The Source of Europe's Mild Climate

The notion that the Gulf Stream is responsible for keeping Europe anomalously warm turns out to be a myth

Richard Seager

If you grow up in England, as I did, a few items of unquestioned wisdom are passed down to you from the preceding generation. Along with stories of a plucky island race with a glorious past and the benefits of drinking unbelievable quantities of milky tea, you will be told that England is blessed with its pleasant climate courtesy of the Gulf Stream, that huge current of warm water that flows northeast across the Atlantic from its source in the Gulf of Mexico. That the Gulf Stream is responsible for Europe's mild winters is widely known and accepted, but, as I will show, it is nothing more than the earth-science equivalent of an urban legend.

This is not to say that there is no climatological mystery to be explained. The countries of northern Europe do indeed have curiously mild climates, a phenomenon I didn't really appreciate until I moved from Liverpool to New York. I arrived in the Big Apple just before a late-summer heat wave, at a time when the temperature soared to around 35 degrees Celsius. I had never endured such blistering temperatures. And just a few months later I was awestruck by the sensation of my nostrils freezing when I went outside. Nothing like that happens in England, where the average January is 15 to 20 degrees warmer than what prevails at the same latitude in eastern North America. So what keeps my former home so balmy in the winter? And why do so many people credit the Gulf Stream?

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Like many other myths, this one rests on a strand of truth. The Gulf Stream carries with it considerable heat when it flows out from the Gulf of Mexico and then north along the East Coast before departing U.S. waters at Cape Hatteras and heading northeast toward Europe. All along the way, it warms the overlying atmosphere. In the seas between Norway and Newfoundland, the current has lost so much of its heat, and the water has become so salty (through evaporation), that it is dense enough to sink. The return flow occurs at the bottom of the North Atlantic, also along the eastern flank of North America. This overturning is frequently referred to as the *North Atlantic thermohaline circulation*, or simply the "Atlantic conveyor." It is part of the global pattern of ocean circulation, which is driven by winds and the exchange of heat and water vapor at the sea surface.

The Gulf Stream indeed contributes to Europe's warmth, but it is wrong to conflate the climate difference across the North Atlantic with the northward flow of warm water in the Gulf Stream. This erroneous logic leads to such statements as (from *The Times* of London): "The British Isles lie on the same latitude as Labrador on the East Coast of Canada, and are protected from a similarly icy climate by the Atlantic conveyor belt." Such claims are absolutely wrong.

The statements scientists make about Atlantic thermohaline circulation typically read more like this one from my Columbia University colleague, Wallace S. Broecker:

> One of the major elements of today's ocean system is a conveyor-like circulation that delivers an enormous amount of tropical heat to the northern Atlantic. During winter, this heat is released to the overlying eastward air masses, thereby greatly ameliorating winter temperatures in northern Europe.

This assertion has the benefit of being both correct and misleading. Because it does not specify what European climate is ameliorated relative to (the climate of eastern North America?), it leaves unchallenged the incorrect version expounded in the popular media—thus contributing to the erroneous beliefs of millions.

The idea that the Gulf Stream is responsible for Europe's mild winters seems to have originated with Matthew Fontaine Maury, an American naval officer who in 1855 published *The Physical Geography of the Sea*, which is often considered the first textbook of physical oceanography. The book was a huge success, went through many printings and was translated into three languages. The role of the Gulf Stream in shaping climate is a recurring theme in Maury's book. For example, he stated:

> One of the benign offices of the Gulf Stream is to convey heat from the Gulf of Mexico, where otherwise it would be excessive, and to disperse it in regions beyond the Atlantic for the amelioration of the climates of the British Isles and of all Western Europe.

According to Maury, if this transport of heat did not take place, "… the soft climates of both France and England

Figure 1. Members of the Serpentine Swimming Club dive into Serpentine Lake in London's Hyde Park on February 18, 2006. Such activities would be unthinkable at an equivalent latitude on the opposite side of the Atlantic, where average February temperatures are typically below –10 degrees Celsius. Many people believe that northern Europe owes its relatively mild winters to heat brought in by the Gulf Stream, but in fact ocean currents do little to warm the region. (Photograph courtesy of the Serpentine Swimming Club.)

would be as that of Labrador, severe in the extreme, and ice bound." Despite the differences in language and style, the modern statements clearly owe their provenance to this 1855 treatise.

Maury thought that God set the ocean up to work this way apparently as part of His design to keep Europe warm (for unspecified reasons). But holding such religious beliefs did not stop Maury from also providing a scientific explanation for the Gulf Stream. His idea was that it was the oceanic equivalent of what in the atmosphere is known as a *Hadley cell*, a convection cell wherein warm air flows upward and poleward, and cold material flows downward and equatorward. In the ocean, heated surface waters take a northeastward route, in Maury's view, because of the need to conserve angular momentum as they move north and, hence, closer to the axis of the Earth's rotation. Maury did not recognize that winds drive ocean currents. And it was not until a century later that a valid explanation of the Gulf Stream emerged: In the jargon of oceanographers, it is a westward-intensified boundary current within a subtropical *gyre* (a large circular current system) driven by the trade winds, which blow from east to west in the tropics, and mid-latitude westerlies, which move in the opposite direction.

Questioning the Myth

After completing my Ph.D. at Columbia University in New York City, I took a temporary postdoctoral position at the University of Washington in Seattle, where I should have immediately realized that something was wrong with the Gulf Stream–European climate story. Seattle and British Columbia, just to the north, I discovered, have a winter climate with which I was very familiar—mild and damp, quite unlike the very cold conditions that prevail on the Asian side of the Pacific Ocean. This contrast exists despite the fact that the circulation of currents in the Pacific Ocean is very different from the situation in the Atlantic.

The analogue of the Gulf Stream in the Pacific Ocean is the *Kuroshio Current*, which flows north along the coast of Asia until it shoots off into the interior of the Pacific Ocean east of Japan. From there, it heads due east (unlike the Gulf Stream, which heads northeast) toward Oregon and California. As such, there is almost no heat carried northward into the Pacific Ocean at the latitudes of Washington and British Columbia. Hence oceanic heat transport cannot be creating the vast difference in winter climate between the Pacific Northwest and similar latitudes in eastern Asia—say, chilly Vladivostok.

Strangely, experiencing a Seattle winter firsthand was not enough to

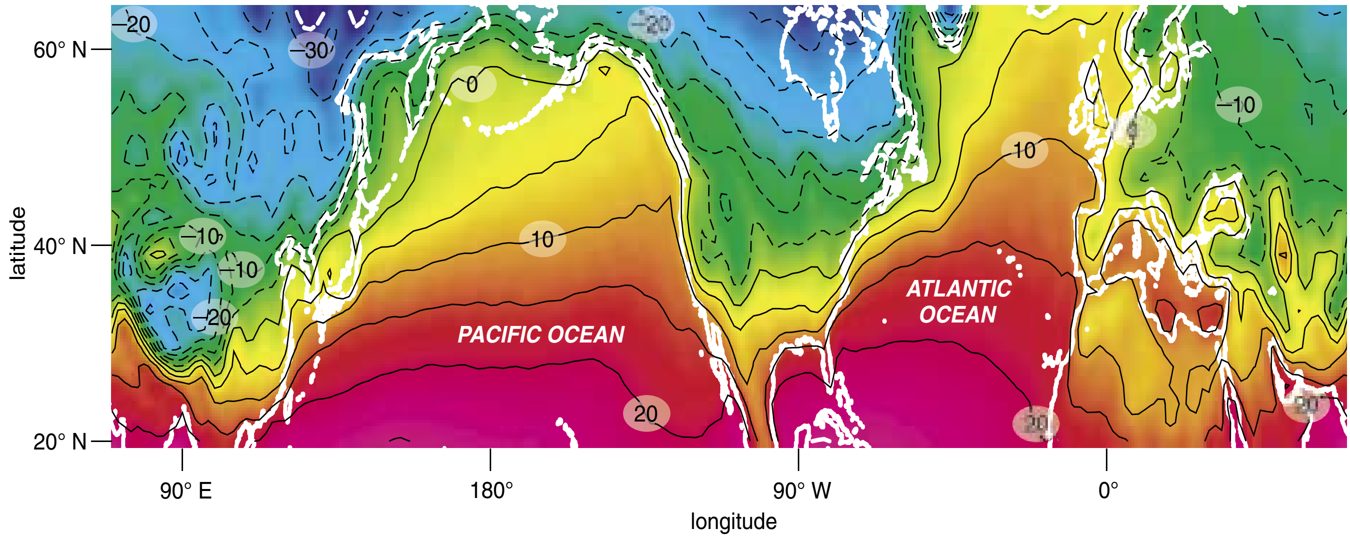

Figure 2. Average January air temperatures are warmer over oceans than they are over land, because the sea retains more summer heat, which can then be released to the overlying air in winter. Sites located close to the coasts thus tend to enjoy mild "maritime" climates. And because prevailing winds over the midlatitudes blow from west to east, coastal areas on the eastern side of ocean basins experience especially mild temperatures. Conversely, the coasts bordering the western side of ocean basins experience winters that are intermediate between typical maritime conditions and the frigid "continental" climates found in interior regions. The difference in January temperatures across the North Atlantic at the latitude of London, for example, amounts to between 15 and 20 degrees Celsius.

make me question the myth. However, in Seattle I did become good friends with David S. Battisti, a professor of atmospheric sciences at the University of Washington. Battisti is one of those great scientists who, with relish and an air of mischief, loves to question conventional wisdom. Over the years he and I have enjoyed many a long evening indulging our shared passions for Italian cooking and wine while talking about climate research. During one of those conversations, sometime in 2000 as I recall, he brought up that he wanted to test the Gulf Stream–European climate idea. It was perfect timing, because just then I had been conducting a series of experiments with a numerical climate model, ones designed to examine the role the ocean plays in determining the global and regional features of the Earth's climate. So Battisti and I went to work.

First we had to consider the range of possibilities. If oceanic heat transport does not create the differences in regional climate across the North Atlantic (or North Pacific), what does? An obvious alternative explanation is that standard of high school geography education: Because the heat capacity of water is so much greater than that of rock or soil, the ocean warms more slowly in summer than does land. For the same reason, it cools more slowly in winter. That effect alone means that the seasonal cycle of sea-surface temperature is considerably less than that of land surfaces at the same latitude, which is why summers near the sea are cooler and winters are warmer than at equivalent sites located inland.

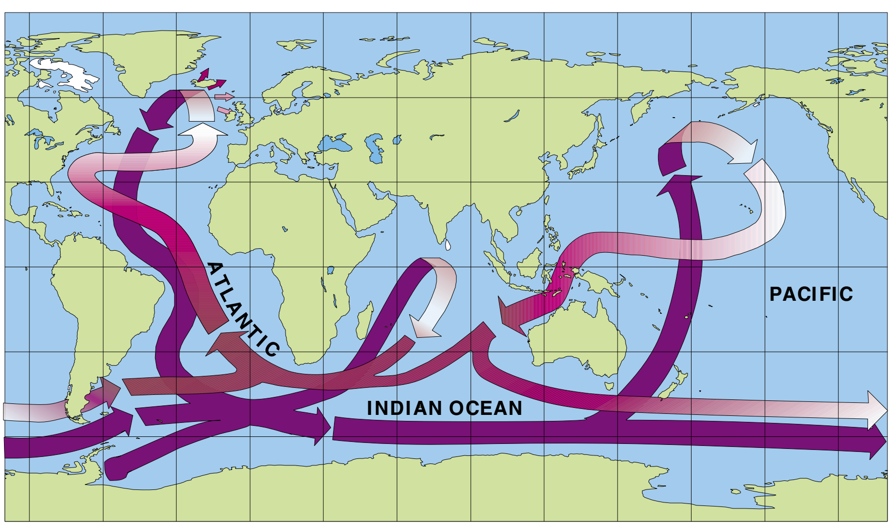

Figure 3. Thermohaline circulation—often dubbed "the ocean conveyor belt"—carries warm surface waters *(pink)* from the tropics to the North Atlantic, with the return flow at depth *(purple)*. But contrary to many accounts (summarized by diagrams such as this), this heat conveyor plays only a minor role in keeping European countries warm during winter months. (Illustration after Wallace Broecker, modified by Ernst Maier-Reimer, courtesy of CLIVAR International Project Office.)

The effect of differing heat capacities is augmented by the fact that the Sun's heat is stored within a larger mass in the ocean than on land. The heat reservoir is bigger because, as the Sun's rays are absorbed in the upper several meters of the ocean, the wind mixes that water downward so that, in the end, solar energy heats several tens of meters of water. On land, the absorbed heat of the Sun can only diffuse downward and does not reach deeper than a meter or two during a season. The greater density of soil and rock (which ranges up to three times that of water) cannot make up for this difference in volume of material that the Sun heats and for the difference in heat capacity of water compared with soil or rock.

Because sea-surface temperatures vary less through the seasonal cycle than do land-surface temperatures, any place where the wind blows from off the ocean will have relatively mild winters and cool summers. Both the British Isles and the Pacific Northwest enjoy such "maritime" climates. Central Asia, the northern Great Plains and Canadian Prairies are classic examples of "continental" climates, which do not benefit from this moderating effect and thus experience bitterly cold winters and blazingly hot summers. The northeastern United States and eastern Canada fall somewhere in between. But because they are under the influence of prevailing winds that blow from west to east, their climate is considerably more continental than maritime.

A Model of Contrasts

Battisti and I naturally wondered whether we could explain the difference in winter conditions between Europe and eastern North America as simply the difference between a maritime climate and a more continental one. To find the answer, he and I used two climate models, ones that normally serve for studies of natural climate variability or for assessments of future climate change. As in all such models, Earth's atmosphere is represented on a three-dimensional grid (latitude, longitude and pressure level in the vertical). For each grid point, the computer solves the relevant equations for the winds, temperature, specific humidity, fluxes of solar and terrestrial radiation and so forth while keeping track of the precipitation and energy fluxes at Earth's surface. The packing of the grid points was sufficiently dense so that we could accurately capture the endless progression of storm systems, which transport vast quantities of heat and moisture poleward. As with the computer models used to forecast the weather (which are basically the same as climate models), the computer code we used calculated conditions forward in time until, for these experiments, a statistical steady state was achieved. To get a representative picture of overall climate, we averaged together many years of simulated weather.

The joy of such numerical models is that you can make radical changes to a virtual Earth's climate system with nothing more than a click of the mouse. To assess the importance of the heat transported by ocean currents such as the Gulf Stream, we compared the results of two versions of these climate models. The first versions were the standard ones, which compute sea-surface temperature after accounting for the heat moved by ocean currents, the absorption of the Sun's rays, and the exchange of heat between the ocean and the atmosphere. In the second versions, the computer code accounted for solar warming and the relevant surface heat exchanges but did not allow the model ocean to transport heat horizontally.

What we found in these tests was that, south of northern Norway, the difference in winter temperature across the North Atlantic was always the same, whether or not we let the ocean move heat around. This result would suggest that oceanic heat transport does not matter at all to the difference between the winter climates of western Europe and eastern North America! We concluded that the temperature difference must, as we had speculated before, be caused by other processes, most likely the seasonal absorption and release of heat by the ocean and the moderating effect this process has on maritime climates downwind.

Our revised view of things did not, however, mean that heat transport in the ocean does not influence climate. The ocean indeed absorbs more heat from the Sun near the equator than it loses back to the atmosphere (primarily

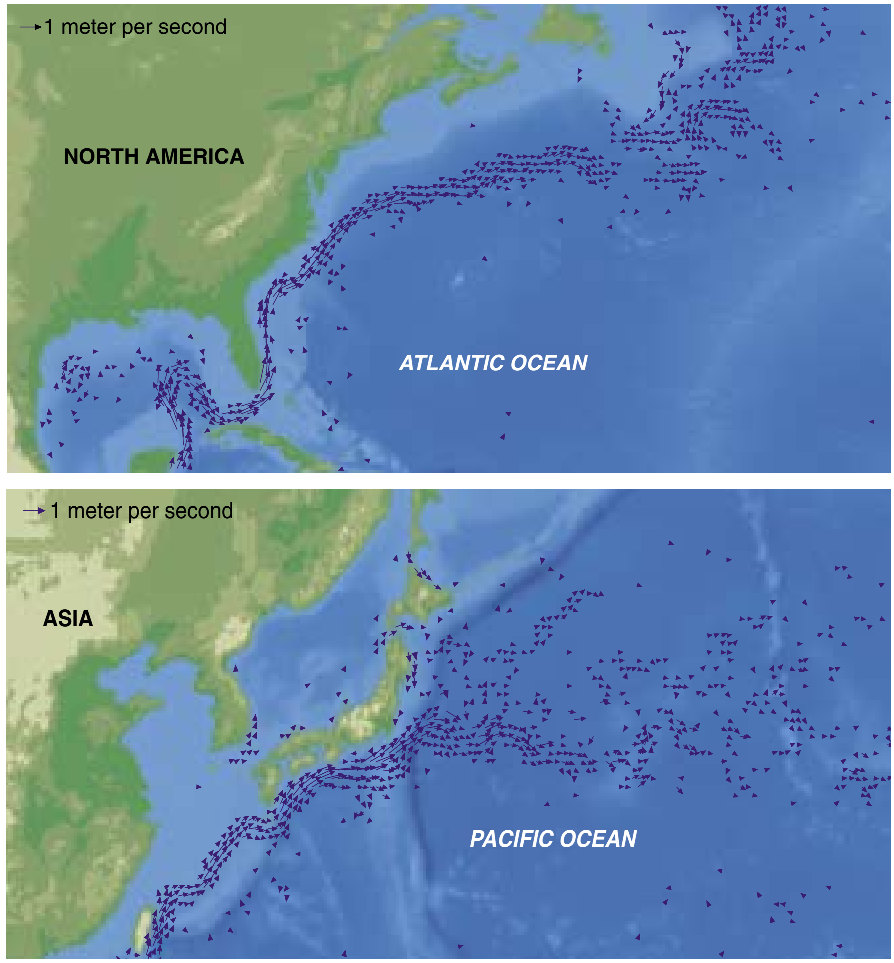

Figure 4. Gulf Stream currents carry an enormous amount of heat from the Gulf of Mexico, around the tip of Florida and up along the East Coast before heading northeast toward Europe *(top)*. (Arrows indicate speed and direction. Measurements of less than 15 centimeters per second are not shown.) So at first glance the supposition that the Gulf Stream is responsible for mild European winters seems reasonable. But the current pattern found in the Pacific *(bottom)* argues otherwise: The equivalent boundary current, the Kuroshio, heads almost due east after it departs from the coast of Japan, meaning that it transports almost no heat northward to warm such places as Seattle or Vancouver on the eastern side of the Pacific. Yet these cities experience comparatively mild winters for their latitudes, suggesting that other factors must account for the phenomenon. (Long-term current observations from Peter P. Niiler, Scripps Institution of Oceanography, and Rick Lumpkin, National Oceanic and Atmospheric Administration.)

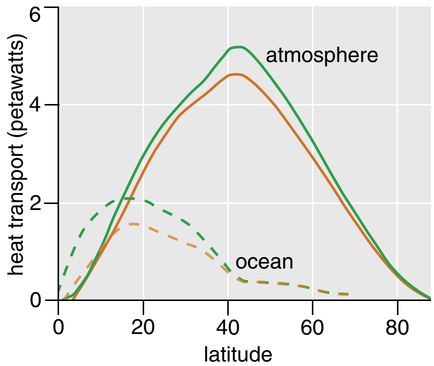

Figure 5. Results of two weather-prediction models *(green* and *orange)*, which are based on observations made over the last several decades, demonstrate that at mid-latitudes, most of the heat conveyed northward from the tropics is carried not by the ocean *(dashed lines)*, but by the atmosphere *(solid lines)*.

by evaporation). And oceanic currents indeed move the excess heat poleward before releasing it to the atmosphere in the middle latitudes. Consequently, removal of the oceanic heat transport globally in our modeling exercise warmed the equator and cooled everywhere else. The climates produced by the models deprived of oceanic heat transport were colder in the subpolar North Atlantic by as much as 8 degrees in some places. The cooling over land areas was more modest, typically less than 3 degrees. These temperature changes, large as they are, are not terribly dramatic compared with the much larger temperature contrast across the North Atlantic Ocean.

Why doesn't the ocean exert a greater influence on North Atlantic climate? According to scientists' best estimates, the ocean and atmosphere move about an equal amount of heat in the deep tropics. But at mid-latitudes, the atmosphere carries several times more heat. Thus, if one considers the region north of, say, 35 degrees North, the atmosphere is much more effective than the ocean in warming winter climates. Also, the winter release of the heat absorbed during the summer is several times greater than the amount of heat that the ocean transports from low to high latitudes in a year. Hence it is the combined effect of atmospheric heat transport and seasonal heat storage and release that keep the winters outside the tropics warmer than they otherwise would be—by several tens of degrees.

Although these numbers are instructive, they are not directly relevant to understanding the warming of Europe. For that, one needs to consider some details of geography. The Gulf Stream and associated current systems in the North Atlantic focus heat (and lose it to the atmosphere) in two clearly defined areas. One is immediately to the east of the United States, where the warm Gulf Stream flows north after leaving the Gulf of Mexico and rounding the tip of Florida. During winter, the prevailing winds blow frigid, dry air off the North American continent and across the Gulf Stream. Because of the large difference in moisture and temperature content between air and sea, the heat lost from the ocean through evaporation and direct heat transfer is immense—a few hundred watts per square meter. Much of this heat is picked up by storms in the atmosphere and carried over the eastern United States and Canada, effectively mitigating what would otherwise be a cold continental climate.

Where else does the Gulf Stream deposit its heat? After departing the American coast, the Gulf Stream heads northeast and turns into what is called the North Atlantic Drift and, farther downstream, the Norwegian Current. After spawning many Atlantic storms, it loses most of the remainder of its heat in the Nordic seas. There the heat can effectively be moved eastward by the prevailing winds to warm northwest Europe. Thus the transport of heat taking place in the North Atlantic warms *both sides of the ocean* and by roughly the same amount, a few degrees. This leaves the much larger, 15-to-20-degree difference in winter temperatures to be explained by other processes.

One subtle but important effect stems from a fundamental principle in physics: the conservation of angular momentum. In meteorology, this principle translates to a rule that atmospheric flow must closely conserve the total angular momentum of a column of air. The angular momentum of the air contains two components: one arising from the rotation of the Earth (which meteorologists call the "planetary component") and another from the curvature of the fluid flow itself. The planetary component, which in the Northern Hemisphere is directed counterclockwise, is at a maximum at the pole and zero at the equator.

The conservation of angular momentum, it turns out, causes the mountains of North America to contribute substantially to the dramatic difference in temperatures across the Atlantic. To fathom why, you must first understand that the *troposphere* (the

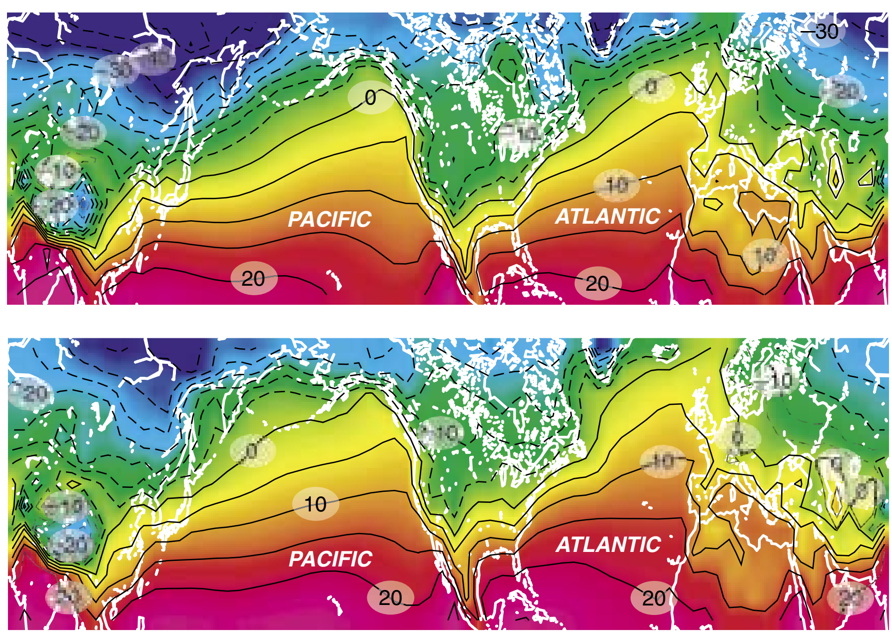

Figure 6. Experiments with numerical climate models allowed the author and his colleagues to ascertain the contribution of ocean currents to the warming of Europe. A model in which oceanic heat transport was switched off *(top)* shows a pattern of January temperatures that is very similar to control runs with oceanic heat transport operative *(bottom)*. The greatest differences occur north of Norway, where ocean currents appear to contribute significantly to the anomalous warmth of the region. Although a modest change in temperature to the south accompanies a shutdown in oceanic heat transport, the large temperature contrast across the North Atlantic remains essentially unaltered.

lower part of the atmosphere, where weather takes place) is bounded at the top by the *tropopause*, a region of stability where temperature increases with height and which acts somewhat like a lid. Thus when air flows over a mountain range—say, the Rockies—it gets compressed vertically and, as a consequence, tends to spread out horizontally. When a spinning ice skater does as much, by spreading his arms, the conservation of angular momentum slows his spin. An atmospheric column going up a mountain behaves in a similar way and swerves to the south to gain some clockwise spin, which offsets part of the counterclockwise planetary component of its spin.

On the far side of the Rockies, the reverse happens: The air begins to stretch vertically and contract horizontally, becoming most contracted in the horizontal when it reaches the Atlantic. And as with an ice skater pulling in his arms, conservation of angular momentum demands that the air gain counterclockwise spin. It does so by swerving to its left. But having moved to the south after crossing the mountains, it is now at a latitude where the planetary component of its angular moment is less than it was originally. To balance this reduction in angular momentum, the air acquires more counterclockwise spin by curving back around to the north. This first southward and then northward deflection creates a waviness in the generally west-to-east flow of air across North America and far downwind to the east.

Such waves are of massive scale. The southward flow takes place over all of central and eastern North America, bringing Arctic air south and dramatically cooling winters on the East Coast. The return northward flow occurs over the eastern Atlantic Ocean and western Europe, bringing mild subtropical air north and pleasantly warming winters on the far side of ocean.

Topographically forced atmospheric waves contribute significantly to the large difference in winter temperature across the Atlantic. When Battisti and I removed mountains from our climate models, the temperature difference was cut in half. Our conclusion was that the large difference in winter temperature between western Europe and eastern North America was caused about equally by the contrast between the maritime climate on one side and the continental climate on the other, and by the large-scale waviness set up by air flow over the Rocky Mountains.

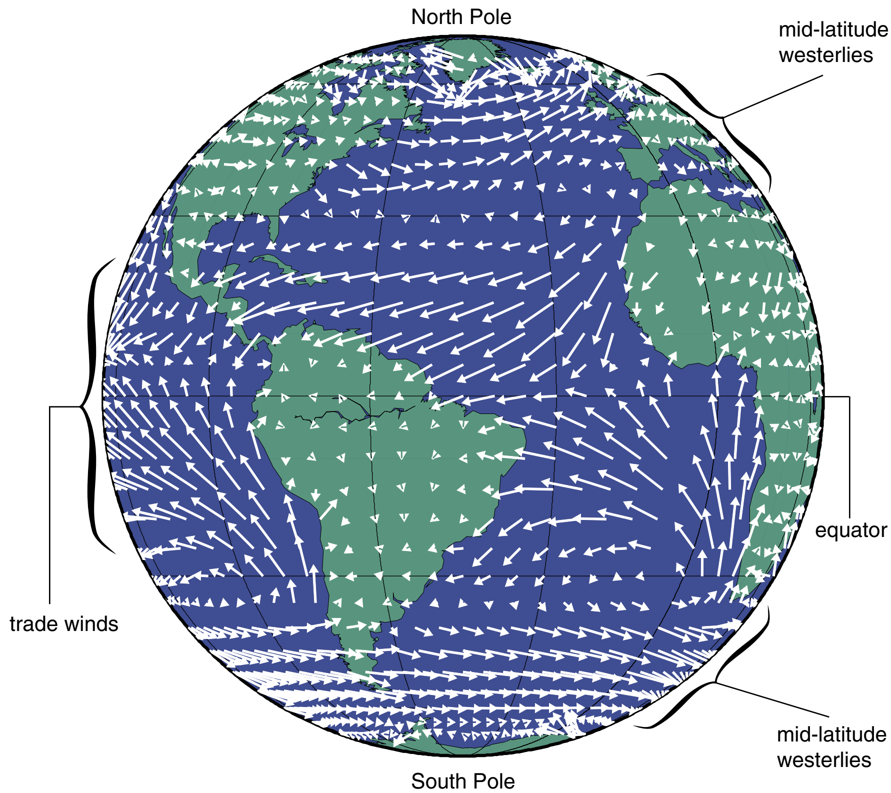

Figure 7. Average winds (shown here for the winter months) move from east to west in the tropics (the trade winds) and from west to east at temperate latitudes (the mid-latitude westerlies). But the flow does not uniformly follow lines of latitude. In the North Atlantic, the mid-latitude westerlies veer south on the western side of the basin and then swerve north on the eastern side. This waviness brings relatively balmy air up from the south to warm Europe during the winter.

A Sea Change in Climate?

Evidence from ocean sediments suggests that at times during the last Ice Age the North Atlantic thermohaline circulation was considerably weaker than it is today, or perhaps it even shut down entirely. One such event took place about 12,900 years ago, during the last deglaciation, and is called the Younger Dryas (after a European cold-dwelling flower that marks it in some terrestrial records). The Younger Dryas began with a dramatic reversal in what was a general warming trend, bringing near-glacial cold to the North Atlantic region. This episode ended with an even more dramatic warming about 1,000 years later. In Greenland and western Europe, the beginning and end of the Younger Dryas involved changes in winter temperature as large as 20 degrees taking place in little more than a decade. But the Younger Dryas was not a purely North Atlantic phenomenon: Manifestations of it also appeared in the tropical and southern Atlantic, in South America and in Asia.

For many years, the leading theory for what caused the Younger Dryas was a release of water from glacial Lake Agassiz, a huge, ice-dammed lake that was once situated near Lake Superior. This sudden outwash of glacial meltwater flooded into the North Atlantic, it was said, lowering the salinity and density of surface waters enough to prevent them from sinking, thus switching off the conveyor. The North Atlantic Drift then ceased flowing north, and, consequently, the northward transport of heat in the ocean diminished. The North Atlantic region was then plunged back into near-glacial conditions. Or so the prevailing reasoning went.

Recently, however, evidence has emerged that the Younger Dryas began long before the breach that allowed freshwater to flood the North Atlantic. What is more, the temperature changes induced by a shutdown in the conveyor are too small to explain what went on during the Younger Dryas. Some climatologists appeal to a large expansion in sea ice

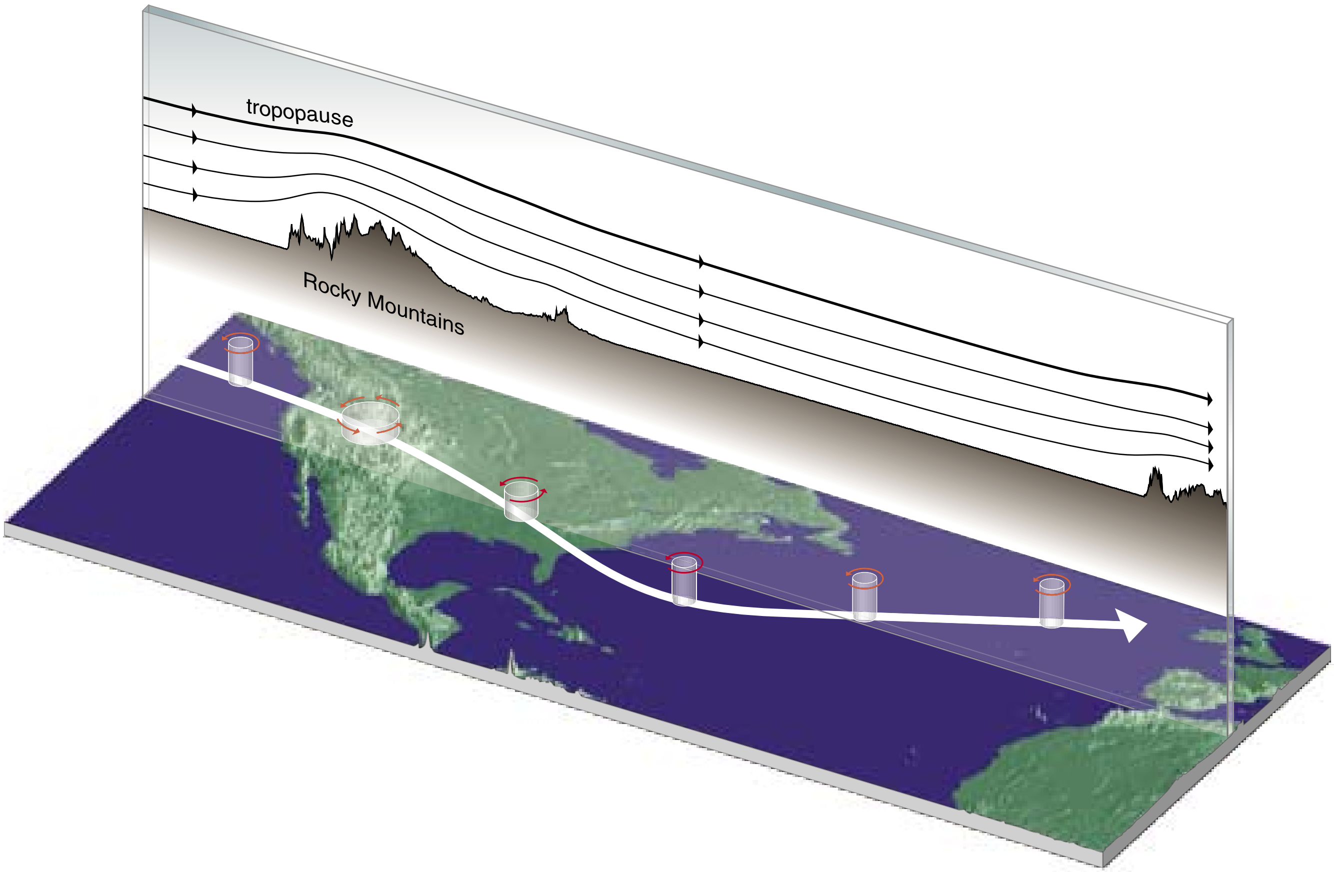

Figure 8. The waviness in the flow of the mid-latitude westerlies that is responsible for keeping European winters mild results from a fundamental principle of physics: the conservation of angular momentum. Because the top of the troposphere acts as something of a lid, air flowing from the Pacific over the Rocky Mountains must compress vertically and, as a consequence, expand horizontally. Conservation of angular momentum demands that a package of air *(depicted as white cylinder)* undergoing such a horizontal expansion must develop a component of clockwise spin to reduce the predominantly counter-clockwise spin it has by virtue of its location in the Northern Hemisphere. (The length of the red arrows indicates relative amount of spin, which is derived from both local air movements and the revolution of the planet.) The new component of clockwise spin manifests itself as a gentle swerve to the south in what is predominantly west-to-east flow. When this package of air then moves over the eastern side of the continent and on over the Atlantic, it does the opposite, expanding vertically and contracting horizontally, which allows it to veer back toward the north. The wavelike pattern sends air heated over the Atlantic to the northeast, where it warms Europe.

to explain the severe winter cooling. I agree that something of this sort probably happened, but it's not at all clear to me how stopping the Atlantic conveyor could cause a sufficient redistribution of heat to bring on this vast a change.

In any event, the still-tentative connections investigators have made between thermohaline circulation and abrupt climate change during glacial times have combined with the popular perception that it is the Gulf Stream that keeps European climate mild to create a doomsday scenario: Global warming might shut down the Gulf Stream, which could "plunge western Europe into a mini ice age," making winters "as harsh as those in Newfoundland," or so claims, for example, a recent article in *New Scientist*. This general idea been rehashed in hundreds of sensational news stories.

The germ of truth on which such hype is based is that most atmosphere-ocean models show a slowdown of thermohaline circulation in simulations of the 21st century with the expected rise in greenhouse gases. The conveyer slows because the surface waters of the subpolar North Atlantic warm and because the increased transport of water vapor from the subtropics to the subpolar regions (where it falls as rain and snow) freshens the subpolar North Atlantic and reduces the density of surface waters, which makes it harder for them to sink. These processes could be augmented by the melting of freshwater reserves (glaciers, permafrost and sea ice) around the North Atlantic and Arctic.

But from what specialists have long known, I would expect that any slowdown in thermohaline circulation would have a noticeable but not catastrophic effect on climate. The temperature difference between Europe and Labrador should remain. Temperatures will not drop to ice-age levels, not even to the levels of the Little Ice Age, the relatively cold period that Europe suffered a few centuries ago. The North Atlantic will not freeze over, and English Channel ferries will not have to plow their way through sea ice. A slowdown in thermohaline circulation should bring on a cooling tendency of at most a few degrees across the North Atlantic—one that would most likely be overwhelmed by the warming caused by rising concentrations of greenhouse gases. This moderating influence is indeed what the climate models show for the 21st century and what has been stated in reports of the Intergovernmental Panel on Climate Change. Instead of creating catastrophe in the North Atlantic region, a slowdown in thermohaline circulation would serve to mitigate the expected anthropogenic warming!

The Longevity of a Legend

When Battisti and I had finished our study of the influence of the Gulf Stream, we were left with a certain sense of deflation: Pretty much everything we had found could have been concluded on the basis of results that were already available. Ngar-Cheung Lau of the National Atmospheric and Oceanic Administration's Geophysical Fluid Dynamics Laboratory (GFDL) and Princeton University had published in 1979 an observational study in which he quantitatively demonstrated the warming and cooling effects that large-scale waves in the atmosphere had in Europe and eastern North America, respectively. In the 1980s, atmosphere modelers such as Brian J. Hoskins and Paul J. Valdes at the University of Reading in England and Isaac M. Held and Sumant Nigam at GFDL had shown how such stationary waves, including those forced by mountains, warm western Europe. In the late 1980s, two other GFDL researchers, Syukuro Manabe and Ronald J. Stouffer, had used a coupled ocean-atmosphere climate model to determine the climate impacts of an imposed shutdown of the North Atlantic thermohaline circulation. Their modeled climate cooled by a few degrees on both sides of the Atlantic and left the much larger difference in temperature across the ocean unchanged. Other published model experiments went on to show the same thing. Further, the distinction between maritime and continental climates had been a standard of climatology for decades, even centuries. What is more, by the late 1990s satellite data, and analyses of numerical models into which those data had been assimilated as part of the weather-forecasting process, had shown that in mid-latitudes the poleward transport of heat by the atmosphere exceeds that by the ocean several-fold.

All Battisti and I did was put these pieces of evidence together and add in a few more illustrative numerical experiments. Why hadn't anyone done that before? Why had these collective studies not already led to the demise of claims in the media and scientific papers alike that the Gulf Stream keeps Europe's climate just this side of glaciation? It seems this particular myth has grown to such a massive size that it exerts a great deal of pull on the minds of otherwise discerning people.

This is not just an academic issue. The play that the doomsday scenario has gotten in the media—even from seemingly reputable outlets such as the British Broadcasting Corporation—could be dismissed as attention-grabbing sensationalism. But at root, it is the ignorance of how regional climates are determined that allows this misinformation to gain such traction. Maury should not be faulted; he could hardly have known better. The blame lies with modern-day climate scientists who either continue to promulgate the Gulf Stream–climate myth or who decline to clarify the relative roles of atmosphere and ocean in determining European climate. This abdication of responsibility leaves decades of folk wisdom unchallenged, still dominating the front pages, airwaves and Internet, ensuring that a well-worn piece of climatological nonsense will be passed down to yet another generation.

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