THE 2022 HURRICANE SEASON

Paul Homewood

The Global Warming Policy Foundation
Briefing 62

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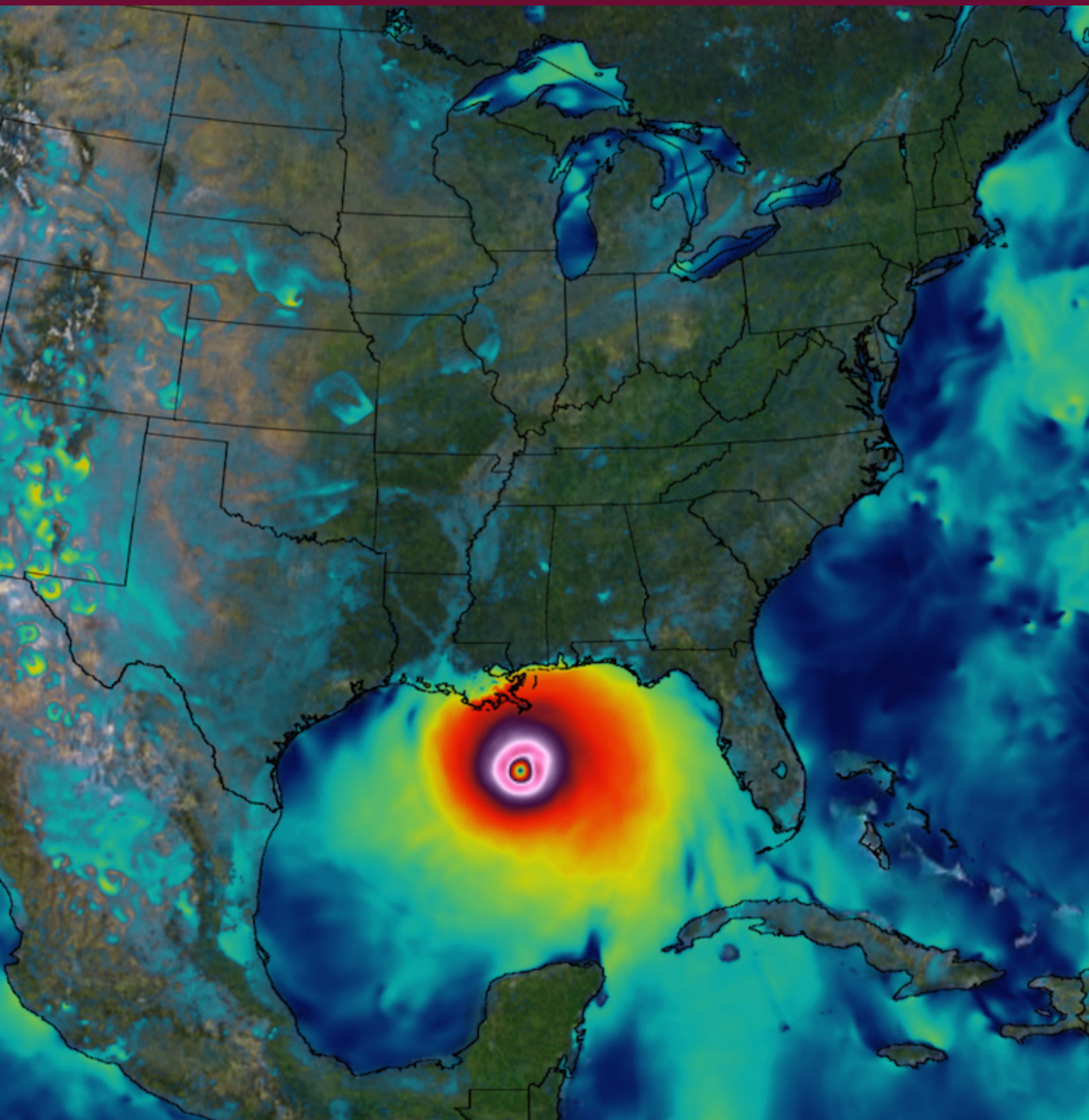

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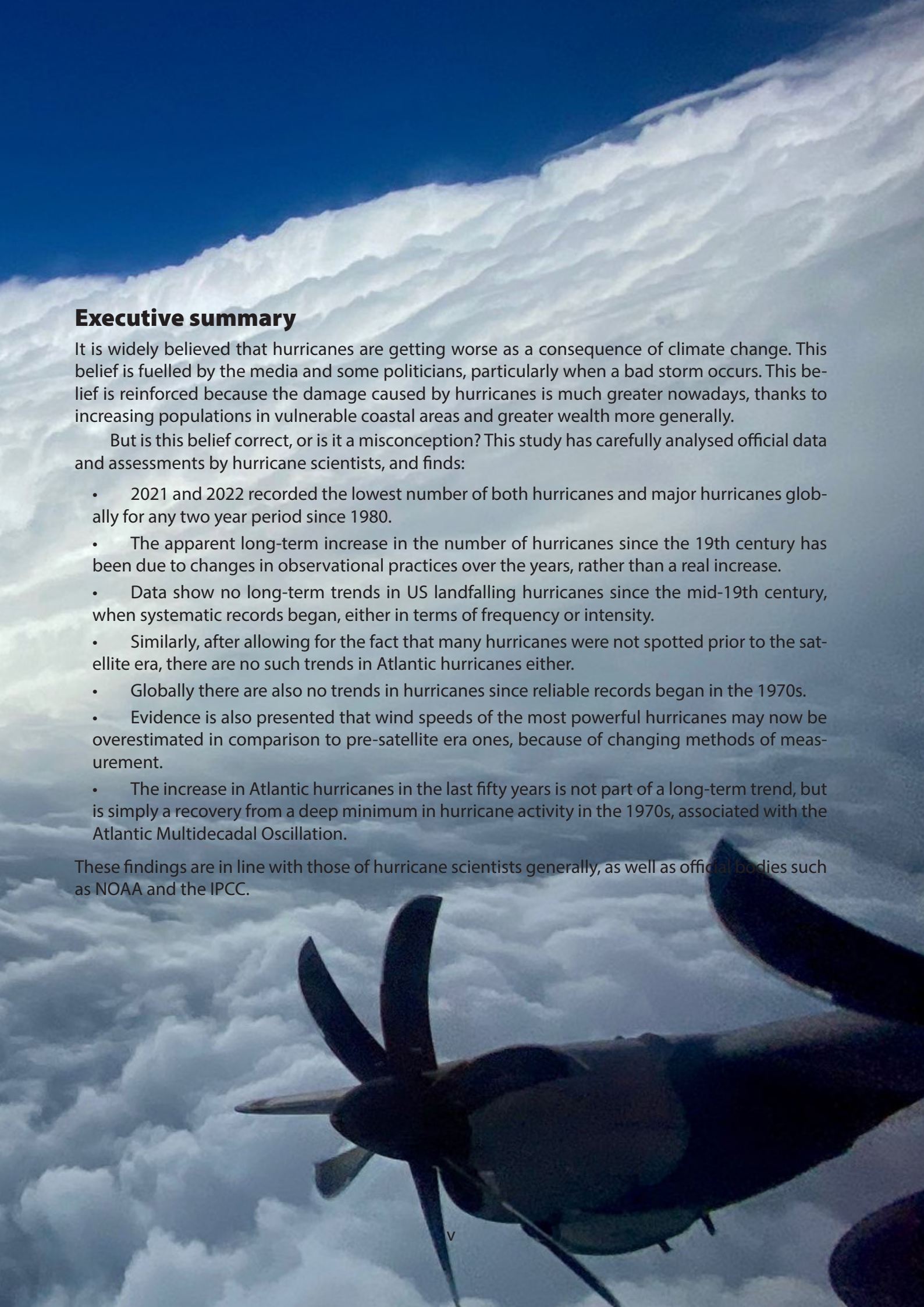
About the author

Paul Homewood had a career as an accountant in industry. He has been writing on climate and energy issues since 2011.



Executive summary

It is widely believed that hurricanes are getting worse as a consequence of climate change. This belief is fuelled by the media and some politicians, particularly when a bad storm occurs. This belief is reinforced because the damage caused by hurricanes is much greater nowadays, thanks to increasing populations in vulnerable coastal areas and greater wealth more generally.

But is this belief correct, or is it a misconception? This study has carefully analysed official data and assessments by hurricane scientists, and finds:

- 2021 and 2022 recorded the lowest number of both hurricanes and major hurricanes globally for any two year period since 1980.
- The apparent long-term increase in the number of hurricanes since the 19th century has been due to changes in observational practices over the years, rather than a real increase.
- Data show no long-term trends in US landfalling hurricanes since the mid-19th century, when systematic records began, either in terms of frequency or intensity.
- Similarly, after allowing for the fact that many hurricanes were not spotted prior to the satellite era, there are no such trends in Atlantic hurricanes either.
- Globally there are also no trends in hurricanes since reliable records began in the 1970s.
- Evidence is also presented that wind speeds of the most powerful hurricanes may now be overestimated in comparison to pre-satellite era ones, because of changing methods of measurement.
- The increase in Atlantic hurricanes in the last fifty years is not part of a long-term trend, but is simply a recovery from a deep minimum in hurricane activity in the 1970s, associated with the Atlantic Multidecadal Oscillation.

These findings are in line with those of hurricane scientists generally, as well as official bodies such as NOAA and the IPCC.

1. Introduction

Tropical cyclones are intense circular storms that originate over warm tropical oceans. Commonly known as hurricanes, they are also named 'typhoons' in the western Pacific, and 'cyclones' in the Bay of Bengal and northern Indian Ocean. For the purposes of this paper they will all be referred to as hurricanes.

Hurricanes have been known about and reported for many centuries, but systematic recording really only started in the mid-19th century. Categorisation of hurricanes by wind speeds also varies in different parts of the world. Here we will refer to the Saffir-Simpson scale, which is always used for Atlantic hurricanes. The scale is based on one-minute sustained wind speeds, ranging from Category 1, with winds of at least 74 mph, up to Category 5, where winds reach 157 mph.

The purpose of this paper is to examine trends in hurricane frequency and intensity, using official data, as well as summarising the latest science. Section 2 looks at how observation practices have changed over time, and the effect they have had on reported data. Sections 3 and 4 present the data for US landfalling and Atlantic hurricanes respectively. Section 5 presents global trends. Finally, Section 6 reviews the latest findings, as reported in the Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change.

2. Observational methodologies

Since the 19th century, the way we observe, monitor and measure hurricanes has changed out of all recognition, as Hagen and Landsea have summarised (Figure 1). The Atlantic hurricane database (or HURDAT) is maintained by the US National Oceanic and Atmospheric Administration (NOAA), and extends back to 1851. However, because tropical storms and hurricanes spend

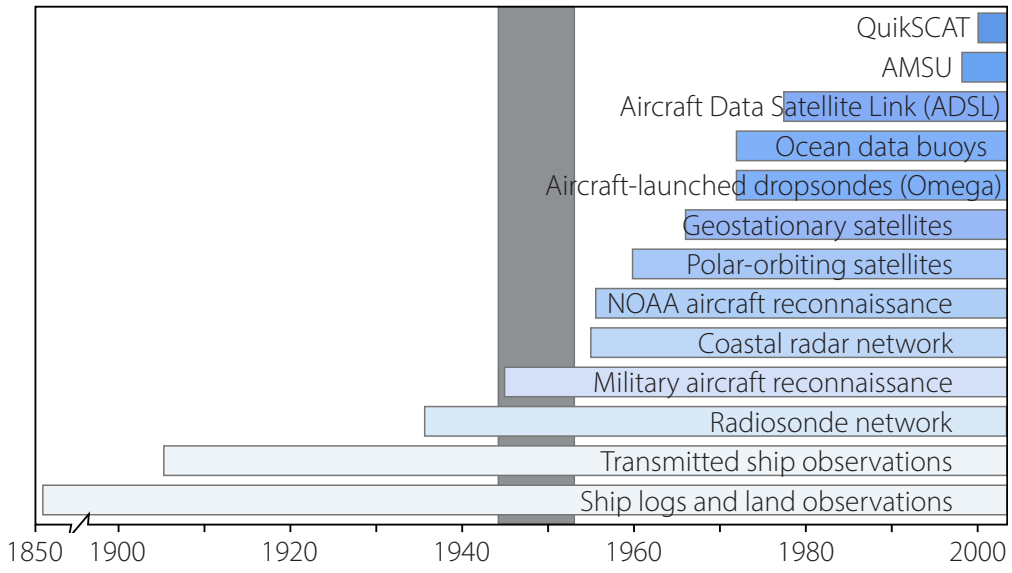


Figure 1: Changes in observational technologies for hurricanes.

Adapted from Hagen and Landsea.[10]

much of their lifetime over the open ocean – some never hitting land – many systems were 'missed' during the late 19th and early 20th centuries. From 1944, aircraft were deployed to systematically monitor hurricanes, and also disturbances that might develop into hurricanes. This did provide much improved surveillance, but still about half of the Atlantic basin was not covered. Beginning in 1966, daily satellite imagery became available at the National Hurricane Center, and thus statistics from this time forward are the most complete.[10]

For hurricanes striking the Atlantic and Gulf coasts of the USA, one can go back further in time, since there are fairly reliable counts due to the relatively high population density in the area since 1900.[1] In the Pacific and Indian Oceans, early coverage was less comprehensive. Full satellite coverage may not have been available till around 1980.[2]

This lack of coverage has a particular impact on the reporting of short lived storms, according to Vecchi and Knutson,[3] who conclude that:

> …after adjusting for such an estimated number of missing storms, there is a small nominally positive upward trend in tropical storm occurrence from 1878–2006. But statistical tests reveal that this trend is so small, relative to the variability in the series, that it is not significantly distinguishable from zero…Thus the historical tropical storm count record does not provide compelling evidence for a greenhouse warming induced long-term increase.

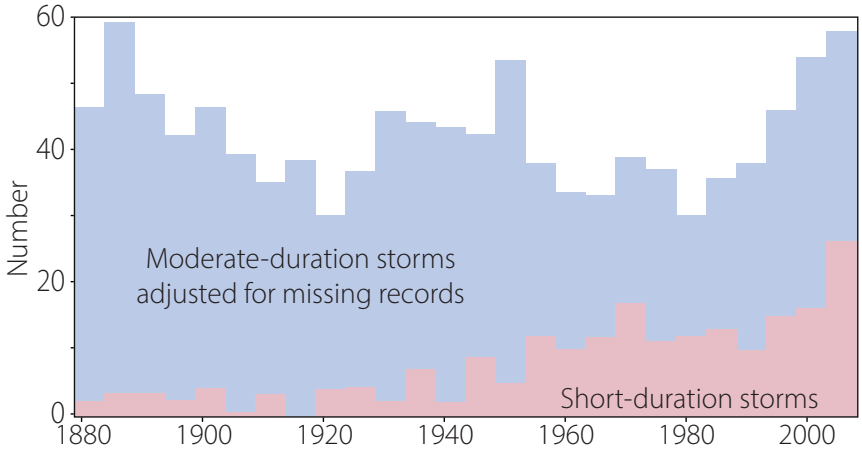


Figure 2: The effect of missing storms.

Their results are redrawn in Figure 2.

It is not only the number of storms which tended to be underestimated. Hagen and Landsea demonstrated that the strength of the most intense hurricanes (Category 5) were also underestimated prior to the satellite era:

> Observations of the peak intensity in strong hurricanes were much less common during the late 1940s/early 1950s when compared with recent years because the ability to measure the central pressure and peak winds in major hurricanes was very limited during the late 1940s/early 1950s. A Category 5 designation would be possible

if a hurricane made landfall as a Category 5 at or very near a weather station, or if a ship passed through the center while at Category 5 intensity. Aircraft reconnaissance was generally only capable of recording Category 4 conditions at most because of the inability to penetrate intense hurricanes.[10]

They reanalysed ten Category 5 hurricanes, from between 1992 and 2007, and found that only two would have been categorised as that category using 1940s' technology. They concluded that several Category 4 and 5 hurricanes would probably have been misclassified as being weaker prior to the satellite era.

It is clear from all of the above that both the frequency and intensity of hurricanes were underestimated prior to the satellite era, making measurement of long-term trends very difficult.

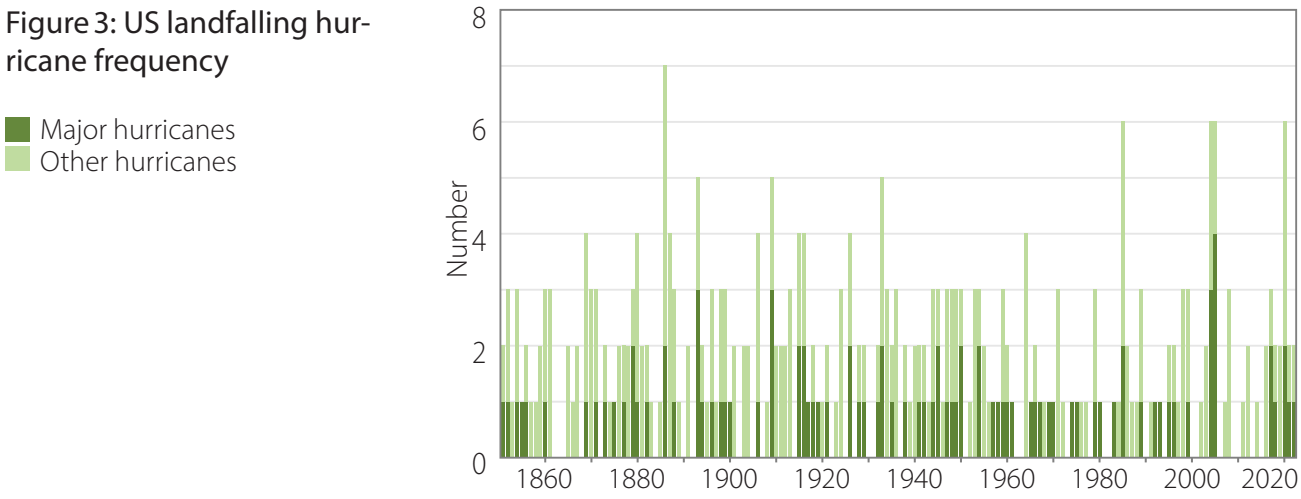
3. US landfalling hurricanes

As already noted, the longest record with reliable counts of hurricanes is for the US Atlantic and Gulf coasts. The US Hurricane Research Division (HRD), which is part of NOAA, has compiled lists of US landfalling hurricanes going back to 1851. However, although population density was quite high in many parts of the coastline, it was quite sparse in others, such as Texas and Florida, until around 1900. The list may therefore be incomplete up to the start of the 20th century. There is also the issue of the Civil War years; there were no hurricanes listed at all in 1862 to 1864. Clearly this is not a reliable count.

Considerable re-analysis work has been carried over the years by the HRD, using a variety of records to reassess the original measurements of wind speeds and central pressure. In the past, it was rare for such measurements to be taken at the exact centre or strongest part of the storm. By re-analysing available data, the scientists have been able to piece together the wider picture, and thus estimate the missing parts.

Figure 3 shows all storms since 1851 that have made landfall as hurricanes on the US mainland, either major (defined as Category 3 and over on the Saffir-Simpson scale) or other. Neither

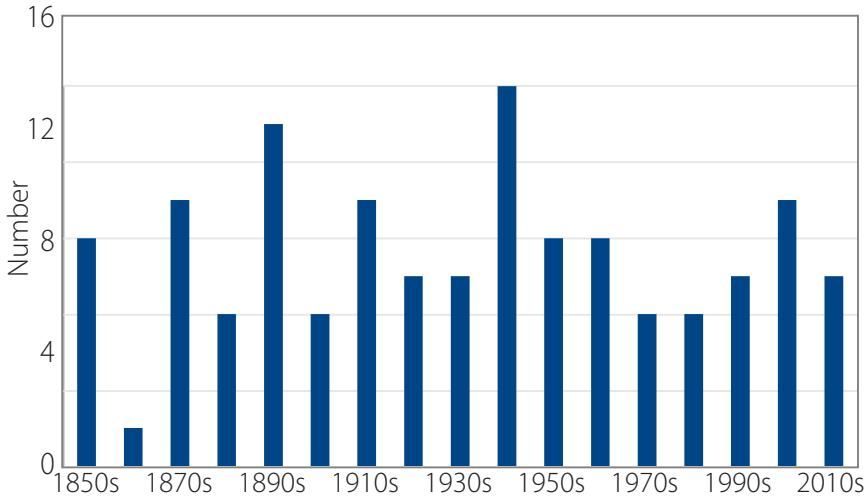
Figure 3: US landfalling hurricane frequency



series shows any evidence of increasing frequency. The busiest decades for major hurricanes were the 1940s and 1890s, whilst the most recent decade, 2011–2020, saw just five, which is slightly below average (Figure 4).

Figure 4: Atlantic hurricane frequency – decadal

Per US Hurricane Research Division.



Prior to the satellite era, hurricane wind speeds were usually estimated from their central pressure, which could be more readily measured. An anemometer would have been unlikely to have been placed at the exact point where wind speeds were highest, and would have been unlikely to have survived if it had been. However, in recent years wind speeds have been calculated using satellite and aircraft data. This has created a data inconsistency, because estimates of wind speeds for hurricanes now tend to be higher than for past ones with similar central pressures.

Table 1 shows the effect. The top line shows a modern hurricane Ian, in 2022, which had a central pressure of 940 mb and estimated sustained wind speeds of 150 mph at landfall. The other lines show a series of major hurricanes from earlier years, with similar pressures but apparently much lower wind speeds, or with much lower pressures, but apparently similar windspeeds.

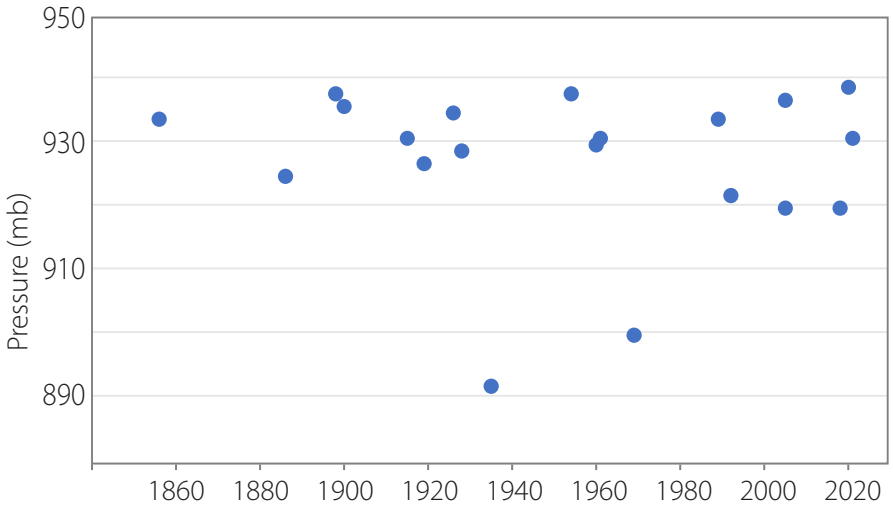
Modern methods may provide more accurate estimates of wind speeds, but if that is true they were consistently underestimated in the past. For that reason it is worth looking at the time distribution of the most intense hurricanes (Figure 5). The two

Table 1: Pressure and windspeed in selected US hurricanes

Hurricane	Year	Central pressure (mb)	Estimated wind speed (mph)
Ian	2022	940	150
Galveston	1915	940	132
Hazel	1954	940	132
Indianola	1886	925	150
Great Miami	1926	929	144
Laura	2020	939	150

Figure 5: Most intense land-falling hurricanes in the US

Per US Hurricane Research Division.



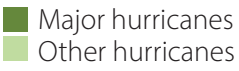
most intense ones – those with the lowest pressure – were the Labor Day hurricane in 1935, and Camille in 1969. These were also the two strongest hurricanes as measured by wind speeds. Hurricane Ian is claimed to be the fifth most powerful to hit the US in terms of wind speed, but this clearly is not borne out by the pressure data, with Ian not even appearing in the top 20.

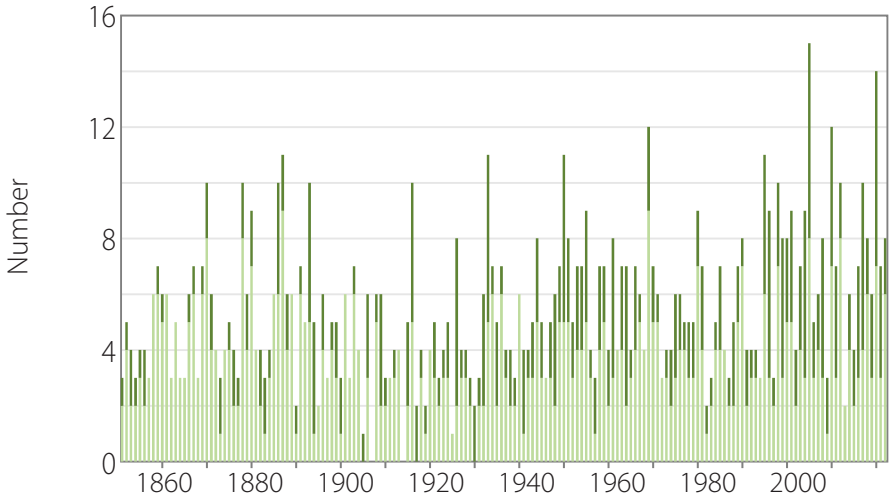
As with the frequency of hurricanes, the data clearly shows no evidence that hurricanes are becoming more intense, or that extremely intense ones are becoming more common.

4. Atlantic hurricanes

There were eight Atlantic hurricanes in 2022, including two major ones (Figure 6).

Figure 6: Atlantic hurricane frequency





As already noted, many hurricanes in the Atlantic were missed prior to the satellite era. Vecchi et al. have shown that when these missing hurricanes are accounted for, basin-wide hurricane and major hurricane activity since the 1970s does not suggest a centennial-scale increase, but instead a recovery from a deep minimum in the 1960s–1980s.

NOAA concur with Vecchi's conclusions, stating:[4]

> There is no strong evidence of century-scale increasing trends in US landfalling hurricanes or major hurricanes. Similarly for Atlantic *basin-wide* hurricanes (after adjusting for observing capabilities), there is not strong evidence for an increase since the late 1800s in hurricanes, major hurricanes, or the proportion of hurricanes that reach major hurricane intensity.

This discrepancy of missing hurricanes can be seen in Figure 7. The top panel shows 1922, when there were five tropical storms, including three hurricanes, recorded in the Atlantic. The bottom panel is for 2022, when there were fourteen and eight respectively. However, as the tracking charts for the two years show, all of the hurricanes in 1922 passed close to land. By contrast, in 2022, most stayed well out to sea.

The deep minimum in Atlantic hurricane activity in the

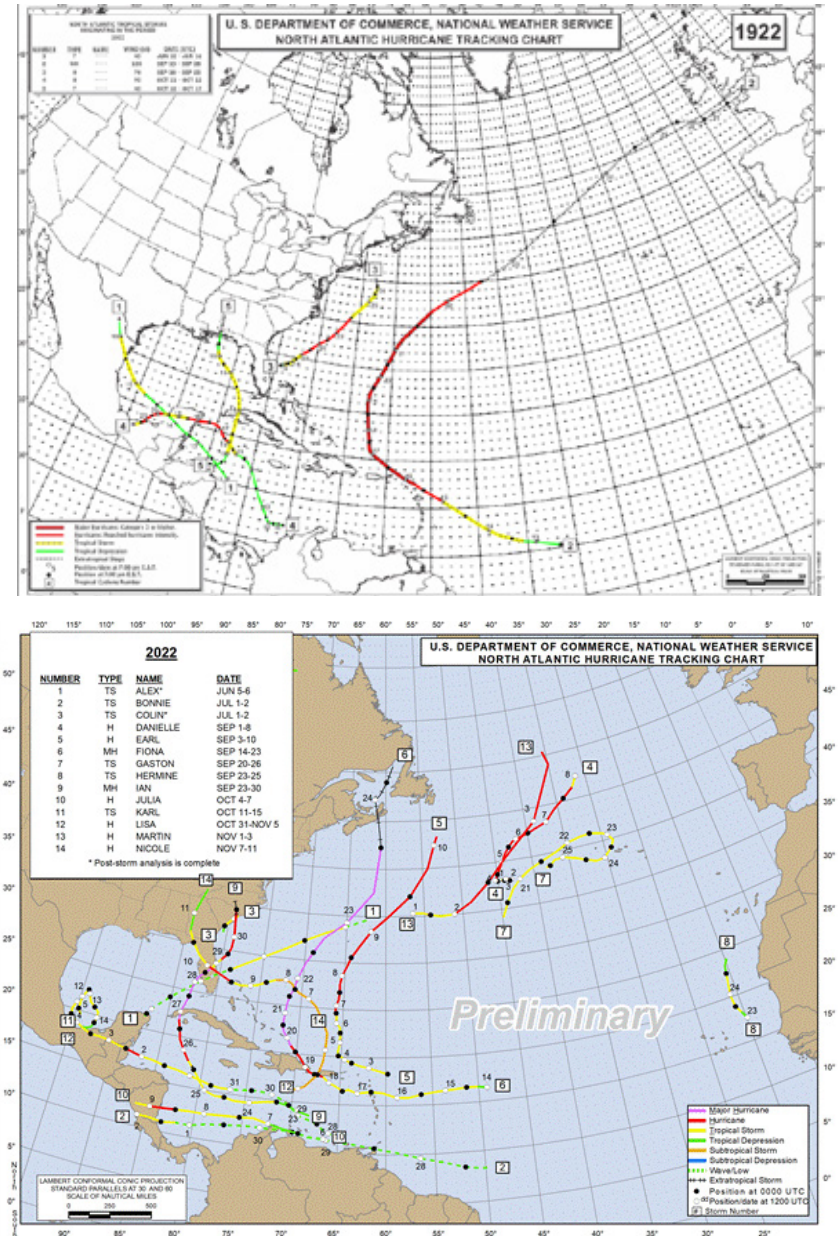


Figure 7: Atlantic hurricane tracks

Top: 1922; bottom, 2022. Source: Hurdat.[11,12]

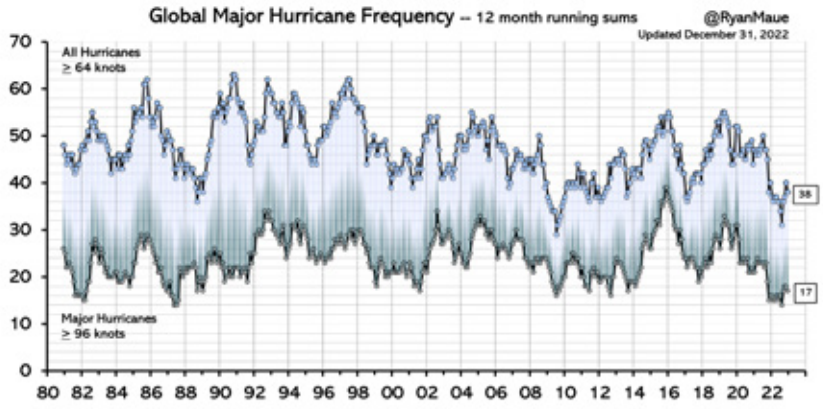
1960s to 1980s is associated with the cold phase of the Atlantic Multidecadal Oscillation (AMO). According to NOAA, the number of tropical storms that mature into severe hurricanes is much greater during the warm phase of the AMO than in its cool phases.[5] It has also been suggested that increase in tropical storm frequency in the Atlantic basin since the 1970s has been at least partly driven by decreases in aerosols from human activity and volcanic forcing.[4] It is however worth noting that the previous cold phase of the AMO, between the 1900s to 1920s, also coincided with reduced hurricane activity.

5. Global trends

As noted, comprehensive observation of hurricanes worldwide probably did not start till around 1980. Figure 8 plots the number of hurricanes and major hurricanes worldwide on a 12-month running basis.[6] Trends of both are either flat or decreasing.

Figure 8: Global hurricane frequency

The top trace is all hurricanes; the lower one is major hurricanes. Source: Ryan Maue.

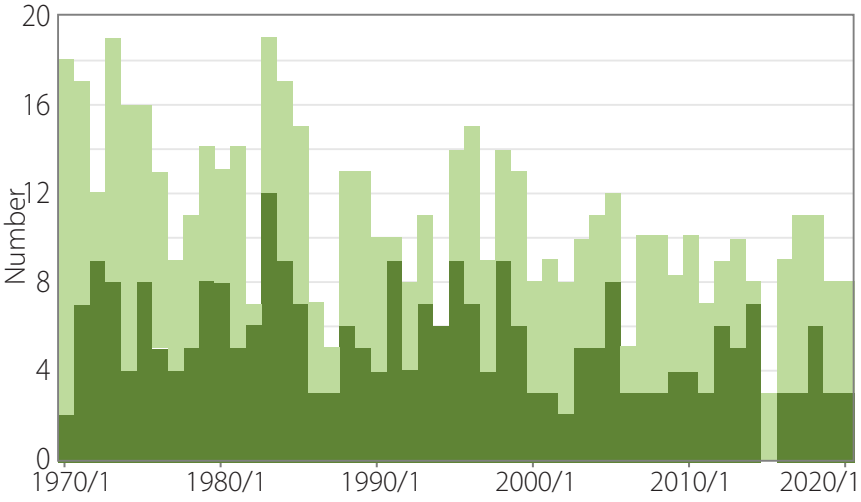


The Australian Bureau of Meteorology maintain records of tropical cyclones, dating back to 1971, that have occurred in the Australian region.[7] There is a clearly declining trend in both overall numbers and severe storms (equivalent to Category 3; Figure 9).

In addition, the Japan Meteorological Agency, which is responsible for monitoring and forecasting typhoons in the

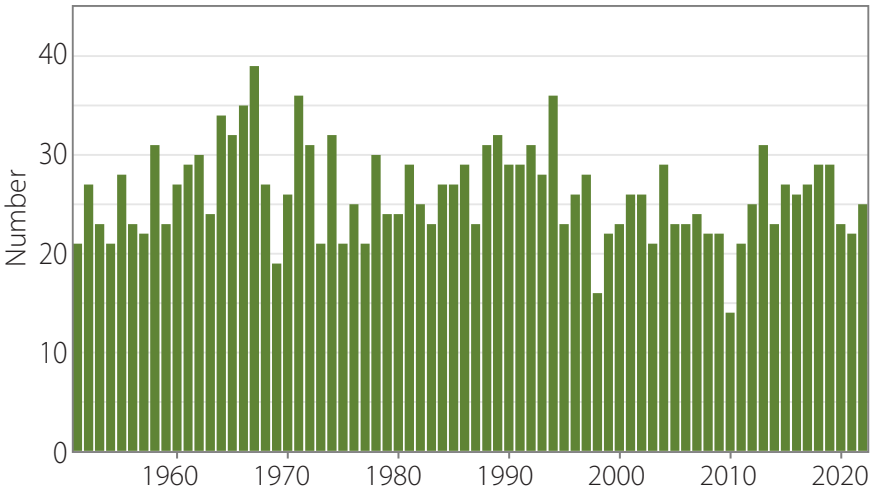
Figure 9: Tropical cyclone frequency in Australian region

Major hurricanes
Other hurricanes



Western Pacific, keeps records of all tropical cyclones and tropical storms.[8] This data again shows a declining trend since 1951 (Figure 10).

Figure 10: Tropical storms and typhoons in Western Pacific



6. What do the IPCC say?

The Intergovernmental Panel on Climate Change, in its Sixth Assessment Report, noted that 'there is low confidence in long term (multi-decadal to centennial) trends in the frequency of all category tropical cyclones', confirming other recent studies.[9] They did note that the global proportion of major hurricanes had increased over the last four decades. However, as already shown, this is a product of the AMO, and not part of any long-term trend.

The report made two other claims. The first was that the latitude where hurricanes reach their peak intensity had shifted northwards, while the second was that climate change had increased heavy precipitation associated with tropical cyclones. However, this claim was derived from highly controversial weather attribution models; the IPCC were unable to find any empirical evidence to support this claim.

Notes

1. NOAA: https://www.aoml.noaa.gov/hrd/hurdat/All_U.S._Hurricanes.html.
2. Judith Curry: https://www.thegwpf.org/gwpf-tv-climate-hysteria-vs-hurricane-resilience/.
3. GFDL - https://www.gfdl.noaa.gov/historical-atlantic-hurricane-and-tropical-storm-records/.
4. GFDL - https://www.gfdl.noaa.gov/global-warming-and-hurricanes/.
5. NOAA - https://www.aoml.noaa.gov/phod/faq/amo_faq.php.
6. Dr Ryan Maue - https://climatlas.com/tropical/.
7. Australian BOM - http://www.bom.gov.au/cyclone/tropical-cyclone-knowledge-centre/history/climatology/.
8. JMA - https://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/climatology.html.
9. IPCC - https://www.ipcc.ch/assessment-report/ar6/.
10. AB Hagen and C Landsea – 'On the classification of extreme atlantic hurricanes utilizing mid-twentieth-century monitoring capabilities'. Journal of Climate, 2012; 25(13): 4461–75.
11. NOAA - https://www.aoml.noaa.gov/hrd/hurdat/1922.html.
12. NOAA - https://www.aoml.noaa.gov/hrd/hurdat/DataByYearandStorm.html.

About the Global Warming Policy Foundation

People are naturally concerned about the environment, and want to see policies that protect it, while enhancing human wellbeing; policies that don't hurt, but help.

The Global Warming Policy Foundation (GWPF) is committed to the search for practical policies. Our aim is to raise standards in learning and understanding through rigorous research and analysis, to help inform a balanced debate amongst the interested public and decision-makers. We aim to create an educational platform on which common ground can be established, helping to overcome polarisation and partisanship. We aim to promote a culture of debate, respect, and a hunger for knowledge.

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