Radar regional mosaic, convectivity and convective/stratiform echo type classification, Version 2.0

Overview

This data set contains mosaic radar data collected during the PECAN (Plains Elevated Convection at Night) period of 01 June to 16 July 2015. Included are Convectivity and convective/stratiform Echo Type, and many other fields. For more information on PECAN, see www.eol.ucar.edu/field_projects/pecan.

Instrument descriptions

NEXRAD

A standard WSR-88D operates in the S band, at a frequency of around 2800 MHz, with a typical gain around 53 dB using a center-fed parabolic antenna. The pulse repetition frequency (PRF) varies from 318 to 1300 Hz with a maximum power output of 700 kW at Klystron output, although dependent on the volume coverage pattern (VCP) selected by the operator. All NEXRADs have a dish diameter of 9.1 m (30 ft) and an aperture diameter of 8.5 m (28 ft). Using the predetermined VCPs, NEXRADs have a traditional elevation minimum and maximum ranging from 0.1 to 19.5 degrees, although the non-operational minimum and maximum spans from −1 to +45 degrees. For more information on NEXRAD see www.ncdc.noaa.gov/data-access/radar-data/nexrad.

Data description

The NEXRAD 3D Multi-Radar Multi-Sensor (MRMS) product (Zhang et al. 2005) was sub-sectioned to include the PECAN domain in Kansas, plus some areas from surrounding states. The MRMS Cartesian grid uses a latitude/longitude projection, with a 0.01° (roughly 1 km) grid spacing in the horizontal dimensions. The area used in this study spanned from 110 to 90 °W and from 30 to 45 °N. The vertical axis has 33 levels from 0.5 to 19 km in altitude, with 0.25 km vertical spacing up to 3 km, 0.5 km vertical spacing from 3 to 9 km, and 1.0 km spacing from 9 to 19 km.

Data processing with the ECCO algorithm

The newly developed ECCO (Echo Classification from COnvectivity) algorithm identifies convective and stratiform types of radar echo in three dimensions. It is based on the calculation of reflectivity texture - a measure of the heterogeneity of the radar echoes on each horizontal plane in a 3D Cartesian volume. Reflectivity texture is translated into convectivity, which is a newly invented quantitative measure of the convective nature of each three dimensional radar grid point. It ranges from 0 (100% stratiform) to 1 (100% convective). By thresholding

convectivity, a more traditional qualitative categorization is obtained which classifies radar echoes as convective, mixed, or stratiform. In contrast to previous algorithms, these echo type classifications are provided on the full three dimensional grid of the observed reflectivity field. The vertically resolved classifications, in combination with temperature data, allow for sub-classifications into shallow, mid, deep, and elevated convective features, and low, mid, and high stratiform regions - again in three dimensions. Details on the algorithm and its validation are described in Dixon and Romatschke (2022).

References

Dixon, M., and U. Romatschke, 2022: 3D Convective/Stratiform Echo Type Classificationand Convectivity Retrieval from Radar Reflectivity. EarthArXiv, https://doi.org/10.31223/X58H02.

Zhang, J., K. Howard, and J. J. Gourley, 2005: Constructing Three-Dimensional Multiple-Radar Reflectivity Mosaics: Examples of Convective Storms and Stratiform Rain Echoes. J. Atmospheric Ocean. Technol., 22, 30–42, https://doi.org/10.1175/JTECH-1689.1.

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Citation

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