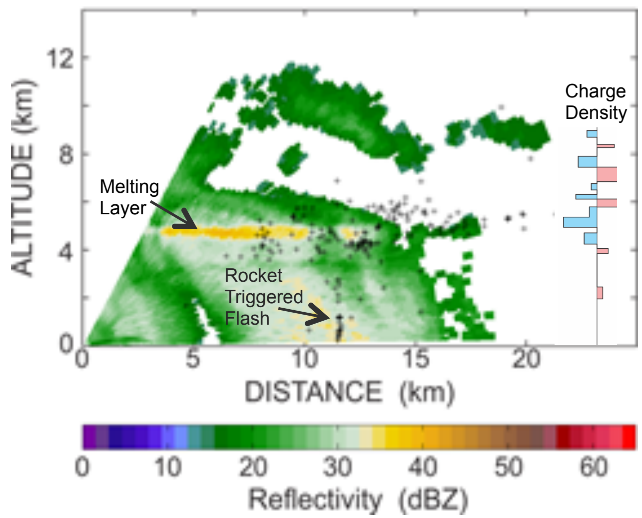
# Field Experiments

**2012 Deep Convective Clouds & Chemistry Experiment (DC3)**

Barth, M., et al., 2015: Bull. Amer. Meteor. Soc., doi: 10.1175/BAMS-D-13-00290.1, in press.

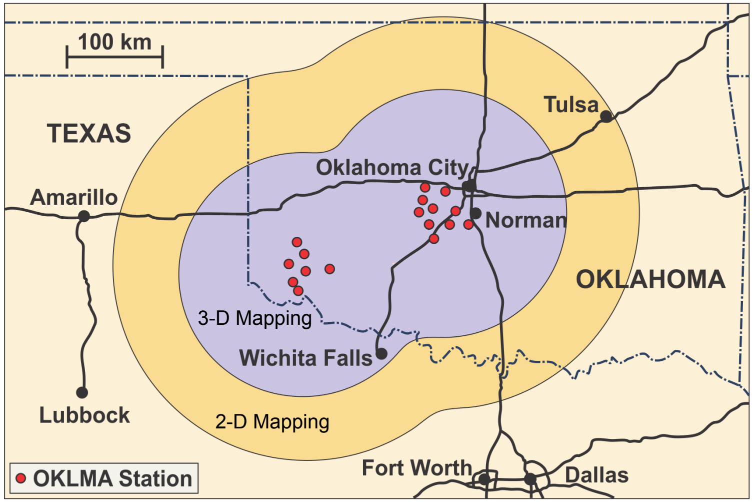
**2013 & 2014 Florida Ballooning (see Sean Waugh poster for Videosonde)**

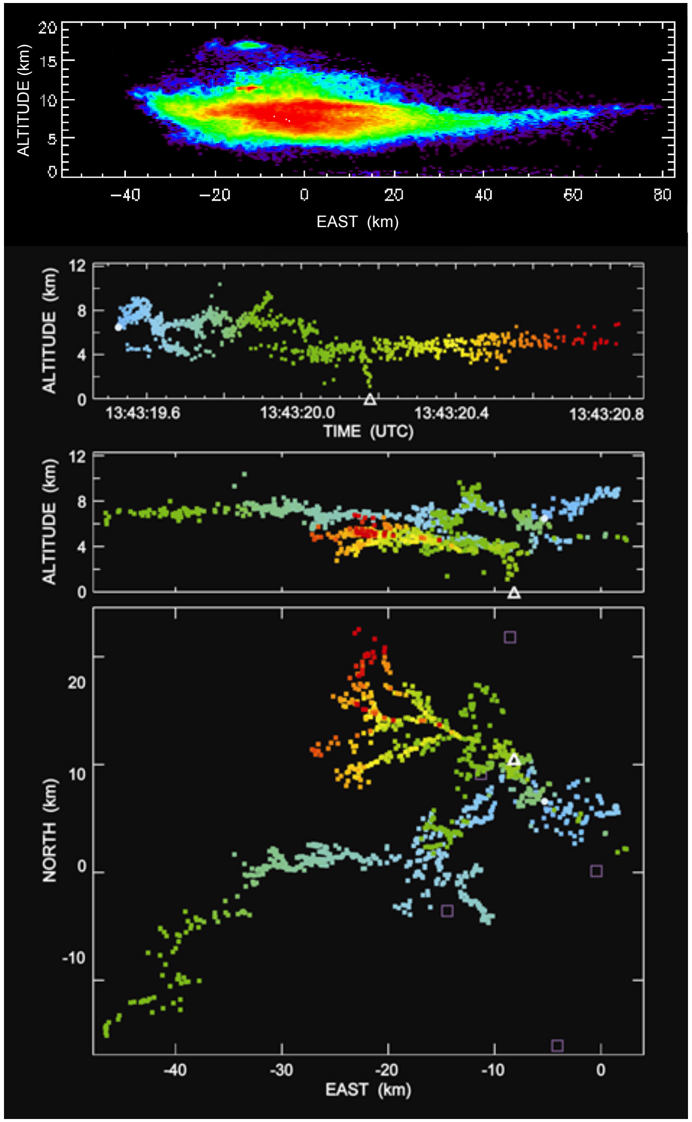

**Mississippi High Voltage Laboratory (2014)**



# Lightning Mapping Array
## (operated with the University of Oklahoma)

- Expanded in 2012
- Enabled Study of Total Lightning
- Proxy Data for GOES-R Geosynchronous Lightning Mapper (GLM)
- Ground Truth for GLM (launch March 2016)



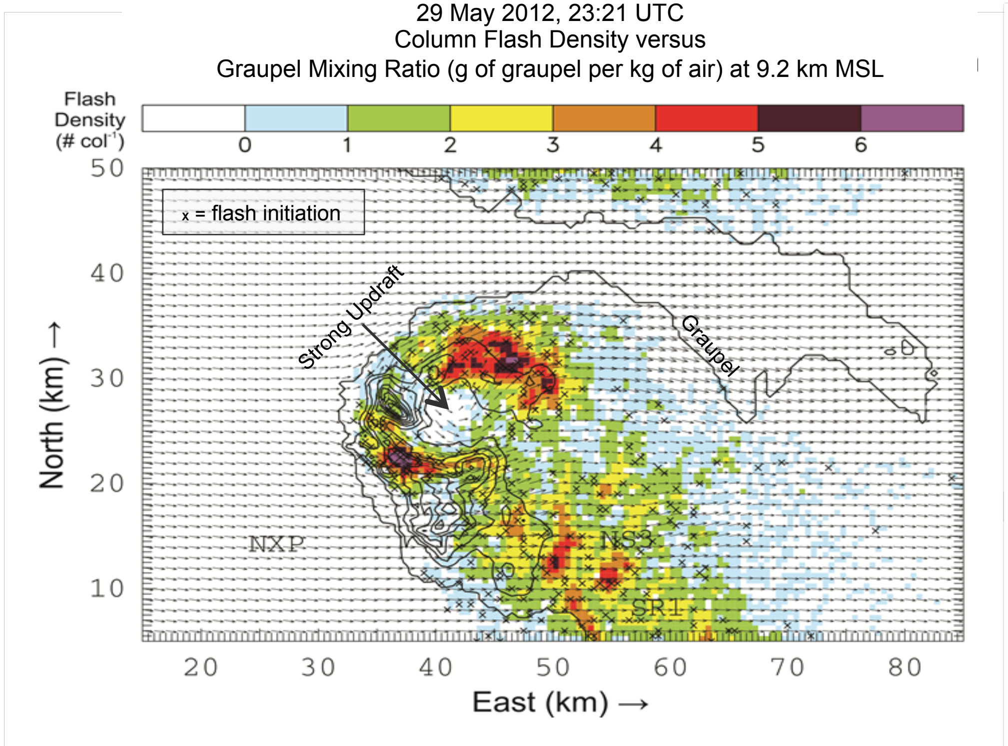




Original array described in MacGorman et al. 2008: *Bull. Amer. Meteor. Soc.*, doi: 10.1175/2007BAMS2352.1.

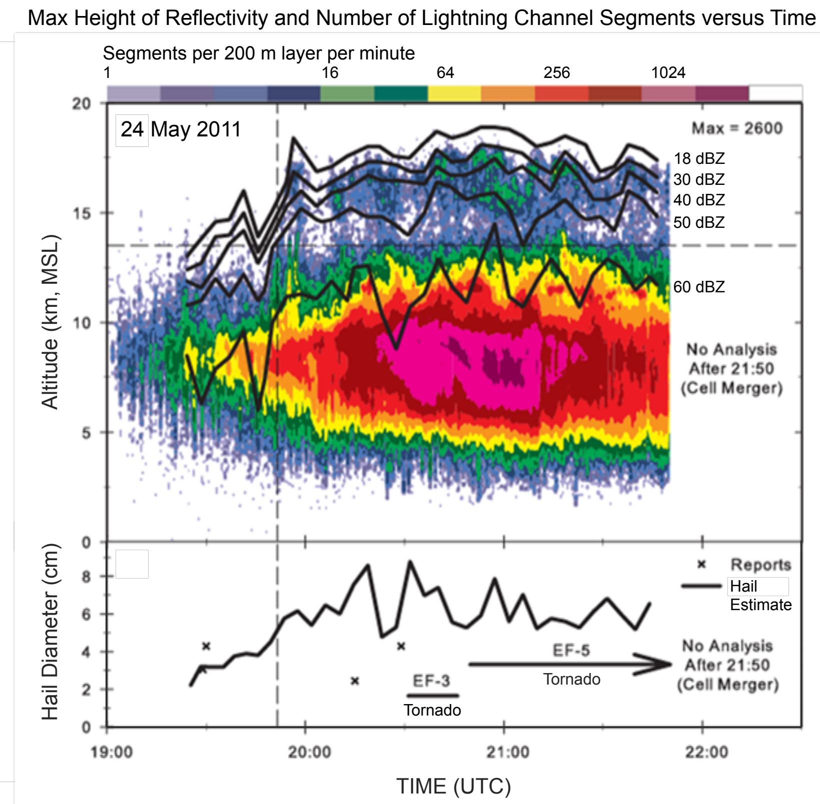
# Lightning Data Analyses

## Lightning Relationships with

- **Storm Kinematics, Dynamics, Microphysics, & Severe Weather**
- **Focus on potential to aid severe weather forecasts & warnings**




*From* DiGangi, E., 2014: MS Thesis, Univ. Oklahoma.

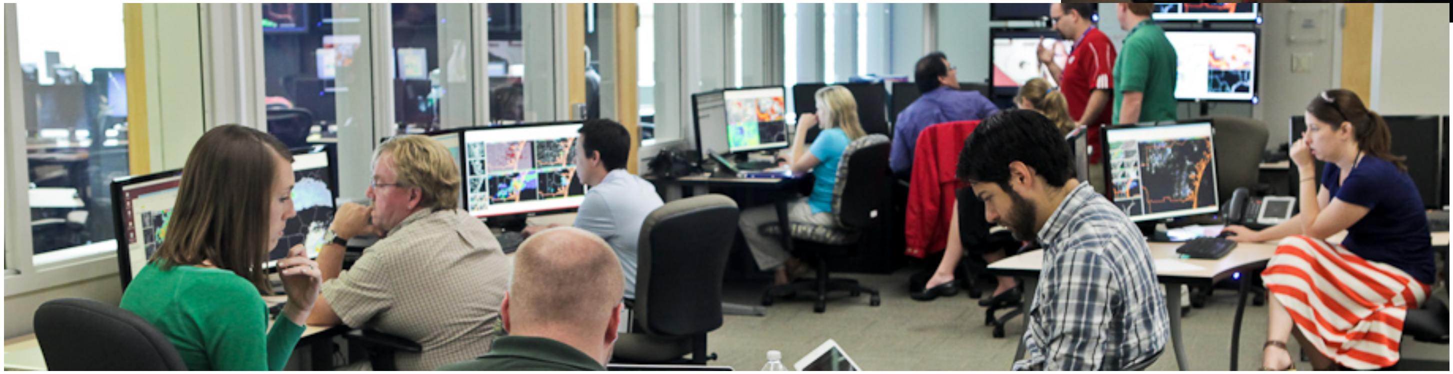



*From* Elliott, M., 2013: MS Thesis, Univ. of Oklahoma.

# Applied Research

## (presentations by Kristin Calhoun and Darrel Kingfield)

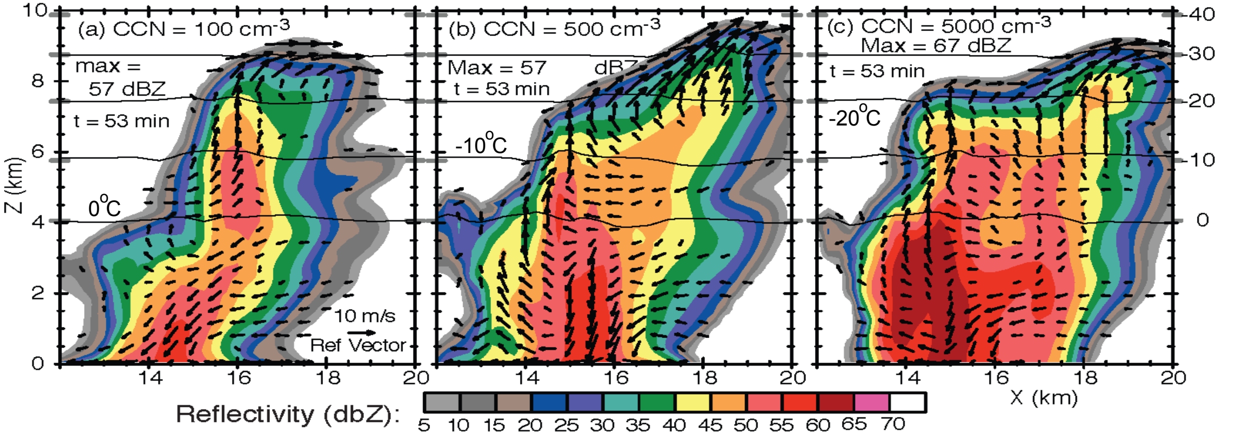
- **Lightning Jump Algorithm**
- **Earth Networks Warning Boxes**
- **Hazardous Weather Testbed**
- **GOES-R Proving Ground**

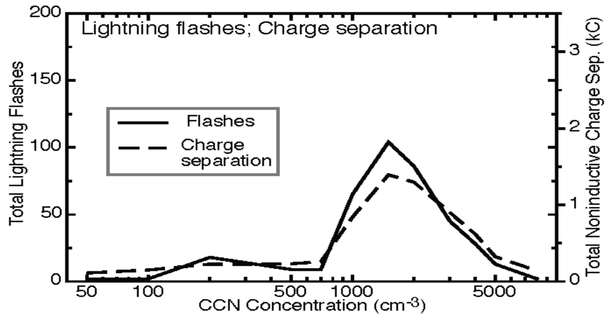


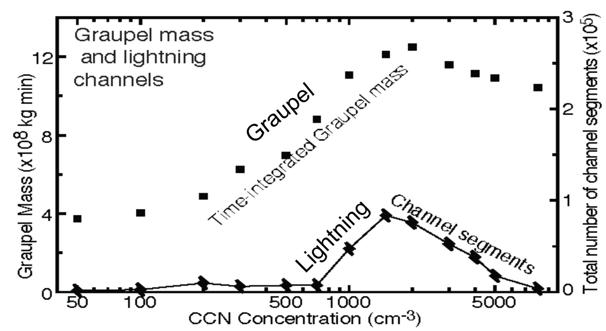
# Electrified Storm Modeling

- **Features Developed**
  - **Electrification in microphysics package**
  - **Lightning parameterizations**
- **Models Used**
  - **COMMAS & WRF-ARW**

Varying Cloud Condensation Nuclei (CCN) Concentrations



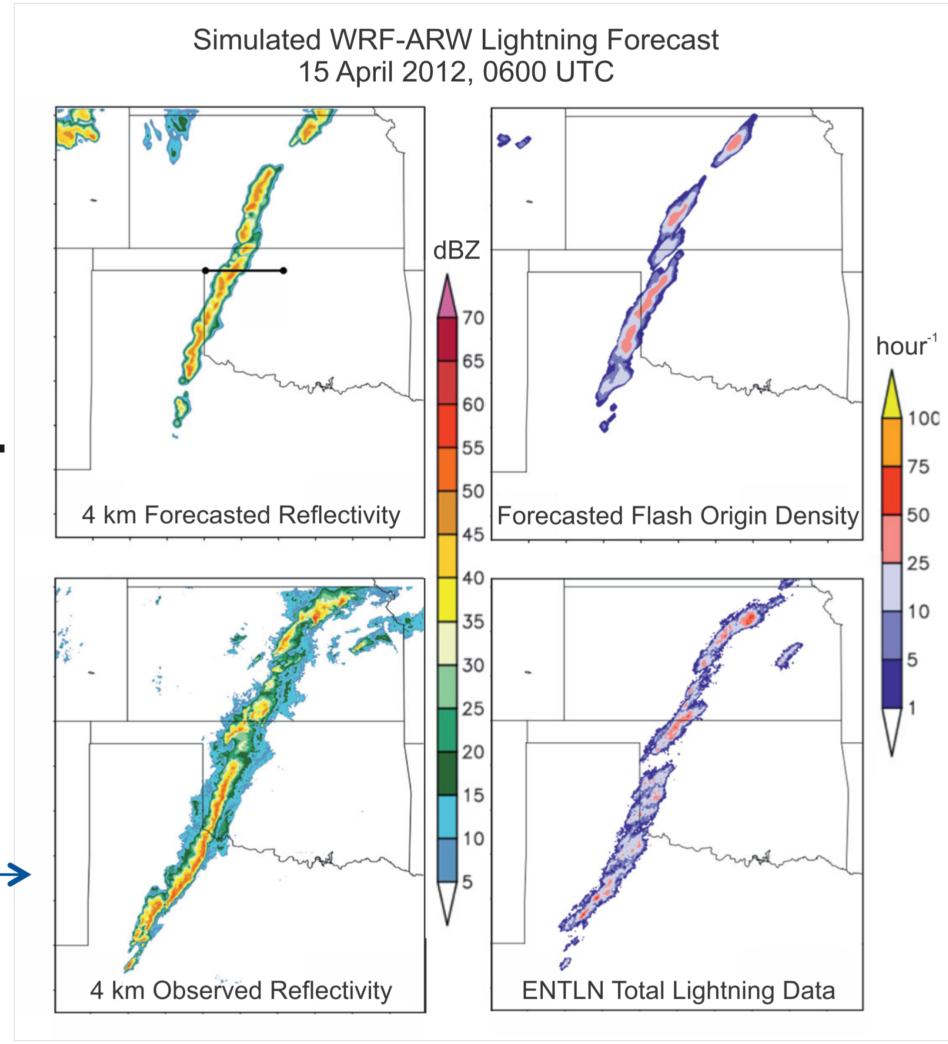

*From* Mansell, E. R., and C. L. Ziegler, 2013: *J. Atmos. Res.*, **70**,
doi: 10.1175/JAS-D-12-0264.1

# Lightning Forecasting & Data Assimilation

- **Lightning Data Assimilation**
  **(see poster by Mansell)**
- **Lightning Forecasting in WRF-ARW (Grand Challenge #4)**

Assimilation:
Fierro, A., et al., 2014: *Mon. Wea. Rev.*, **142**, doi: 10.1175/MWR-D-13-00142.1.

Lightning forecasting figure from:
Fierro, A., E. Mansell, D. MacGorman, and C. Ziegler, 2013: *Mon. Wea. Rev.*,**141**, doi: 10.1175/MWR-D-12-00278.1. →



# Summary

## Successes

- Have learned much about macroscale electrical and kinematic processes that produce lightning
- Electrified numerical storm model that produces realistic charge distributions and lightning
- Initial lightning data assimilation and forecasting

## Remaining challenges

- Microscale details of lightning initiation
- Particle charging outside mixed-phase region
- Best operator for lightning assimilation into forecast models
- Efficient lightning parameterization for lightning forecasts
- Getting correct forecasted location and characteristics of storms