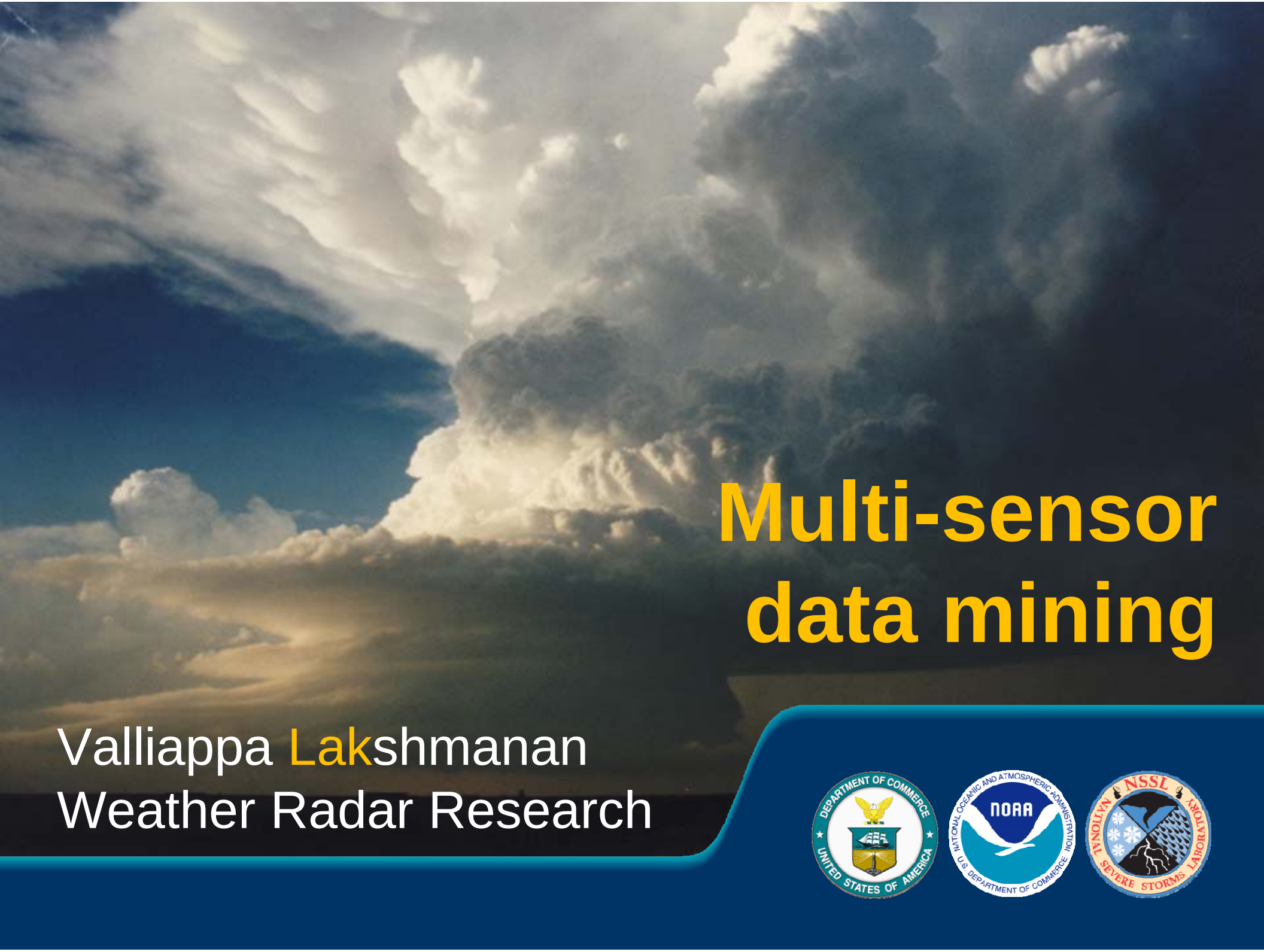


Multi-sensor data mining

Valliappa Lakshmanan
Weather Radar Research

Outline: Warning Decision Support System -Integrated Information (WDSS-II)

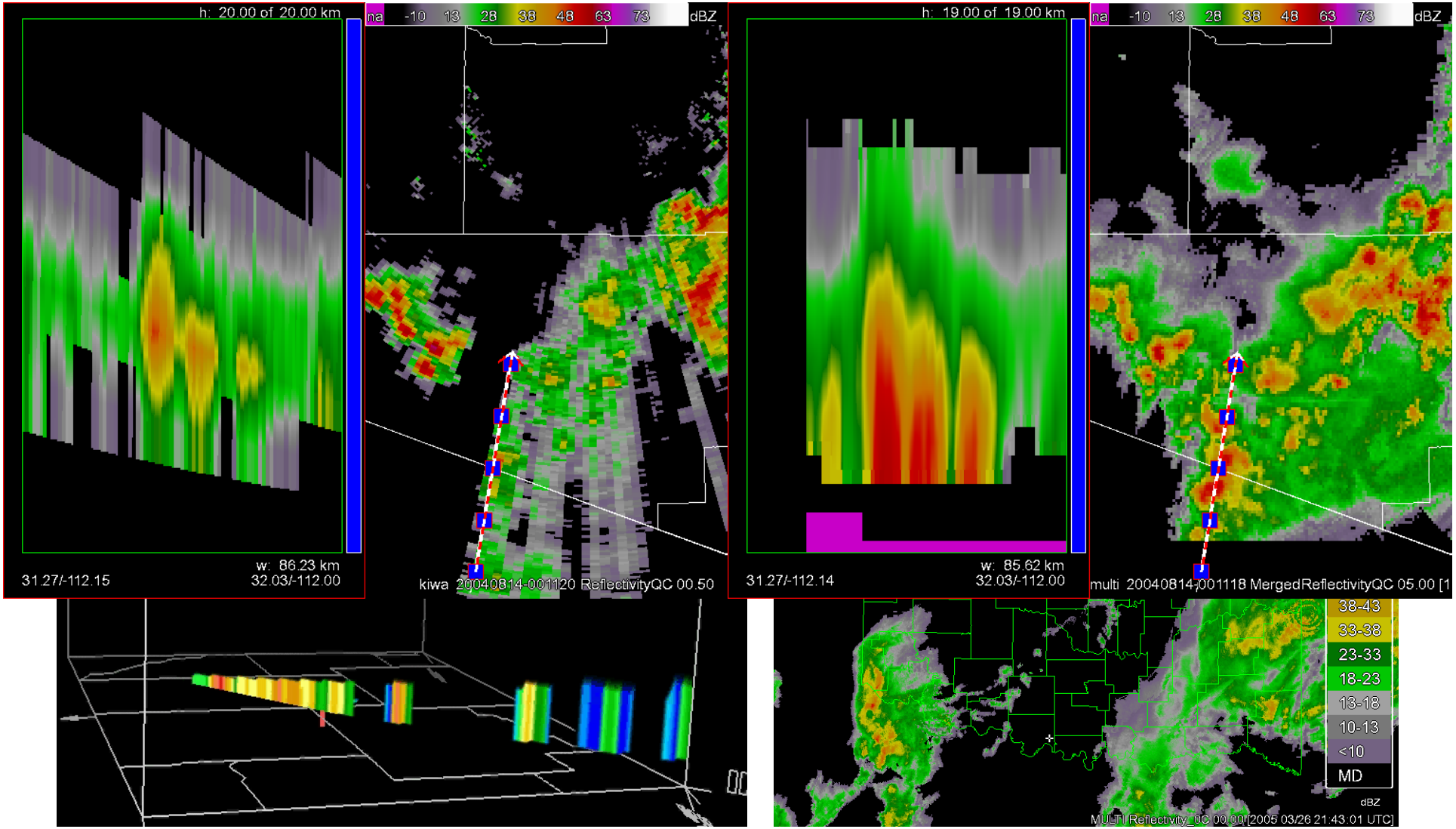
Capability (*hardware, software, products*) for real-time data mining from multi-sensor data sets

- Data mining to guide decision makers in making sense of large multi-sensor datasets in real time
  - Radar (NEXRAD, TDWR, PAR, CASA), Satellite (GOES/GOES-R), Lightning (NLDN, LMA), Modeling (NWP)
- Improve predictability of severe weather leading to increased accuracy and lead times for warnings
- Rapid tech transfer for research to operations

Specific *scientific applications* of data mining will be covered in forecast and hydrology presentations

NEXRAD CONUS multi-radar system

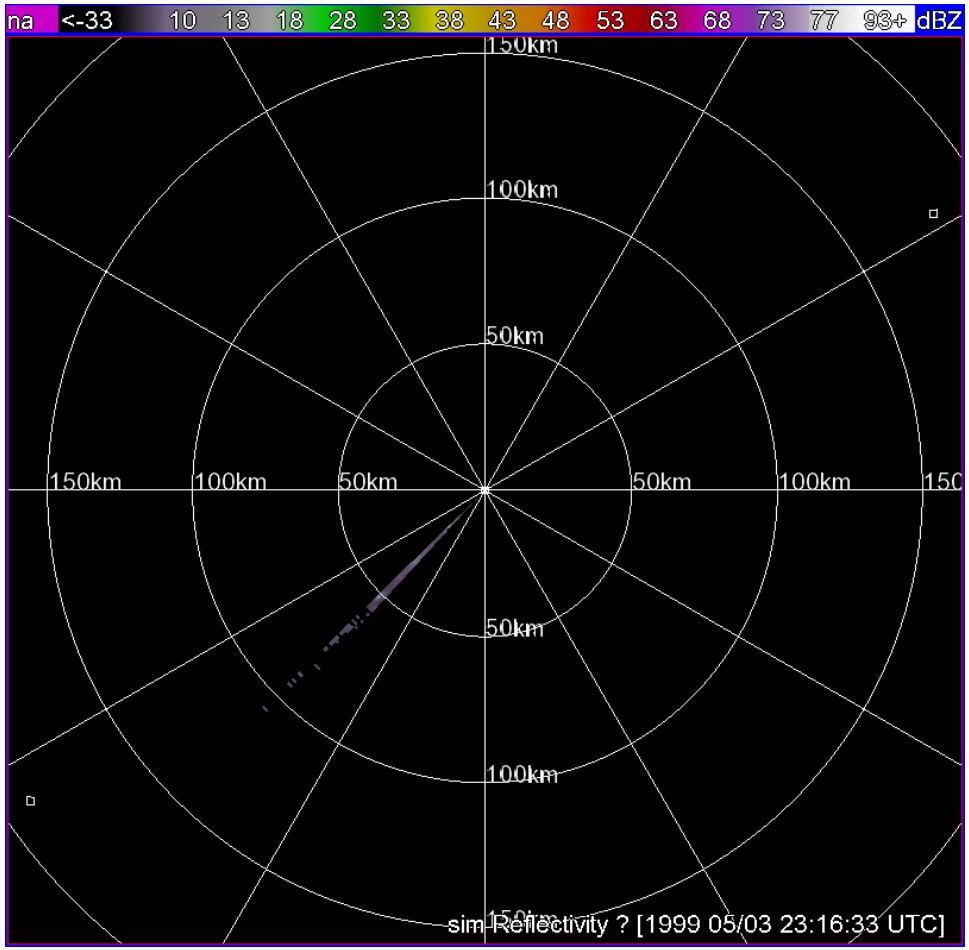
CONUS-scale radars; cluster of 40+ Linux machines

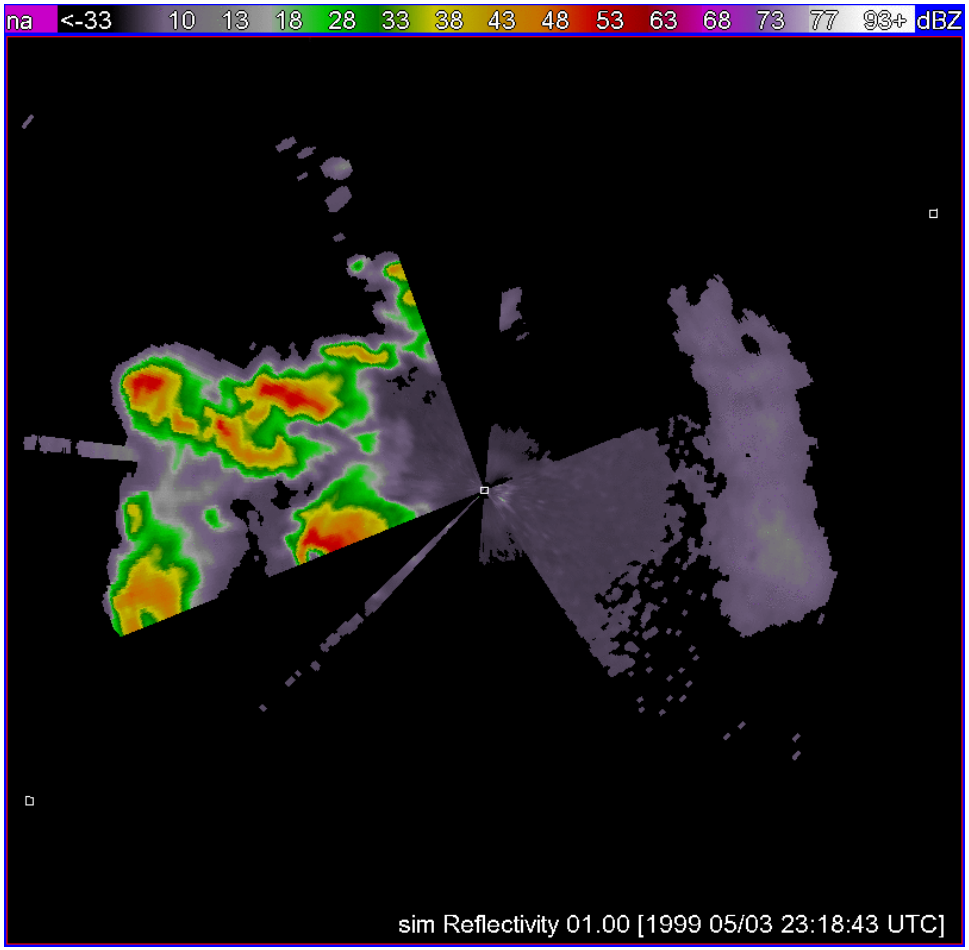


Phased Array Radar Adaptive Scanning Strategies

Intelligent agents build 3D polar database in realtime

- Build virtual volume scans from adaptive scanning





Quality / Performance

High-resolution CONUS products used in real-time

- SPC/NCEP, NWS-FO; NCAR, FAA, HWT
- Google Earth layer to general public (3.5-12M hits from an average of 12,000 sites/month)

Software to create ~100 products

- Operationally: BMRC (Australia) and CWB (Taiwan)
- Licensed (WxCentral, WDT): 46% of US TV stations

Mostly funded by NSSL and NOAA HPCC

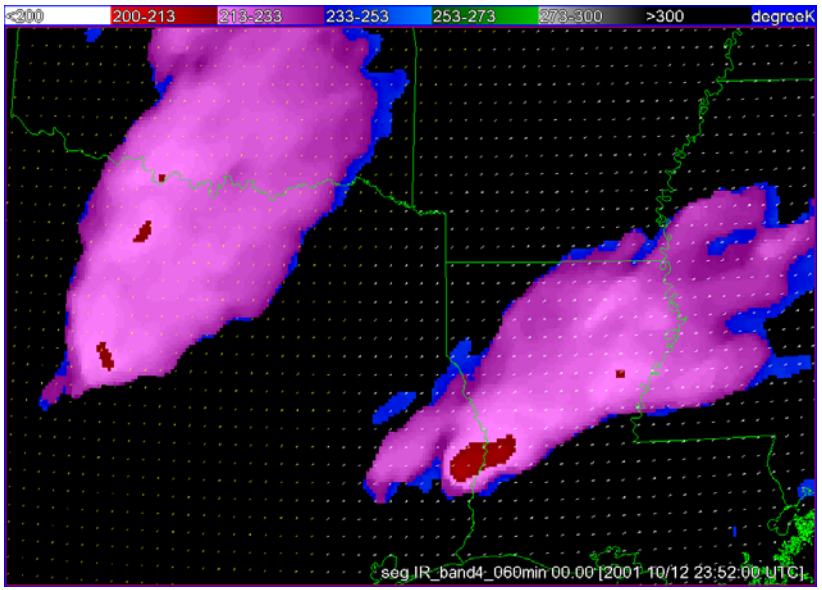
- NSF-CISE: collaborations with Georgia Tech, OU
- Support research projects at 30+ universities

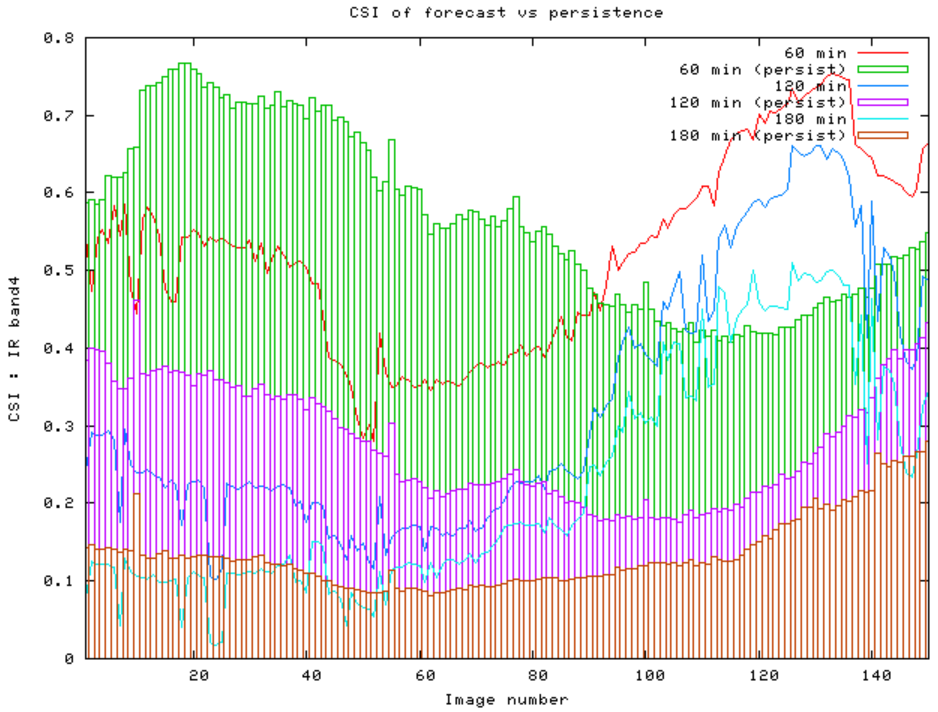
NOAA silver medal, Tech Transfer award, 6 journal articles

Satellite (GOES-R)

Selected for precipitation nowcasting in GOES-R

- Uses WDSS-II segmentation + advection algorithm



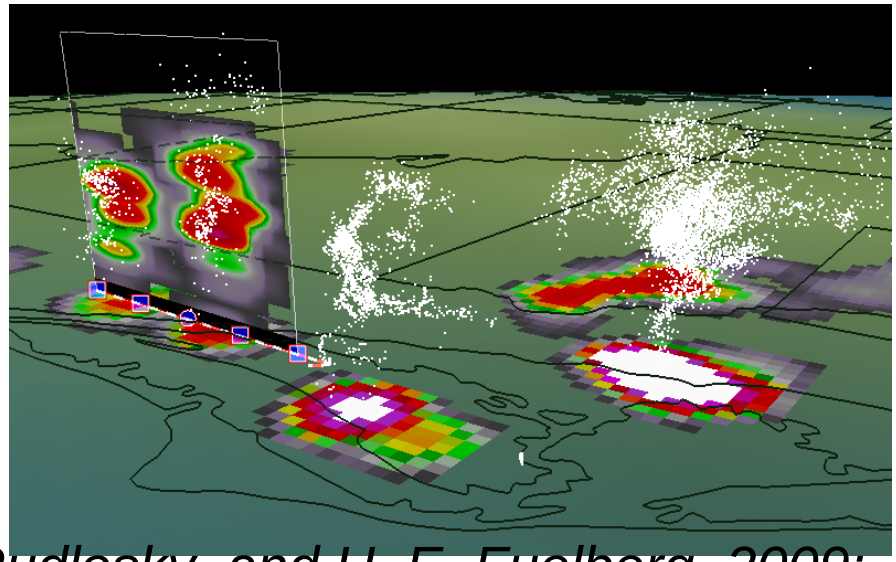


Future Directions

- Improve resolution of nationwide products from 1km to 0.5km (velocity-based products already 0.25km)
- Future Technology transfer
  - Reprocess CONUS dataset at NCDC
  - Multi-sensor product generator in AWIPS-II
- Future Research
  - Algorithms for severe weather and hydrology
  - PAR, refractivity, CASA, mobile radars, storm-scale models, probabilistic warnings, etc.
  - Spatiotemporal data mining (with OU CS)
- Support large-scale, real-time data mining

Example of University Research Enabled by WDSS-II

LMA visualization and attribute extraction



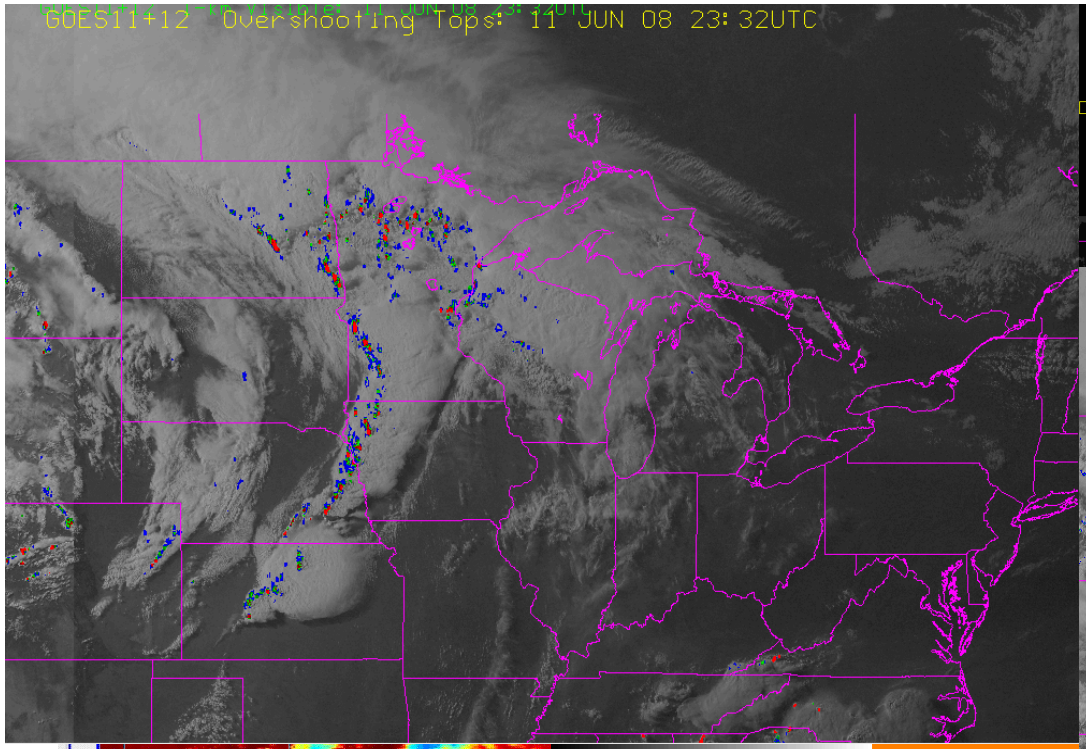
(*Courtesy: Scott Rudlosky, Florida State University*)

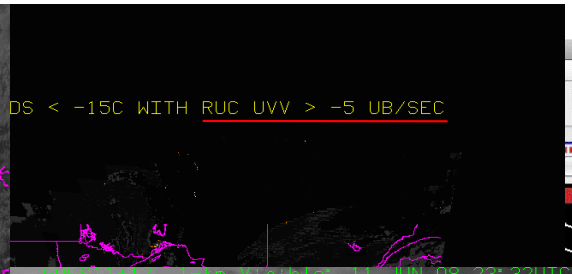
Scott D. Rudlosky, and H. E. Fuelberg, 2009: ***Utilizing WDSS-II to automate dataset preparation for a statistical investigation of total lightning and radar echoes within severe and non-severe storms;*** *4th Conference on the Meteorological Applications of Lightning Data, Phoenix, AZ*

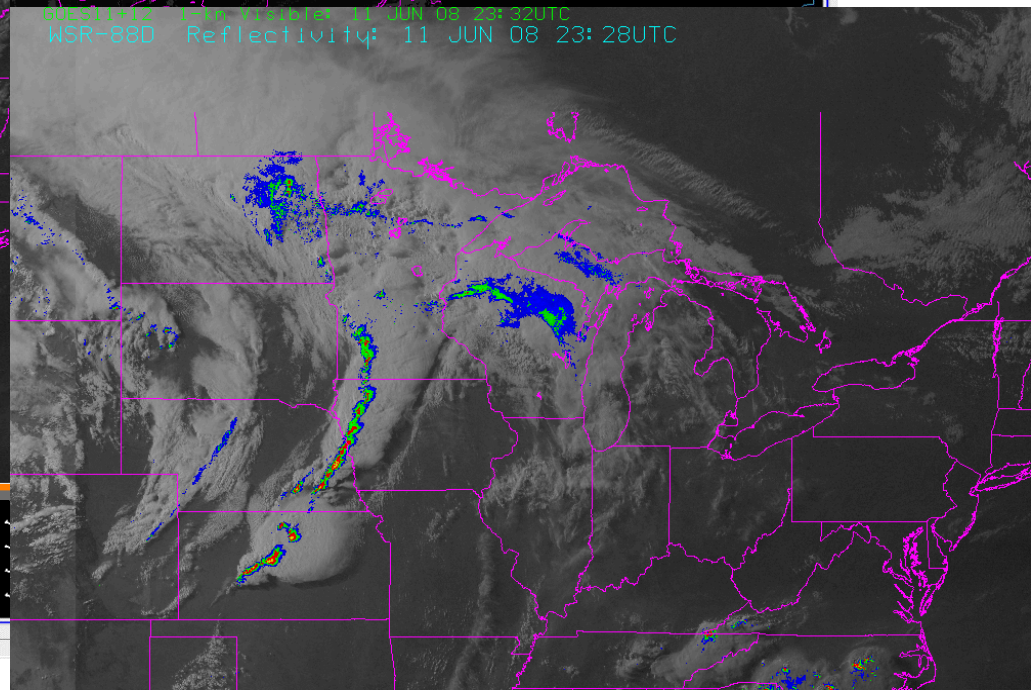
Satellite Convective Initiation

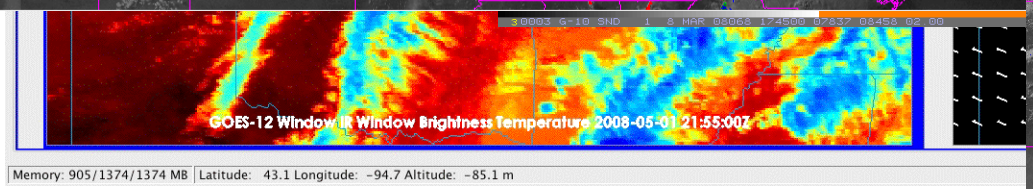
Collaborating on convective initiation research

- Nowcasting, anvil growth, overshooting tops









Summary

Multi-sensor data mining in real-time

- Algorithms for detecting, diagnosing, nowcasting severe weather from different types of sensors, thus improving accuracy and lead times for warnings
- Unique, rapid technology transfer to universities, NOAA agencies, foreign bureaus and private companies

Increase lead-time and accuracy for weather and water warnings and forecasts

Increase development, application, and transition of advanced science and technology to operations and services