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Climate change feedback processes on regional scales over the continental U.S.

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The climate system involves many intertwined interactive processes; the signs and magnitudes of climate change reflect many positive and negative feedbacks combined. The warming enhancement due to atmospheric moistening and negative radiative forcing from aerosol (direct effect) are two feedback examples of climate change on the global scale. Regionally, local climate change also reflects remote forcing and telecommunications resulting from climate change. Diagnosing regional climate change feedbacks will improve understanding in climate dynamics and shed light on eventual climate and climate change predictions. This presentation identifies and examines three feedback processes related to the climate change in the central portion of the U.S. The first process examined is the baroclinicity feedbacks where the horizontal gradient in surface warming increase thermal winds and baroclinic instability that further interacts with climate change. The second feedback is soil moisture feedback. The future climate change causes soil moisture to change, which alters the soil heat capacity and thus feedback on near-surface temperature change. The last process is the boundary-layer (BL) depth/low-level jet (LLJ) feedback, as stronger surface warming and thus higher BL height upstream would induce stronger LLJ and moisture transport downstream, resulting in more convectivness and likely cooling effect. Adopting the IPCC AR4 GCMs' projected surface warming and soil moisture change, we used WRF model to evaluate these feedbacks under both the past and future climates. The preliminary results show that the magnitudes of the surface temperature change attributable to these feedbacks can reach /- 1-2K, reinforcing/compensating regional climate change. This presentation will report a series of modeling results and discuss the implications to the climate change attribution and prediction.