Sometimes You Need a Weatherman to Tell You Which Way the Wind Blows

My Weather Underground Experience, 1991 - 2025

Dr. Jeff Masters
Meteorologist for Yale Climate Connections
Co-founder, The Weather Underground
https://yaleclimateconnections.org/section/eye-on-the-storm/
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YALE Climate Connections

A Humble Beginning: the UM-WEATHER telnet service, 1991

```
telnet madlab.sprl.umich.edu 3000

------------------------------------------------------------------------------
*               Welcome to THE WEATHER UNDERGROUND telnet service!           *
------------------------------------------------------------------------------
*                                                                            *
*   National Weather Service information provided by Alden Electronics, Inc. *
*    and updated each minute as reports come in over our data feed.          *
*                                                                            *
------------------------------------------------------------------------------

Press Return for menu
or enter 3 letter forecast city code-- DTW

Weather Conditions at 09:53 AM EST on 29 Nov 2012 for Detroit Metro, MI.
Temp(F)    Humidity(%)    Wind(mph)    Pressure(in)    Weather
================================================================================
  37          59%         SSW at 10       30.32      Mostly Cloudy

Forecast for Detroit, MI
1023 am EST Thu Nov 29 2012

.Rest of today...Mostly sunny. Highs 45 to 49. Southwest winds
5 to 15 mph.
```

Where did the name “Weather Underground” come from?

The original Weather Underground (the Weathermen), founded in 1969, was the radical wing of the Students for a Democratic Society (SDS). The Weathermen got their name from the the line,

"You don't need a weatherman to know which way the wind blows”

from the 1965 Bob Dylan song "Subterranean Homesick Blues".

Logo of the original Weather Underground

After going commercial in 1995, we make the front page of the Ann Arbor News in 1997

Weather: Periods of heavy rain. Low 38. Thursday, rain & windy. High 48. **Details on back page.**

THE ANN ARBOR NEWS

• • • 35¢
Wednesday
February 26, 1997

BRIGHT FORECAST

Weather Internet site that began as project in U-M lab becomes startup firm

THE WEATHER UNDERGROUND

- **What:** One of the most popular weather Web sites.
- **Where:** http://www.wunderground.com.
- **Key players:** Perry Samson, The Weather Underground's director of education and professor of atmospheric, oceanic and space sciences at the University of Michigan; Jeffrey Ferguson, director of communications; Jeffrey Masters, director of information.
- **What's with the name?** Given the playful nature of The Weather Underground partners, it's not surprising they chose a tongue-in-cheek moniker. Weather Underground was the name of the militant arm of Students for a Democratic Society, a radical movement founded at the U-M in the '60s. 'They were kind of a nasty group,' Ferguson says. 'We're not.'

By MARY MORGAN
NEWS STAFF REPORTER

When it rains in reality, it pours at The Weather Underground, a popular Internet site run in large part by a handful of Ann Arbor weather wonks.

And therein lies a business.

What started as a project at the University of Michigan – housed in a delightfully cluttered "Mad Lab" at the College of Engineering's department of atmospheric, oceanic and space sciences – has morphed into a startup firm that's thundering against much mightier rivals like The Weather Channel.

"It's all very new to us, going from the academic world to the real world," says Jeff Masters, who as a graduate student wrote some of the software that lets The Weather Underground do what it does.

On stormy days, about 1.5 million people worldwide check out http://www.wunderground.com to get the latest weather information. A search feature allows users to see weather conditions in just about any corner of United States.

The site offers in-depth reports for all types of weather watchers, from pilots and farmers to skiers and wind surfers. Colorful maps trace temperature patterns, while a radar map gives a reading of current precipitation.

Now, The Weather Underground is

See WEATHER, Back Page

NEWS PHOTO • ROBERT CHASE

Professor Perry Samson is one of the creators of The Weather Underground, which got its start in a lab on the University of Michigan's North Campus.

Wunderground launches blogs: 2005

Dr. Jeff Masters' WunderBlog

The 360-degree Rainbow

Posted by: **Dr. Jeff Masters** (), 8:18 PM GMT on April 14, 2005 +5

Most people don't realize it, but a rainbow is actually a full circle. You usually can't see the full circle, since half of the rainbow lies beneath the horizon, where it is not raining. After all, there is no weather underground. However, if one is in an airplane or overlooking a waterfall, the 360-degree rainbow can be seen. I know--I have seen them twice from research airplanes that were flying through rain showers. Check out the 360-degree rainbow image at the bottom. Note that there is a separate optical phenomena, called a glory (caused by diffraction), surrounding the shadow of the airplane. Unfortunately, I only had a 23mm wide angle lens, and could not capture the entire 360-degree rainbow. To my knowledge, no one has captured a photograph of a full **NATURAL** 360-degree rainbow. You can easily photograph one using a sprinkler, as this photographer has done here.

I challenge all you wunderphotographers to capture a 360-degree rainbow image in rain or waterfall mist. First photographer to post such a natural 360-degree rainbow image wins a free 2-year wunderground.com membership!

360-degree rainbow (JeffMasters)

A rainbow is not a half-circle, but a full circle, as this photo taken from NOAA's P-3 Orion weather reseach aircraft demonstrates. A rain shower beneath the aircraft allowed me to see the entire circle of the rainbow, although the 23-mm wide angle lens was not quite wide enough to capture the entire circle.

About JeffMasters

Jeff co-founded the Weather Underground in 1995 while working on his Ph.D. He flew with the NOAA Hurricane Hunters from 1986-1990.

Add to Favorites

Blog Control Panel

- Add New Blog Entry
- Add WunderPhotos
- Edit Blog Profile
- Edit Recommended Links
- Edit Personal Weather Stations
- Edit Banned List
- Edit Ignored List
- Set Timezone

Tropical Blogs

- Dr. Jeff Masters' WunderBlog
- Angela Fritz's WunderBlog
- Bryan Norcross' Official Blog
- Stu Ostro's Meteorology Blog
- LRandyB's Tropical Weather Discussion
- Portlight Disaster Relief Blog

Tropical Weather Stickers®

- Dr. Jeff Masters' Blog Sticker
- Hurricane Flash WunderMap®
- Hurricane Tracking Flash Stickers

Create a New Blog Entry

Local Weather

Ann Arbor, Michigan
45 °F
Partly Cloudy

Detailed Conditions & Forecast

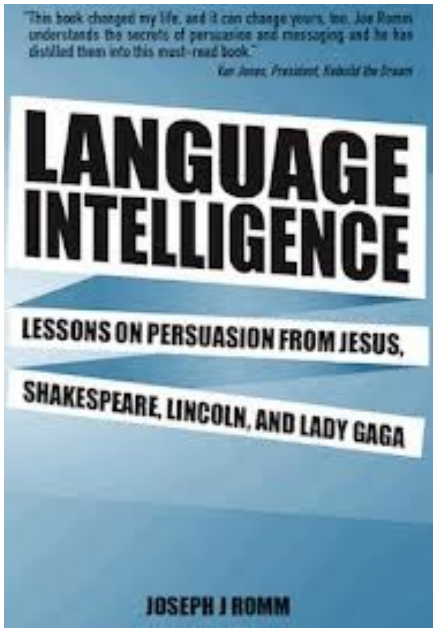
Recent Photos

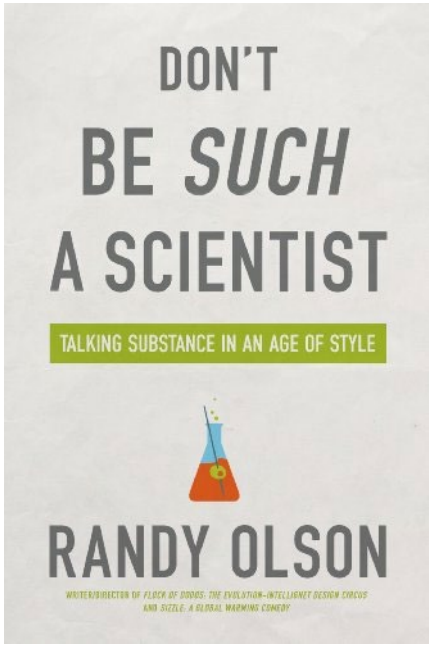



Don’t be Such a Scientist! Tell stories, use metaphors.

Sample metaphor for climate change’s impact on extreme precipitation: It’s like replacing your garden hose with a fire hose: the water comes out stronger, faster, and more unpredictably.

Conclude with solutions--invoke “The Little Engine That Could”, not “Chicken Little”!





People Respond to Simple Messages Repeated Often by Trusted Sources

Bad words:	Replace with:
Anthropogenic	Human-caused
Radiation	Solar energy
Greenhouse gases	Heat-trapping gases
Enhance	Increase
Anomaly	Departure from average
Aerosol	Tiny atmospheric particle
Positive Feedback	Vicious cycle
Uncertainty	Range

Credit: Susan Hassol, climatecommunication.org

When talking about climate change, audience research shows that it is most important to emphasize these points:

1) Earth's climate is warming.
2) This time, humans are responsible.
3) The vast majority of climate scientists agree.
4) The warming climate is already causing significant impacts to people and ecosystems.
5) There are choices we can make now to reduce the severity of future impacts.

Images with people in them are among the most compelling

China floods and landslides, 2010:
4245 killed, $51 billion damage

Put Extreme Events Into Historical Context: Use EM-DAT, NOAA Billion-Dollar Disasters, Gallagher Re, AON (But NOT AccuWeather!)

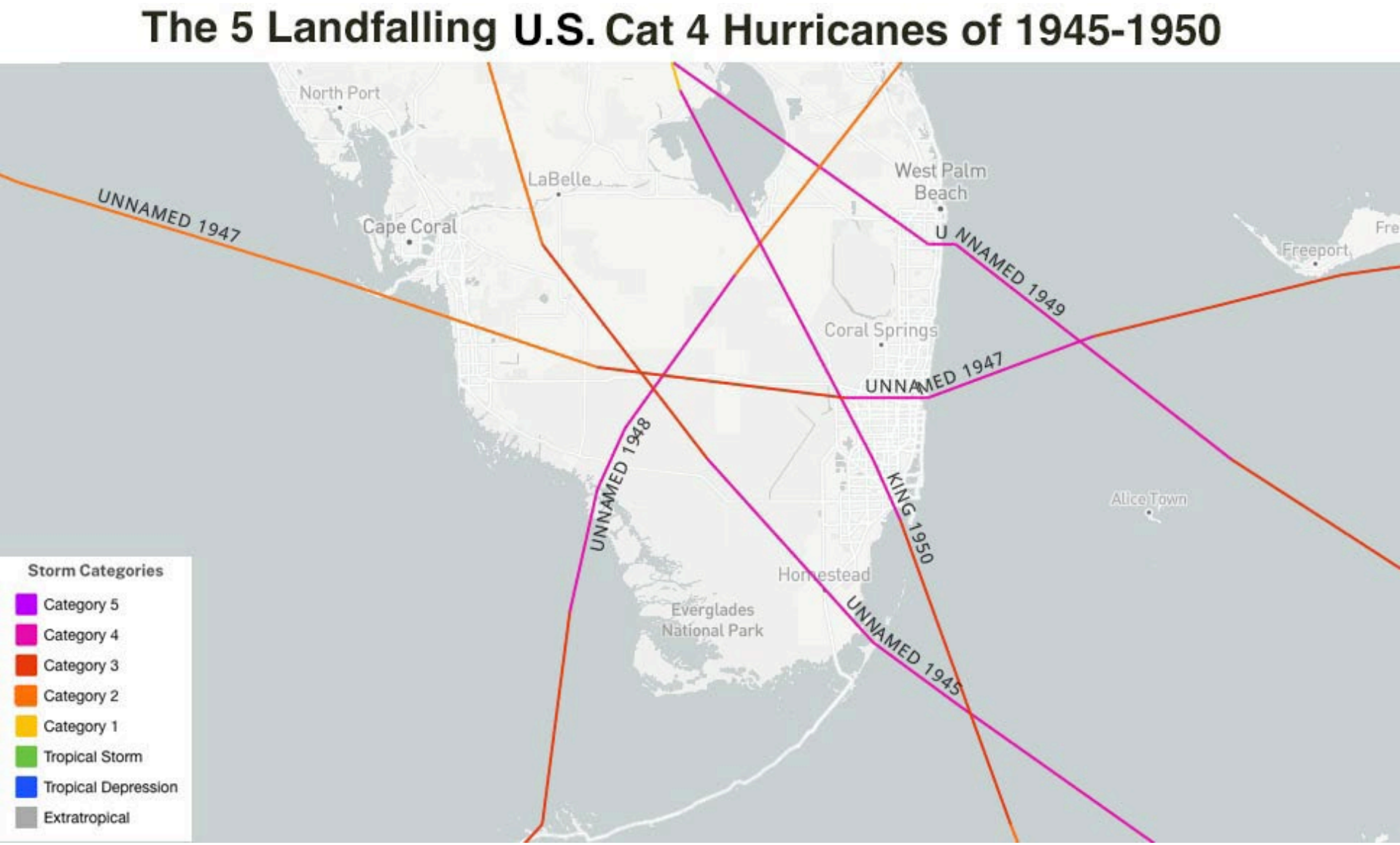
New York's LaGuardia Airport after the November 25, 1950 Nor'easter

Dr. Jeff Masters
@drjeffmasters.bsky.social

Helene's Cat 4 landfall gives the U.S. a record eight Cat 4 or Cat 5 Atlantic hurricane landfalls in the past eight years (2017-2024), seven of them being continental U.S. landfalls. That's as many Cat 4 and 5 landfalls as occurred in the prior 57 years.

September 26, 2024 at 11:34 PM Everybody can reply

Acknowledge That Weather has Natural Extremes



Costliest Global Weather Disasters, 1980-2025

Rank	Disaster	Location	Year	Damage	Deaths
1	Hurricane Katrina	U.S. LA/MS/AL/FL	2005	$201 billion	1,392
2	Hurricane Harvey	U.S. TX/LA	2017	$160 billion	89
3	Hurricane Ian	U.S. FL/SC/NC	2022	$120 billion	152
4	Hurricane Maria	U.S. PR/VI	2017	$115 billion	2,981
5	Hurricane Sandy	U.S. NY/NJ/CT	2012	$88 billion	159
6	Hurricane Ida	U.S. LA/MS/NJ/NY/CT	2021	$85 billion	77
7	Hurricane Helene	U.S. FL/GA/NC/SC	2024	$79 billion	219
8	Los Angeles Wildfires	U.S. California	2025	$65 billion	29
9	Hurricane Irma	U.S. FL/GA/SC/PR	2017	$64 billion	97
10	Hurricane Andrew	U.S. FL/LA	1992	$60 billion	62
11	Flood	China	1998	$57 billion	3,656
12	Flood	Thailand	2011	$55 billion	813
13	Drought/Heat Wave	U.S. Midwest/East	1988	$55 billion	454
14	Flooding	U.S. Mississippi River	1993	$46 billion	48
15	Hurricane Ike	U.S. TX/LA/MS	2008	$43 billion	112
16	Drought/Heat Wave	U.S. Midwest/East	2012	$42 billion	123
17	Drought/Heat Wave	U.S. MIdwest/East	1980	$41 billion	1,260
18	Hurricane Milton	U.S. FL/SC	2024	$34 billion	32
19	Hurricane Ivan	U.S. AL/FL	2004	$34 billion	57
20	Flood	China	2024	$31 billion	605
20	Flood	China	2021	$31 billion	347
20	Hurricane Michael	U.S. FL/GA	2018	$31 billion	49

In 2024 dollars, from https://www.ncei.noaa.gov/access/billions/events/ for the U.S., and EM-DAT outside the U.S.

Fight Back Against Climate Denial!

Figure 4.16

Global Deaths from Severe Weather 1920–2020

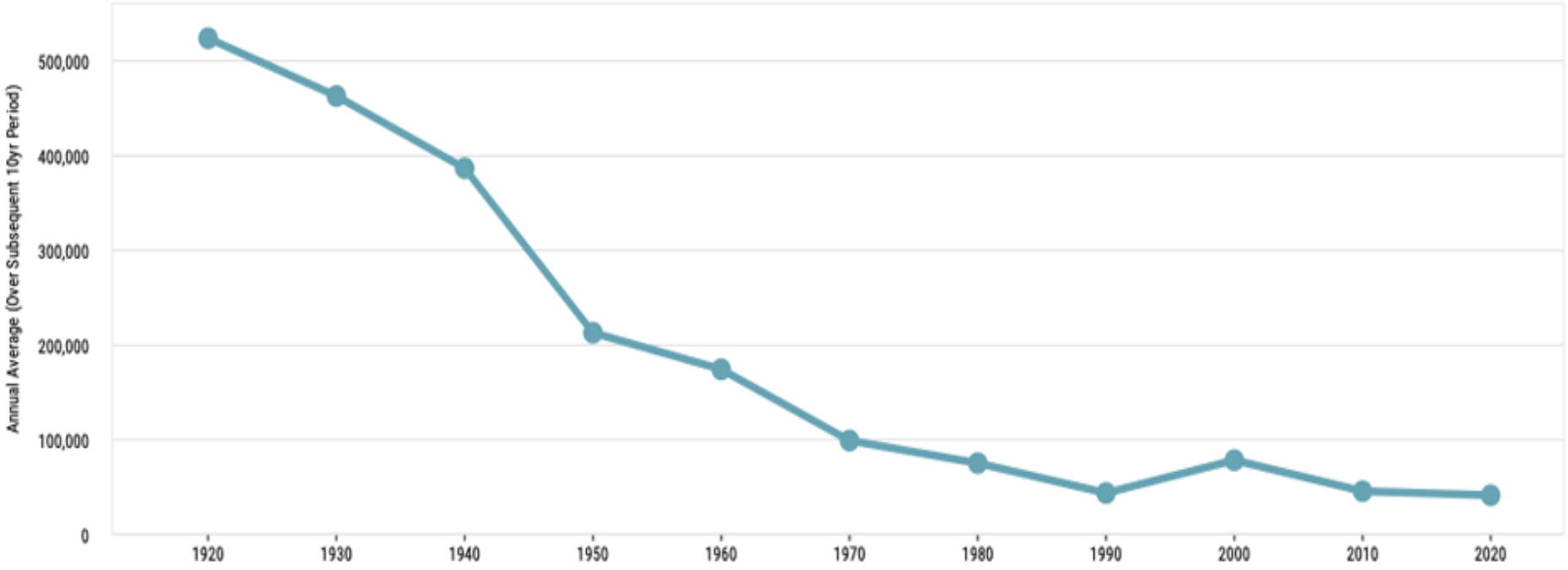


Figure 4.16 – "EM-DAT: The International Disasters Database." EM-DAT, Centre for Research on the Epidemiology of Disasters (CRED). ; Lomborg, Bjorn. "Welfare in the 21st Century: Increasing Development, Reducing Inequality, the Impact of Climate Change, and the Cost of Climate Policies." Technological Forecasting and Social Change, North-Holland, 24 Apr. 2020.

Source: Bettering Human Lives, Chris Wright CEO of Liberty Energy, 2024

Heat Waves With 1,000+ Deaths

Rank	Location	Year	Deaths
1	Europe	2003	71,310
2	Europe	2022	61,570
3	Russia	2010	55,736
4	Europe	2023	47,690
5	Europe (Italy, Germany, France,	2024	>9,000
6	UK, France, Belgium, Netherlands	2020	6,567
7	France/Belgium	2015	3,685
8	India/Pakistan	2015	3,477
9	Europe	2006	3,418
10	Europe	2019	2,727
11	India	1998	2,541
12	U.S./Canada	1936	1,693
13	India/Pakistan/Bangladesh	2003	1,472
14	Saudi Arabia (the Hajj in Mecca)	2024	1,301
15	U.S.	1980	1,260
16	U.S./Canada	2021	1,044
17	India	2002	1,030
17	Greece/Turkey	1987	1,030
19	Portugal/Spain	2022	1,019
20	U.S.	2024	>1,000

Deadliest Wildfires Globally Since 1900

Rank	Location	Year	Deaths
1	Minnesota, U.S. (Cloquet Fire)	1918	1,000
2	Indonesia	1997	240
3	China/Soviet Union (Black Dragon Fire)	1987	191
4	Australia (Black Saturday Bushfires)	2009	180
5	Chile	2024	137
6	Maui, Hawaii, U.S.	2023	102
7	Kabylia, Algeria	2021	90
8	Attica, Greece	2018	87
9	California, U.S. (Camp Fire, Paradise)	2018	85
10	Landes, France	1949	80
11	Australia	1983	75
12	Cochrane, Ontario, Canada	1911	73
13	Australia	1939	71

Notes: Data is from EM-DAT, except for the 2018 Camp Fire (data from CalFire), the Chile fires (data from Gallagher Re) and the Maui fire (data from the state of Hawaii). EM-DAT omits data for the Great Fire of 1910 in Idaho/Montana (87 deaths) and Kursha-2 Fire of 1936 in the Soviet Union (250+ deaths).

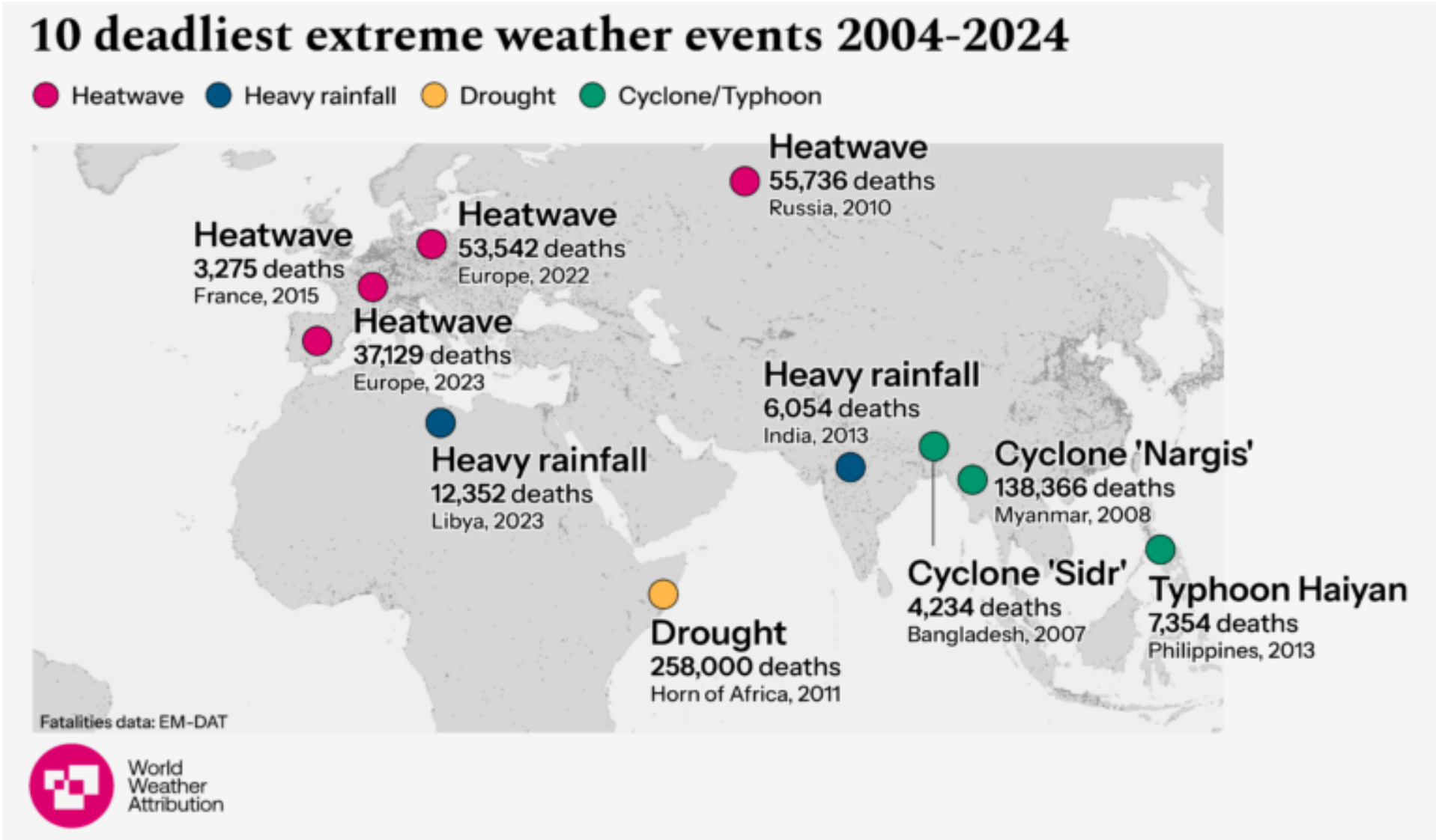
Deadliest Weather Disasters of Africa

YALE Climate Connections

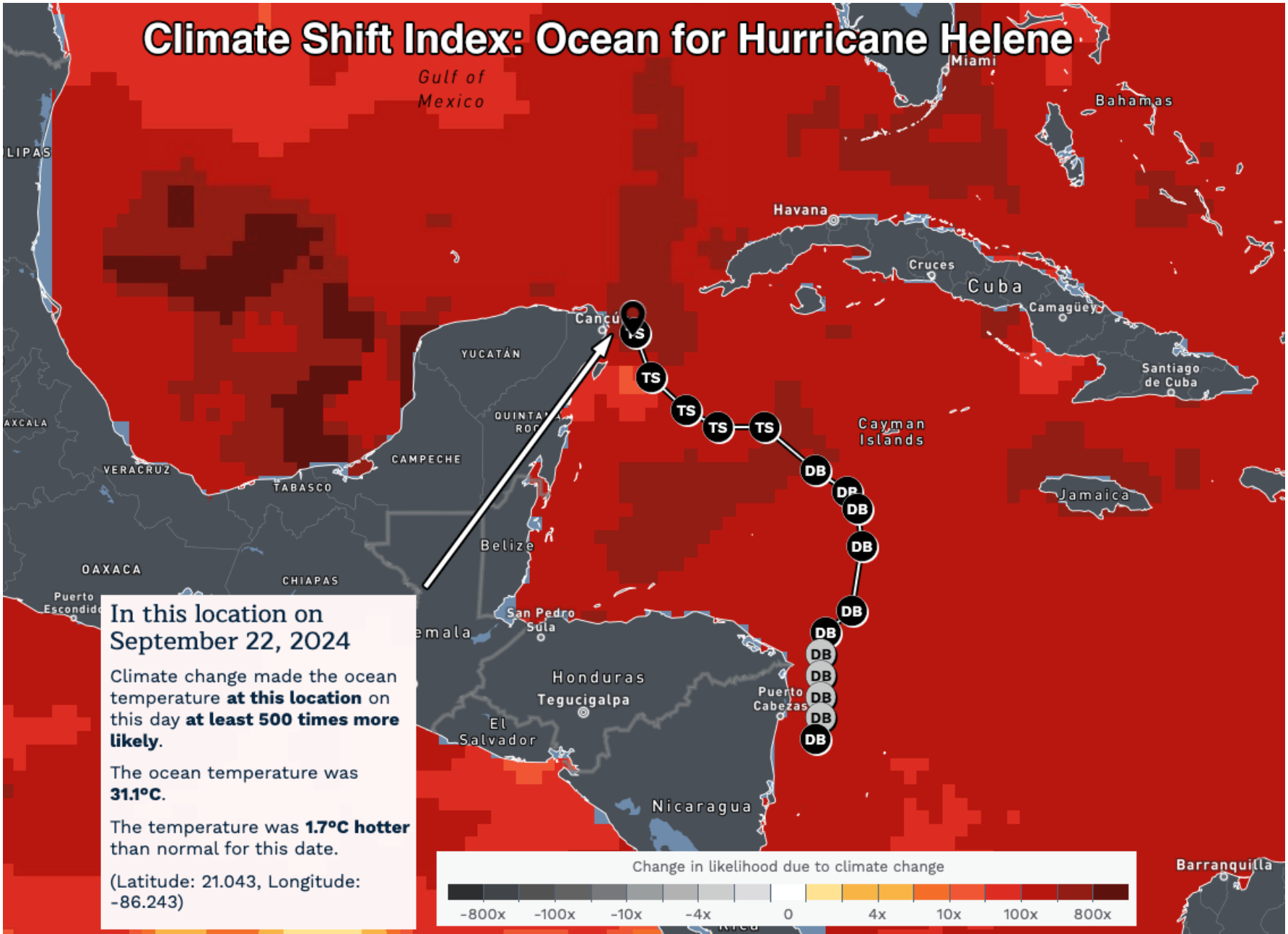
Rank	Disaster	Location	Year	Deaths
1	Drought	Ethiopia, Sudan	1983-85	450,000
2	Drought	Somalia	2010-12	258,000
3	Drought	Ethiopia	1973-78	100,000
4	Drought	Mozambique	1981-85	100,000
5	Drought	Niger	1910-14	85,000
6	Drought	Somalia	2017-18	44,700
7	Drought	Somalia	2022-23	>43,000
8	Drought	Cabo Verde	1946	30,000
9	Drought	Cabo Verde	1920	24,000
10	Drought	Cabo Verde	1940-44	20,000
11	Drought	Somalia	1974-76	19,000
12	Storm Daniel	Libya	2023	13,200
13	Drought	Cabo Verde	1900	11,000
14	Drought	Chad	1981-85	3,000
14	Flood	Algeria	1927	3,000
16	Flood	DRC, Rwanda, Uganda	2023	2,984
17	Drought	Uganda	2022	2,465
18	Flood	Somalia	1997	2,311
19	Drought	Ethiopia	1965	2,000
20	Flood	Chad, Niger, Nigeria, Mali, Cameroon, Côte d'Ivoire	2024	1,489
21	Cyclone Freddy	Malawi, Mozambique, Madagascar, Zimbabwe	2023	1,412
22	Cyclone Idai	Mozambique, Zimbabwe, Malawi, Madagascar	2019	1,294
23	Mudslide	Sierra Leone	2017	1,102
24	Flood	Algeria	2001	921
25	Flood	Nigeria, Niger, Benin, Chad, Mali, Cameroon	2022	876
26	Cyclone Eline	Mozambique, Madagascar, Zimbabwe	2000	800
27	Flood	Morocco	1995	730
28	Flood	Egypt	1994	600
29	Drought	Somalia	1987	600
30	Flood	South Africa	2022	544

Data from EM-DAT except Somalia 2022 (Watson and Checchi, 2023); Somalia 2017-18 (Warsame *et al.* 2023); and Somalia 2010-12 (FEWS NET).

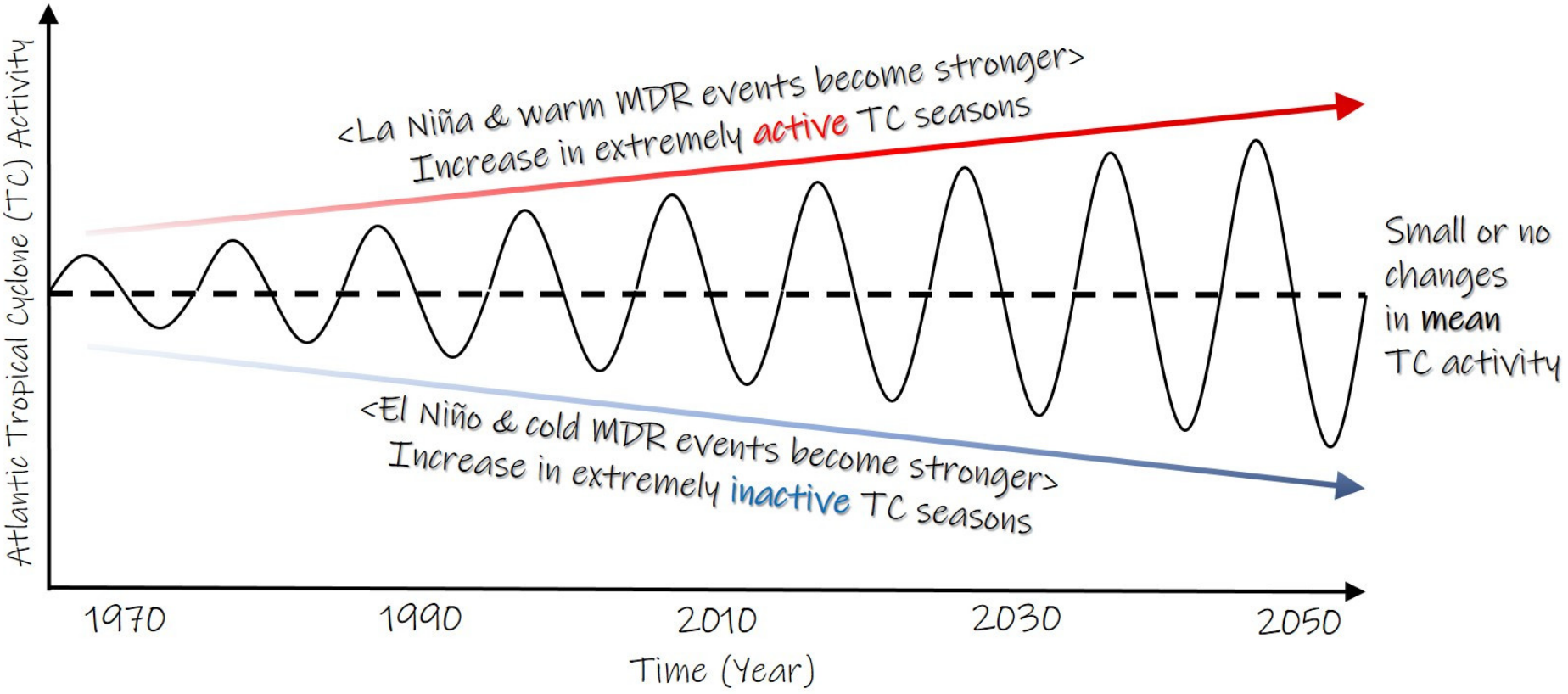
Effective Messaging by World Weather Attribution, 2024: "Human-caused climate change intensified all of the 10 deadliest extreme weather events of the last 20 years and contributed to more than 570,000 deaths."



Great Realtime Attribution Tool: Climate Central's Climate Shift Index



My Biggest Challenge: Extreme Weather is Increasing Because Climate Change is Causing Atmospheric Dynamics Changes - How to Communicate That?



Extreme Summer Jet Stream Patterns Predicted to Increase 50% by 2100

(Mann et al., 2017, Projected changes in persistent extreme summer weather events: The role of quasi-resonant amplification)

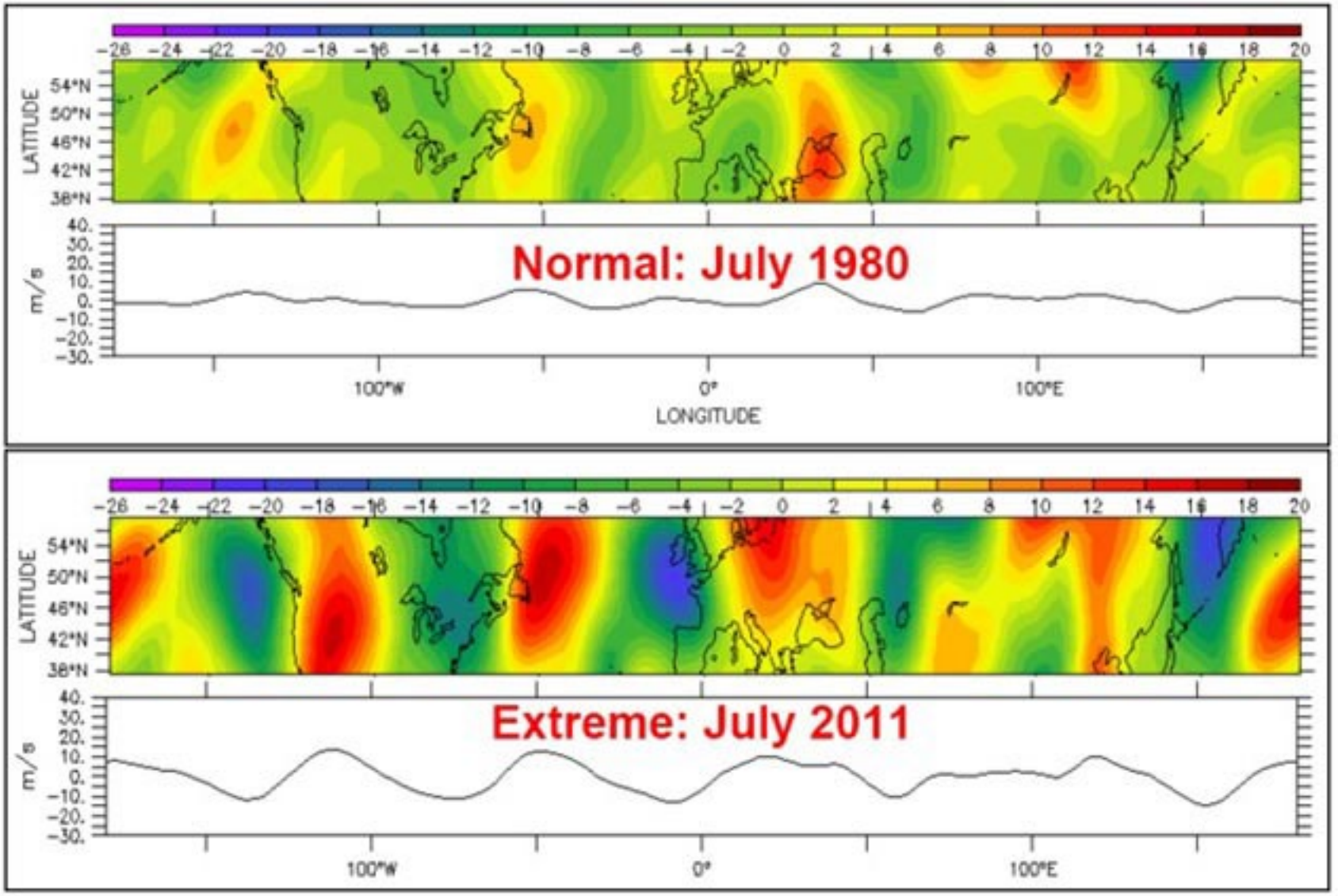


Figure 1. The northward wind speed at an altitude of 300 mb in the mid-latitudes of the Northern Hemisphere during July 2011 and July 1980. (Credit: Vladimir Petoukhov, https://theconversation.com/weather-extremes-atmospheric-waves-and-climate-change-12581)

More Research Needed to Improve Communication Strategies

nature climate change

Brief Communication | Open access | Published: 13 June 2024

Extreme weather events do not increase political parties' environmental attention

Tim Wappenhans ✉, António Valentim, Heike Klüver & Lukas F. Stoetzer

Nature Climate Change **14**, 696–699 (2024) | Cite this article

8433 Accesses | **113** Altmetric | Metrics

Abstract

Exposure to extreme weather events can make people more aware of environmental changes; however, it remains unclear how such events influence politicians' behaviour. Combining supervised learning algorithms on over 260,000 press releases by European parties with a difference-in-differences design, we find that apart from Green parties, extreme weather events do not increase attention towards environmental issues. This suggests the consequences of climate change might not directly increase political attention.

https://blogs.lse.ac.uk/europpblog/2024/12/10/there-is-little-evidence-extreme-weather-events-spur-political-action-on-climate-change/

Communicate Safely! Consult http://csldf.org

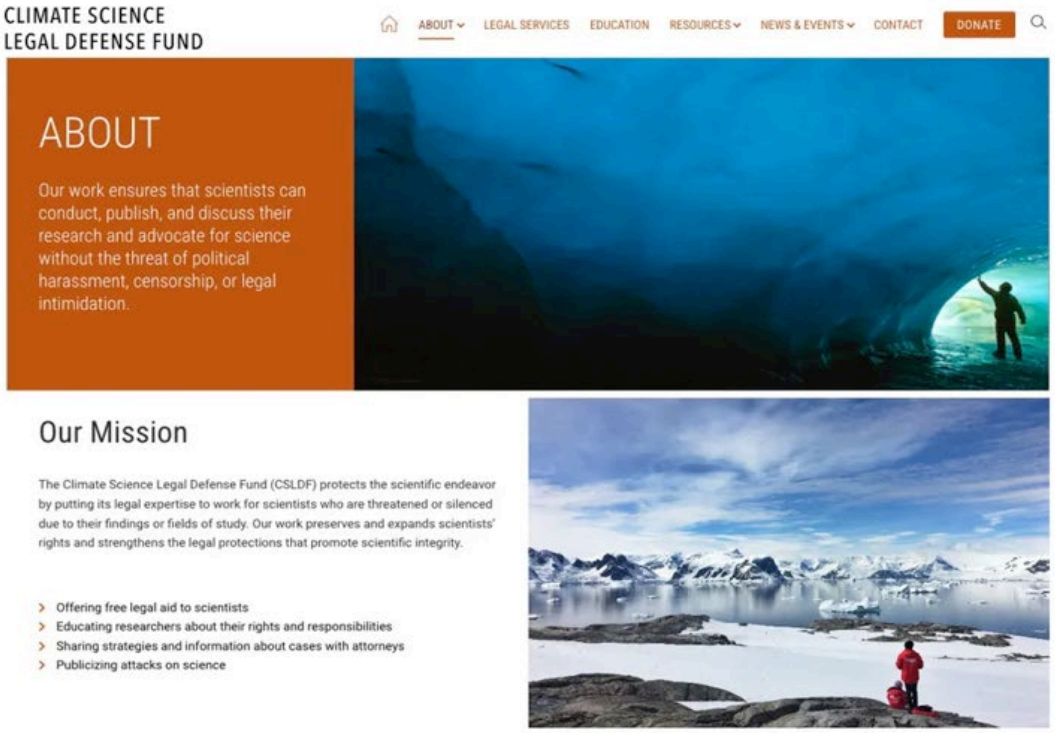
YALE Climate Connections

ARTICLES ▾ EN ESPAÑOL ▾ RADIO PROGRAM ▾ ABOUT ▾ NEWSLETTER

Climate Science Legal Defense Fund gearing up for a busy 4 years

The Climate Science Legal Defense Fund is gearing up for a high-stakes protracted struggle to defend climate scientists during in coming Trump presidency.

by JEFF MASTERS
DECEMBER 9, 2024



The Climate Science Legal Defense Fund (CSLDF) provides free legal and educational support to researchers facing harassment and intimidation for their work.

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https://yaleclimateconnections.org/section/eye-on-the-storm/
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