

**Date:** May 12<sup>th</sup>

**Time:** 11:00 AM

**Location:** Maryland Hall 110

**Speaker:** Dr. Mark Holzer  
Columbia University

**Title:** “The Ocean's Memory of the Atmosphere: Ventilation-Rate, Residence-Time, and Path-Density Distributions”

### **Abstract**

The ocean is a vast reservoir of atmospheric constituents that enter the ocean with a characteristic global pattern of fluxes, remain dissolved in the oceans for times ranging from seconds to millennia, and are then re-ventilated to the atmosphere with another characteristic pattern of fluxes. This talk presents a new approach for thinking about the ocean circulation in terms of distributions of ventilation rates, transport volumes, and path densities.

Tracer-independent diagnostics will be developed that partition both ventilation rates and transport volumes according to the interior residence time between successive surface contacts with specified entry and exit patches. For overlapping entry and exit patches, eddy diffusion imparts a singularity to the ventilation-rate distribution at zero residence time, which implies that generally ventilation rate cannot be quantified by a single scalar, but must be characterized by a distribution. To track water through the interior between successive surface contacts, we calculate the density, per unit volume and residence time, of paths connecting specified surface patches. This path density allows us to quantify to what degree the now entrenched picture of the great ocean conveyor is correct and what role eddies play in modifying this picture. Results from a global circulation model will be used to illustrate the rich detail that our diagnostics provide on the way the ocean communicates with the surface.