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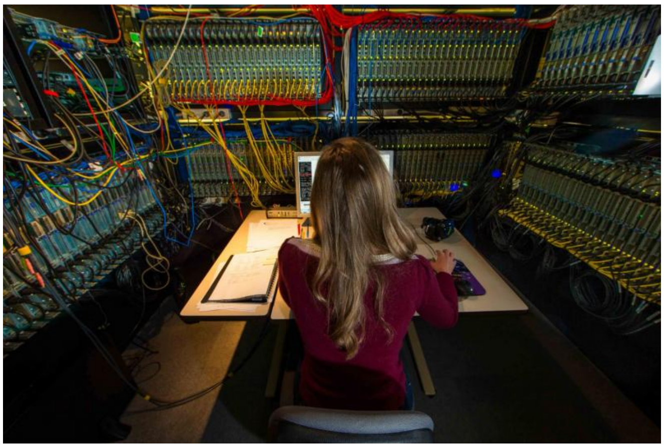
17 December 2015



The team used the TerraWulf high-end computing cluster to generate their map. Credit: Stuart Hay, ANU

The temperature 3,000 kilometres below the surface of the Earth is much more varied than previously thought, scientists have found.

The discovery of the regional variations in the lower mantle where it meets the core, which are up to three times greater than expected, will help scientists explain the structure of the Earth and how it formed.

"Where the mantle meets the core is a more dramatic boundary than the surface of the Earth," said the lead researcher, Associate Professor Hrvoje Tkal?i?, from The Australian National University (ANU).

"The contrast between the solid mantle and the liquid core is greater than the contrast between the ground and the air. The core is like a planet within a planet." said Associate Professor Tkal?i?, a geophysicist in the ANU Research School of Earth Sciences.

"The centre of the earth is harder to study than the centre of the sun."

Temperatures in the lower mantle the reach around 3,000-3,500 degrees Celsius and the barometer reads about 125 gigapascals, about one and a quarter million times atmospheric pressure.

Variations in these temperatures and other material properties such as density and chemical composition affect the speed at which waves travel through the Earth.

The team examined more than 4,000 seismometers measurements of earthquakes from around the world.

In a process similar to a CT scan, the team then ran a complex mathematical process to unravel the data and build the most detailed global map of the lower mantle, showing features ranging from as large as the entire hemisphere down to 400 kilometres across.

The map showed the seismic speeds varied more than expected over these distances and were probably driven by heat transfer across the core-mantle boundary and radioactivity.

"These images will help us understand how convection connects the Earth's surface with the bottom of the mantle," said Associate Professor Tkal?i?.

"These thermal variations also have profound implications for the geodynamo in the core, which creates the Earth's magnetic field."

The study is published in *Scientific Reports*.

Provided by Australian National University