Cave in China in 1980, and passed on to Lanzhou University. But it wasn't until the 2010s that archaeologist Dongju Zhang and her colleagues began studying the bone.

The team faced a problem. The remains at Denisova Cave had all been identified because they still contained some DNA, which could be compared with genetic sequences from other ancient humans. But there was no DNA left in the jawbone.

Instead, the scientists looked for ancient proteins, which tend to last longer than DNA. In dentine from the teeth, they found collagen proteins suitable for study. The team compared these with equivalent proteins in great apes including Denisovans and Neanderthals, and found that they lined up closest with samples from Denisovans.

Previous work[2] identified Neanderthal remains using both proteins and DNA — but the success of the latest study could lead to a greater emphasis on getting ancient proteins out of fossils that haven't yielded DNA, says Chris Stringer, a palaeoanthropologist at the Natural History Museum in London. The method could prove particularly useful for older samples or those from warmer climates, where DNA degrades quickest.

THE ROOF OF THE WORLD

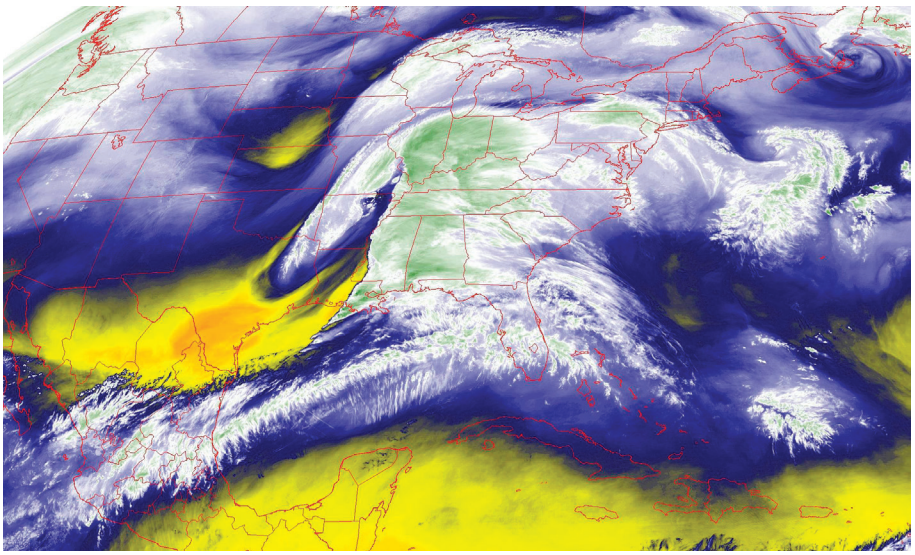
The altitude of the new Denisovan's home — 3,280 metres above sea level — surprised researchers, and helps to solve a mystery about Denisovans' genetic contribution to modern Tibetans. "It is astonishing that any ancient humans were at that altitude," says Stringer.

Some Tibetans have a variant of a gene called *EPAS1* that reduces the amount of the oxygen-carrying protein haemoglobin in their blood, enabling them to live at high altitudes with low oxygen levels. Researchers[3] had thought that this adaptation came from Denisovans, but this was difficult to reconcile with Denisova Cave's relatively low altitude of 700 metres. The latest study suggests that Denisovans evolved the adaptation on the Tibetan Plateau and passed it to *Homo sapiens* when the species arrived around 30,000–40,000 years ago, says co-author Frido Welker, a molecular anthropologist at the University of Copenhagen.

If Denisovans in Asia were adapted to high altitudes, similar sites could harbour more of their remains. And the jawbone is likely to prompt scientists to reconsider classification of other ancient-human remains. "We can kind of work ourselves through the fossil record, and link up more and more specimens with the Denisovans," says Bence Viola, a palaeoanthropologist at the University of Toronto in Canada. ■

1. Chen, F. *et al. Nature* https://doi.org/10.1038/s41586-019-1139-x (2019).
2. Welker, F. *et al. Proc. Natl Acad. Sci. USA* **113**, 11162–11167 (2016).
3. Huerta-Sánchez, E. *et al. Nature* **512**, 194–197 (2014).

NOAA/GOES



Satellite images of water-vapour levels are used to predict weather patterns.

ATMOSPHERIC SCIENCE

5G data networks threaten forecasts

Wireless technology could interfere with Earth observations.

BY ALEXANDRA WITZE

The US government has begun auctioning off blocks of wireless radio frequencies to be used for the next-generation cellular communications network, known as 5G. But some of these frequencies lie close to those that satellites use for crucial Earth observations — and meteorologists are worried that 5G mobile-phone transmissions could hamper their data collection.

Unless regulators or telecommunications companies take steps to reduce the risk of interference, Earth-observing satellites flying over areas of the United States with 5G wireless coverage won't be able to detect water vapour in the atmosphere accurately. Meteorologists rely on that information, and without it, weather forecasts worldwide are likely to suffer.

"This is a global problem," says Jordan Gerth, a meteorologist at the University of Wisconsin–Madison.

The US National Oceanic and Atmospheric Administration (NOAA) and NASA are currently locked in a high-stakes negotiation with the Federal Communications Commission (FCC), which oversees US wireless networks. NOAA and NASA have asked the FCC to help them to protect frequencies used for Earth observations from interference as 5G rolls out. But the FCC auctioned off the first chunk of the 5G spectrum with minimal protection. The sale ended on 17 April, reaping nearly US$2 billion.

Because the United States is such a large communications market, the government's decisions about how to deploy 5G are likely to influence global discussions on the technology. Regulators from around the world will meet in October in Egypt to set international agreements for which frequencies companies can use for 5G transmissions, and what level of interference with Earth observations is acceptable.

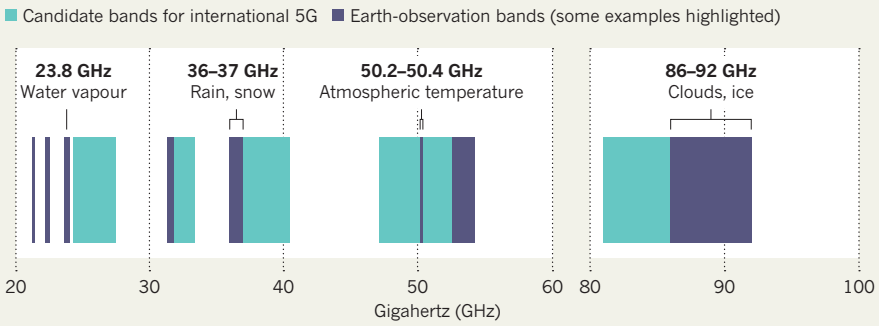
Astronomers, meteorologists and other scientists have long worked to share the spectrum with other users, sometimes shifting to different frequencies. But "this is the first time we've seen a threat to what I'd call the crown jewels of our frequencies", says Stephen English, a meteorologist at the European Centre for Medium-Range Weather Forecasts in Reading, UK.

They include the 23.8-gigahertz frequency, at which water vapour in the atmosphere emits a faint signal. Satellites monitor energy radiating from Earth at this frequency to assess humidity in the atmosphere below. Forecasters feed these data into models to predict how storms and other weather systems will develop.

But a 5G station transmitting at nearly the same frequency will produce a signal that looks like that of water vapour. "We wouldn't know that that signal is not completely natural," says Gerth. Forecasts would be less accurate if scientists used those bad data. ▶

SHARING SPECTRUM

International regulators are divvying up radio-frequency bands to be used in future 5G wireless networks. Weather experts worry that some proposed 5G frequencies are close to, and might interfere with, Earth observations from satellites.



SOURCE: ITU

The recent FCC auction involved 2 groups of frequencies: one between 24.25 and 24.45 gigahertz and the other between 24.75 and 25.25 gigahertz. Wireless transmissions near the lower end of that range could interfere with the 23.8-gigahertz water-vapour measurement (see 'Sharing spectrum'). The FCC did not respond to *Nature*'s request for comment on the matter.

Think of it like living next to a neighbour who blasts music, Gerth says. A lot of the noise will probably bleed through the wall into your apartment. But if you can persuade the person to turn down their music, you'll sleep better.

Radio-frequency engineers measure noise in decibel watts. Regulators limit the noise allowed; more-negative numbers indicate more-stringent controls. The FCC auction set a limit of –20 decibel watts on the US 5G network — much noisier than the caps under consideration by most other nations. The European Commission, for instance, has settled on –42 decibel watts for 5G base stations.

Many hope that Europe's proposal will influence regulators to adopt strict global noise standards at the meeting in Egypt. The US plan would allow over 150 times more noise than the EU's, says Eric Allaix, a meteorologist at Météo-France in Toulouse who heads a World Meteorological Organization steering group on radio-frequency coordination.

There's relatively little research on how bad weather forecasts could get as interference increases at 23.8 gigahertz and other crucial frequencies. "But the more we lose, the greater the impact will be," Gerth says.

NOAA and NASA have reportedly finished a study on the effects of differing levels of noise interference, but it has not been made public. In 2010, the National Academies of Sciences, Engineering, and Medicine reported that losing scientific access to the 23.8-gigahertz signal would eliminate 30% of useful data in microwave frequencies, which feed global weather forecasts.

The Department of Commerce, which oversees NOAA, said that it "strongly supports the administration's policy to promote US leadership in secure 5G networks, while at the same time sustaining and improving critical government and scientific missions". NASA administrator Jim Bridenstine declined to comment, but detailed his concerns about 5G at an agency meeting last month.

The FCC plans to auction three more frequency bands in December — some of which are used for satellite observations of precipitation, sea ice and clouds. ■