

On some level, most people understand the difference between climate and weather. Climate is the context: the accumulation of temperatures and precipitation trends that vary depending on location and season. Weather is what we experience, and extremes are part of the package. This was the message delivered by the UK Met Office, which pointed out that stormy conditions are more likely during winter months. Despite such assessments, however, people continually confound weather and climate in the heat — or cold — of the moment. Confusion seems unavoidable.

In the United States, the cold snap extended as far south as Florida, forcing thousands of flight cancellations at the height of the holiday season. Climate sceptics celebrated, apparently unable or unwilling to accept that even a warming planet experiences cold temperatures. A small cohort of scientists countered with arguments that global warming might in fact be contributing to the string of abnormally cold US winters in recent years. The argument is that rapid Arctic warming and melting sea ice are destabilizing the fast-flowing air current known as the polar jet stream, leading it to the kind of drunken meandering that can push Arctic air across North America — and deliver powerful storms to the United Kingdom. If that is true, Cameron may well have been right.

Evidence for the claim that global warming could be disrupting the jet stream is disputed. Similar weather events have happened in the past, and at least one review of the record suggests that nothing is amiss — at least nothing that scientists can pin down as obviously outside the normal year-to-year seasonal variations. This does not mean that climate change has no role, of course. It just means that we do not yet know. In the words of one climate modeller, until the models and the observations align, we ought to reserve judgement. As far as the public is concerned, there is little to do but dress appropriately, keep an open mind and let the science play out.

The same dynamic has been playing out in recent years with regard to the average global temperature, which has plateaued since 1998. At

first blush, the global-warming ‘hiatus’ runs counter to the warming projected by climate models. Here again, climate sceptics have pounced, and some climate scientists have rightly begun to explore both the climate system and their models to sort out the apparent discrepancy. As reported on page 276, researchers are homing in on a potential explanation that ties the periodic warming and cooling of the eastern equatorial Pacific Ocean to global temperature trends.

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In particular, the cool phase of the Pacific Decadal Oscillation — which took hold in 1998, coinciding precisely with the hiatus — seems to drive heat into the ocean, effectively cooling the atmosphere.

Plenty of questions remain. According to this theory, temperatures will rise anew when the eastern Pacific flips into its warm phase in the coming years. But how much warming should we expect when that happens? Exactly how sensitive is Earth’s climate system to increasing atmospheric levels of greenhouse gases? Some have argued, in part on the basis of current temperature trends, that climate models tend to overestimate warming, which would be good news indeed if true. But there are many ways to estimate the climate’s likely response to greenhouse gases, and the evidence cuts both ways.

Ultimately, the hiatus has provided an opportunity to better understand both the climate system and climate models. One lesson is that the climate, like day-to-day weather, has its ups and downs. Another is that the average global temperature — although a useful indicator — is not the only measure of how the climate changes. Scientists are still trying to work out what all of this means for the future, but if the past is any indication, we may have to live with a fair degree of uncertainty. From a policy perspective, little has changed. The range of potential impacts projected by climate models warrants much more aggressive action than has been initiated so far. ■

V is for vortex

An endangered species helps scientists to learn why migrating birds fly in a familiar formation.

The northern bald ibis (*Geronticus eremita*) was once such a widespread sight in the skies of north Africa that the bird was immortalized as an ancient Egyptian hieroglyph. The picture symbol denoted the word *akh*, which means ‘to be resplendent, to shine’. Ibis populations are less resplendent today, with just a few hundred of the wild birds remaining, mainly in Morocco. They can still shine, however; a study of 14 northern bald ibises reported this week on page 399 offers the first experimental evidence that helps to resolve one of the great questions of the natural world: why do migrating birds often fly in an elegant V formation?

The obvious answer is that it saves energy. Just as the mass ranks of a peloton in a cycle race make life easier for riders, and as tight formations can save aircraft fuel, the signature shape of a flock of ibises or geese is assumed to make flight less of a flap — at least for the bulk of the birds that follow the leader. (That is another, less obvious, theory for the V shape: that the bird at the front is the best navigator.)

Some of the most influential research studies do little more than test whether the obvious answer to a question is the correct one. When it comes to bird flight, the validity of the obvious answer has, until now, been concealed by an obvious problem. Namely, that the equipment for monitoring the flight of wild birds tends to disappear over the horizon along with the bird to which it is attached. (Sensors that are able to relay the data tend to be too heavy for birds to carry.)

This is where the endangered plight of the northern bald ibis offered an opportunity to science. Several captive-breeding programmes exist, and a big part of preparing the birds for release is to teach them their traditional migration routes. Hand-reared ibises are trained to follow conservation experts who are inside a microlight aircraft. So, crucially, when these birds set off to fly in formation, they come back.

Steven Portugal, a researcher at the Royal Veterinary College in Hatfield, UK, used the training flights of ibises raised at a zoo in Vienna to test the benefits of formation flying. His team fitted the birds with lightweight data loggers that could measure both their body position and flapping movements.

The juvenile birds took a while to get into shape; a V formation is harder to achieve and maintain than it looks, and it looks pretty difficult. (RAF pilots told to fly in a tight V shape during the Second World War spent more time watching the position of the plane in front than scanning for enemy fighters.) Still, the 14 ibises did manage it for long enough for the scientists to accurately record both the distance between each bird and the timing of the creatures’ wing flaps.

The results: when in formation, each bird was able to synchronize the flapping of its wings so that it could exploit the updraught created by the swirling vortex of air from the flapping wingtip of the bird in front. When the flock got it right, each following bird delayed its wingbeat by just enough to spread a wave of synchrony through each arm of the V. When they got it wrong and a following bird drifted directly behind the bird in front, the follower registered the problem and adjusted the timing of its flaps so that it did not become tangled in the powerful downdraught of the same vortex. For more, see the associated News & Views article on page 295. Or look up at the sky, and delight in the rare beauty of an obvious answer. ■

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