

A Targeted Modeling Study of the Interaction between a Supercell and a Preexisting Airmass Boundary

Jennifer M. Laflin and Adam L. Houston,
University of Nebraska-Lincoln, Lincoln, NE

ABSTRACT

It is theorized that supercell thunderstorms account for the majority of significantly severe convective weather which occurs in the United States, and as a result, it is necessary that the mechanisms which tend to produce supercells are recognized and investigated. Airmass boundaries have been identified as a preferred location for supercell development due to the enhanced horizontal vorticity and forced ascent that are found along the boundary. This study examines the specific influence of a preexisting airmass boundary on supercell development through a set of idealized simulations. These simulations are based on a supercell which formed along an outflow boundary in the panhandle of Texas on 25 May 1999, and involve both homogeneous environments from the warm and cool sides of the boundary, as well as a representation of the actual environment with a boundary present. Detailed analyses of these simulations are then performed to determine the specific influence of the preexisting airmass boundary on supercell formation and morphology. It was found that the airmass boundary has three main impacts on the simulated storm: 1) creation and support of a low-level mesocyclone via tilting of enhanced horizontal vorticity in the cool side of the boundary; 2) increasing the strength of the boundary storm updraft early in the simulation, which allows the storm to persist long enough to split and become a long-lived supercell; and 3) a combination of the cool airmass and storm generated gust front, which creates forced ascent at low levels and supports continual inflow of warm air into the storm.