"The Imprint of Climate Change Over the Last Millennium in Modern-Day Ocean Tracer Distributions"

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When: **Friday, April 3, 2009 10:30 a.m. to 11:30 a.m.**

Where: **Seminar Room 1.603**
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Host: **Charles Jackson, UTIG**

The waters of the deep ocean were last in contact with the sea surface many hundreds of years ago. Is the signal of past changes in the Earth's climate, such as the Little Ice Age and the Medieval Warm Period, detectable in present-day ocean tracer fields? Through air-sea interaction and upper ocean processes, the entire sea surface produces distinct combinations of tracer properties, and thus it is natural to define a distinct water type for each surface site. Here I describe a new box inversion method to explore the contributions of all surface sites to the ocean interior, as well as the degree to which the observed tracer fields can be explained by a steady state circulation with unchanging surface boundary conditions. The method is novel in the use of geographic constraints, taken into account by modeling the pathways connecting each surface box to each interior box. Modern-day climatologies of temperature, salinity, phosphate, nitrate, oxygen, and oxygen-18/oxygen-16 isotope ratio are simultaneously inverted at 2-degree horizontal resolution with 25 vertical levels. Interior properties are found to be in disequilibrium with respect to the surface, not just in the upper ocean as would be expected due to anthropogenic forcing, but also in the deep ocean. Calling upon radiocarbon and oxygen utilization rates, I estimate the time since each water parcel was last at the surface. This second inversion indicates that vestiges of surface waters formed throughout the last millennium are still present in the modern-day ocean, primarily in the deep Pacific, which are anomalous with respect to modern surface properties. Furthermore, I explore the changes in surface boundary conditions, deep-water production rates, and variations in ocean transport pathways which can help explain the modern distribution of ocean tracers.