source: Wikipedia

displacement of indigenous people -> conflicts

fights in 2001 claimed 1000s of lives

Dayak



vs

Madurese migrants



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Fatalities and Losses in the U.S.

Cumulative Billion \$ Losses
in U.S. (1980-2003)

heat waves/droughts:	144
hurricanes (B.K.):	102
floods:	55
cold-weather storms:	28
wildfires:	13
tornadoes:	7

source: Munich Re

Average Annual Death Rate
in U.S. (1996-2015)

heat waves:	131
tornadoes:	84
floods:	82
hurricanes:	62
wind:	53
lightning:	38
rip currents:	53 (2006-2015)

of all severe weather in U.S., on average,
heat waves are #1 killer
heat waves lead to highest economical losses

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Some Numbers: Death Rates (1947-1980)

most frequent event:
highest single-event
fatalities:

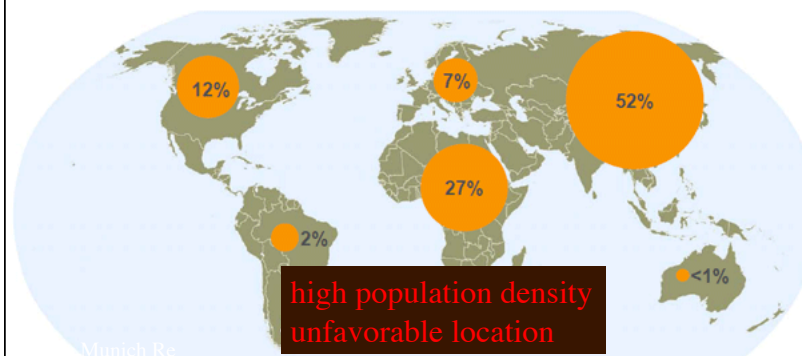
floods

hurricanes, EQs (each ~450,000)

area with most fatalities:

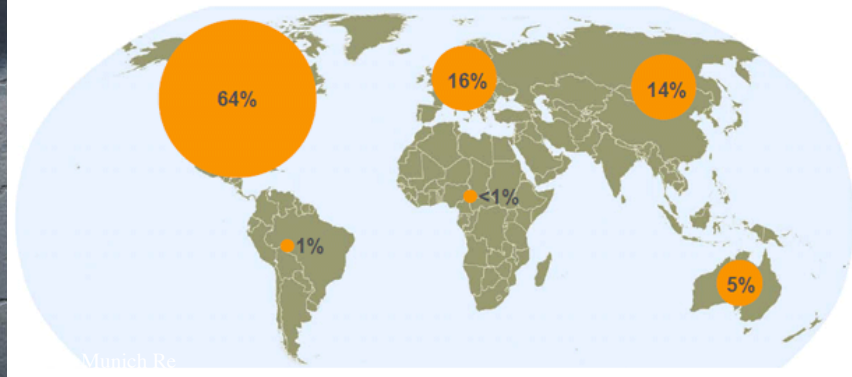
Asia

Natural catastrophe fatalities were highest in developing and emerging countries in the period 1980-2012



Numbers: Insured Losses (1980-2012)

Natural catastrophes worldwide 1980 – 2012
Percentage distribution of insured losses per continent



64% of world's losses in North America

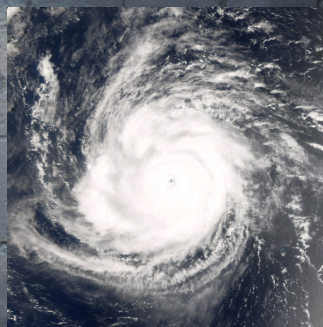
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Energy Sources and Forces of Disasters

Images: wikipedia

an average hurricane (10 days) releases
as much energy as the
Mw=9.5 5/22 1960 Chile earthquake

Book chapter 2
watch short videos!



- from Sun
- fusion
- latent heat

$$E_S = 5300 * E_E$$



- from Earth/plate tectonics
- primordial
- potential energy

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Short video 2a Forces - Potential Energy Short video 2b

energy that is stored in some form to be later used 'loading' potential energy by exerting a force

Newton's Apple




Fig. 2.3

Spring

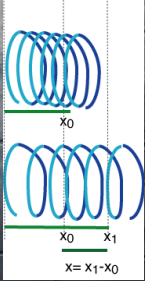


Fig. 2.5

EQ Fault

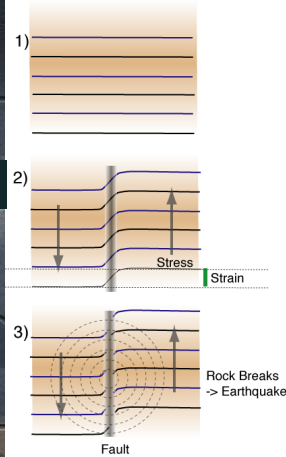


Fig. 2.6

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Force and Deformation on an EQ Fault

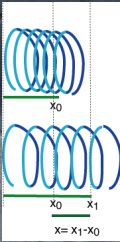


Fig. 2.5

Short video 2b

cause:
force <-> **stress**

consequence:
deformation <-> **strain**

$F_g = k \times x$

strain is a result of stress

example for an earthquake

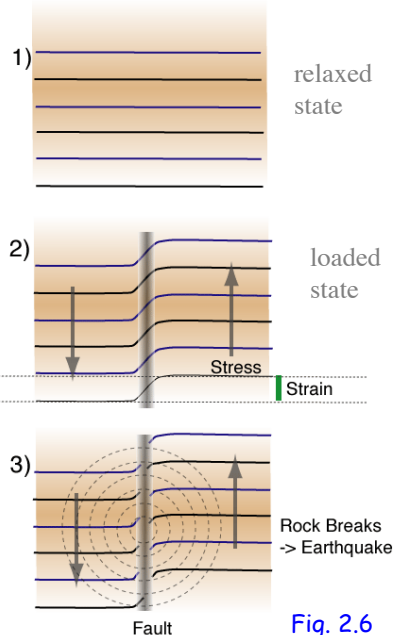


Fig. 2.6

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Basic Types of Energy

Watch short Videos on forces, energy (topic 2)

- potential (e.g. landslide, earthquakes, plate tectonics)
- kinetic (e.g. wind storms, landslides, volcanoes)
- rotational (e.g. Earth, Earth-Moon, tornadoes, landslides)
- heat (e.g. volcanoes, plate tectonics, severe weather)

internal heat

external heat

"primordial" + radiogenic

fission

SUN 

fusion

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Earth's 4 External Sources of Heat

- Earth's surface receives 5300 times more heat from sun than from inside
- sun's energy produced by nuclear fusion



!!!SUN!!!

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Latent Heat

“hidden heat”

Heat Capacity: ability to absorb heat while temperature rises slowly

Air:	0.00031 cal/cm ³ /°C
Quartz Sand:	0.31
Granite:	0.51
Water:	1.0
Aluminum:	0.215
Copper:	0.0924
Glass:	0.20
Human body:	0.83

Table 2.1

- water has high heat capacity!
- serves as **moderator**

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The 3 Phases of H₂O

- ice
- water
- water vapor/steam

any substance

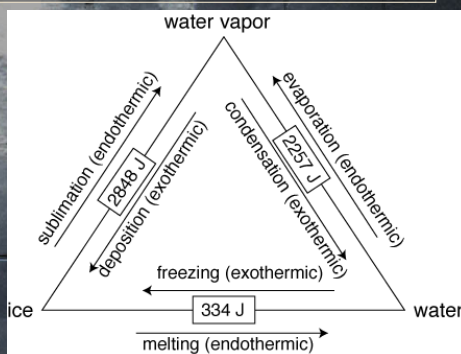
solid

liquid

gas

any phase change costs or releases energy

Fig. 2.12



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Latent Heat, Evaporation and Condensation

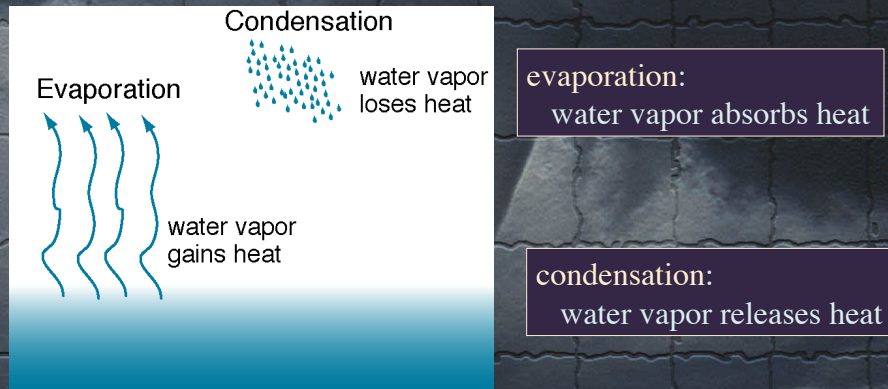


Fig. 2.13

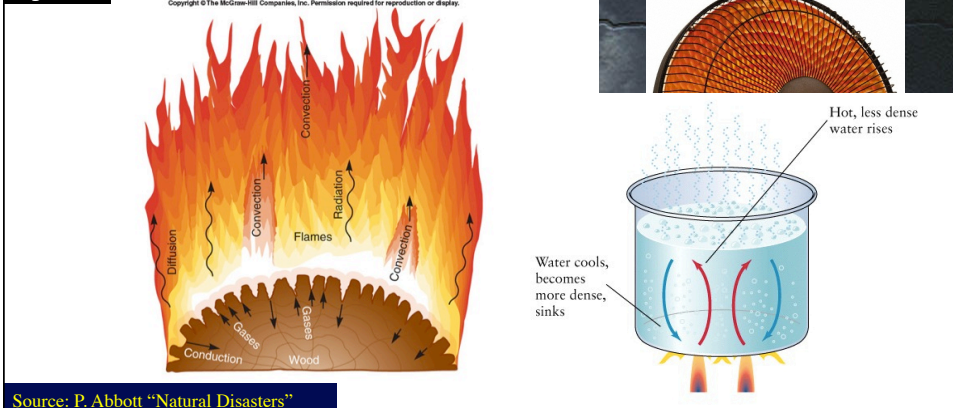
it takes 600 cal to
evaporate 1g water

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4 Ways to Transport Heat

- conduction (energy passed between vibrating atoms)
- radiation (EM waves, no particle movement)
- diffusion (migration of single particles)
- convection (mass transport; MOST EFFECTIVE)

Fig 2.11



Source: P. Abbott "Natural Disasters"