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Center for Environmental  
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Friday, September 28, 2018  
3:00 PM, 132 Gilman Hall

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***"The Climate's Response to Anthropogenic Emissions:  
The Role of Ocean Circulation"***

**Presented by Dr. Rei Chemke**

Columbia University

The effects of ocean circulation on the climate's response to anthropogenic emissions at low and high latitudes are examined. At low latitudes, the Hadley cell plays an important role in setting the strength and position of the hydrological cycle. Climate projections show a weakening of the Hadley cell, together with widening of its vertical and meridional extents. These changes are projected to have profound global climatic impacts. Current theories for the Hadley cell response to increased greenhouse gases account only for atmospheric and oceanic thermodynamic changes, but not for oceanic circulation changes. Here, the effects of ocean circulation changes on the Hadley cell response to increased greenhouse gases are examined. First, using a hierarchy of ocean-model configurations under increased greenhouse gases or arctic sea-ice loss, we show that, by cooling the surface and atmosphere, ocean circulation contracts and strengthens the Hadley cell, and thus reduces its projected response.

At high latitudes, we examine the effects of ocean circulation on the North Atlantic sea surface temperature, which has large climate impacts in the Northern Hemisphere. In recent years and in climate projections a cooling trend is found in the North Atlantic surface (the North Atlantic warming hole). Using observations and large ensemble of model simulations, we find that since the beginning of 21st century there has been a reduction in surface meridional heat advection, which cools the North Atlantic midlatitudes and is part of an emerged forced response to anthropogenic emissions and not part of internal climate variability, and thus projected to continue in coming decades.