Session: Boundary Layer Observations
in Support of Aviation Weather Services

Polarimetric WSR-88D Weather Radars

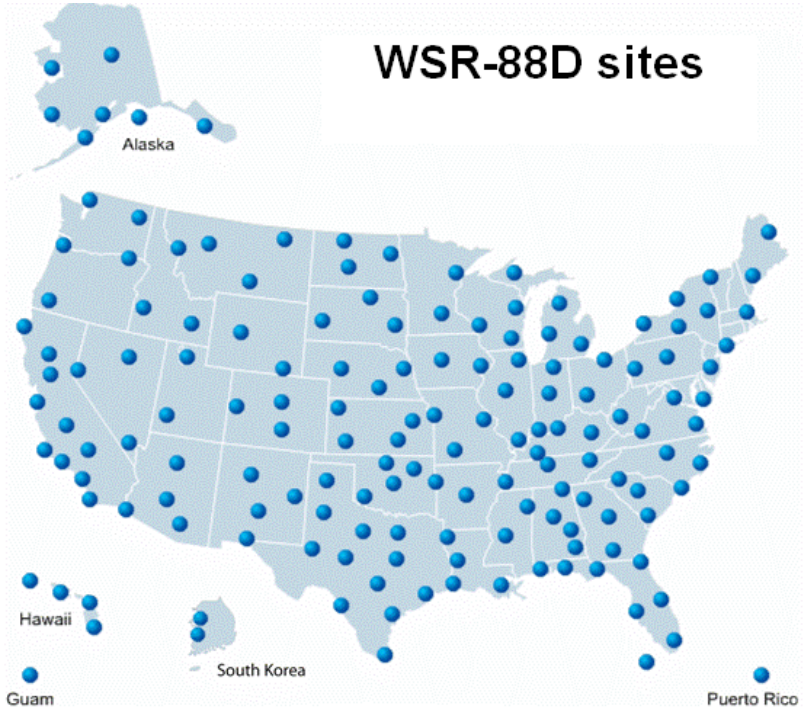
Terry J. Schuur
and
Alexander V. Ryzhkov

University of Oklahoma/CIMMS
and
NOAA/National Severe Storms Laboratory

Terry.Schuur@noaa.gov
Alexander.Ryzhkov@noaa.gov

The Polarimetric WSR-88D

- The US WSR-88D radar network is being upgraded to include polarimetric capabilities.



Polarimetric radar provides:

Improved ability to discriminate between different precipitation types.

Improved data quality through identification of non-meteorological targets (including birds).

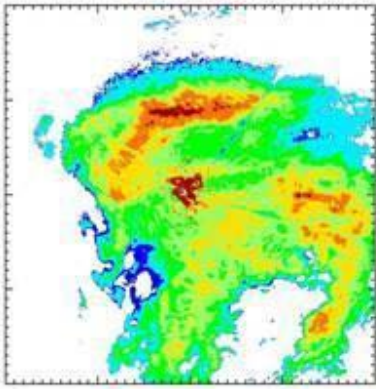
More accurate rainfall estimation.

More accurate microphysical information to be used for numerical model initialization.

Potential Benefits to Aviation Users

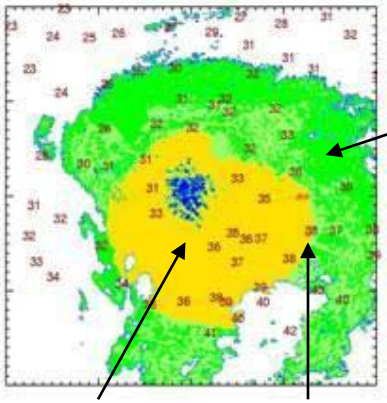
- Identify precipitation type in winter storms (dry/wet snow, sleet, rain)
- Discriminate hail from rain and gauge hail size
- Identify intensifying convective storms
- Identify location of birds
- Investigate the feasibility of identifying aircraft icing conditions.

Today's Reflectivity

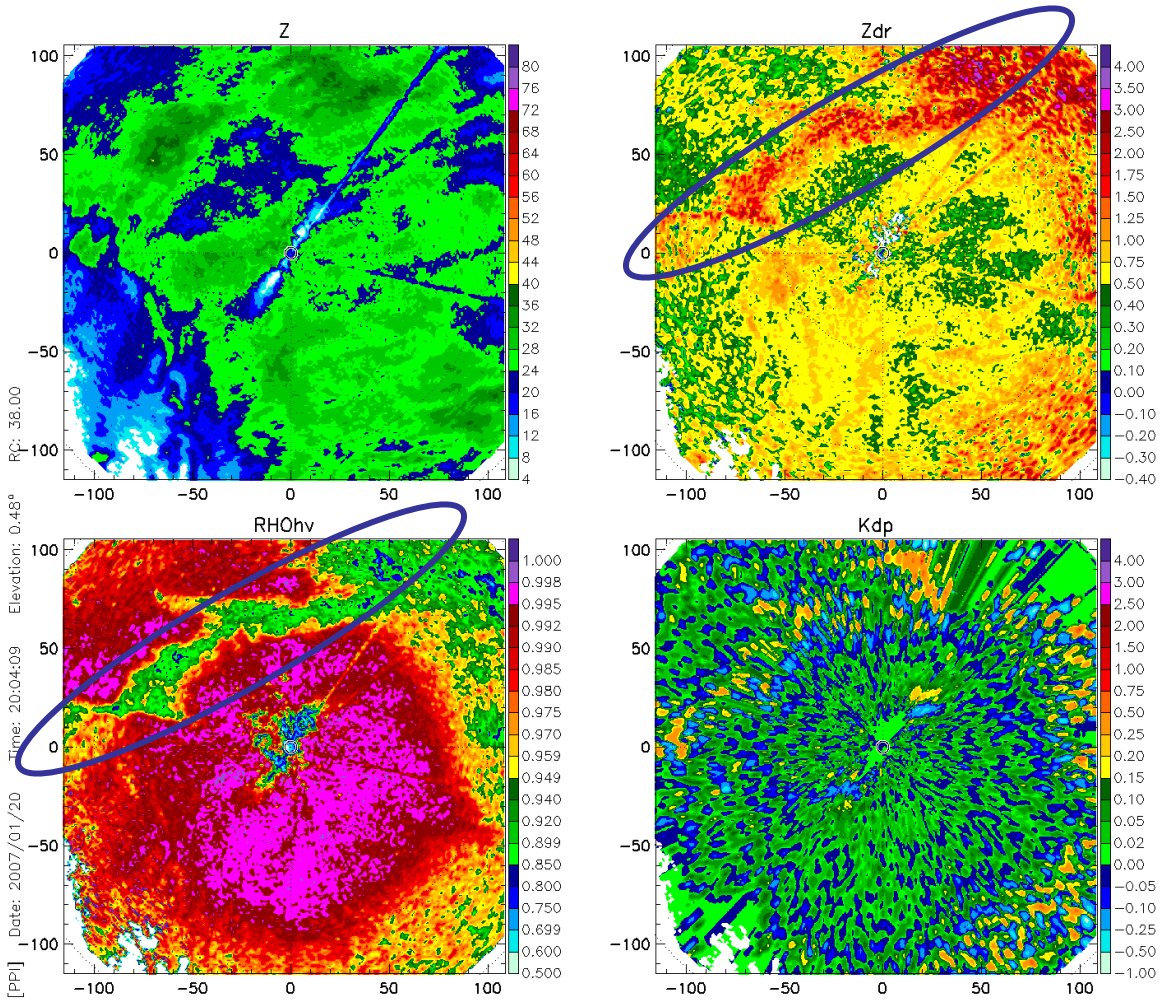


Rain/Snow Line Not Clear

Dual Polarization Data



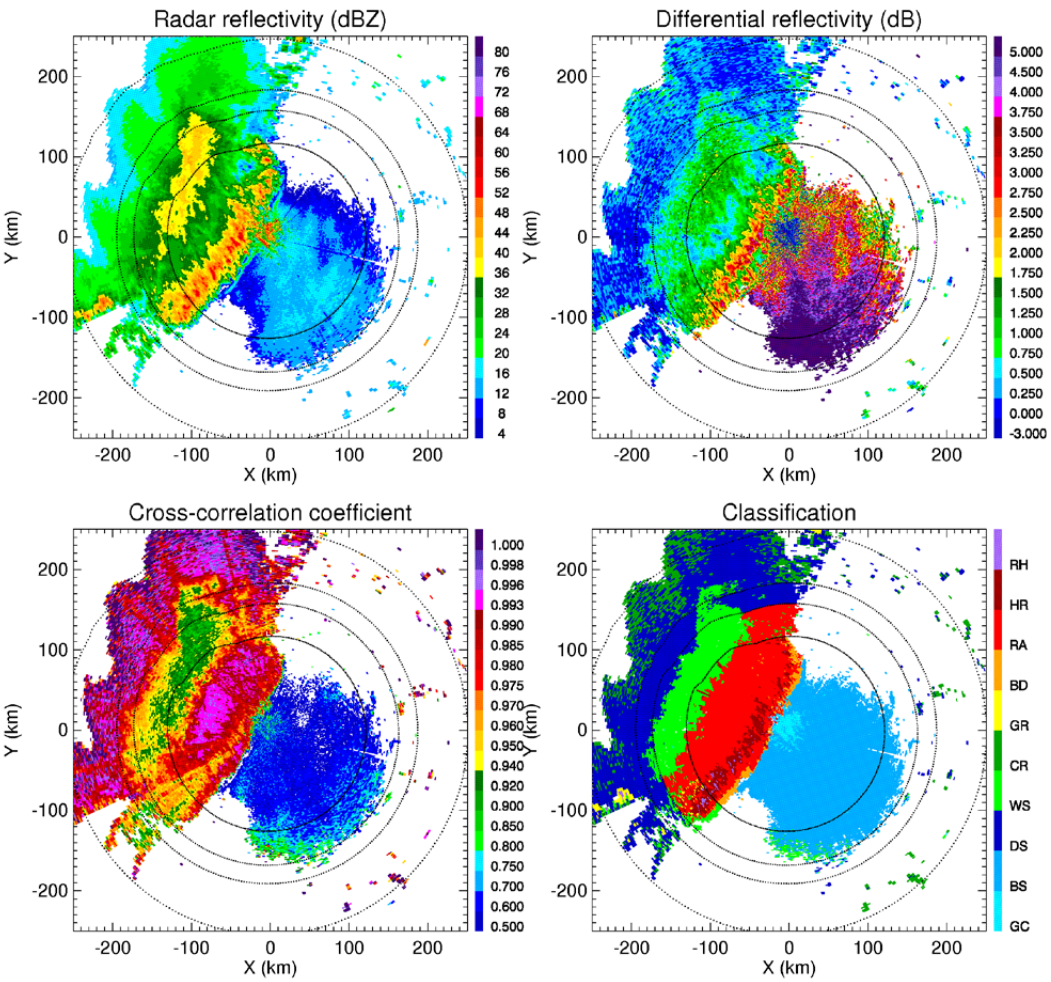
Example: Transition from rain to snow on January 20, 2007



Mixture of large, wet aggregates and rain drops in transition region results in:

1) an increase in Differential Reflectivity (Z_{DR})
2) a decrease in Correlation Coefficient (ρ_{HV}).

Example: Hydrometeor Classification Algorithm



A “fuzzy logic” Hydrometeor Classification Algorithm (HCA) has been developed. The HCA uses weighting functions to combine information from all polarimetric variables to:

1) Discriminate between meteorological and non-meteorological scatterers.

2) Determine dominant precipitation type.

Hydrometeor Classification Algorithm

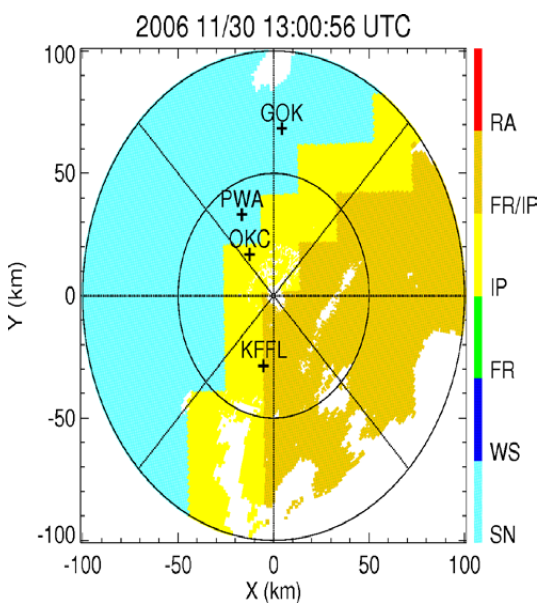
Combining Model Output with Polarimetric Radar Data

The radar-based HCA:

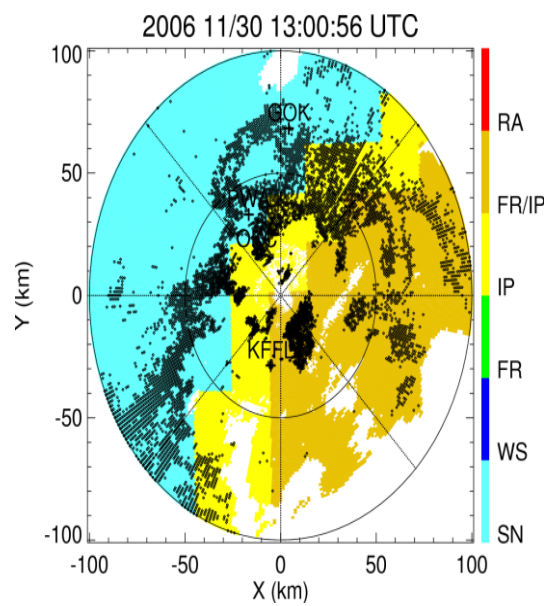
- Does not utilize thermodynamic data.
- Provides classification on conical surfaces that, even at 0.5 elevation, may be well above ground level.

Current research seeks to combine thermodynamic information from the Rapid Update Cycle (RUC) model with polarimetric classification capabilities.

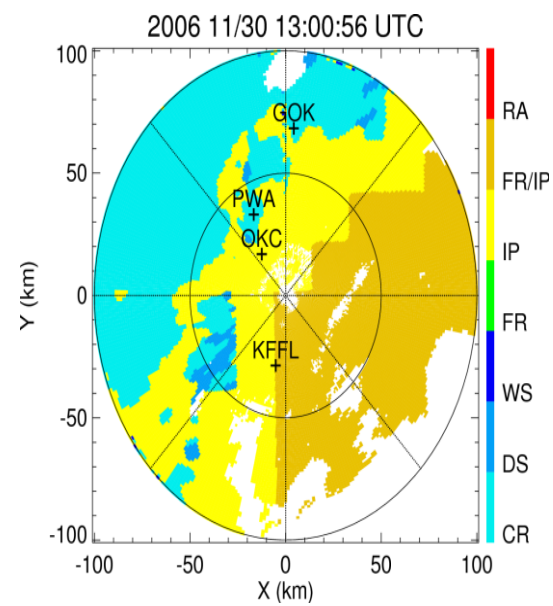
Classification based on RUC T_w Profiles



Polarimetric Bright Band Identification



Modification for Final Classification



Summary

- The polarimetric upgrade to the national WSR-88D network is underway.

- The polarimetric WSR-88D has a proven ability to discriminate between different precipitation types.

- Current research seeks to improve polarimetric classification of precipitation type at the surface by including thermodynamic information from numerical models.

- The polarimetric WSR-88D also improves radar data quality through the identification of non-meteorological echoes. This includes the ability to easily identify the location of birds.

Other potential applications to aviation users include:

Convective updraft identification.

Hail location and sizing.

Future work will also explore:

Identification of polarimetric signatures associated with aircraft icing.

Use of polarimetric radar-derived microphysical information in storm-scale models.