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Earth's core provides insights into air temperature and anthropogenic forcing

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The headlines appearing in a NASA website feature article by Alan Buis in March 2011 read: “*NASA Study Goes to Earth's Core for Climate Insights. The latest evidence of the dominant role humans play in changing Earth's climate comes not from observations of Earth's ocean, atmosphere or land surface, but from deep within its molten core.*” A NASA/university study of data on the Earth's rotation, movements in its molten core and global surface air temperatures is revealing some fascinating correlations. The article points out that scientists have already established the occurrence of fluctuations of about 1 ms in the length of day on Earth and that such seasonal changes in the length of day are influenced by exchanges in energy between the fluid motions of the Earth's atmosphere and the solid Earth. Over longer timescales, 65–80 years, the length of day varied up to 4 ms. Liquid iron flowing in Earth's outer core oscillates in waves of motion for decades and with timescales that correspond closely to long-duration variations in Earth's length of day. A link between the long-duration variations in Earth's length of day and fluctuations of up to 0.2°C in Earth's long-term global average surface air temperature has been observed by other studies.

Researchers Jean Dickey and Steven Marcus of NASA's Jet Propulsion Laboratory, and Olivier de Viron of the Universite Paris Diderot and Institut de Physique du Globe

de Paris are studying this using existing data from a model of fluid movements within Earth's core (angular momentum of the core) and data on yearly averaged length-of-day observations (Earth's rotation rate). These are mapped against two time series of observed annual global average surface temperature going back to 1860 and 1880. Using results from computer climate models of Earth's atmosphere and ocean to account for human-produced temperature changes, they generated corrected temperature records. Until circa 1930 (when anthropogenic forcing becomes significant), the uncorrected temperature data correlated strongly with data on movements of Earth's core and Earth's length of day and thereafter started to diverge greatly. Global surface air temperatures continued to increase, but there were no corresponding changes in Earth's length of day or movements of Earth's core. The corrected temperature record, however, remained strongly correlated with both Earth's length of day and movements in the Earth's core throughout the entire temperature data series.

“*Our research demonstrates that, for the past 160 years, decadal and longer-period changes in atmospheric temperature correspond to changes in Earth's length of day if we remove the very significant effect of atmospheric warming attributed to the buildup of greenhouse gases due to mankind's enterprise. Our study implies that human influences on climate during the past 80 years mask the natural balance that exists among Earth's rotation, the core angular momentum and the temperature at Earth's surface.*” (Dickey, <http://www.nasa.gov/topics/earth/features/earth20110309.html>).

Their work *Air Temperature and Anthropogenic Forcing: Insights from the Solid Earth* was published January 2011, in the *Journal of Climate* 24, 569–574, doi:10.1175/2010JCLI3500.1 (<http://journals.ametsoc.org/loi/clim>).

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