Radar reflectivity as a proxy for convective mass transport

Gretchen L. Mullendore
University of North Dakota, Grand Forks, ND

A. J. Homann
NOAA/NWS Indianapolis, IN

C. Schumacher and K. Bevers
Texas A&M University, College Station, TX

ABSTRACT

To fully understand the ramifications of deep convection on the chemical budget, and consequently the ramifications on the radiative budget and climate change, we need better ways of quantifying the current amount of convective mass transport in the upper-troposphere and lower-stratosphere (UTLS). A methodology for using radar reflectivity as a direct observation of vertical transport of mass from the boundary layer to the UTLS is investigated, and the level of maximum detrainment (LMD) is proposed. In the squall line case study, echo top heights and dual-Doppler derived divergence profiles are used to define the mass detrainment range. Anvil ice water content, with a simple correction for ice fall-speed, is found to be a good proxy for both the LMD, which for the storm analyzed is 13.75 km, and for the detrainment range of 6 to 20 km. The case study presented shows a strong correlation between anvil properties determined from radar reflectivity and the mass detrainment profile. Thus, radar reflectivity can be used as an indicator of the LMD and improve our understanding of convective mass transport. This methodology is currently being adapted for non-dual Doppler radar, such as the NEXRAD network. These findings highlight the importance of upper-level elevation scans for research and the need for continued collaboration between the operational and research communities.