AGM2015: ANTINEUTRINO GLOBAL MAP 2015

NGA GLOBAL MAP TO ADVANCE R&D IN GEOPHYSICS AND NONPROLIFERATION

The Antineutrino Global Map 2015 (AGM2015) characterizes the Earth's radioactivity and depicts the planet's natural and anthropogenic emissions of antineutrinos. These subatomic particles are key to better understanding nuclear reactor detection, the natural radiation of the Earth, and even indications of how planets form. Neutrino physicists and geologists from the NGA, the University of Hawaii, Hawaii Pacific University, the University of Maryland, and Ultralytics, LLC, released a paper on the AGM2015 in the September 2015 issue of Nature's Scientific Reports, a peer reviewed journal. This collaboration demonstrates NGA's commitment to its vision of knowing the Earth, showing the way and understanding the world.

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The neutrino and its antimatter cousin, the antineutrino, are the tiniest subatomic particles known today. They are produced by stars of all types, the atmosphere, supernovae, nuclear reactors and radioactive materials. In 2005, antineutrinos were detected for the first time emanating from the inner Earth. Most recently, neutrinos observed in Antarctica in 2015 are thought to be associated with high-energy cosmic phenomenon. These messenger particles are key to studying the most inaccessible regions in the universe.

Radioactive elements measured on meteorites that fell to Earth can be compared with our geo-neutrino readings, which provide clues to how planets are formed around the early solar nebula.

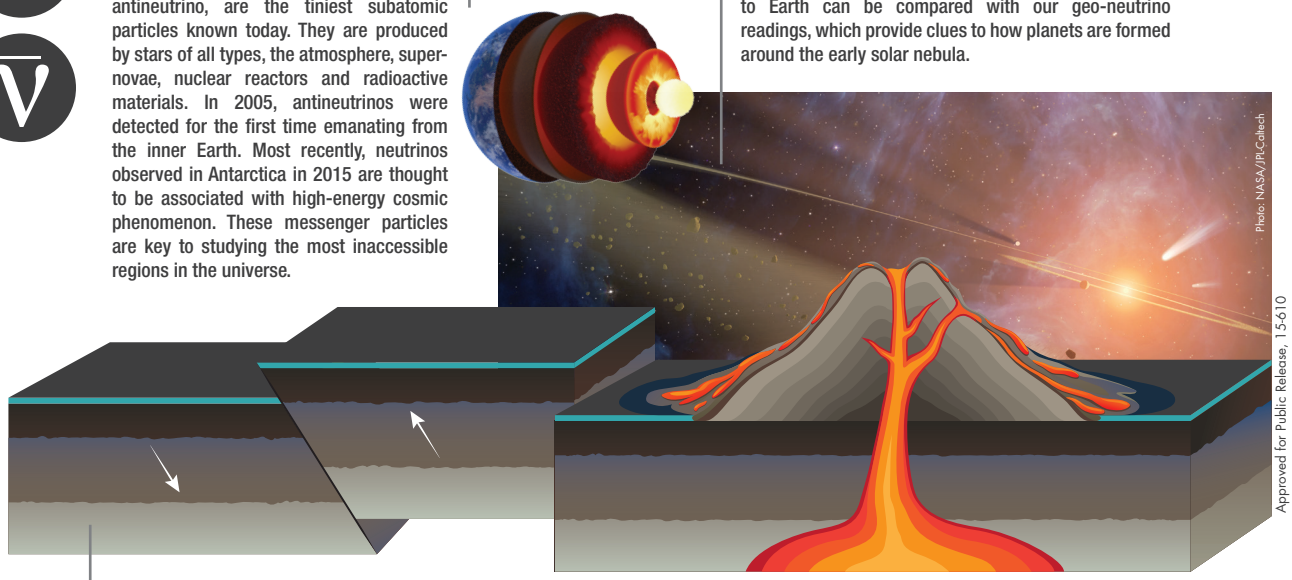

Photo: NASA/JPL-Caltech

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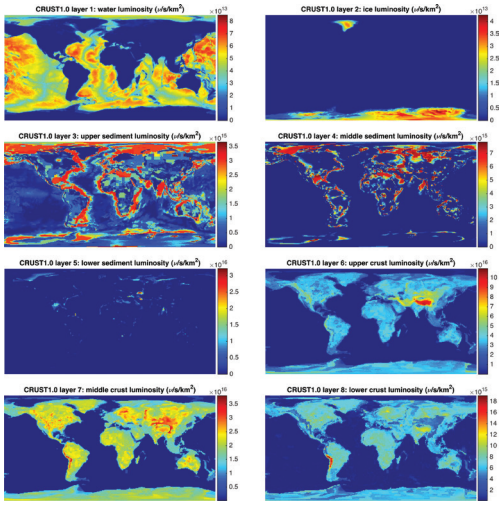
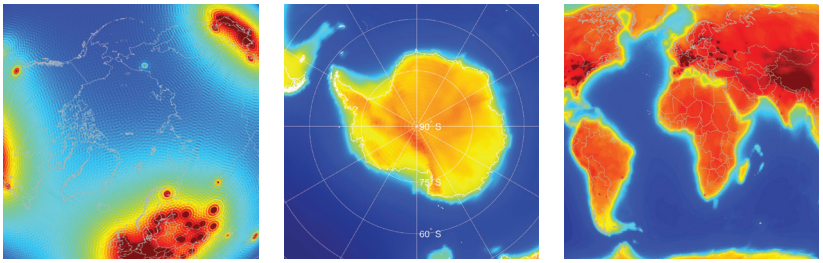
Antineutrinos emanating from the inner Earth, known as geo-neutrinos, zip through the planet carrying vital information for geophysicists to study. Today, less is known about the deepest parts of our planet than about the Sun. Geo-neutrinos make it possible to discover what is impossible by traditional methods, including the direct measurement of radioactive elements like uranium and thorium. This radioactive heat is the driving force behind tectonic plate movement and magma flows on the surface of the Earth. Measuring geo-neutrinos helps scientists at NGA understand how the Earth is changing and moving every day.





The AGM2015 was developed using ice data from the National Oceanic and Atmospheric Administration, EGM2008 (Earth Gravitational Model 2008) developed by NGA, CRUST 1.0 (a model of the Earth's crust) from the U.S. Geological Survey, open source geophysical data sets, and the results of international collaborations in Italy and Japan. All of this data was combined by NGA and visualized in this first-of-its-kind map. NGA plans to update the AGM2015 as the agency's understanding of antineutrinos improves and more data becomes available. NGA released a poster, KMZ file and GEOTIFF version of the map, which are available for download on www.nga.mil.

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