**ATS/CIRA Colloquium**

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# Do mid-latitude jet shifts cause cloud feedbacks?

**Hosted by Libby Barnes**

**Friday, September 23, 2016**

**ATS room 101; Discussion will begin at 11:15am**
**Refreshments will be served at 10:45am in the weather lab**

In response to increasing atmospheric greenhouse gas concentrations, most global climate models project that the mid-latitude jet streams will shift poleward over the 21st century. Consequently, the tracks of mid-latitude low-pressure systems and their associated cloud features are also anticipated to shift poleward over this time. As these cloud features move from a lower to a higher latitude, they will move from a latitude of greater incoming solar radiation to one of less incoming solar radiation. Thus, it seems logical to assume that such poleward movement in the clouds will lead to a warming feedback, as the clouds will be reflecting less solar radiation when they move to higher latitudes.

In this talk, I will challenge this notion using satellite observations from the NASA CERES mission. When the mid-latitude jet shifts poleward, upward vertical velocity anomalies and hightopped storm track clouds do indeed shift poleward with the jet. However, downward vertical velocity anomalies increase equatorward of the jet, contributing to an enhancement of the boundary layer inversion strength (EIS) and an increase in low cloud amount there. Because shortwave cloud-radiative effects (CRE) depend on the reflection of solar radiation by clouds in all layers, the shortwave cooling effects of mid-latitude clouds increase with both upward vertical velocity anomalies and positive EIS anomalies. Over mid-latitude oceans where a poleward jet shift contributes to positive EIS anomalies but *downward* vertical velocity anomalies, the two effects cancel, and net observed changes in shortwave CRE are small. Hence, there is little evidence from observations to suggest that a poleward movement of the jet alone could contribute to a large warming feedback.

Most global climate models capture the observed dynamical anomalies associated with midlatitude jet shifts but are incapable of capturing the associated cloud-radiative effects, particularly in the Southern Hemisphere, where many models indicate robust cloud-radiative warming effects with a poleward jet shift. Reasons for these model-observational differences will be diagnosed, and the implications of these model biases for future climate projections will be explored.

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