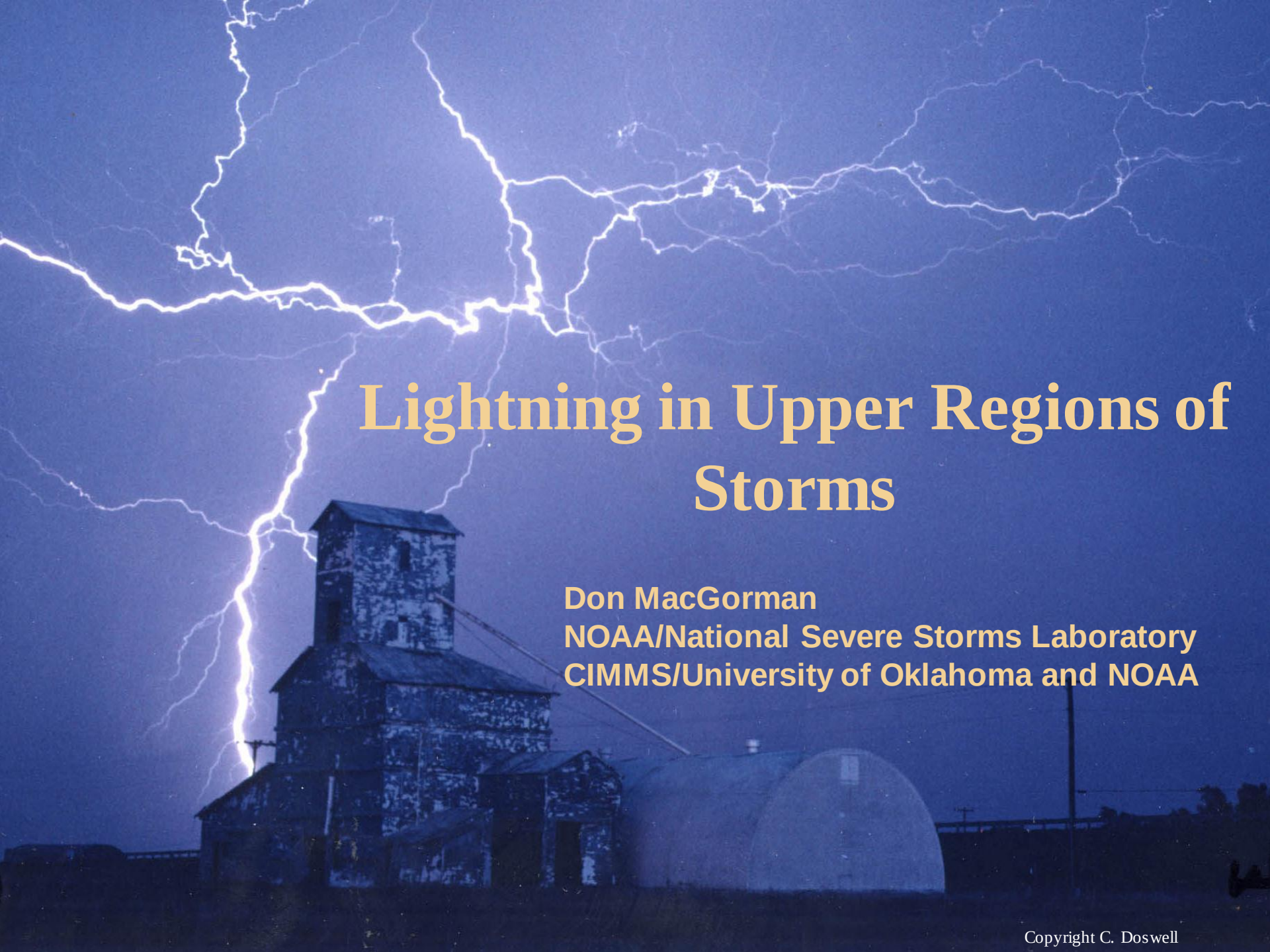
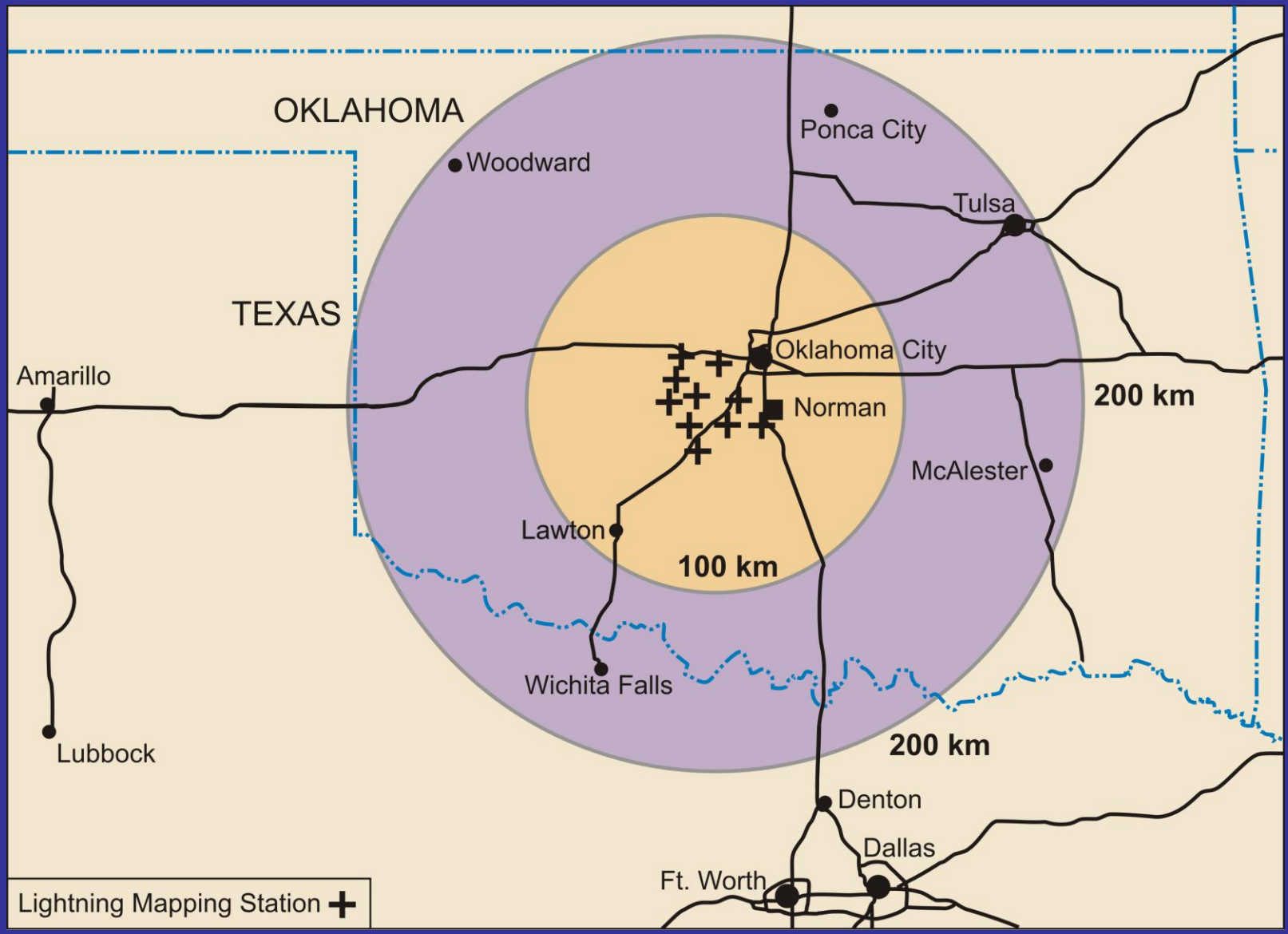


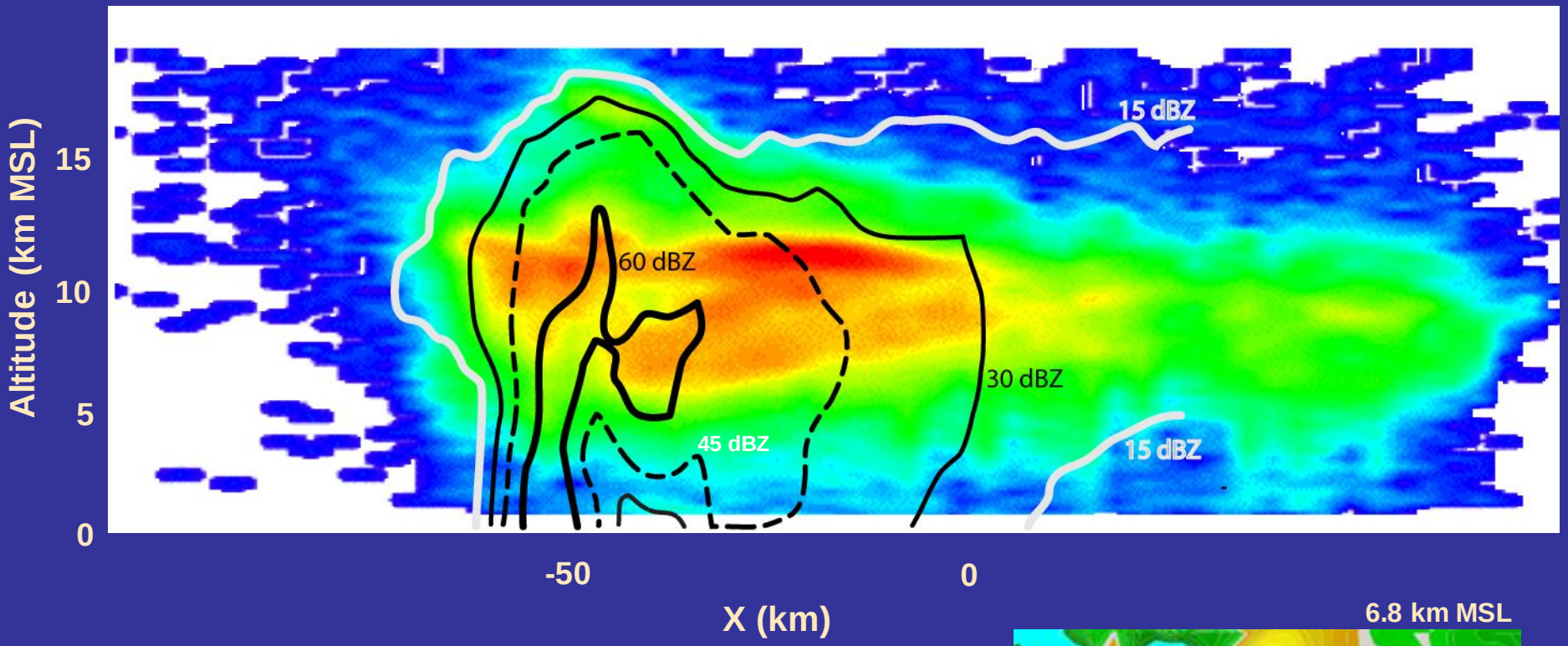
# Lightning in Upper Regions of Storms

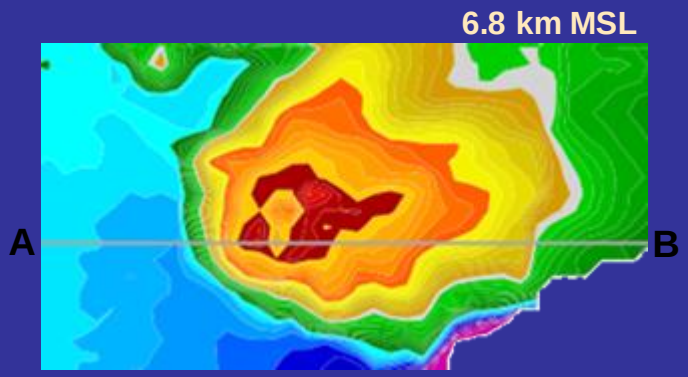
**Don MacGorman**
**NOAA/National Severe Storms Laboratory**
**CIMMS/University of Oklahoma and NOAA**

# Present OKLMA



# Reflectivity and LMA Event Density



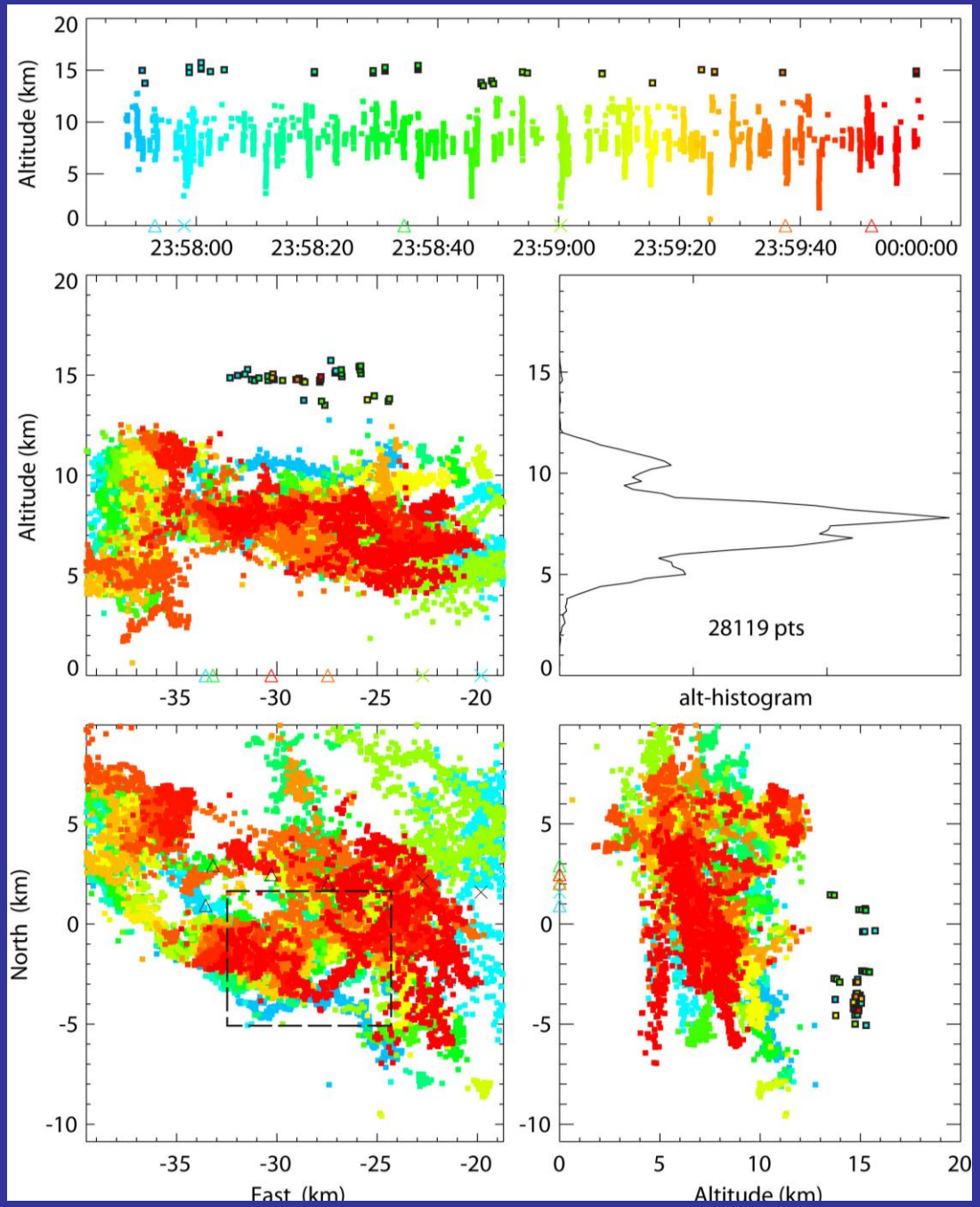

Radar: 0016:45 – 0018:32 UTC

LMA Data: 0015 – 0020 UTC

# 24 May 2004

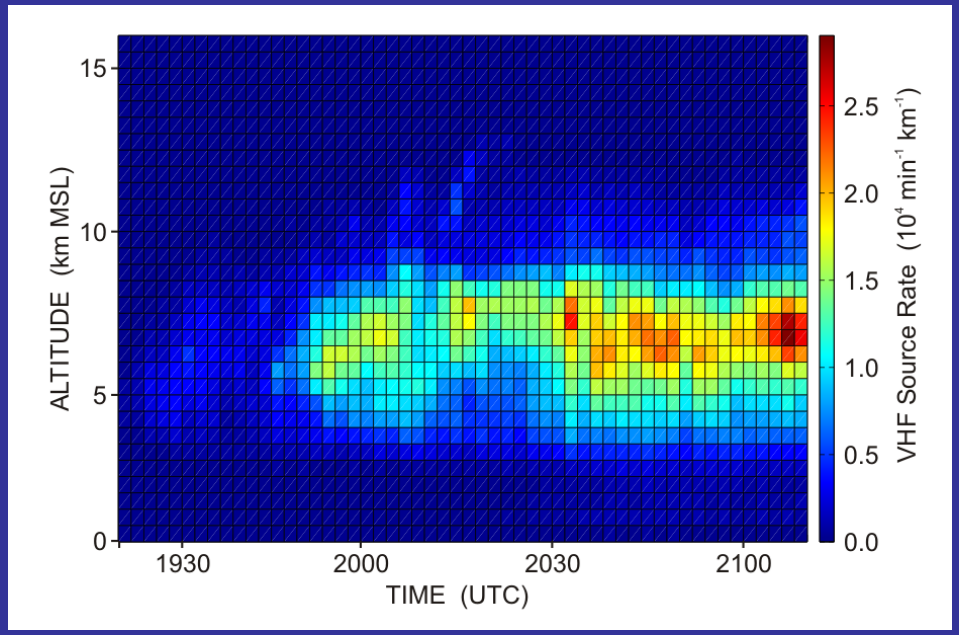
## 23:58 UTC

## 2.2 minutes

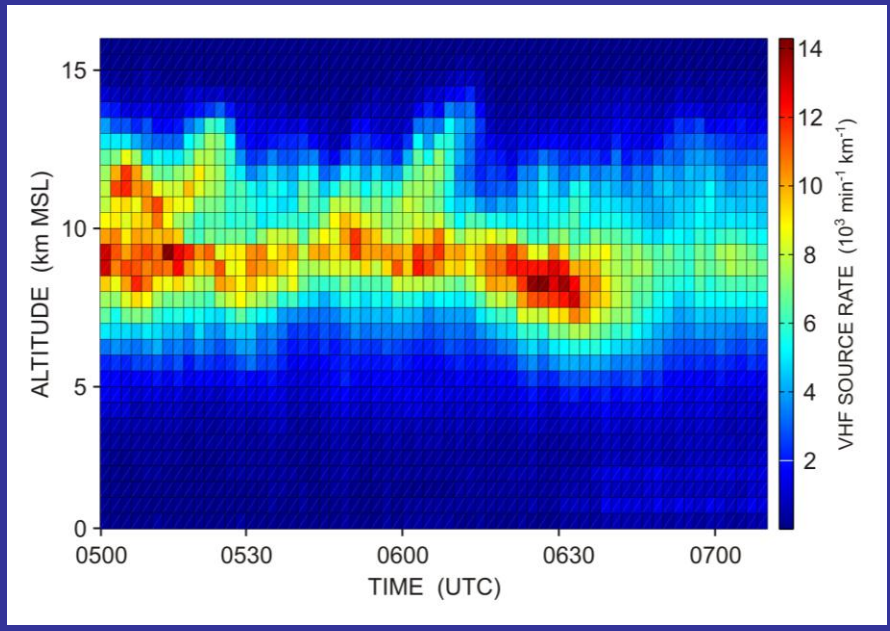


# Comparison of Height Distribution in Two Supercell Storms

## Seasonal Variation

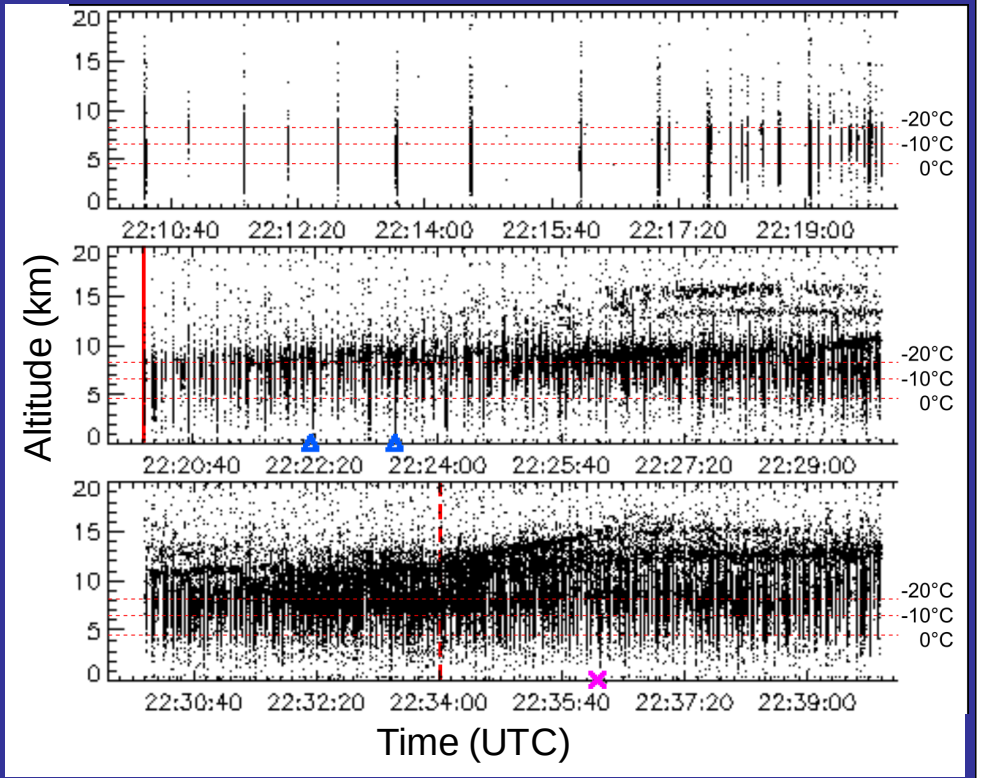


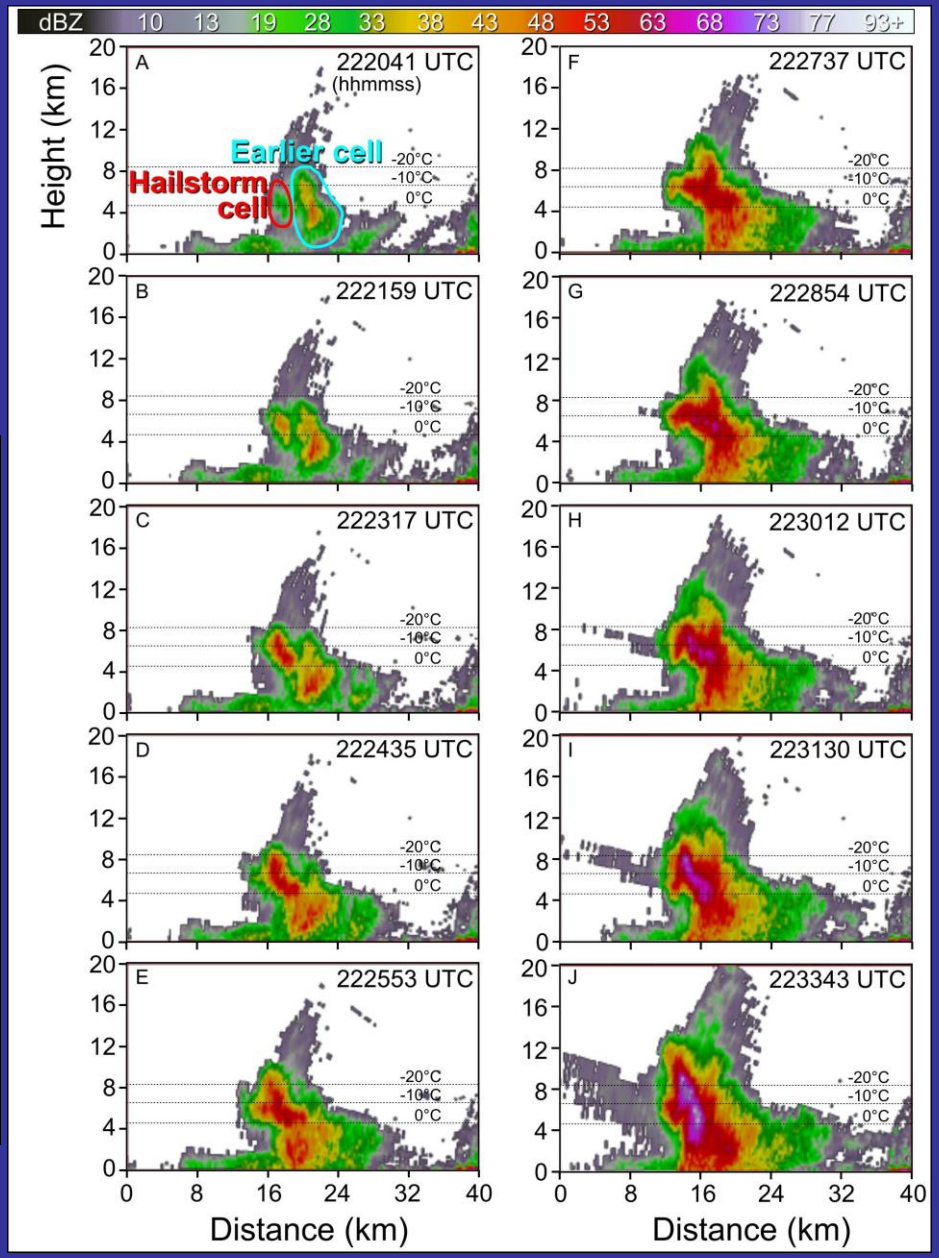

Mid-February



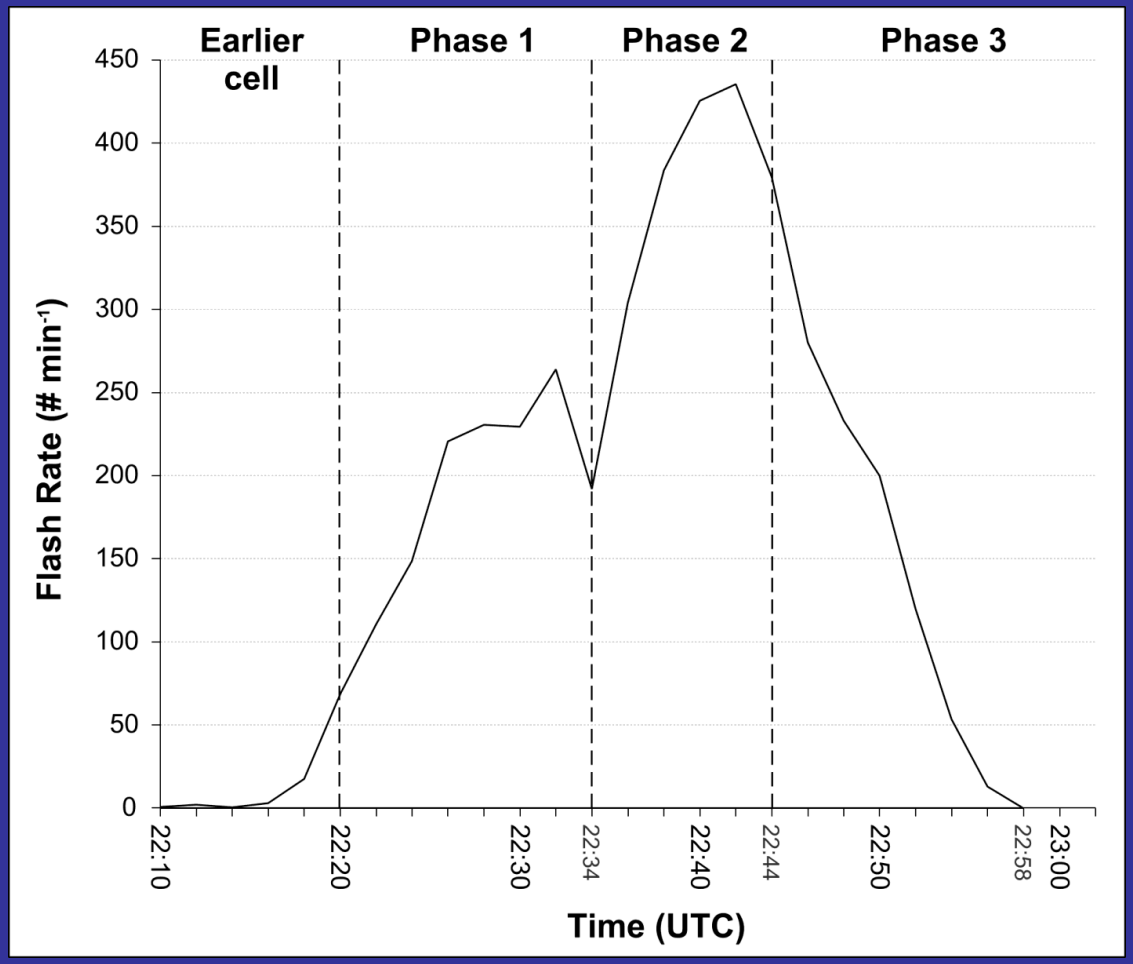

Late March

# OK-LMA & PAR Data
## 15 August 2006

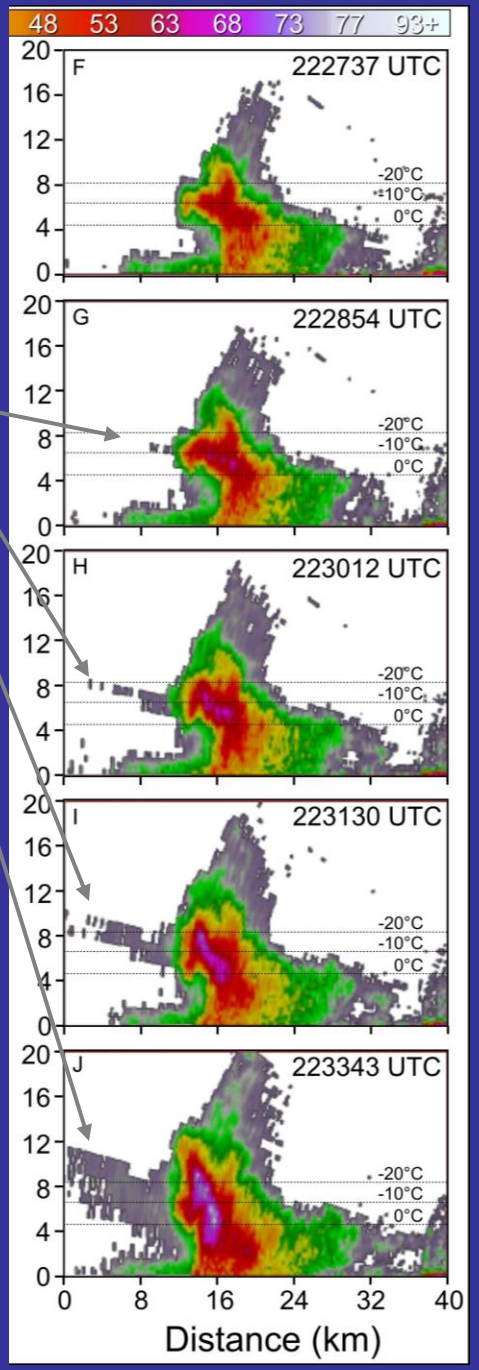


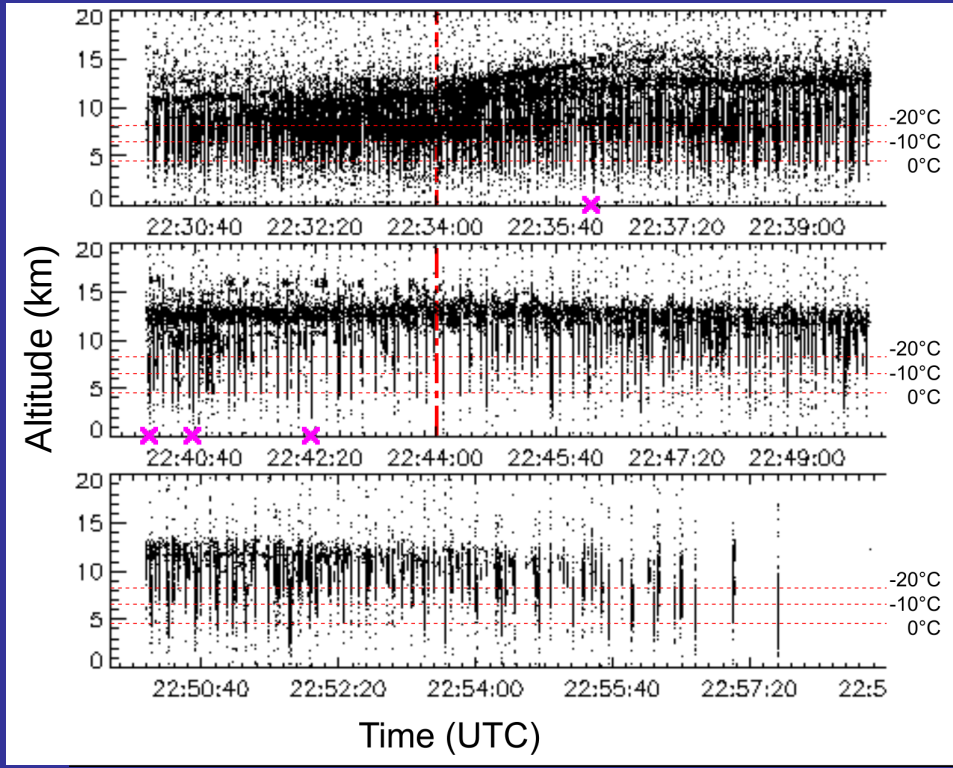
# OK-LMA Flash Rates & PAR Data with Wet Hail Signature

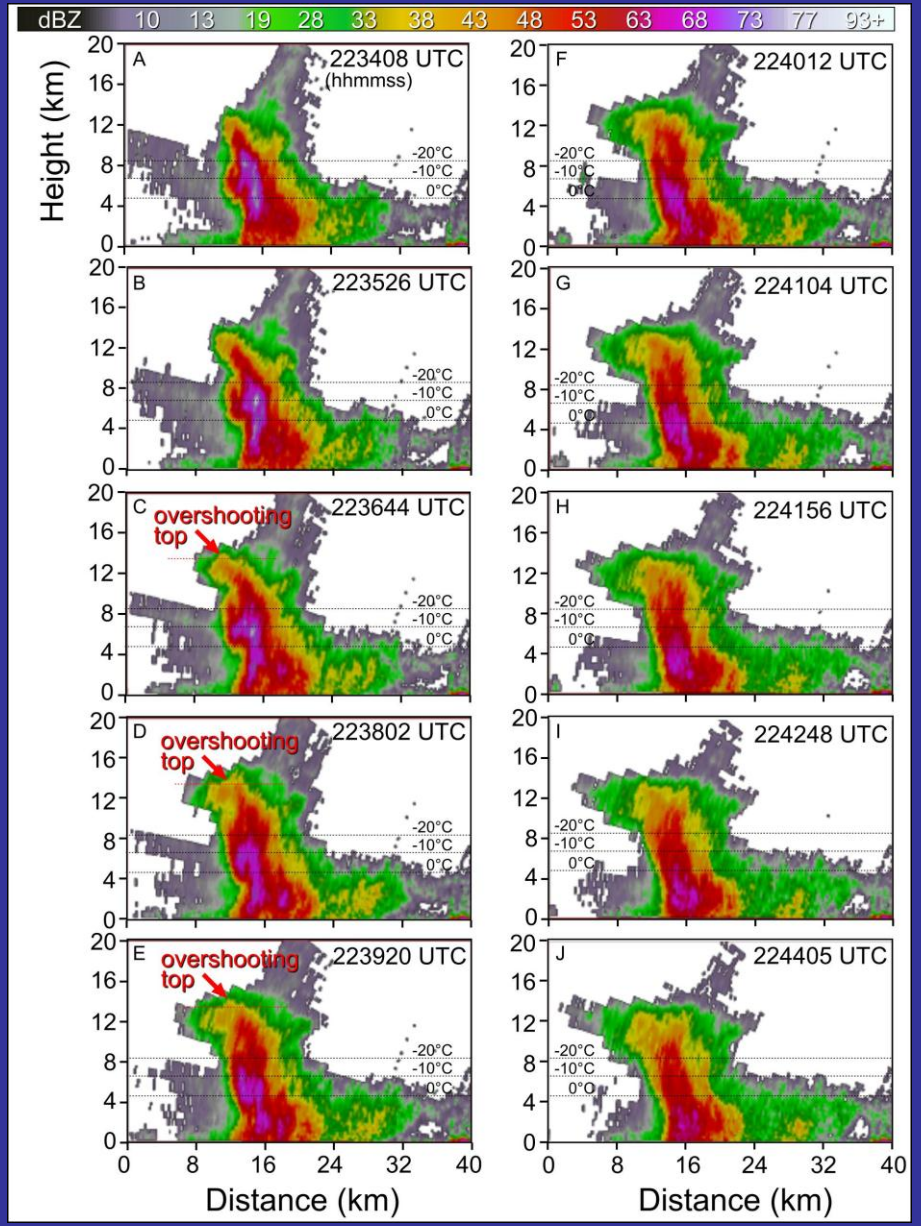



Three-Body Scatter Spike (TBSS)



# OK-LMA & PAR Data
## 15 August 2006



# Preliminary Findings

- Lightning in overshooting top of all warm-season supercell storms and of many severe storms checked thus far
- Lightning not in overshooting top of much shallower February supercell

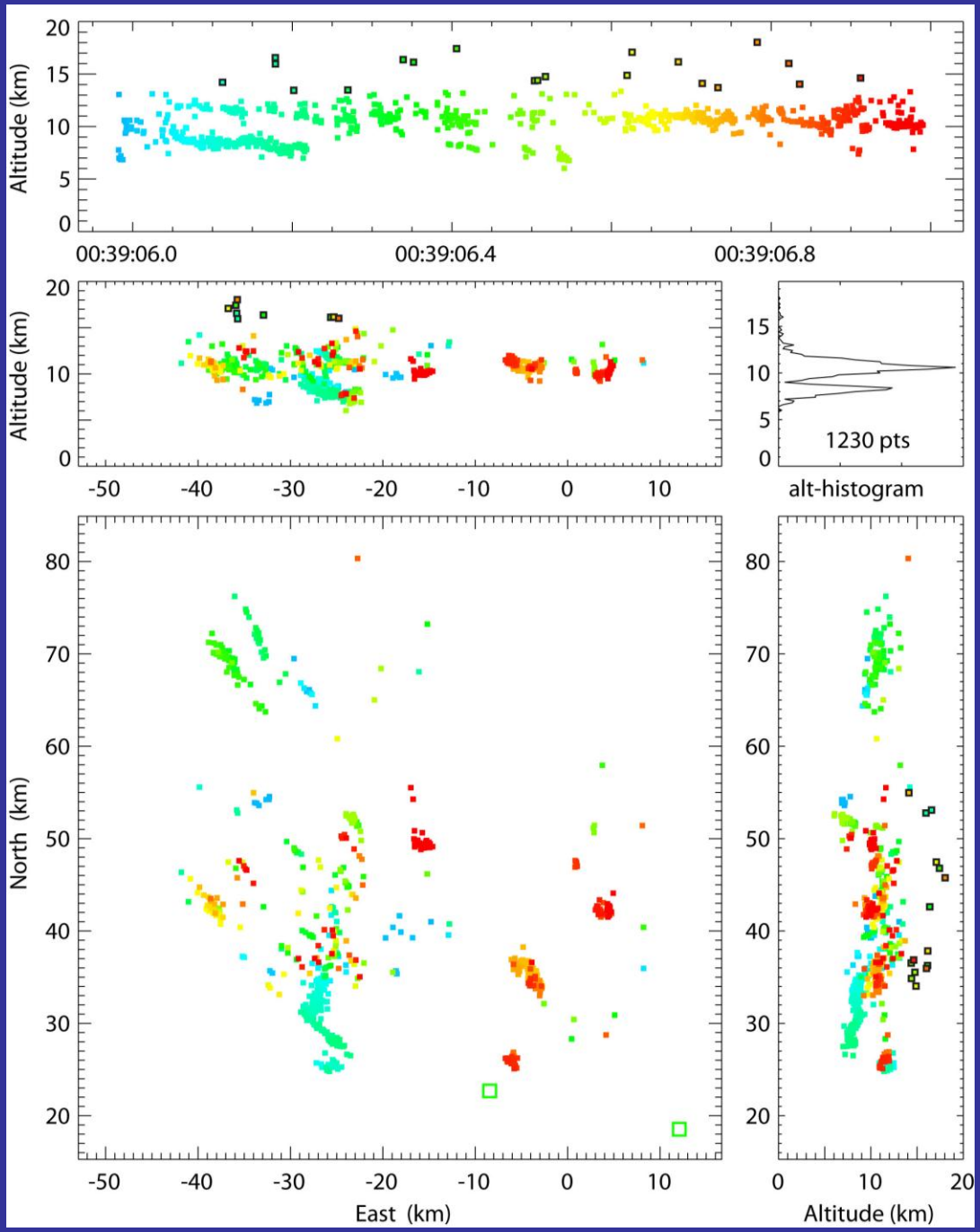
# Preliminary Findings (continued)

- Some storms have only continual, isolated VHS sources in, above, or streaming downshear of overshooting top
- Some storms also have occasional bursts of many VHF sources (>10) in small flashes in overshooting top
- Some storms have continual, isolated VHF sources in a broad upper region (≥ 9-10 km MSL), similar to observation by Taylor et al. (2004)

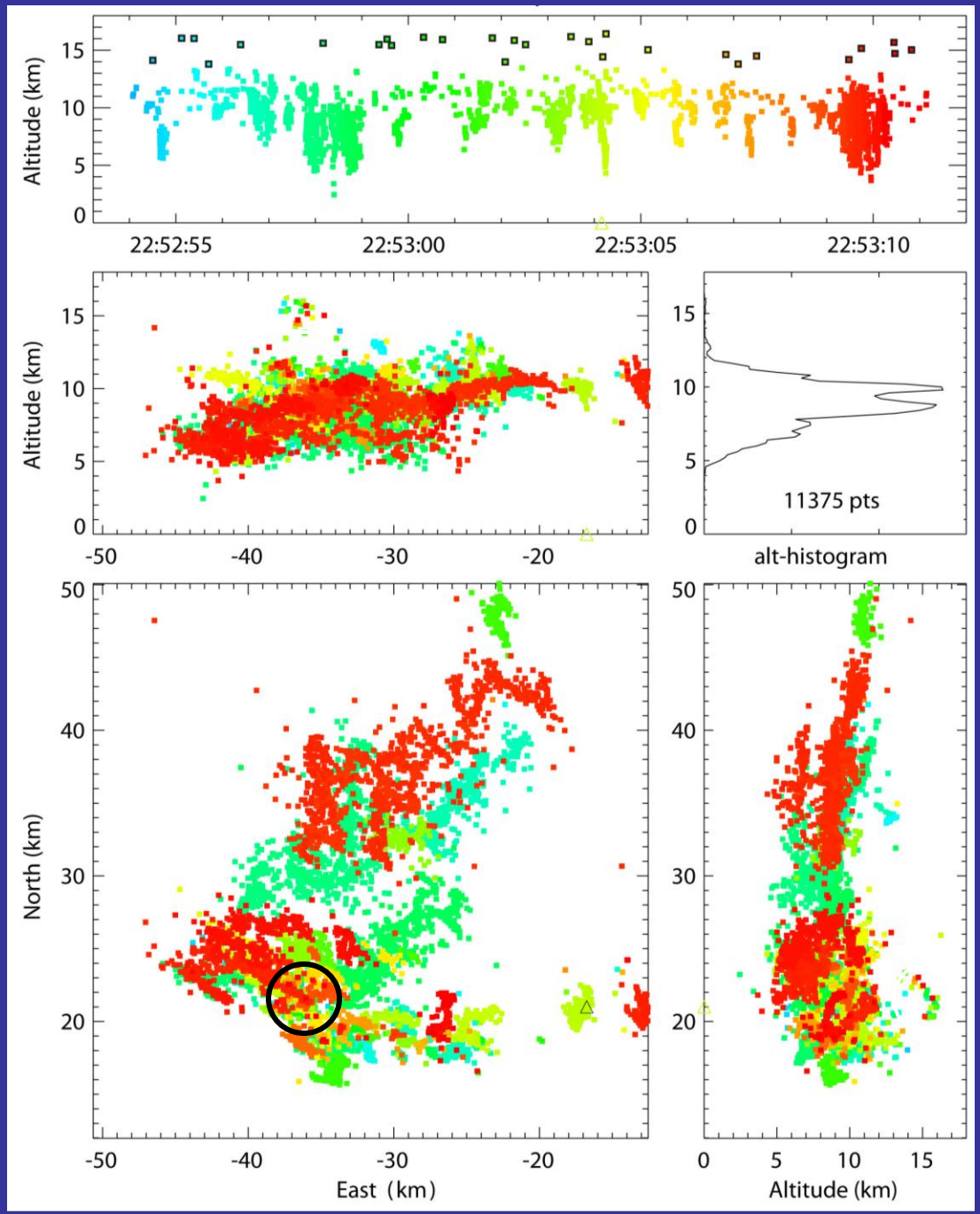
# 30 May 2004

## 00:39:06 UTC

## 1 second



# 26 May 2004
## 22:53 UTC
## 17 seconds



# LMA Mapped Points
# 30 May 2004
# 0010:21 UTC