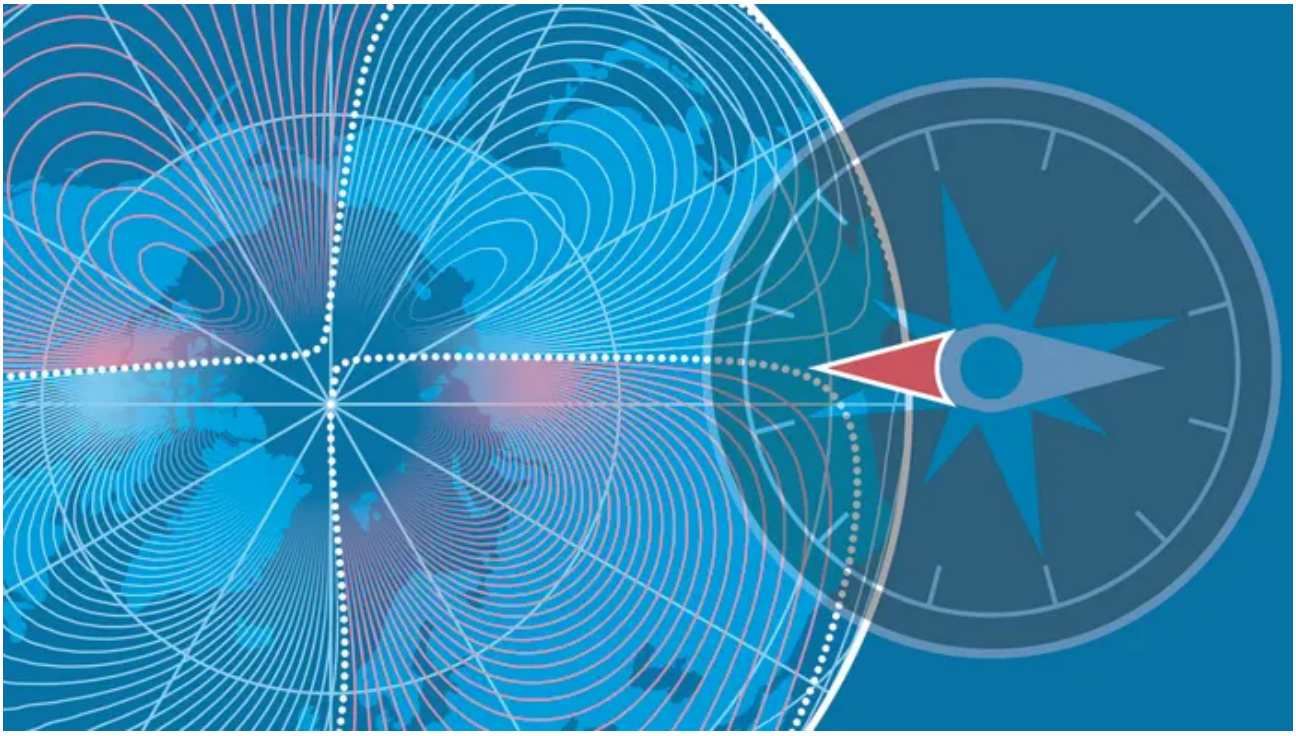
Science

Shift in Earth's magnetic north throws navigators off course

Vital point on planet's surface races at unprecedented speed across Arctic



Clive Cookson in London 11 HOURS AGO

Navigators have relied upon it for centuries. More recently it has become an essential aid in everything from smartphone apps to aviation and shipping.

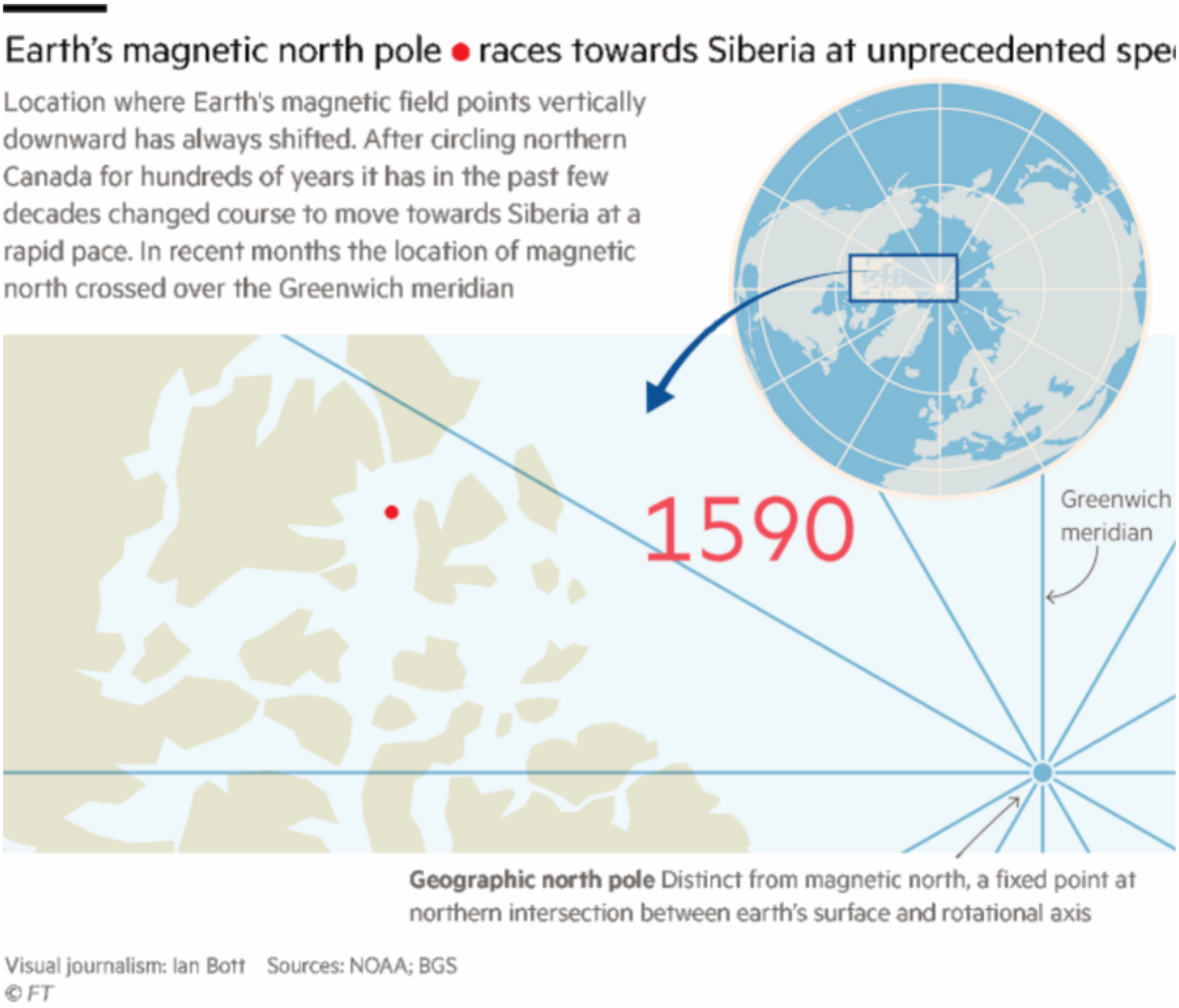
The magnetic north pole is the peripatetic point on the Earth's surface where its magnetic field, created by molten iron churning deep within the planet's core, points directly downwards.

But the latest calculations reveal how magnetic north is shifting position at a rate that is unprecedented in recorded history, racing across the Arctic region at 50 kilometres a year and showing little sign of slowing down.

"The movement since the 1990s is much faster than at any time for at least four centuries. We really don't know much about the changes in the core that's driving it," said Ciaran Beggan, a geomagnetic specialist at the British Geological Survey.

The findings were contained in the updated version of the World Magnetic Model released this

week by its joint compilers, the BGS and US National Centers for Environmental Information.



Together with satellite positioning data, the model underpins modern navigation, and frequent revisions are essential so operators can reconcile magnetic sensor and compass readings with geographic reality.

From the time records were first kept in the 16th century until the late 1990s, the magnetic north pole plotted a fairly stable course as it wandered slowly around what is now the Canadian Arctic. But then it picked up pace as it plotted a new course northwards towards its geographic equivalent at the top of Earth ś rotational axis.

The speed has increased in recent years with magnetic north heading rapidly in the direction of Siberia. This year it passed within 390km, or 3 degrees, of the geographic north pole and

crossed the Greenwich meridian for the first time.

The magnetic field is generated mainly by a dynamo effect, as molten iron moves within the Earth's core and creates electric currents. Yet scientists are only just beginning to understand the fluid dynamics of the core that could one day allow for more accurate magnetic forecasting.

Phil Livermore and colleagues at Leeds University's institute of geophysics recently deduced that a "jet stream" of liquid iron was flowing within the core, something that could explain fluctuations in magnetic north's behaviour.

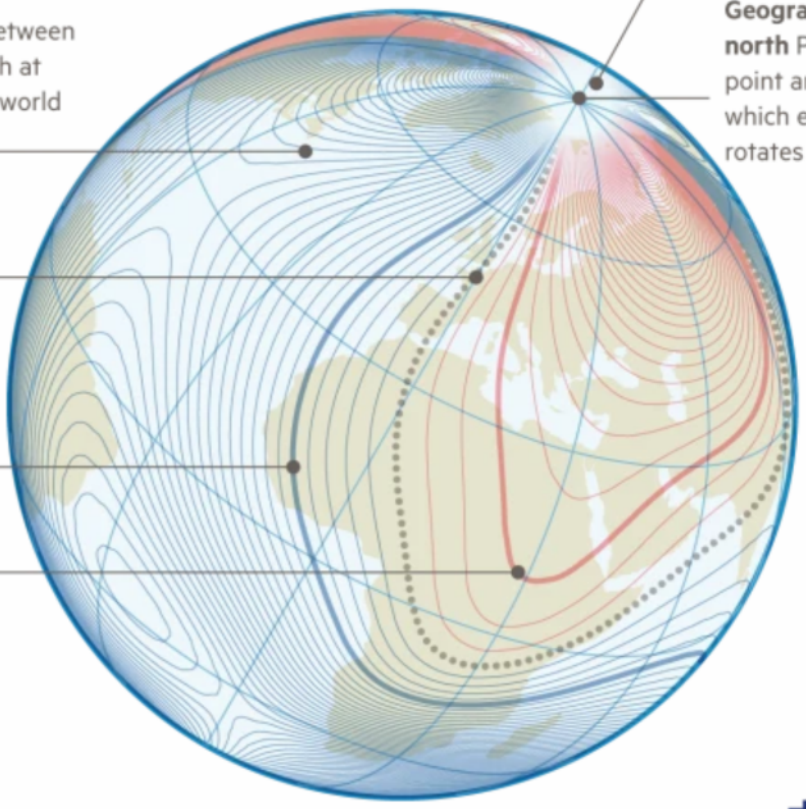
"We should be able to predict the 'weather' of the core by tracking this movement just like we forecast real weather," said Prof Livermore. "But the liquid iron is far harder to track because it lies beneath 3,000 kilometres of rock."

The updated model also confirmed that the Earth's magnetic field is weakening by about 5 per cent every century. If this continues, the field could reverse, ushering in an era of magnetic chaos as the north pole flips south and vice versa.

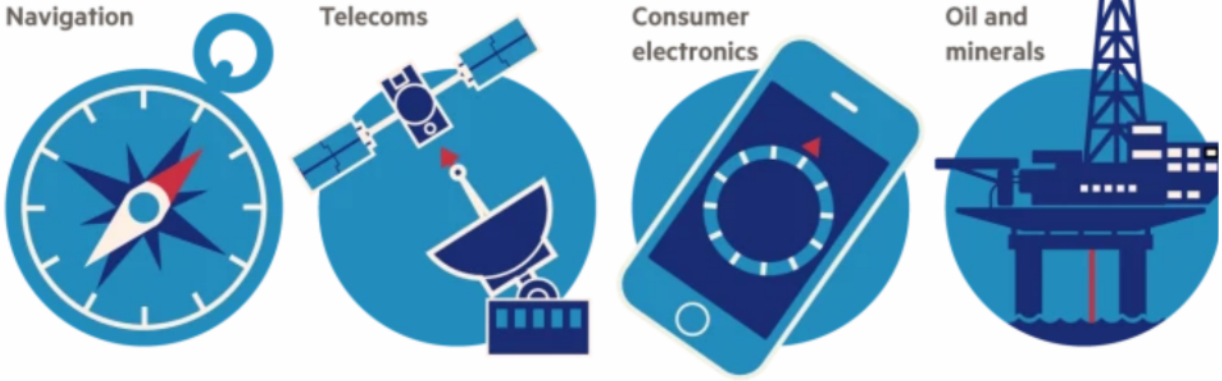
Geological records show this has happened before, most recently 780,000 years ago. In a sense, another reversal is overdue because on average one happens every 500,000 years or so, but geomagnetism is too complex for that simplistic view to be a useful guide.

The changing World Magnetic Model

Fluid nature of Earth's core, and magnetic field it influences, requires regular updates



Applications



Though GPS satellite navigation provides a precise position, all ships and aircraft also carry a magnetic compass to tell the direction of travel. It is also a back-up in case satellite signals are lost

Antennas and dishes need to be oriented in exactly the right direction for efficient transmission and reception of radio signals. The magnetic model enables this

Digital compasses built into smartphones and cameras show the direction in which the device is pointing. Apps such as Google Maps make use of this facility

Exploration companies use the model to disentangle Earth's main magnetic field from local magnetic signals. Their engineers also rely on an electronic compass to orient drill heads

Implications for air travel

At John Wayne airport in California, the runway signalling had to be

A magnetic flip would have dire consequences for any civilisation around when it happened, because the magnetic field would no longer shield the Earth against violent space weather.

Until the new reversed field established itself, terrestrial life —and infrastructure such as satellites, aviation and electrical grids —would be heavily exposed to damaging solar and cosmic radiation. Fortunately, few geophysicists expect such a reversal in the next few centuries.

In the more immediate future, scientists have little idea how long magnetic north will continue on its new path or at what speed. Curiously, on the other side of the planet, the magnetic south pole has stayed almost stationary for decades.

The outlook for the next decade, based on the most reliable geophysical modelling, is for magnetic north to continue on its current trajectory for about 500km. But scientists cannot rule out further deviations in the Earth s unpredictable magnetic field.