

# We had all better hope these scientists are wrong about the planet's future

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By [Chris Mooney](#) March 22 at 8:00 AM



Climatologist James Hansen on the Eleuthera coastal ridge on Nov. 22, 2015, in Eleuthera, Bahamas. (Charles Ommanney for The Washington Post)

*This story has been updated.*

An influential group of scientists led by James Hansen, the former NASA scientist often credited with having drawn the first major attention to climate change in 1988 congressional testimony, has published a dire climate [study](#) that suggests the impact of global warming will be quicker and more catastrophic than generally envisioned.

The research invokes collapsing ice sheets, violent megastorms and even the hurling of boulders by giant waves in its quest to suggest that even 2 degrees Celsius of global warming above pre-industrial levels would be far too much. Hansen has called it the most important work he has ever done.

The sweeping paper, 52 pages in length and with 19 authors, draws on evidence from ancient climate change or “paleo-climatology,” as well as climate experiments using computer models and some modern observations. Calling it a “paper” really isn’t quite right — it’s actually a synthesis of a wide range of old, and new, evidence.

[\[The world's most famous climate scientist just outlined an alarming scenario for our planet's future\]](#)

“I think almost everybody who’s really familiar with both paleo and modern is now very concerned that we are approaching, if we have not passed, the points at which we have locked in really big changes for young people and future generations,” Hansen said in an interview.

The research, [appearing Tuesday](#) in the open-access journal Atmospheric Chemistry and Physics, has had a long and controversial path to life, having first appeared as a “discussion paper” in the same journal, subject to live, online peer review — a novel but increasingly influential form of scientific publishing. Hansen first told the news media about the research last summer, before this process was completed, leading to [criticism](#) from some journalists and fellow scientists that he might be jumping the gun.

What ensued was a high-profile debate, both because of the dramatic claims and Hansen’s formidable reputation. And his numerous co-authors, including Greenland and Antarctic ice experts and a [leader](#) of the United Nations’ Intergovernmental Panel on Climate Change, were nothing to be sniffed at.

After [record downloads](#) for the study and an [intense public review process](#), a revised version of the paper has now been accepted, according to both Hansen and Barbara Ferreira, media and communications manager for the European Geophysical Union, which publishes Atmospheric Chemistry and Physics. Indeed, the article is [now freely readable](#) on the Atmospheric Chemistry and Physics website.

The paper, according to Ferreira, was subject to “major revisions in terms of organisation, title and conclusions.” Those came in response to criticisms that can all be [read publicly](#) at the journal’s website. The paper also now has two additional authors.

Most notably, perhaps, the editorial process led to the removal of the use of the phrase “highly dangerous,” in the paper’s title, to describe warming the planet by 2 degrees Celsius above pre-industrial levels.

*[\[What we’re doing to the Earth has no parallel in 66 million years, scientists say\]](#)*

The original paper’s title was “Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2 °C global warming is highly dangerous.” The final title is “Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2 °C global warming could be dangerous.”

But nonetheless, James Hansen’s climate catastrophe scenario now takes its place in the official scientific literature relatively intact. So let’s rehearse that scenario, again, for the record.

Hansen and his colleagues think that major melting of Greenland and Antarctica can not only happen quite fast — leading to as much as several meters of sea level rise in the space of a century, depending on how quickly melt rates double — but that this melting will have dramatic *climate change* consequences, beyond merely raising sea levels.

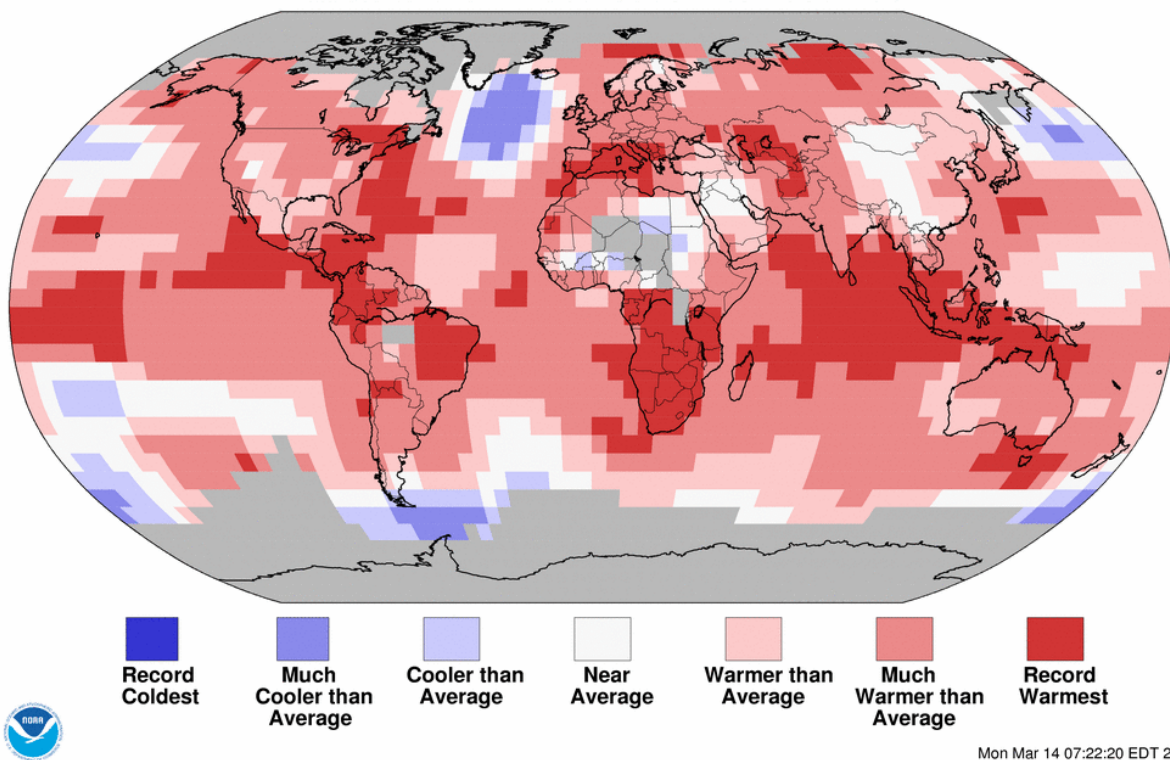
That's because, they postulate, melting will cause a "stratification" of the polar oceans. What this means is that it will trap a pool of cold, fresh meltwater atop the ocean surface, with a warmer ocean layer beneath. We have actually seen a possible hint of this with the anomalously cold "blob" of ocean water off the southern coast of Greenland, which some have attributed to Greenland's melting.

Indeed, shortly before the new paper's publication, the National Oceanic and Atmospheric Administration released [new recent data](#) on the globe's temperature that certainly bears a resemblance to what Hansen is talking about. For not only was the globe at a record warmth overall over the last three months, but it also showed anomalous cool patches in regions that Hansen suspects are being caused by ice melt – below Greenland, and also off the tip of the Antarctic peninsula.

## Land & Ocean Temperature Percentiles Dec 2015–Feb 2016

NOAA's National Centers for Environmental Information

Data Source: GHCN–M version 3.3.0 & ERSST version 4.0.0



(National Oceanic and Atmospheric Administration.)

“My interpretation is that this is the beginning,” Hansen says of these cool patches in curious parts of the global ocean. “And it’s one or two decades sooner than in our model.”

However, when it comes to both the melt rates for Greenland and Antarctica, and also these cool ocean patches, we have a very limited time span of observations. It is far from clear, yet, that

Hansen's interpretation of them will prevail, and the new study also suggests closely observing these areas in coming years.

Stratification, the key idea in the new paper, means that warm ocean water would potentially reach the base of ice sheets that sit below sea level, melting them from below (and causing more ice melt and thus, stratification). It also means, in Hansen's paper, a slowdown or even eventual shutdown of the overturning circulation in the Atlantic ocean, due to too much freshening in the North Atlantic off and around Greenland, and also a weakening of another overturning circulation in the Southern Ocean.

This, in turn, causes cooling in the North Atlantic region, even as global warming creates a warmer equatorial region. This growing north-south temperature differential, in the study, drives more intense mid-latitude cyclones, or storms. The study suggests such storms may kick up gigantic oceanic waves, which may even be capable of feats such as hurling boulders in some locations, not unlike the huge rocks seen on the Bahamian island of Eleuthera, which I [visited with Hansen and his co-author](#), geologist Paul Hearty, in November.

*[\[That's heavy: Climate-change warnings include rising seas and wild weather shifts. But giant flying boulders?\]](#)*

These rocks play a key role in the new paper, just as they did in the original study draft. Indeed, long before the current paper, Hearty had documented, in [peer-reviewed publications](#), that Eleuthera's rocks appear to have come from the ocean and to have been lifted high up onto a coastal ridge. This appears to have happened during a past warm period, the Eemian, some 120,000 years ago, when the planet was only slightly warmer than today but seas were far higher — but the idea is that something like it could happen again.





The giant boulders of Eleuthera that have sparked a great debate among scientists about their origin. On the left is 'The Bull' (2,000 tons) and on the right is 'The Cow' (1,000 tons). (Charles Ommanney for The Washington Post)

The paper contains many ideas and departures, but the key one is its suggestion of the possibility of greater sea level rise in this century than forecast by the U.N. Intergovernmental Panel on Climate Change.

“The models that were run for the IPCC report did not include ice melt,” Hansen said at a news conference regarding the new paper Monday. “And we also conclude that most models, ours included, have excessive small scale mixing, and that tends to limit the effect of this freshwater lens on the ocean surface from melting of Greenland and Antarctica.”

There is a great deal at stake. Hansen has [cited](#) the paper in court proceedings in a case playing out in Oregon, where a series of young plaintiffs, including his granddaughter Sophie, are suing the United States for violating their constitutional rights by allowing fossil fuel burning. While scientists will have to digest the new version of the paper, when the initial draft paper was released, at the website of Atmospheric Chemistry and Physics Discussions, it prompted both scientific praise and also major skepticism.

David Archer, a geoscientist at the University of Chicago and a reviewer for the first round of the paper, [called it](#) “another Hansen masterwork of scholarly synthesis, modeling virtuosity, and insight, with profound implications.” But Peter Thorne, another official reviewer and a climate researcher with the National University of Ireland Maynooth, [wrote that](#) “it is far from certain

that the results contended shall match what will happen in the real-world.” Thorne also expressed his “personal discomfort at the paper being openly and actively publicized before the discussion period is complete.”

Michael Mann, a Pennsylvania State University climate scientist familiar with the original study, said: “Near as I can tell, the issues that caused me concern originally still remain in the revised manuscript. Namely, the projected amounts of meltwater seem unphysically large, and the ocean component of their model doesn’t resolve key wind-driven current systems (e.g. the Gulf Stream) which help transport heat poleward. That makes northern hemisphere temperatures in their study too sensitive to changes in the Atlantic meridional overturning ocean circulation,” the scientific name for the ocean circulation in the Atlantic that, the study suggests, could shut down.

However, another Penn State researcher, glaciologist Richard Alley, said by email that “though this is one paper, it usefully reminds us that large and rapid changes are possible, and it raises important research questions as to what those changes might mean if they were to occur. But, the paper does not include enough ice-sheet physics to tell us how much how rapidly is how likely.”