

# Correlation of Earth's Magnetic Field and Oxygen with Implications for Habitability

Earth is the only known rocky planet to support complex life forms that use oxygen and to have a strong intrinsic magnetic field in much of its history.

Earth's magnetic field is hypothesized to provide protection for the atmosphere from erosion by energetic particles coming from the Sun.

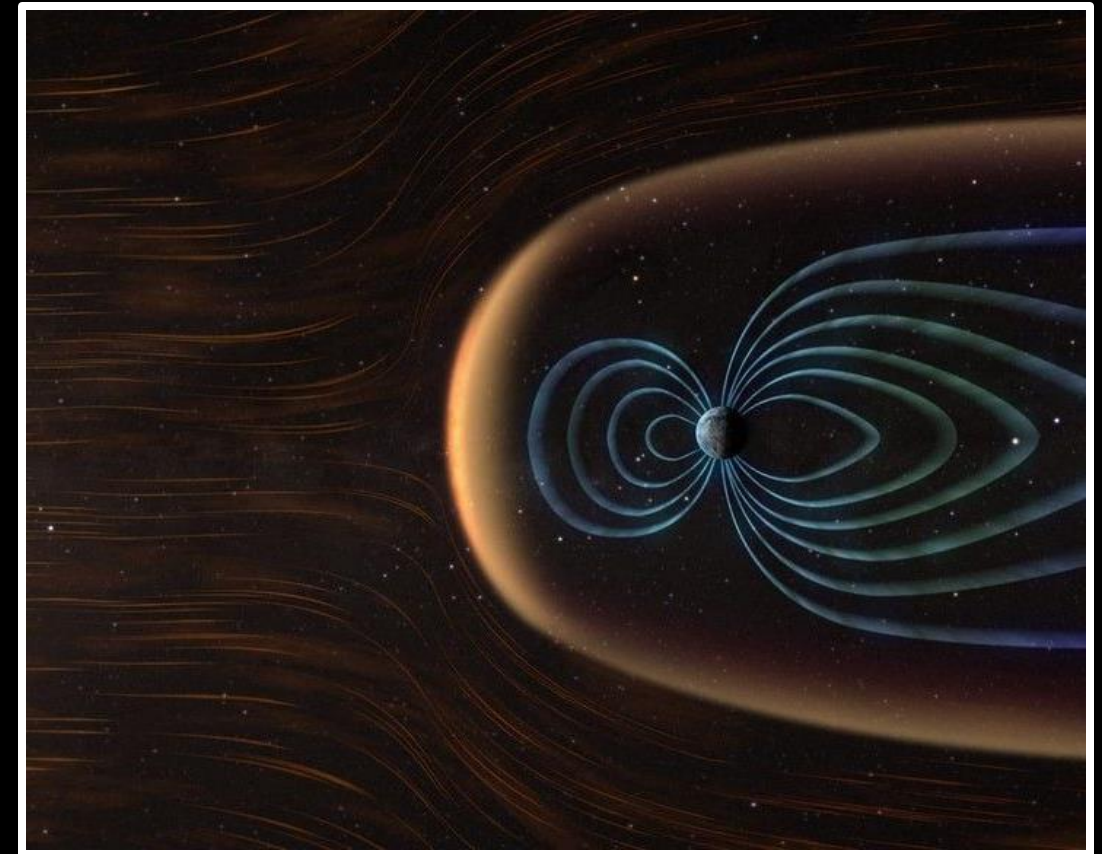
A new study from Kuang et al. provides the first observational evidence for a relationship between these two features, showing that for 540 million years, the ebb and flow in the strength of Earth's magnetic field has correlated with fluctuations in atmospheric oxygen.

Paleomagnetism and oxygen records both show increasing secular trends but remain highly correlated on long timescales even after both time series are detrended.

This correlation may indicate Earth's magnetic field strength and atmospheric oxygen levels are both responding to a single driver, such as the movement of Earth's continents.

Future work will investigate if and how other nutrient cycles (e.g. nitrogen) relate to magnetic field evolution.

Understanding how geodynamism relates to planetary atmospheres can aid our search for other habitable worlds; this finding illustrates how NASA Earth Science can inform our role in exploring space.



Earth's magnetic field interacting with solar wind. Credit: NASA's Goddard Space Flight Center/Conceptual Image Laboratory

**Journal Article:** Kuang, W., Kopparapu, R., Krissansen-Totton, J., & Mills, B. J. (2025). Strong link between Earth's oxygen level and geomagnetic dipole revealed since the last 540 million years. *Science Advances*, 11(24).

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