445. Objective Storm Tracking Using Echo Top Height Maxima from High-Resolution Three-Dimensional Radar Observations

Cameron R. Homeyer*, School of Meteorology, University of Oklahoma, Norman, OK, USA.

Introduction

Objective tracking of convection has important forecasting and research applications. Prior studies have employed techniques that track low-level radar reflectivity maxima using only plan view observations or volume estimates (so-called centroid or object-based methods). Those algorithms have been shown to identify too few or too many cells, suffer in the presence of merging or splitting storms, and provide conflicting estimates of storm motion. Moreover, such approaches are designed to work with single radar observations that offer limited spatial coverage. This poster introduces a new storm tracking algorithm that identifies and tracks echo top height maxima in high-resolution three-dimensional multi-radar composites and compares its performance to operational single radar object-based methods. The echo top algorithm is simpler than previous attempts to track convection and provides accurate, continuous storm tracks that improve upon some of the limitations of single radar object-based methods. A high-impact case with varying degrees of convective scale and organization is used here to demonstrate its performance.

Technical Detail

Data:

- Next Generation Weather Radar (NEXRAD) program Weather Surveillance Radar-1988 Doppler (WSR-88D) observations merged into high-resolution three-dimensional polarimetric composites using methods established in our research group
- Single WSR-88D radar operational object-based storm cell identifications from NOAA's Severe Weather Data Inventory (SWDI)

Case Summary:

- 11-12 May 2014, severe storms in Kansas and southeastern Nebraska. Analysis time period begins at 18 UTC on 11 May and ends at 8 UTC on 12 May. Here is a link to the NWS SPC event archive:

How Tracking Methods Work:

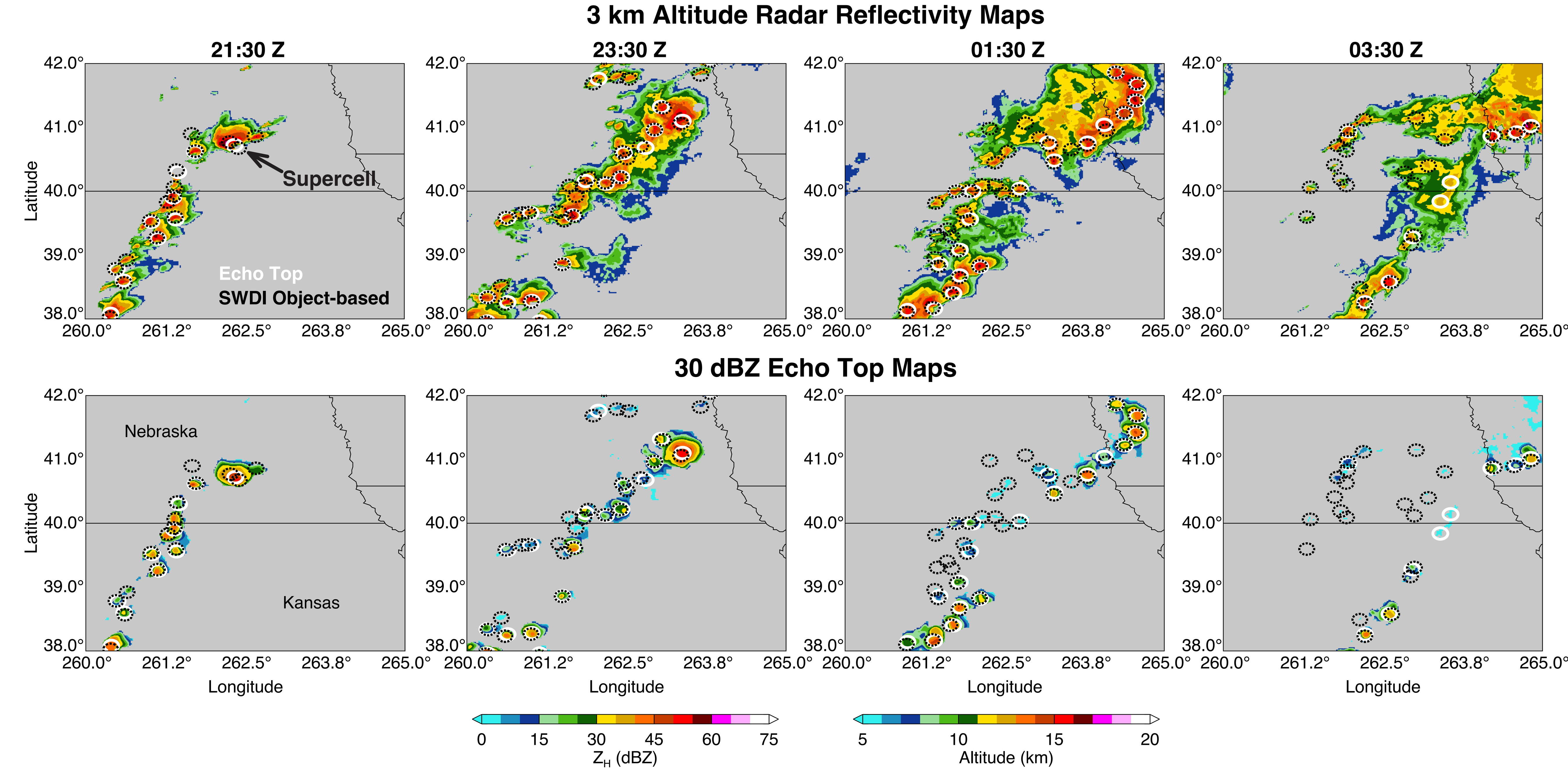
Object-based

1. Identify local maxima in reflectivity at each elevation
2. Define centroid (closed contour) that best represents and/or isolates cell
3. Link centroids in consecutive scans by closeness (time increment typically required to be less than 20 min between scans)
4. Retain cell IDs that have vertical continuity

Echo Top

1. Identify local maxima in 30 dBZ echo top field
2. Link maxima in consecutive composite times if within 15 km of eachother at a time increment ≤ 5 min
3. Keep tracks that are at least 15 min in duration
4. Extract relevant dynamical and microphysical information from polarimetric variables within a 15 km radius of echo top maximum

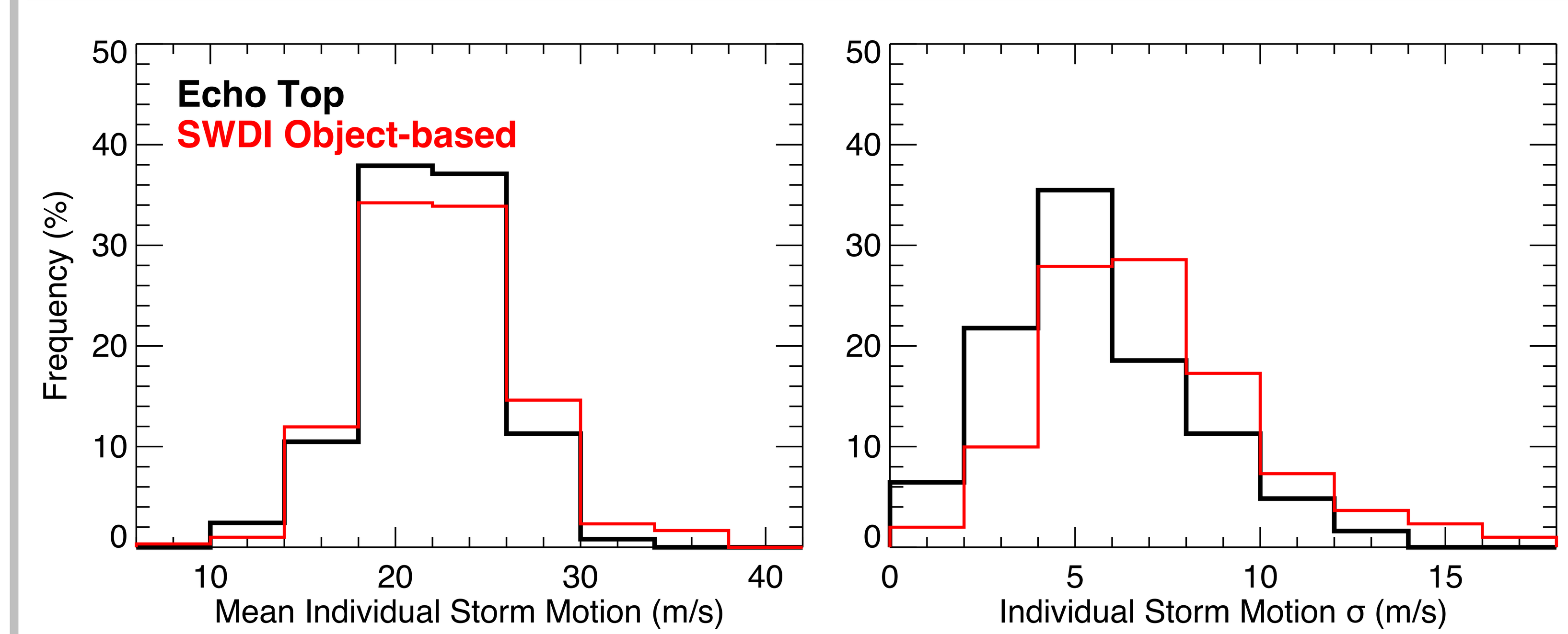
Instantaneous Cell Identification Comparison (tracks ≥ 15 min)



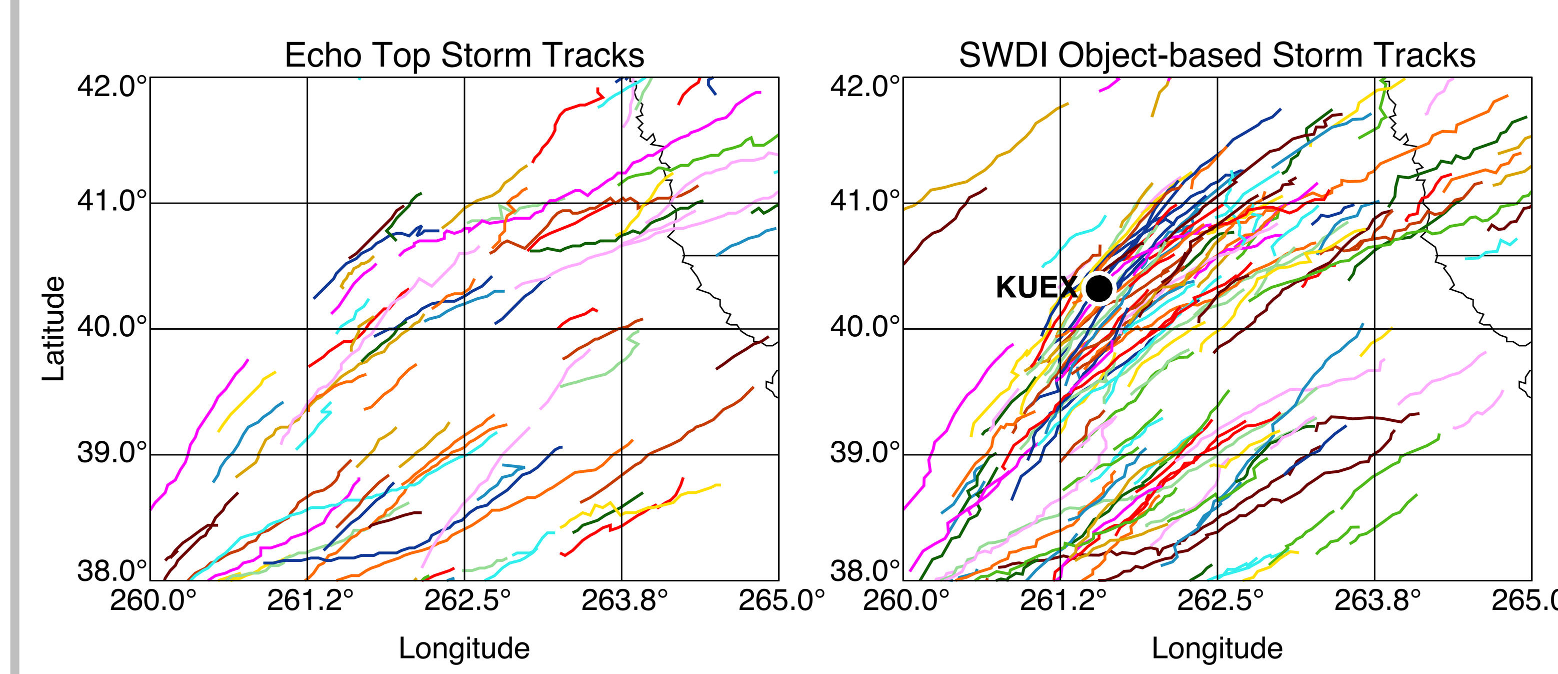
Link to Movie:

Link to Movie:

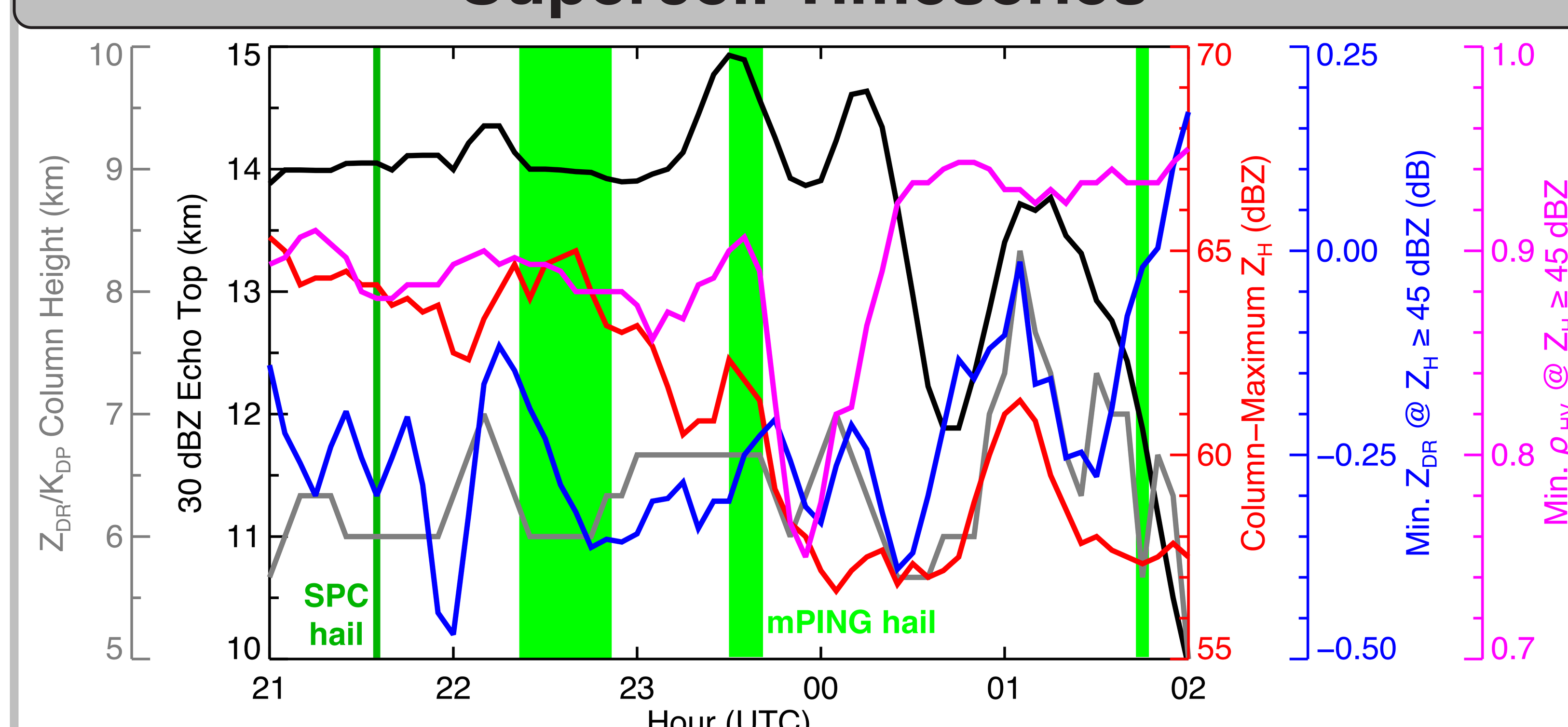
Storm Motion Comparison (tracks ≥ 15 min)



Storm Track Comparison (tracks ≥ 30 min)



Supercell Timeseries



mPING: Meteorological Phenomena Identification Near the Ground crowdsourcing application developed by NOAA National Severe Storms Laboratory.

Summary

- Echo top tracking isolates deeper storms (those extending above the melting level)
- Differences in identified storm location from echo top and object-based methods are typically negligible, but important offsets can occur in strong supercells (object-based methods may identify hook and forward flank precipitation as separate storms)
- Echo top tracking provides less variable estimates of storm motion
- Polarimetric radar composites provide a wealth of information for studying individual storm lifecycles

***Cameron Homeyer is an Assistant Professor in the School of Meteorology at the University of Oklahoma. Find out more:**