The Cold Blob That's Heating Europe

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1. Introduction

Climate change is definitely changing our climate (well duh!). I keep seeing additional clues as to how. Of course, so do climatologists, and they are making guesses, and running endless variations of climate models, hoping to fully understand what's happening.

Earth's climate / weather is an incredibly complex system. I would guess we are at least several years away from having models and computer-fleets to run them on powerful enough to be able to predict the climate effects before they happen.

However, I will keep reporting new findings as they come to light. The latest comes from a recent issue of Science (Reference 1) and helps us understand an effect I reported on in 2021, with an assist from Dr. Hansen.

Stuck: *I've known for some time that, in the U.S., in summer, weather patterns can stall in one place for some time, because I read an article in Scientific American about it in 2019, and consequently wrote the paper on the climate change effect that caused this:*

I occasionally use and reference writings by Dr. James Hansen. If you know anything about climate science, you know who Dr. Hansen is. Once or twice a month his team sends me a brief paper. The post linked below is an update of the above paper and includes additional content from Dr. Hansen's recent paper (7/13/2021). There are also words on the same effect from other sources.

https://energycentral.com/c/ec/stuck

2. The Cold Blob

Global warming disrupts weather in many ways, but Europe's string of record-breaking hot and dry summers has defied an easy link to climate change. Climate models do show Europe warming faster than the rest of the planet, but the recent scorchers were triggered by peculiar weather conditions: masses of hot, dry air parked over the continent, blocking any incursions of cool or moist relief.[1]

A new study suggests global warming could be responsible after all. It proposes a chain of events that starts with an infusion of meltwater from shrinking Arctic ice, which ultimately alters massive ocean currents and regional air circulation patterns. The study, published late last month in Weather and Climate Dynamics, also suggests monitoring such patterns, which are apparent during winter months, could allow forecasters to predict extreme summer heat months to years in advance. "Physically what the authors write makes sense," says Judah Cohen, a weather scientist at Atmospheric and Environmental Research.

[1] Eli Kintisch, Science (on-line subscription), "Is Arctic melt driving European heat waves?" March 15, 2024, https://www.science.org/content/article/cold-blob-arctic-meltwater-may-be-causing-european-heat-waves Above link is to a directly accessed version of this reference that I believe is identical to my on-line subscription version.

Arctic melting—from both floating sea ice and glaciers on Greenland and elsewhere—is adding roughly 6000 cubic kilometers of water or more to the ocean per decade, more than enough to fill the Grand Canyon. As freshwater pours into the North Atlantic Ocean, it sits on top of heavier ocean saltwater and impedes mixing. With less heat being stirred in from below, the surface water gets colder than usual during the fall and winter months, says Marilena Oltmanns, a climate scientist at the U.K. National Oceanography Centre. This phenomenon may explain the so-called "cold blob," a patch of sea in the North Atlantic that NASA modeling suggests is one of the few spots on Earth getting colder.

To explore how the freshwater influx might be affecting weather, Oltmanns and her colleagues needed new salinity measurements in the North Atlantic, which satellites and ocean models struggle to accurately quantify. So, they developed a way to combine data from satellites, buoys, and weather stations to provide a proxy for salinity. They found that Arctic freshwater levels varied sharply from winter to winter, depending on the extent of melting during the previous summer.

Then, after studying 4 decades of ocean and atmospheric data, the team hypothesized how the freshwater and the resulting cold blob might affect European weather. North Atlantic storms draw energy from the boundary between the blob and warm waters farther south, Oltmanns says. When the freshwater-induced cold blobs were more intense, the boundary was sharper, the data showed. The result was stormier winters with more powerful westerly winds.

Because of the Coriolis effect, a phenomenon linked to Earth's rotation, winds can sweep water laterally. As a result, the stronger westerlies move a warm ocean flow called the North Atlantic Current—an extension of the Gulf Stream—northward from roughly 45°N to 60°N. That shift can persist into subsequent summers. And like a barrier, this warm current, curling up and around the British Isles, deflects the jet stream, allowing a mass of hot, dry air, sometimes called a high-pressure blocking system, to camp out over Europe.

That's a complex mechanism, but Oltmanns says the statistics back it up. For example, the team analyzed the 10 hottest and 10 coldest summers in Europe since 1980 and the North Atlantic conditions that preceded them. The hottest summers were all preceded by big freshwater events, whereas the coldest ones weren't, Oltmanns says.

"The study convincingly puts meat on the bones of an expectation I and others have had for a while—that the cold blob south of Greenland would influence North Atlantic weather patterns, as well as those downstream over Europe," says Jennifer Francis, a climate scientist at Woodwell Climate Research Center.

The scenario could complicate another theory about Arctic meltwater: that it could be slowing the Gulf Stream by reducing the amount of salty water that sinks in the North Atlantic and helps drive the current. In theory, a slowing Gulf Stream would deprive Europe of heat and could unleash more extreme weather including deadly cold spells, as dramatized in The Day After Tomorrow, a 2004 climate disaster film. But if the researchers are right, the melting Arctic might make Europe warmer, not colder, Francis says, conclusions that "generally fly in the face of expectations for a more Day After Tomorrow-like scenario."

Oltmanns suggests the study's methods could aid weather forecasters and public health officials during the winter so they could prepare for summer heat. "If we had known the mechanism before," she says, "we could have been able to predict these summers in advance."

Author's comment: I saw "The Day After Tomorrow" at least once. Although I believe it did show very cold conditions in the UK in one scene, its focus was on the Eastern U.S. This was an interesting flic, but not necessarily intended to be accurate.

3. The Stuck High-Pressure Ridge

I referenced my earlier paper "Stuck" in the Intro, and also Dr. Hanen's contributions to this paper. One observation he made was:

…a special factor contributed to the remarkable Pacific Northwest heat wave. Jacob and Reeder discuss the meteorologic origin of an extreme atmospheric Rossby (planetary) wave with a slow-moving high-pressure system that essentially parked over the Pacific Northwest.

For those with short memories, I pulled a recap of that heat wave by Bing's generative AI:

The 2021 Pacific Northwest heatwave was an extreme weather event that significantly impacted Western North America from late June through mid-July 2021. Here are some key details about this unprecedented heatwave:

Extent and Affected Regions:

The heatwave affected several areas in Western North America, including:

- *Northern California*
- *Idaho*
- *Western Nevada*
- *Oregon*
- *Washington State*
- *British Columbia (Canada)*
- *Alberta, Manitoba, the Northwest Territories, Saskatchewan, and Yukon (Canada) during its latter phase.*

Inland regions of Central and Southern California, Northwestern and Southern Nevada, and parts of Montana also experienced elevated temperatures, although not as extreme as in the northwestern regions.

Temperature Records:

The heatwave resulted in some of the highest temperatures ever recorded in the region:

Canada: The highest temperature ever measured in Canada was recorded during this heatwave at 49.6°C (121.3°F).

British Columbia: The highest temperatures in British Columbia were also observed.

United States: Washington state experienced record highs, and Oregon tied its previous record.

The extreme heat extended from Oregon to northern Manitoba, with daily highs reaching as far east as Labrador and as far southwest as Southern California.

Causes and Attribution:

The heatwave was attributed to an exceptionally strong ridge of high pressure centered over the affected area.

This ridge's strength was linked to the effects of climate change.

Extreme event attribution indicated that this heatwave was a 1000-year weather event, made 150 times more likely due to climate change.

Further projections suggest that with continued global warming, it could become a 10-year event in a climate warmed by 2°C relative to pre-industrial levels.

Impacts:

Wildfires: The extreme heat sparked numerous extensive wildfires, leading to widespread destruction. The eponymous Lytton wildfire destroyed the village of Lytton, British Columbia, the day after the city set the record high temperature for Canada.

Infrastructure Damage: Heat damaged road and rail infrastructure, forced business closures, disrupted cultural events, and melted snowcaps (resulting in some cases of flooding).

Agricultural Losses: Agriculture across the region suffered, with at least a one-third decrease in yield from the worst-affected crops and a loss of at least 651,000 farm animals.

Human Toll:

Deaths: The heatwave led to an estimated 1,408 deaths, with 914 confirmed deaths:

Canada: Around 600 excess deaths.

United States: Over 229 confirmed deaths.

It became the deadliest weather event in the history of Canada.

In summary, the 2021 Pacific Northwest heatwave was an extraordinary event with severe consequences, emphasizing the urgent need for climate action and preparedness in the face of extreme weather events.

Final author's comment: In my home state (California), we are familiar with a persistent high-pressure cell off of the West Coast. This has been a strong contributing factor in our 2000 through 2021 Drought. We have had above normal rainfall starting in 2022 through this year (our latest snowpack measurement was 113% in early April). However, we are well aware that the next major drought could be around the corner. [2]

[2] Larry Altman. The Independent, "Sierra Snowpack Update Spreads Optimism Among Water Managers," April 11, 2024, https://www.independentnews.com/environment/sierra-snowpack-update-spreads-optimism-among-water-managers/article_3d37aebc-f78d-11ee-9787-df5df5b22d6e.html#:~:text=The%20snowpack%20at%20a%20key%20spot%20in%20California%E2%80%99s,off%20that%20will%20fill%20rivers%2C%20lakes%20and%20reservoirs.