Geophysical Research Abstracts
Vol. 13, EGU2011-2772, 2011
EGU General Assembly 2011

Sensitivity between sea ice and tropopause polar cyclone intensity

Steven Cavallo
NCAR, MMM, Boulder, United States (cavallo@ucar.edu, 303-497-8181)

Tropopause polar vortices (TPVs) are frequently observed, high latitude, coherent structures based on the tropopause. These features can be broad, with radii up to 2000 km, and persistent, with lifetimes of up to several months, thus potentially influencing the large-scale atmospheric circulation and sea ice. The Arctic is a favorable region for TPVs to be maintained radiatively due to both isolation from the stronger shear associated with the midlatitude jet stream, and relatively low latent heating rates. With declining sea ice concentrations, upward surface sensible and latent heat fluxes are projected to increase considerably, especially during colder months. Here, the sensitivity of cyclonic TPV intensity to changes in the surface boundary conditions is examined in a series of idealized numerical modeling experiments.

Results show the elimination of sea ice alone has a substantial effect on TPV intensity. When the surface is completely covered by sea ice, upward latent heat fluxes are relatively small, and radiative processes strengthen the vortex primarily from an enhanced vertical water vapor gradient in the vortex core. Without sea ice, increases in latent heat flux increase the vertical water vapor gradients. However, the greater amounts of water vapor lead to more cloud cover and precipitation, ultimately reducing the radiative mechanism of vortex intensification. The relationship of these feedbacks to the lower atmospheric circulation will also be discussed.