

ATS/CIRA Colloquium

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Progress on Diagnosing, Partitioning, and Understanding Cloud Feedbacks

Hosted by Sue van den Heever

Monday, February 20, 2012

**ATS room 101; Discussion will begin at 3:30pm
Refreshments will be served at 3:00pm in the coffee lounge**

The response of clouds to a warming climate represents one of the largest sources of disagreement among model projections of future climate change. My research seeks to quantify, understand, and ultimately constrain cloud feedbacks using theory, observations, and global climate models. Here I will present a novel technique to compute and partition cloud feedbacks. At the heart of the technique is the cloud radiative kernel, which quantifies the impact on top-of-atmosphere radiative fluxes of changes in cloud fraction segregated by cloud top pressure and optical depth. Compared to other means of calculating cloud feedback, this technique has the huge advantage of allowing for quantification of the contribution to cloud feedback from different cloud types as well as from changes in cloud altitude, optical depth, and total amount.

Several features of modeled cloud feedbacks will be discussed, including the robustly positive cloud amount feedback, the strongly negative high latitude cloud optical depth feedback, and the robustly positive altitude feedback. Focusing in on the tropical longwave high cloud altitude feedback, I will demonstrate that its sign and magnitude are well-explained by theoretical constraints. Furthermore, I will show that observed tropical high clouds behave in a manner consistent with those in models, extending to higher altitudes as the tropics warms. Avenues of future progress on cloud feedbacks that are facilitated by cloud radiative kernels will be discussed. Specifically, I will advocate for a divide-and-conquer approach to understanding the robust and non-robust aspects of individual cloud feedbacks and for quantifying and reducing the sources of inter-model spread in individual cloud feedbacks.

Link to colloquium videos and announcement page: <http://www.atmos.colostate.edu/dept/colloquia.php>