

How quakes move planets

—by Richard Harris

The magnitude 8.8 quake in Chile this March apparently changed the length of the day—and shifted the way the Earth wobbles, according to scientists at NASA's Jet Propulsion Laboratory.

Not that anyone noticed.

Here's why scientists figure that the Earth changed the way it rotates. It turns out our planet doesn't spin like a perfect top; it actually wobbles a bit.

"The consequence of that is that the rotation pole actually moves, and it moves over the area about the size of a tennis court," says Richard O'Connell at Harvard University.

This is called the Chandler wobble. Back in the mid 1970s, O'Connell wrote a paper that showed how big earthquakes keep kicking the Earth and by so doing, keep the Earth wobbling.

THE EARTH'S WANDERING, WOBBLY AXIS

Earthquakes aren't alone in keeping that wobble going, though. It's also propelled by sloshing ocean waters and by huge air masses like typhoons. All this shifting around can also change the speed at which the Earth spins. And that, of course, affects the length of a day.

So how much difference can an enormous quake make? Scientists at the Jet Propulsion Laboratory figure that the shift caused by the quake in Chile should have shortened each day on Earth by about a millionth of a second. They also figure that the Earth's wobbly axis should have shifted by about three inches within that tennis-court-size area where it tends to wander.

But did it? It's Brian Luzum's job at the U.S. Naval Observatory to keep tabs on the Earth's rotation and orientation. And he says even the best instruments in the world can't measure a change in day length as small as a millionth of a second.

THE WOBBLE DOESN'T SHOW UP IN DATA

It is possible to measure the Earth's wobble pretty precisely. But considering how many things affect that wobble, it's hard to see the effect of the quake as well.

"On a day-to-day basis, we actually will see changes on the order of two to three inches happening every day, and to try to pick out this signal in and among all the other signals, is just not really feasible," Luzum says.

The one hope was that the quake changed the wobble so abruptly that it would show up in the data.



"One would like to see it, to have that eureka moment, but when we did look at the data there was no such jump," Luzum says.

Theory says it happened, but the observations thus far aren't good enough to back it up.

MELTING ICE ALSO MOVED THE EARTH

Yet, even if these planetary effects are trivial on a day-to-day basis, they can really add up over geological time. Adam Maloof at Princeton University notes that ice has been melting over the past 12,000 years, as we come out of the last ice age. That's changing the Earth's orientation by about an inch, each and every year.

"You can imagine that as the ice melts you are redistributing the mass on the surface of the Earth," Maloof says. "So all this water that's caught up in the ice in poles is melting and moving into the oceans at lower latitudes."

And if you go way back in time—like to a period 800 million years ago—this kind of movement was dramatic. Over the course of a few million years, the land mass at the North Pole shifted monumentally: It slid south by 50 degrees. "That's basically like taking Paris to the equator," Maloof says.

Nobody knows why the shift happened, though Maloof says one idea is that a huge volcanic plume, like the one that created the Hawaiian Islands, developed near one of the poles, and that lopsided mass forced the Earth to rotate.

"It would have had major ramifications for sea level, climate, landscape, equilibrium, all sorts of effects like this," he says.

As for the effect of one quick catastrophic event: It's fair to say the Chilean quake touched hearts around the world more tangibly than it changed the spin of our planet. [NPR]