active – and I had noticed how the Cirrus trails were spreading across the blue as I walked through London to the railway station. There were some low-level Cumulus clouds around, whose movement showed the direction of the low wind – not always so easy to determine amongst the capricious eddies that form in the vicinity of high buildings.

Pausing, and standing with my back to the wind, I could see that the thickening high Cirrus were spreading to my right, suggesting that a region of low pressure was on its way. Did it depress me that this beautiful uninterrupted view of Cirrus would not last? On the contrary, I was curious to see if the cloud would develop in the way I had read about – keen to watch its silent performance, laid on for my pleasure.

Throughout the westward journey, I observed the warm front at the leading edge of the depression silently choreograph the clouds. Ahead of it, the Cirrus spread in anticipation, forming a milky veil, which joined, thickened and lowered into an Altostratus. Then, as if on cue, the first drops of rain gathered on the window of the carriage – tiny drops at first, but gradually developing into rivers down the pane.

By the time the train passed the boundary between cooler and warmer air at ground level, the Altostratus above had thickened and lowered still further. The steady rain fell more heavily from Nimbostratus, which hung low in the sky. Had I been watching from London, it might have taken 24 hours for this part of the low-pressure system to pass over. On the train, I was through to the warmer air in a matter of hours.

At my destination, the thinning Nimbostratus had begun to separate into broken Stratocumulus. Now in the central region of the kink, without the lifting from competing air masses, the skies were clearer. I felt sure this would pass, however, and through the afternoon Cumulus clouds began to build and one or two softened at their tops. Their glaciating upper regions indicated that they'd changed into Cumulonimbus.

By early evening, the warm hues of the low Sun were hidden from view. The sky above was bruised with dark, pregnant mounds. The clouds let rip in sudden, energetic showers. It was cooler again

and I knew that the rear of the low-pressure system was now passing over – the steeper mass of cold air burrowing under the warmer, moister air on its progress east towards London. My spirits weren't dampened by the passage of the depression. I stood outside in the rain and felt the cascade of drops on my forehead – abundant, plentiful, cleansing the air with their fall. The blades of the grass twitched and shuddered in the downpour.

Enjoying the clouds is a matter of watching their progression. No cloudspotter can tell if it will rain with a quick glance at the sky. This would be akin to seeing someone's photograph, snapped at random, and knowing how they were feeling. Had it caught them mid-blink, would this mean they were sleepy? Had their face been frozen in a split-second grimace – would it mean they were in pain? No, it would mean the shot was a dud.

We need to watch a person's expression change from one moment to the next to say how they are. Likewise, beautiful Cirrus spun across the heavens will tell us little about the mood of the atmosphere. To know this, we must have the patience to watch the expressions develop.

IT IS HARDLY CONTROVERSIAL to consider the clouds as harbingers of the weather. The same cannot be said of predicting earthquakes by them. But a retired Chinese chemist, now living in New York, does exactly that. Zhonghao Shou claims that the appearance of certain types of cloud is a valuable and undervalued tool in short-term earthquake prediction.

Whilst his theories are dismissed as nonsense by many seismologists, Shou is so convinced of the link between certain 'non-meteorological' cloud formations and the occurrence of major quakes that, since his retirement, he has devoted his life to poring over satellite images of cloud cover in order to make quake predictions. He claims that the appearance of 'earthquake clouds' can help him anticipate the location and magnitude of a quake with an average advance warning of thirty days.

Shou has identified five distinct types of earthquake cloud.

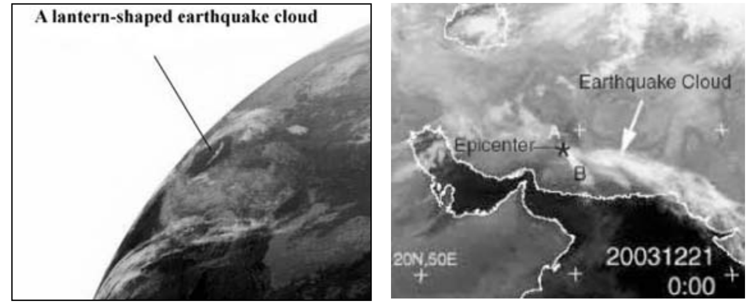
The most dramatic and unusual-looking are the 'line-shaped' and 'feather-shaped' ones, appearing as narrower or wider individual streaks of high cloud, much like short, straight Cirrus clouds. These can appear very suddenly, forming in a matter of seconds, like the condensation trail from a rocket. 'Lantern-shaped' earthquake clouds take the form of a line within a gap in a pre-existing layer of high cloud. The tail of the cloud points towards the epicentre of the impending earthquake, he claims, and its length, when compared with previous sightings and their subsequent quakes, gives an indication of the likely magnitude. Shou's records suggest that a quake will take place within 103 days or less from the appearance of one of the clouds, with the average time being thirty days.

Predicting earthquakes from clouds

He does not claim to have a clear understanding of how quakes might affect the clouds, but offers an explanation similar to the way a volcano smokes before erupting. 'Underground water vapour, at a very high temperature and pressure, erupts to the surface from one or more crevices,' he proposes. 'It then rises up to form a cloud when it meets the cold air in the atmosphere above.' Shou suggests that the subterranean rock might develop small cracks as a result of the seismic stresses in advance of a major fault. Underground water then percolates into these crevices, becoming heated by the enormous friction. Under tremendous pressure, as it expands, the water eventually erupts to the surface as a jet of vapour, forming a cloud in the skies above. This can act as a marker – its position and orientation indicating the general location of the impending fault, its size suggesting the degree of seismic force, and so the quake's magnitude.

Without any geological training, Shou is the first to admit that the mechanism behind earthquake cloud formation needs research. As far as he is concerned, it is the accuracy of his predictions that is most important.

Since he began logging his predictions in 1994, Shou claims that around 70 per cent of his predictions have proved correct, in spite of his only having access to publicly available satellite images. Had he access to higher-resolution, continuous images, which are generally classified, he claims his success rate would be higher.



LEFT: What Zhonghao Shou calls a 'lantern-shaped' earthquake cloud. RIGHT: On 25 December 2003, Shou used this cloud to predict an earthquake of magnitude 5.5 or more. The point from which it emerged (*) marks the epicentre of a 6.6 magnitude earthquake, which struck the following day in the Iranian city of Bam.

Those seismologists who considered Shou to be a quack began to take notice after 25 December 2003. On that day, he made an earthquake prediction on his website. Looking through images taken a few days before from the Meteosat-5 weather satellite, positioned over the Indian Ocean, Shou had identified a classic earthquake cloud along a well-known geological fault line in southeastern Iran. The images, which showed a huge trail of cloud appearing to emerge from half-way along the fault line, led Shou to predict an earthquake of a magnitude greater than 5.5 on the Richter scale in the region sometime within the next sixty days.

At 5.26am on 26 December, a quake of magnitude 6.6 struck along the fault line, with its epicentre in the ancient Iranian city of Bam – a position that corresponded almost exactly with the tip of the cloud that Shou had identified. It caused massive destruction, killing more than 26,000 people and injuring tens of thousands. Of the buildings in the 1,500-year-old Silk Route trading city, 70 per cent were flattened.

Following the remarkable success of his Bam prediction, Shou was invited in May 2004 to talk at a UN and Iranian Space Agency workshop in Tehran, which was debating the use of space technology for environmental security and disaster rehabilitation. According to Ansari Amoli, the space agency's remote sensing and disaster management expert, Shou's presentation was well received by the geologists, seismologists and meteorologists present. 'His earthquake clouds appear to be a very promising way of improving the short-term earthquake prediction, if used in conjunction with traditional methods,’ says Amoli. ‘But there is a need for a much better understanding of the mechanisms at work. I believe that it is an area that is worthy of serious research by earthquake specialists.’

Whether or not his methods for predicting earthquakes will begin to be accepted by the wider scientific community has yet to be seen. Some see them as far-fetched. ‘Only Mr Shou thinks there is any relationship between clouds and earthquakes happening 10km below the surface of the earth,’ was the comment of Dr Lucy Jones, Scientist-in-Charge of the Pasadena Field Office of the United States Geological Survey. His theories might not be as ridiculous as she makes out, however. They certainly have a long historical pedigree.

The Roman historian Pliny the Elder, drawing on the observations of Aristotle in AD77, alluded to clouds appearing in advance of earthquakes:

> *There is no doubt that earthquakes are felt by persons on shipboard, as they are struck by a sudden motion of the waves, without these being raised by any gust of wind… There is also a sign in the heavens; for, when a shock is near at hand, either in the daytime or a little after sunset, a cloud is stretched out in the clear sky, like a long thin line.*[3]

They are also described in the 32nd chapter of the *Brihat Samhita*, a Sanskrit text from the sixth century AD by the philosopher, mathematician and astronomer Varahamihira. The work, which is considered a seminal text of ancient Indian astronomy and astrology, claims that a particular type of earthquake is preceded a week before by an unusual cloud formation:

> *Its indications appearing a week before are the following: Huge clouds resembling blue lily, bees and collyrium in colour, rumbling pleasantly, and shining with flashes of lightning, will pour down slender lines of water resembling sharp clouds. An earthquake of this circle will kill those that are dependent on the seas and rivers; and it will lead to excessive rains.*[4]

The first recorded prediction of an earthquake based on the appearance of the clouds appears in the *Chronicle of Lon-De County, China*, compiled in 1623:

> *It was sunny and warm; the sky was blue and clear. Suddenly, there appeared threads of black clouds spanning the sky like a long snake. The clouds stayed for a long time, so there would be an earthquake.*[5]

Shou claims to have found records of an earthquake in Guyuan, in China’s Ningxia province, on 25 October 1622, the only one of its magnitude in Western China within the 148 years between 1561 and 1709.[6]

WHETHER OR NOT they can find clouds that presage earthquakes, cloudspotters certainly can see those that predict the arrival of local weather systems. It is the behaviour of the high clouds, such as Cirrus, that they should watch. When they are spreading and thickening across the blue these Cirrus seem not so much floes of angel hair, as tufted whiskers of a wise man’s beard. He’s a genial old fellow, who’ll tell of the weather in store. But he speaks in a whisper. It is one that only those who pay attention will ever hear.

John Miles (member 1177)

Whether Cirrus are angel hair or a wise man’s beard, this is presumably the comb.