FACULTY GRANTS COMMITTEE
REPORT FORM

Name: Todd D. Sikora

Department: Earth Sciences

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Nocturnal Destabilization Associated with the Summertime Great Plains Low-Level Jet
Thomas R. Parish; Richard D. Clark; Todd D. Sikora
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Abstract
The Great Plains low-level jet (LLJ) has long been associated with summertime nocturnal convection over the central Great Plains of the United States. Destabilization effects of the LLJ are examined using composite fields assembled from the North American Mesoscale Forecast System for June and July 2008–12. Of critical importance are the large isobaric temperature gradients that become established throughout the lowest 3 km of the atmosphere in response to the seasonal heating of the sloping Great Plains. Such temperature gradients provide thermal wind forcing throughout the lower atmosphere, resulting in the establishment of a background horizontal pressure gradient force at the level of the LLJ. The attendant background geostrophic wind is an essential ingredient for the development of a pronounced summertime LLJ. Inertial turning of the ageostrophic wind associated with LLJ provides a westerly wind component directed normal to the terrain-induced orientation of the isotherms. Hence, significant nocturnal low-level warm-air advection occurs, which promotes differential temperature advection within a vertical column of atmosphere between the level just above the LLJ and 500 hPa. Such differential temperature advection destabilizes the nighttime troposphere above the radiatively cooled near-surface layer on a recurring basis during warm weather months over much of the Great Plains and adjacent states to the east. This destabilization process reduces the convective inhibition of air parcels near the level of the LLJ and may be of significance in the development of elevated nocturnal convection. The 5 July 2015 case from the Plains Elevated Convection at Night field program is used to demonstrate this destabilization process.