

# Global warming could change Earth's tilt

- 21:02 20 August 2009 by [Rachel Courtland](#)
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Warming oceans could cause Earth's axis to tilt in the coming century, a new study suggests. The effect was previously thought to be negligible, but researchers now say the shift will be large enough that it should be taken into account when interpreting how the Earth wobbles. The Earth spins on an axis that is tilted some 23.5° from the vertical. But this position is far from constant – the planet's axis is constantly shifting in response to changes in the distribution of mass around the Earth. "The Earth is like a spinning top, and if you put more mass on one side or other, the axis of rotation is going to shift slightly," says [Felix Landerer](#) of NASA's Jet Propulsion Laboratory in Pasadena, California.

The changing climate has long been known to move Earth's axis. The planet's north pole, for example, is migrating towards 79 °W – a line of longitude that runs through Toronto and Panama City – at a rate of about 10 centimetres each year as the Earth rebounds from ice sheets that once weighed down large swaths of North America, Europe, and Asia.

The influx of fresh water from shrinking ice sheets also causes the planet to pitch over. Landerer and colleagues estimate that the melting of Greenland's ice is already causing Earth's axis to tilt at an annual rate of about 2.6 centimetres – and that rate may increase significantly in the coming years.

Now, they calculate that oceans warmed by the rise in greenhouse gases can also cause the Earth to tilt – a conclusion that runs counter to older models, which suggested that ocean expansion would not create a large shift in the distribution of the Earth's mass.

## Tracking sea levels

The researchers modelled the changes that would occur if moderate projections made by the [Intergovernmental Panel on Climate Change](#) – a doubling of carbon dioxide levels between

2000 and 2100 – were to become reality.

The team found that as the oceans warm and expand, more water will be pushed up and onto the Earth's shallower ocean shelves. Over the next century, the subtle effect is expected to cause the northern pole of Earth's spin axis to shift by roughly 1.5 centimetres per year in the direction of Alaska and Hawaii.

The effect is relatively small. "The pole's not going to drift away in a crazy manner," Landerer notes, adding that it shouldn't induce any unfortunate [feedback](#) in Earth's climate.

But he says the motion is strong enough that it needs to be taken into account when interpreting shifts in Earth's axis. Tracking the motion of the poles could help place limits on the total amount of sea level rise over decades.

"The oceans take up at least 80 per cent of the heat that is added from greenhouse gases," Landerer told *New Scientist*. "They have a huge heat capacity, so this effect is going to be there for quite a bit."

## **Faster spin**

[Maik Thomas](#) of the German Research Centre for Geosciences in Potsdam, who was not affiliated with the study, says the new work overturns previous ideas. "Up to now, people had believed that height variations [from ocean temperature changes] gave no contribution to polar motion," he told *New Scientist*. "This is an effect that now has to be considered."

But Thomas notes that polar motion is unlikely to yield a good measurement of sea level rise, whose signal may be difficult to disentangle from a host of other factors that contribute to changes in Earth's tilt, from movements in Earth's crust and mantle to the periodic effects of [El Niño](#), an oscillation of the ocean-atmosphere system in the Pacific.

And climate change can also affect the Earth's spin. Previously, Landerer and colleagues showed that global warming would cause Earth's mass to be redistributed towards higher latitudes. Since that pulls mass closer to the planet's spin axis, it causes the planet to rotate faster – just as an ice skater [spins faster](#) when she pulls her arms towards her body.

Journal reference: *Geophysical Research Letters* (in press)