

SIO15: Natural Disasters

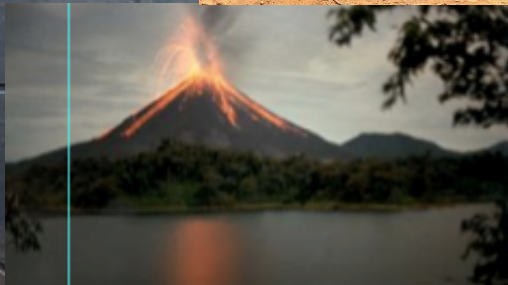
<https://geowiki.ucsd.edu/sio15>



- all lectures will be recorded via UCSD podcast
- check your UCSD emails regularly for announcements



Zoom office hour: 5 pm today



Some Not so Obvious Natural Disasters

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

Why care/discuss?

- humans are increasingly affected
- humans have an increasing impact

Heat Waves

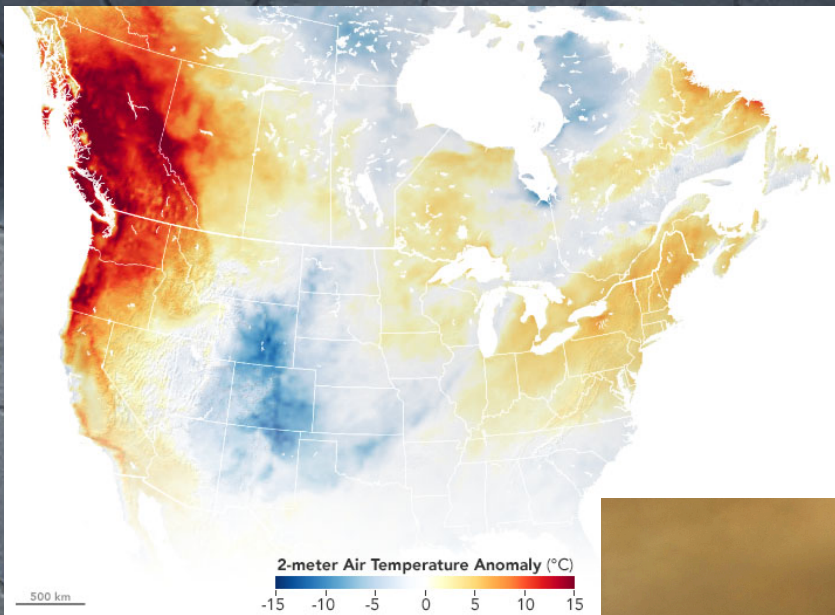
definitions vary!
depends on country/state/location/organization

World Meteorological Organization:

“daily max. temp exceeds average max. temp by 5°C (9°F) for > 5 consecutive days”

typically form near H air pressure system

2021 Pacific Northwest



jun 25 – jul 7

- 121.3°F/49.6°C Lytton, BC
- > 1400 fatalities (600 in US)
- \$9B damages

smoke from wildfires

- travel across continent
- are toxic



6/28 Mt. Shasta

source: Wikipedia

2023 Western North America

2023

May - ??

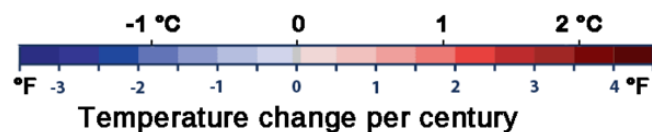
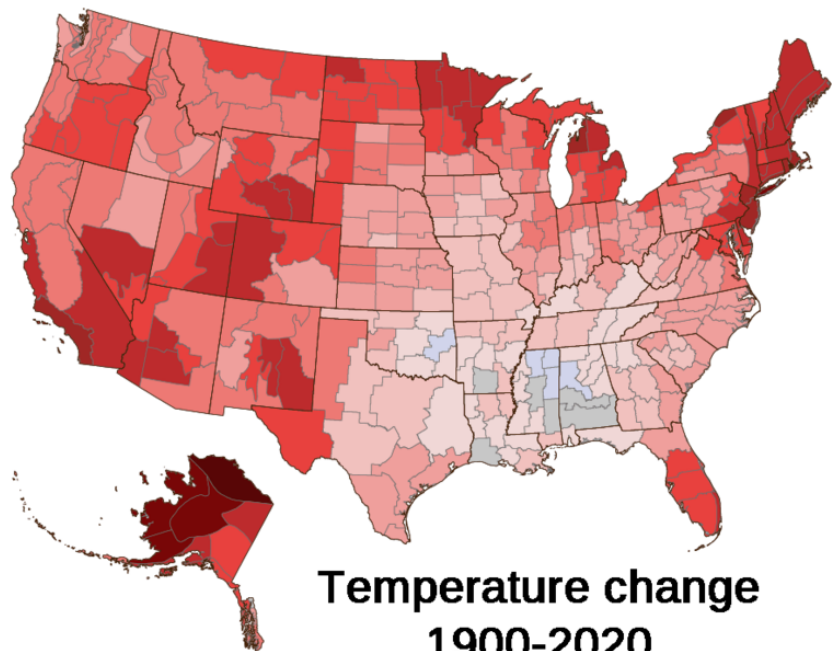
fatalities:

Mexico 112

US 883

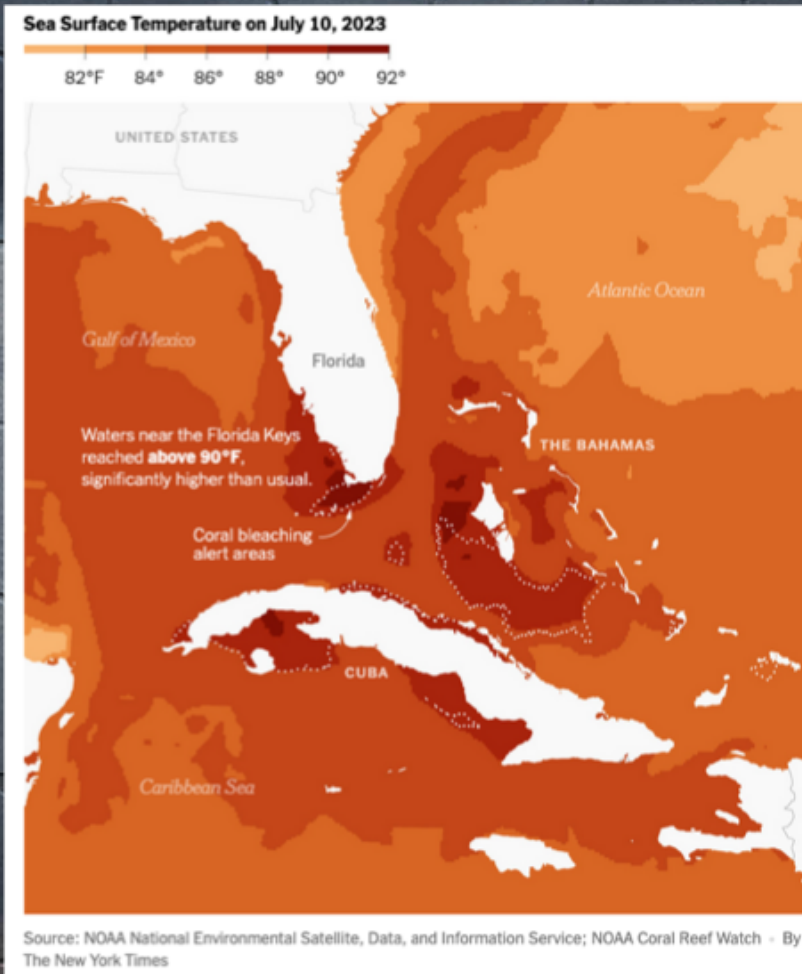
overall warming in last 120 years

heating up in last
120 years:
Alaska (!!!)
NE U.S.
Western US
Florida ←



source: Wikipedia

2023 Gulf Coast SST 'Bath Tub'



Florida Keys T 90+°F

- severe risk of coral bleaching
- other marine life
- drop in oxygen
- fish need MORE oxygen

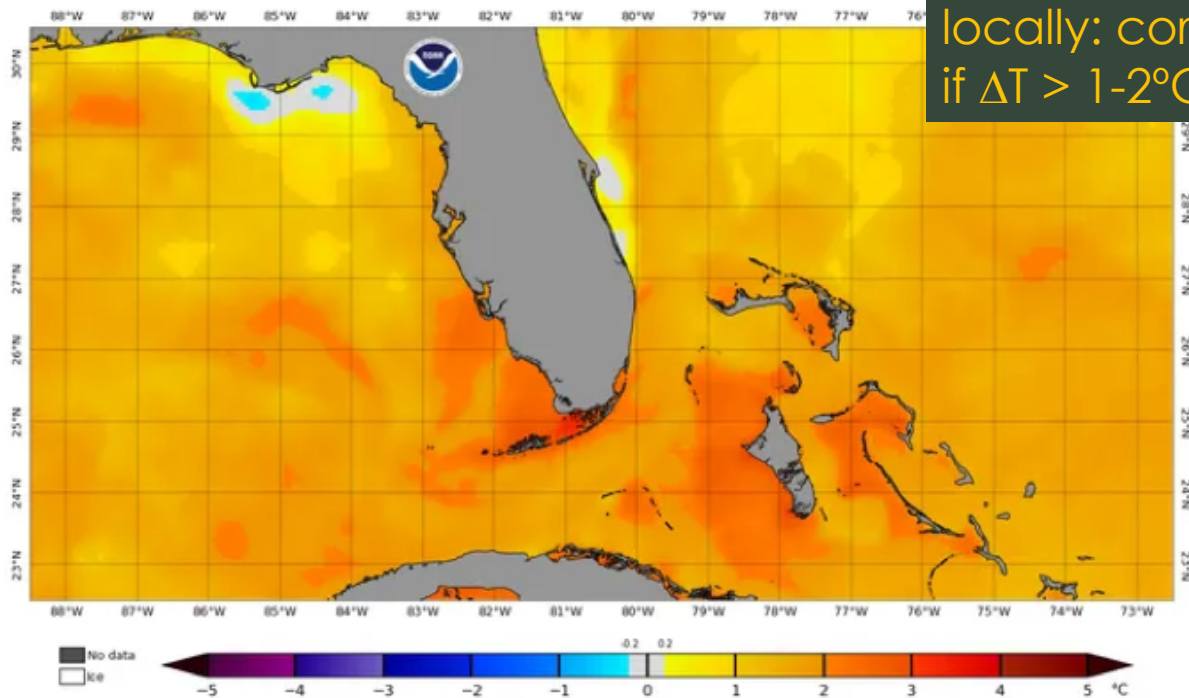
locally: corals bleach
if $\Delta T > 1-2^{\circ}\text{C}$

source: New York Times

2023 Gulf Coast SST 'Hot Tub'

Florida up to 4°C anomaly

NOAA Coral Reef Watch Daily 5km SST Anomalies (v3.1) 24 Jul 2023



locally: corals bleach if $\Delta T > 1-2^{\circ}\text{C}$

Sea surface temperatures off the southern tip of Florida and the Florida Keys are running more than 2 degrees above normal. NOAA

source: USA Today

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. (2002-2021)

heat waves:	112
floods:	86
tornadoes:	78
wind:	51
hurricanes:	32
cold snaps:	32
rip currents:	57

source: NWS/NOAA

2024: CDC says 1000+ heat deaths

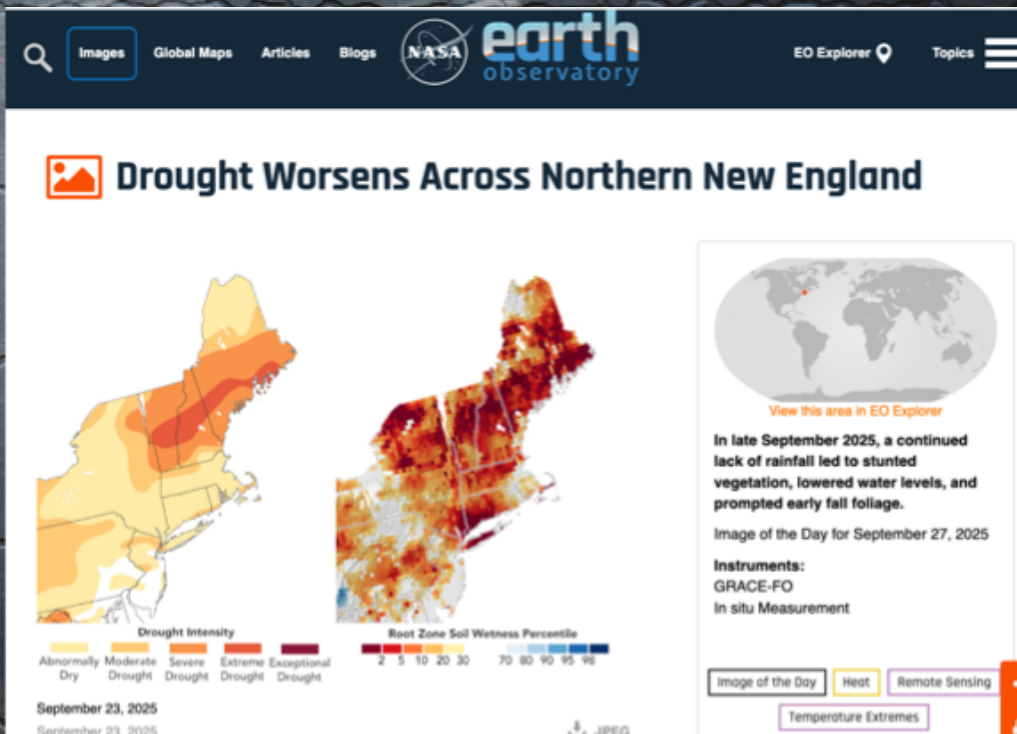
of all severe weather in U.S., on average,
heat waves are #1 killer
heat waves lead to highest economical losses

Heat Waves and Droughts

heat waves: typically last 6-90 days
droughts: months - years

*may or may not go
hand in hand*

this just in from NASA (9/23/25)



U.S. Drought Monitor

<https://droughtmonitor.unl.edu>

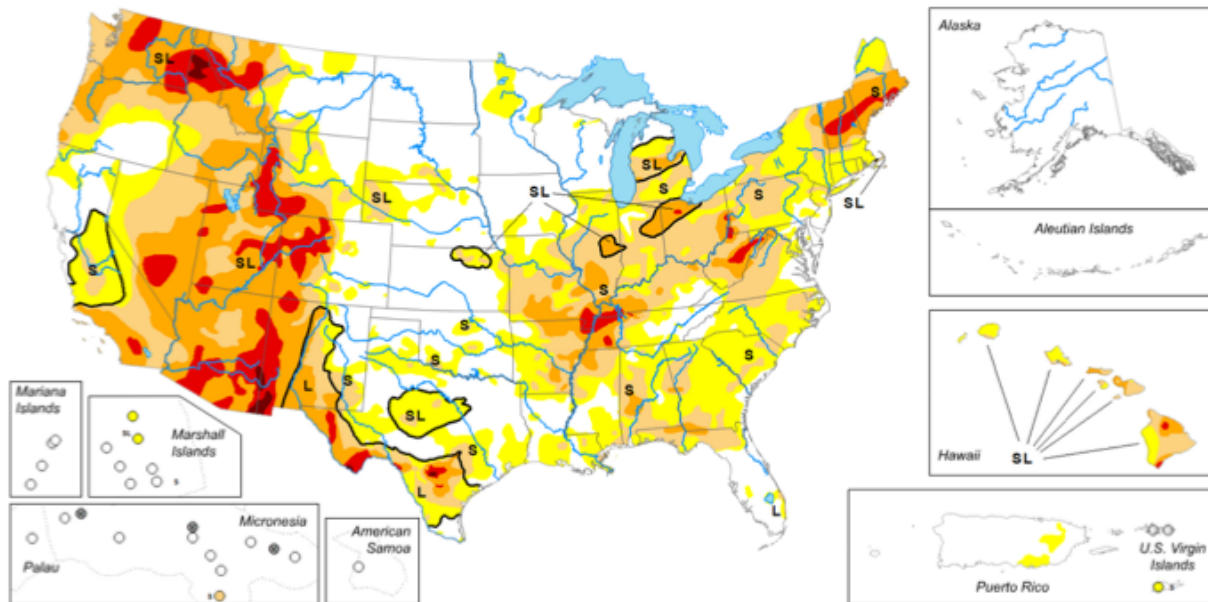
U.S. Drought Monitor

[Current](#) [Maps](#) [Data](#) [Summary](#) [About](#) [Conditions & Outlooks](#) [Ag in Drought](#) [En Español](#) [NADM](#)

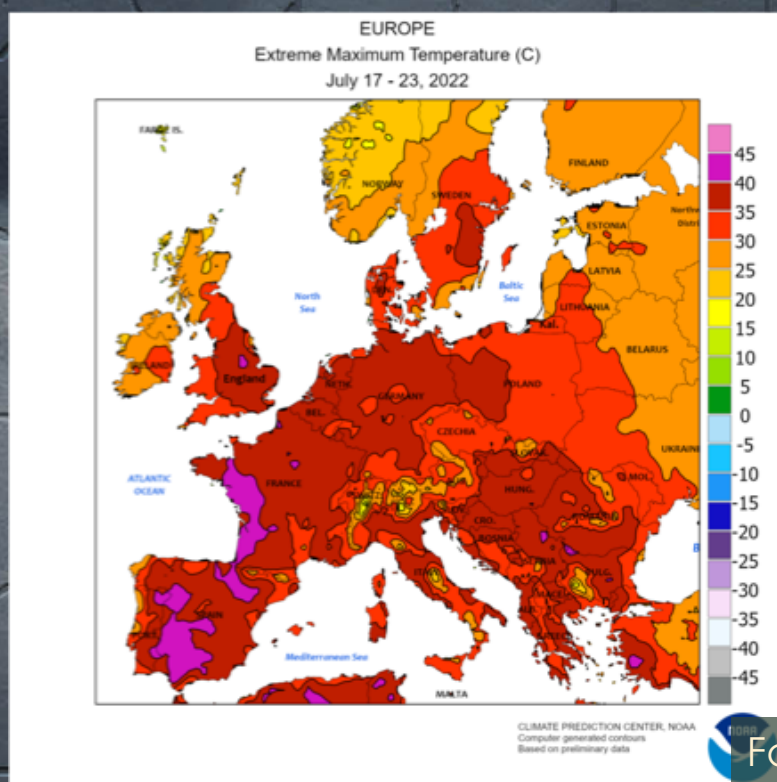
Map released: September 25, 2025

Data valid: September 23, 2025

☐ View grayscale version of the map



The 2022 Europe Heat Waves



source: Wikipedia

2022 Heat waves
and drought

Jun – Sep:
record temps: Portugal - UK
wildfires: Portugal, Spain,
France, Greece

France:
nuclear reactor shut-down
b/c low river level
-> severe problems with
power generation (AC? EVs?)

Fatalities - 23,000+
France: 11,000
Germany: 8,100
Spain: 2,900
Portugal: 1,100

some sources
say 61,600+

The 2003 Europe Heat Wave

104°F in
many places

"hottest summer in 500 years"
(last record heat: 1757)

"London hotter than Cairo"

"WWII vessel in Danube"

"record wine!"

Fatalities

some sources
say 70,000

35,000

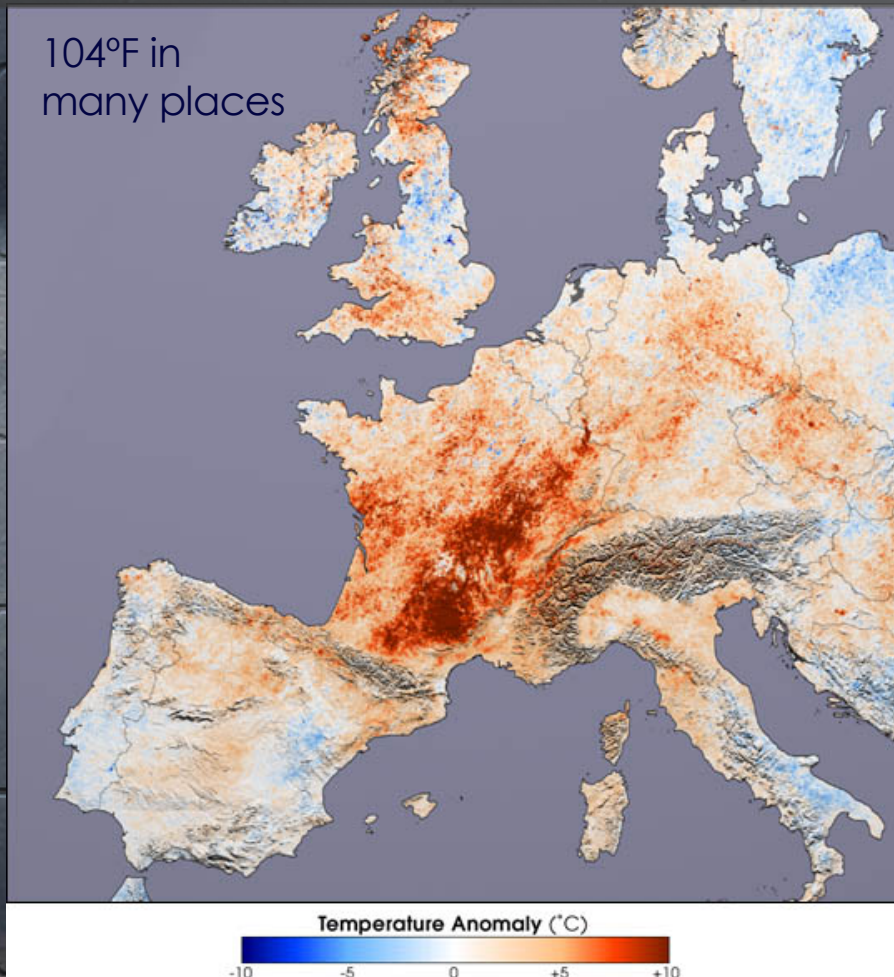
France: 14,000

Germany: 7,000

Spain: 4230

Italy: 4175

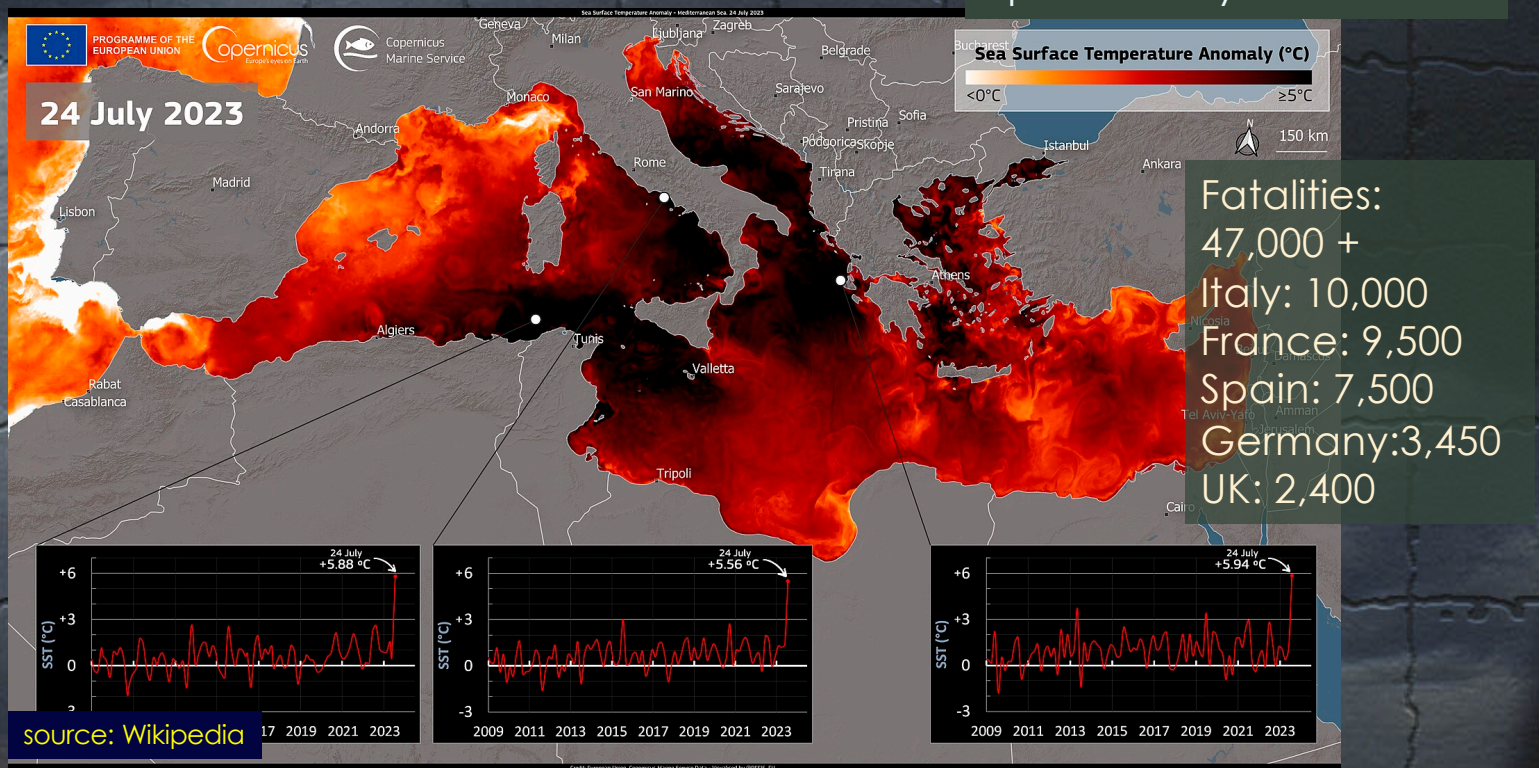
UK: 2045



The 2023 Europe Heat Waves (Jun – Sep)

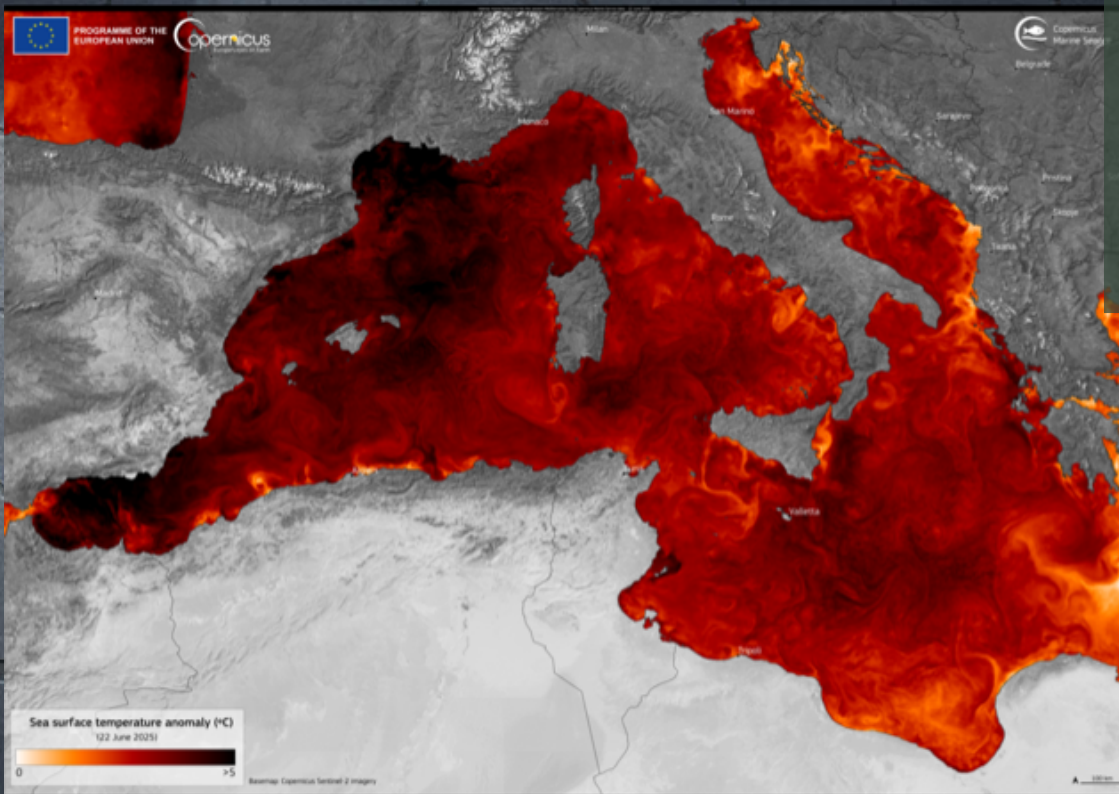
7/10++ 2023 Cerberus Heat wave

hottest temps ever recorded in Europe
- particularly SE and SW



The 2025 Europe Heat Waves (Apr – Sep)

6/22 Mediterranean SST anomaly

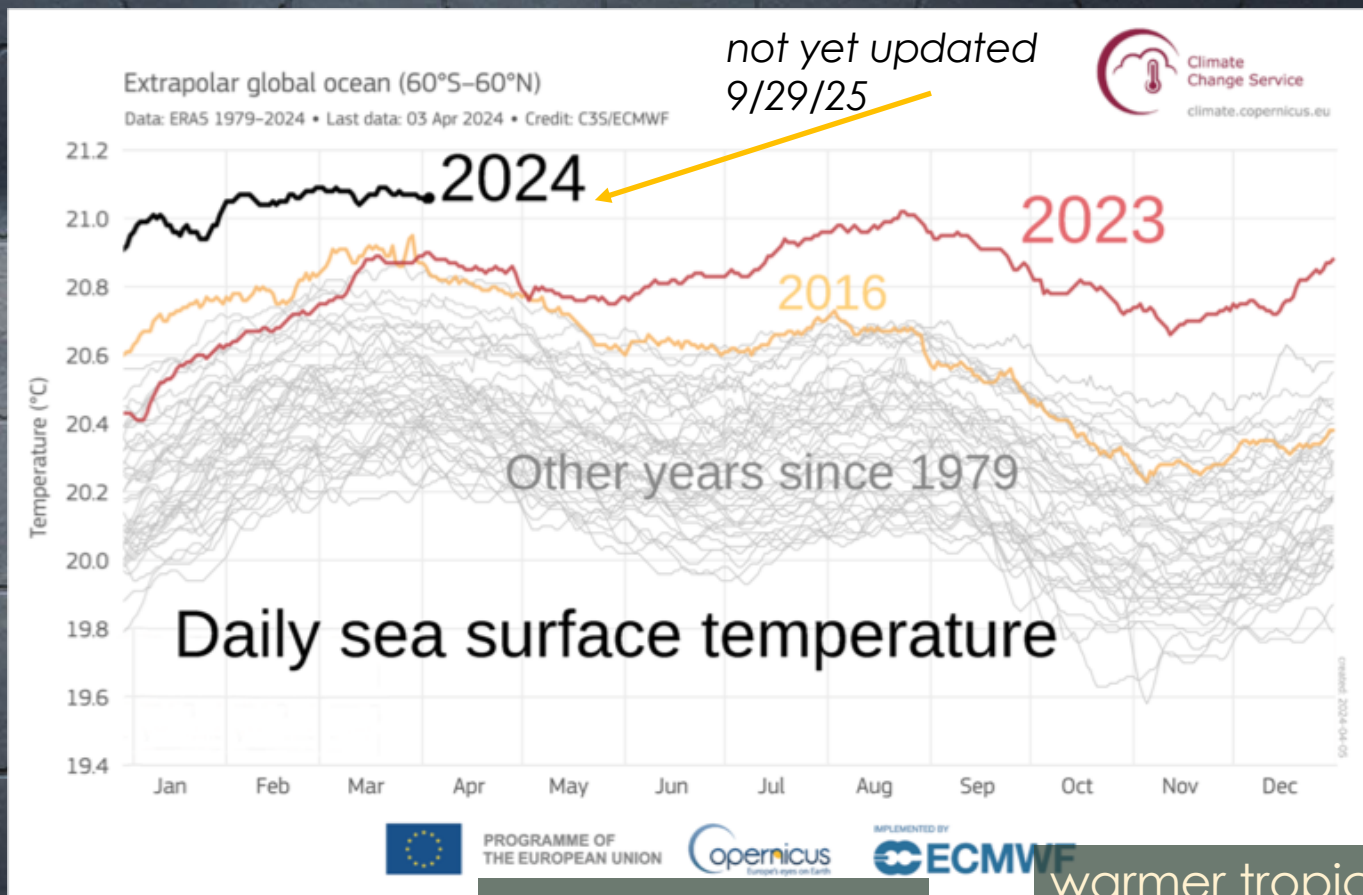


source: Wikipedia

wildfires in
Portugal, France,
Greece, Turkey
Balkan,
Germany,
Spain,
UK, Scotland (!)

Fatalities:
2,188 +
perhaps as high
as 16,500+

Global Heat 2024 - Oceans

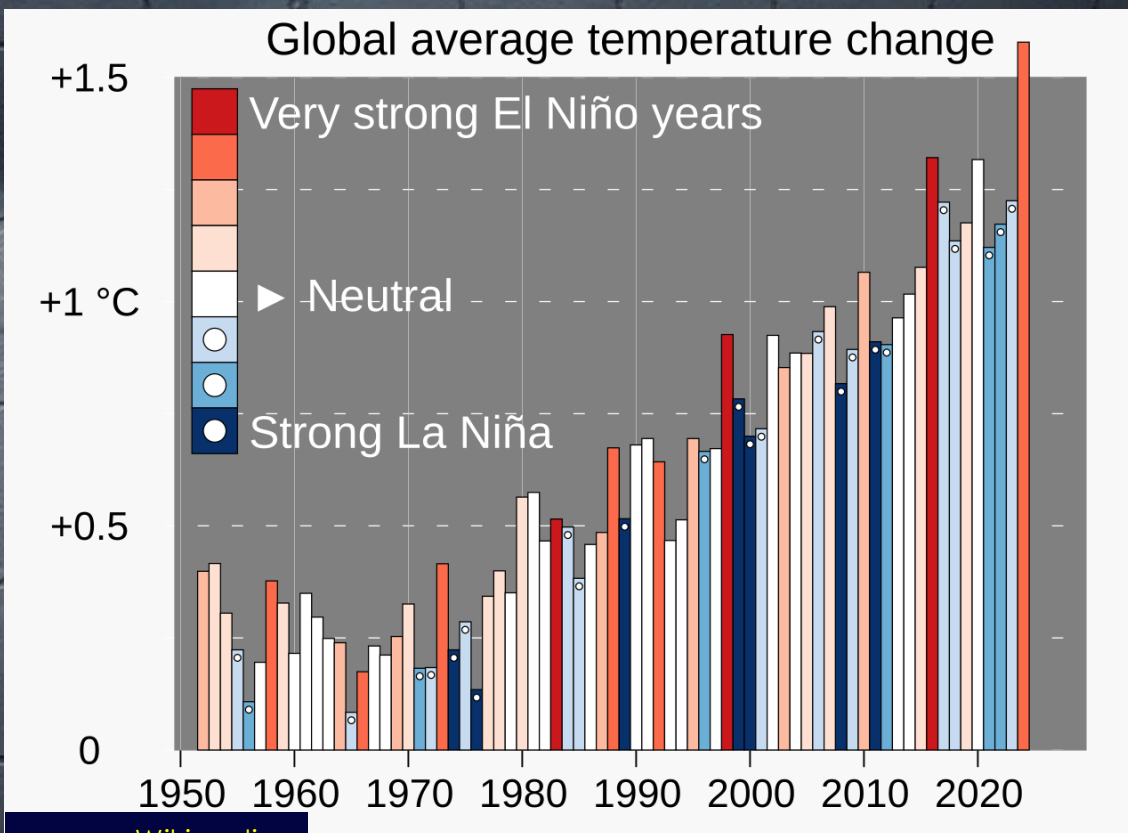


source: Wikipedia

hottest since 1979
excludes Arctic

warmer tropical
oceans fuel more
potent hurricanes

Global Average Temperature (Oceans+Land)



source: Wikipedia

2023/24 enhanced by
"moderate" El Niño

Some Numbers: Death Rates (1947-1980)

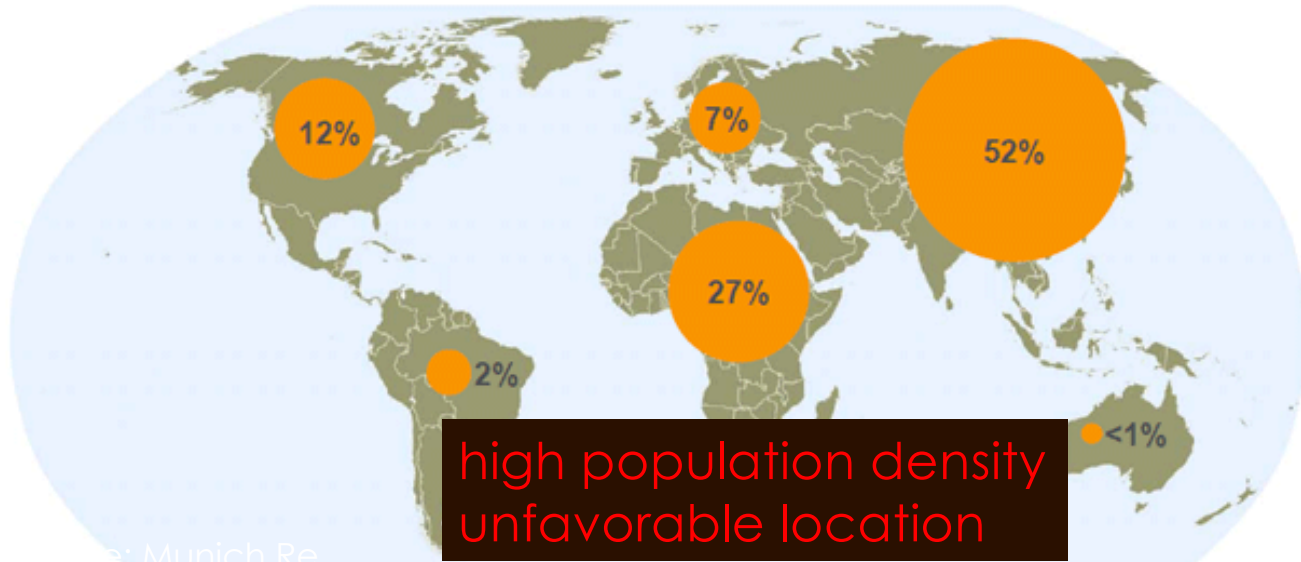
most frequent event:
highest single-event
fatalities:

floods
hurricanes, EQs (each
~450,000)

area with most fatalities:

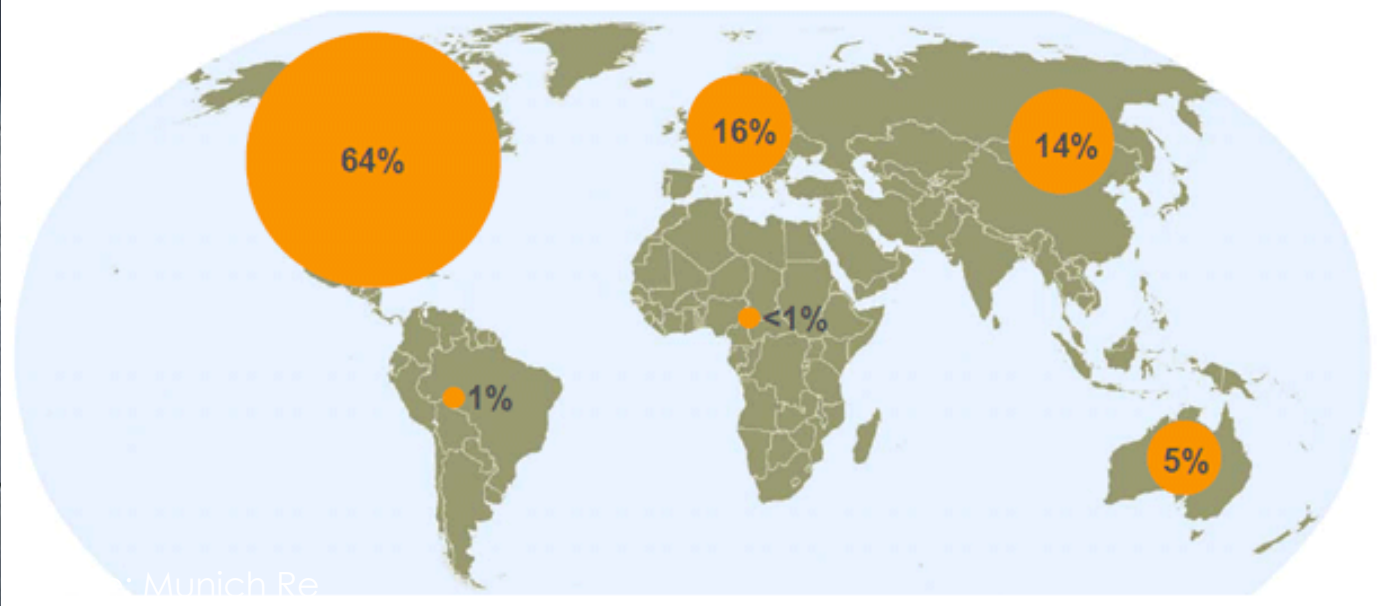
Asia

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

The Costliest Disasters in U.S. History

- 2021 Texas Freeze (\$197Billion)
- 2005 Hurricane Katrina (\$125 Billion)
- 2017 Hurricane Harvey (\$125 Billion)
- 2017 Hurricane Maria (\$92 Billion)
- 2012 Superstorm Sandy (\$69 Billion)
- 2021 Hurricane Ida (\$65 Billion)
- 2017 Hurricane Irma (\$ 65 Billion)
- 1989 N. A. Drought (\$53 Billion)
- 2014 N.A. Drought (> \$50 Billion)
- 1994 Northridge Earthquake (\$49 Billion)
- 2008 Hurricane Ike (\$38 Billion)
- 2005 Hurricane Wilma (\$27 Billion)
- 1992 Hurricane Andrew (\$27 Billion)
- 2004 Hurricane Ivan (\$26 Billion)
- 2018 Hurricane Michael (\$25 Billion)
- 2018 Cali Wildfires (\$24 Billion)
- 2020 Hurricane Laura (\$19 Billion)
- 2005 Hurricane Rita (\$19 Billion)
- 2004 Hurricane Charley (\$17 Billion)
- 1993 Mississippi Flood (>\$ 15 Billion)
- 2016 Hurricane Matthew (\$15 Billion)

U.S.: country with largest (insured) losses worldwide

Prolonged Floods:
underappreciated
less newsworthy
no flood insurance
-> less insured losses

... NEVER
MENTIONED
IN ANY OFFICIAL
LIST

Not inflation-adjusted

Numbers: Insured Losses in \$B (1970-2017)

- | | | |
|-----|-------------------------------|----------|
| 1) | Japan: Tohoku EQ 2011 | (360/35) |
| 2) | USA: Hurricane Katrina 2005 | (125) |
| 3) | USA: Hurricane Harvey 2017 | (125) |
| 4) | Puerto Rico: Hurr. Maria 2017 | (92) |
| 5) | USA: Superstorm Sandy 2012 | (69) |
| 6) | USA: Hurricane Irma 2017 | (65) |
| 7) | USA: Drought 1988/89 | (53) |
| 8) | USA: Drought 2012/13 | (53) |
| 9) | Thailand: Flood 2011 | (46) |
| 10) | USA: Hurricane Andrew 1992 | (27/43) |
| 11) | USA: Northridge EQ 1994 | (49/21) |
| 12) | USA: Hurricane Ike 2008 | (38/21) |
| 13) | USA: Hurricane Ivan 2004 | (26/15) |
| 14) | USA: Hurricane Wilma 2005 | (27/15) |

Wiki:

- 2) 1995 Kobe EQ 197
- 3) 2008 Sichuan EQ 148

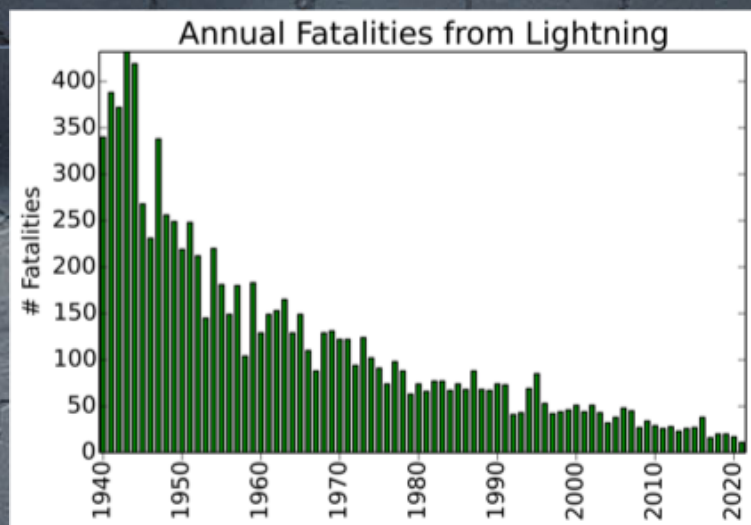
Pakistan Flood (2010)
\$42B

country with
largest (insured)
losses:
USA

- Swiss Re: insured losses
- updates from wikipedia

Mississippi Flood (1993)
\$12B

Some Weird Statistics: U.S.

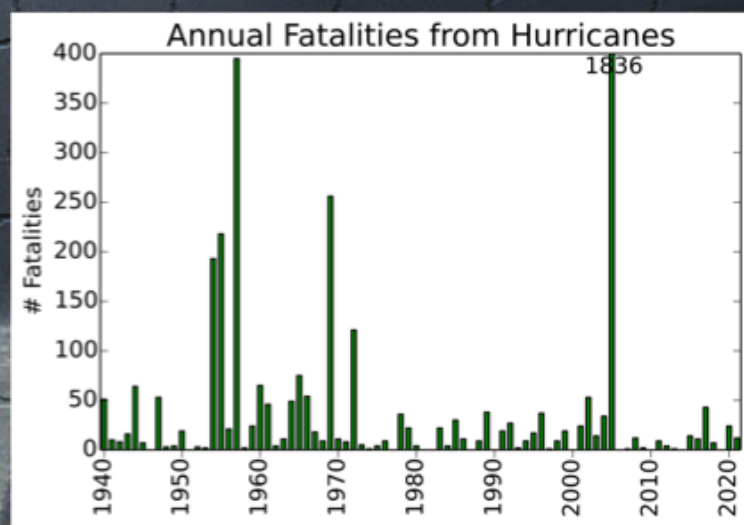


82 yrs ave: 115

30 yr ave: 37

10 yr ave: 23

Lightning has a
downward trend



82 yrs ave: 34

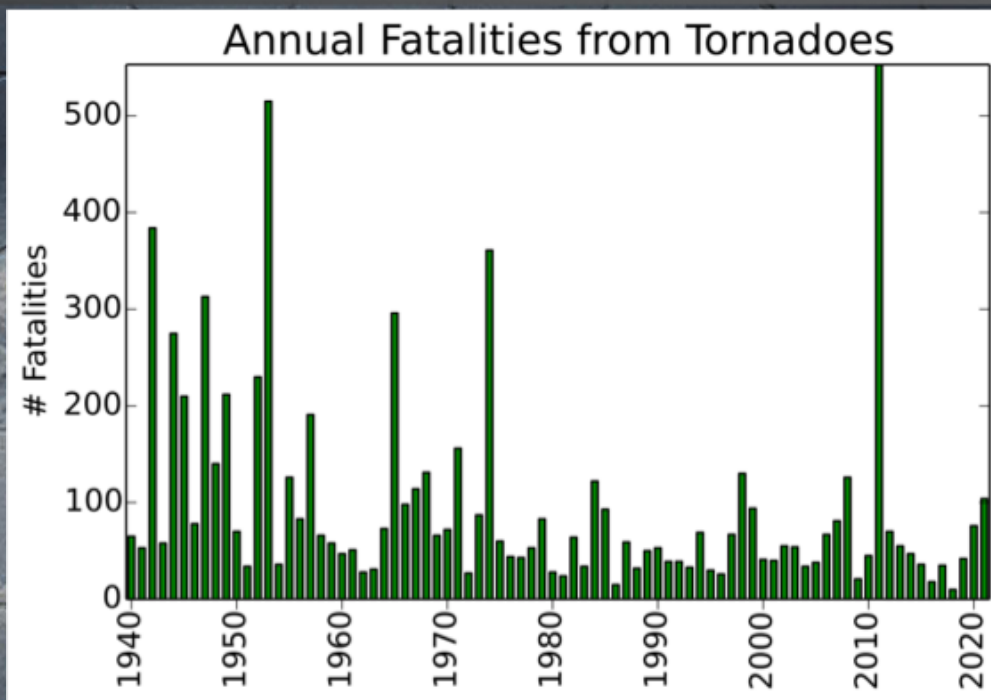
20 yr ave: 32

10 yr ave: 12*

* does not include 2017 Hurricane Maria

hurricane statistics dominated
by single events

Some Weird Statistics: U.S.



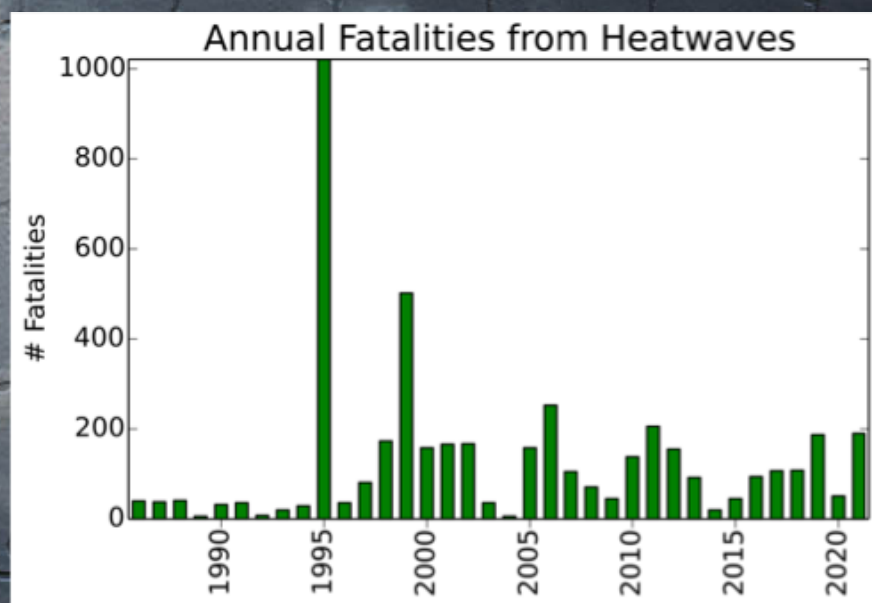
Marked decrease in fatalities up to late 1900s
But decline not continuing !?

More new homes with less tornado shelters !!

Some Weird Statistics: U.S.

30 yr ave: 148
10 yr ave: 105

Typical Year – Last 20 Years
Hurricanes: 32
Heat Waves: > 100



Heat waves are currently #1 killer and most costly!