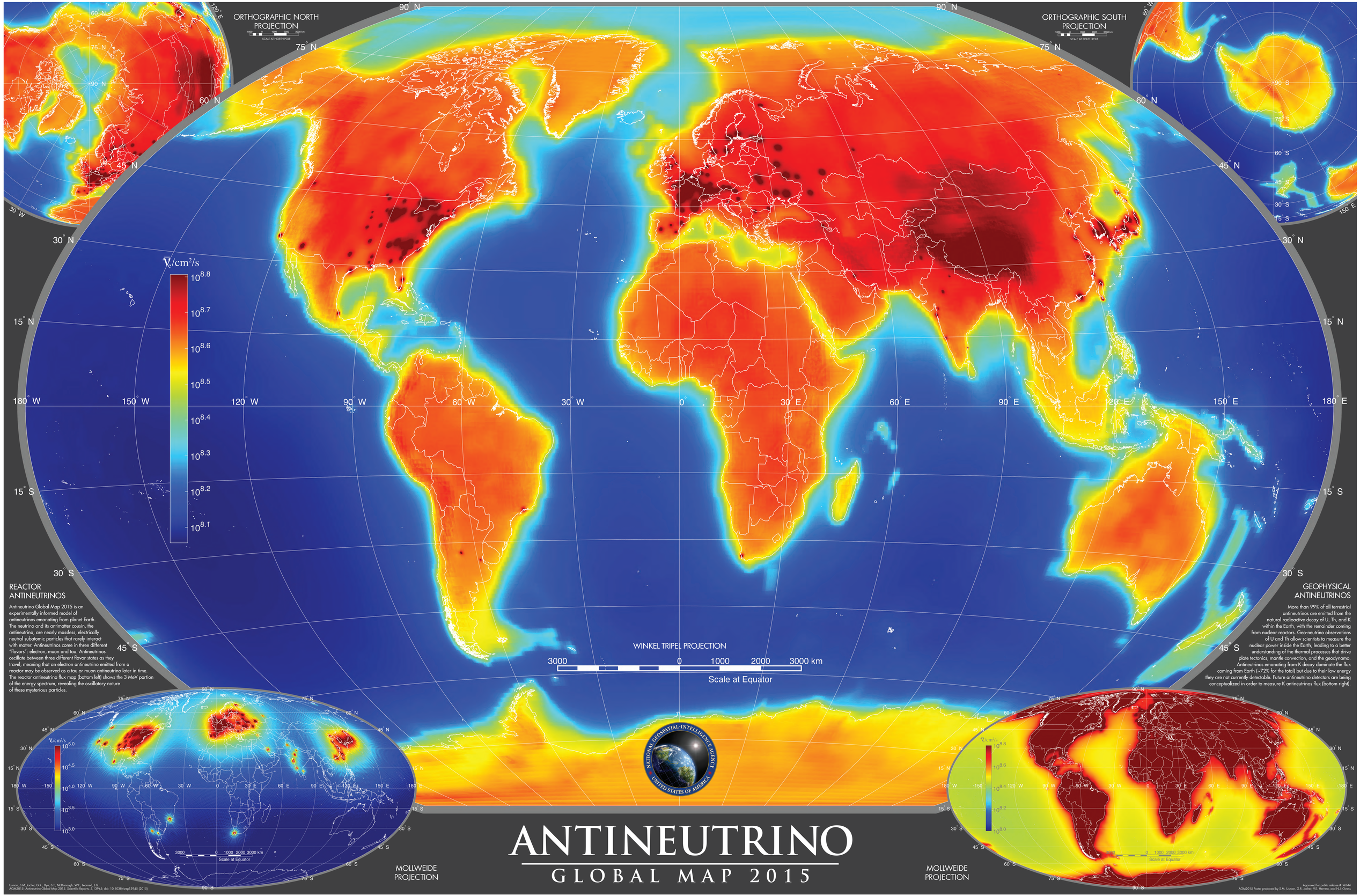

REACTOR ANTINEUTRINOS

Antineutrino Global Map 2015 is an experimentally informed model of antineutrinos emanating from planet Earth. The neutrino and its antimatter cousin, the antineutrino, are nearly massless, electrically neutral subatomic particles that rarely interact with matter. Antineutrinos come in three different "flavors": electron, muon and tau. Antineutrinos oscillate between three different flavor states as they travel, meaning that an electron antineutrino emitted from a reactor may be observed as a tau or muon antineutrino later in time. The reactor antineutrino flux map (bottom left) shows the 3 MeV portion of the energy spectrum, revealing the oscillatory nature of these mysterious particles.

GEOPHYSICAL ANTINEUTRINOS

More than 99% of all terrestrial antineutrinos are emitted from the natural radioactive decay of U, Th, and K within the Earth, with the remainder coming from nuclear reactors. Geo-neutrino observations of U and Th allow scientists to measure the nuclear power inside the Earth, leading to a better understanding of the thermal processes that drive plate tectonics, mantle convection, and the geodynamo. Antineutrinos emanating from K decay dominate the flux coming from Earth (~72% for the total) but due to their low energy they are not currently detectable. Future antineutrino detectors are being conceptualized in order to measure K antineutrinos flux (bottom right).

ANTINEUTRINO

GLOBAL MAP 2015

Usman, S.M., Jocher, G.R., Dye, S.T., McDonough, W.F., Learned, J.G.
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