Jan 18th, 4:00 PM - 5:00 PM

CO2 Levels And Climate Change During Early Eocene Hyperthermals

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MONTCLAIR STATE UNIVERSITY

The MSU Sustainability Seminar Series Presents:

CO_2 levels and climate change during Early Eocene hyperthermals

WHEN: January 18 (Thursday), 4:00 pm
WHERE: CELS 120 lecture hall

Dr. Ying Cui
Dartmouth College

Dr. Cui is currently an Obering Postdoctoral Fellow from the Department of Earth Sciences at Dartmouth College. She obtained a PhD in Geosciences and Biogeochemistry at Penn State. Her research deals with carbon cycles during ancient hyperthermal events, such as the Paleocene-Eocene Thermal Maximum and the end-Permian mass extinction event. Her main research interest is in exploring the links between extinction, carbon emission and hyperthermals. She has published 12 peer-review articles related to this research topic, including *Nature Geoscience*, *Earth and Planetary Science Letters*, *Geochimica et Cosmochimica Acta* and *Earth-Science Reviews*. She is currently funded by National Science Foundation to study the atmospheric pCO_2 and Earth system climate sensitivity during the Cenozoic.

Early Eocene (56 to 33.9 million years ago) is punctuated by a series of rapid and extreme global warming events, known as the 'hyperthermals', triggered by massive release of carbon dioxide. Despite the carbon emission rate might have been ten times smaller than the current emission from burning fossil fuels and cement production, the early Eocene hyperthermals are considered one of the best analogues for CO_2 concentration projected into the future. The temperature records are well established from deep sea sediments during these hyperthermals, but the CO_2 levels in the atmosphere remain poorly known, partly due to the lack of a reliable CO_2 proxy.

Thanks to a newly developed C_3 land plant CO_2 proxy, we were able to calculate the upper limit of the CO_2 levels just before and during five early Eocene hyperthermals (PETM, H1, H2, I1 and I2). This proxy is based on the empirical relationship between carbon isotope fractionation and the ambient CO_2 levels: i.e. as CO_2 level rises, carbon isotope fractionation also increases. By comparing the carbon isotope excursion recorded in the ocean and on land, we were able to find that CO_2 levels just before each of the hyperthermals may have been less than 1000 parts per million, or ppm. CO_2 level as high as 2600 ppm might have occurred only briefly during the hyperthermals. This suggests that to maintain the early Eocene ice-free condition and global average surface temperature of ~25 ^{o}C, other greenhouse gases, such as methane, water vapor and nitrous oxide must have played more important role.