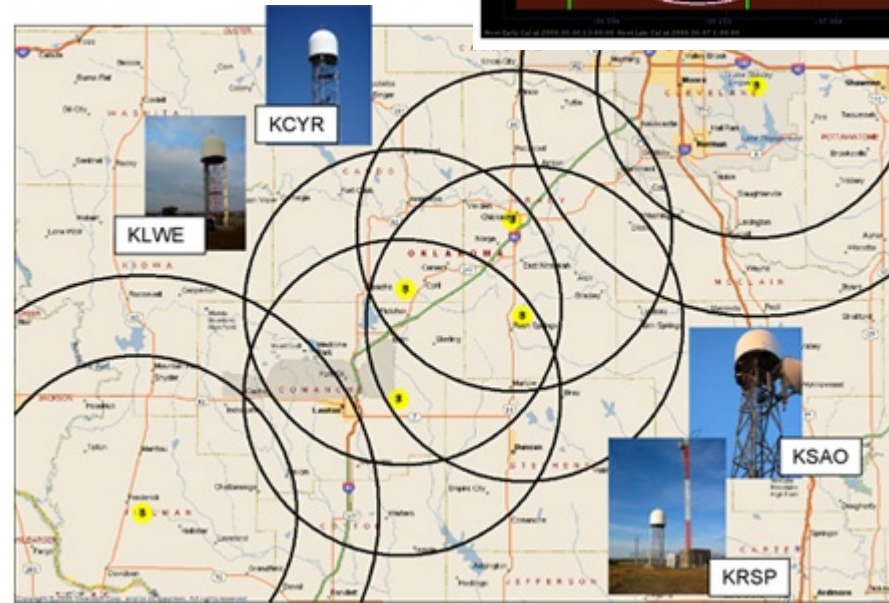
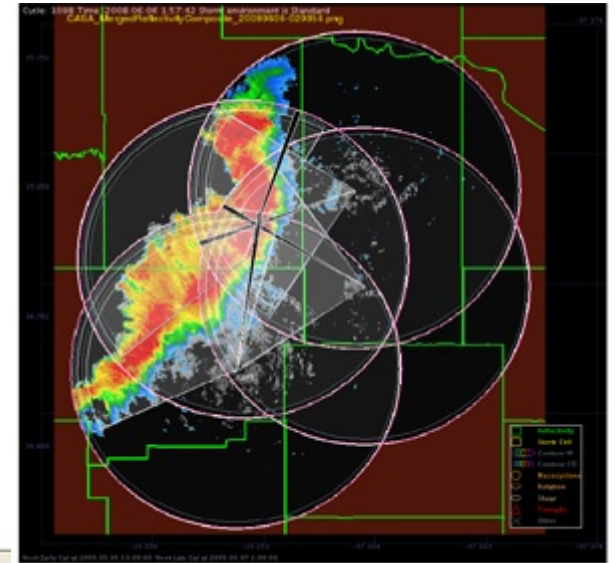


# Introduction

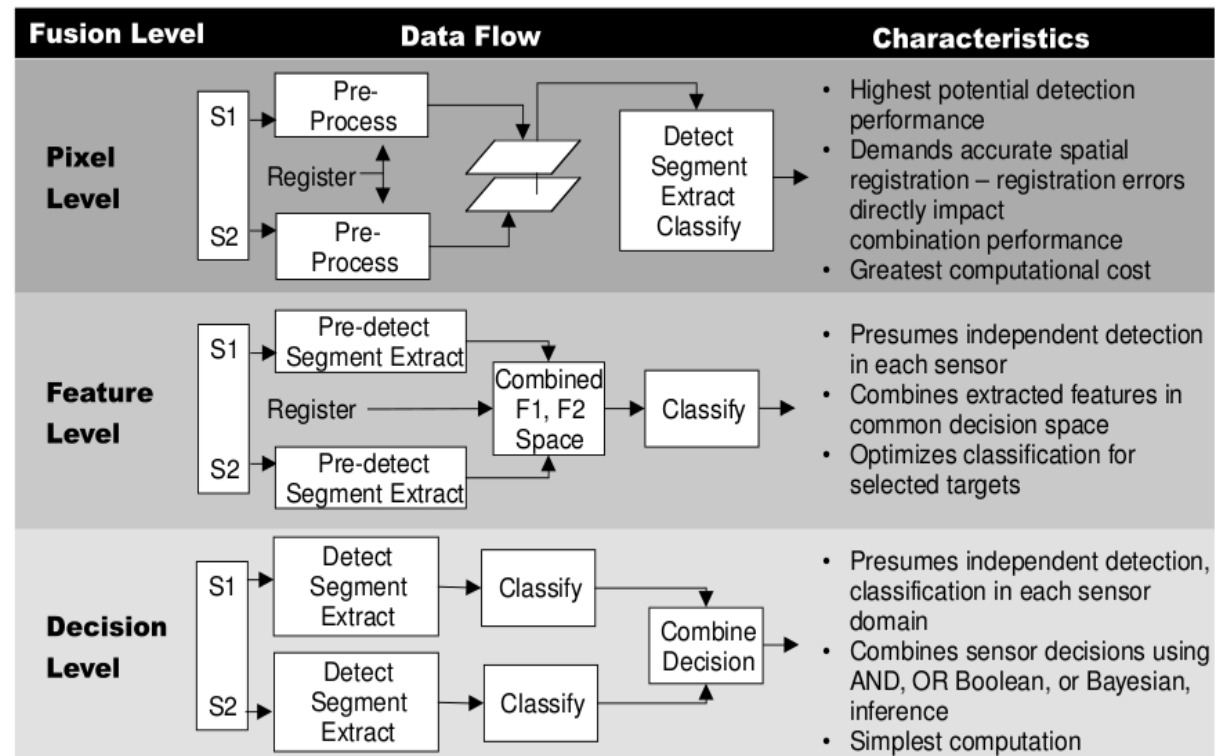
- The comprehensive observation of atmosphere phenomena requires multiple sources of observation
- Different spatial and temporal resolution are involved
- Data fusion and image fusion are necessary processing to bring all data together in coherent framework in space and time



From <http://www.casa.umass.edu>

# Data fusion techniques (1/3)

Multi-sensor data fusion can be performed at four different processing levels, according to the stage at which the fusion takes place: signal level, pixel level, feature level, and decision level.



*From Waltz, 2001*

# Data fusion techniques (2/3)

**Signal level fusion.** In signal-based fusion, signals from different sensors are combined to create a new signal with a better signal-to noise ratio than the original signals.

**Pixel level fusion.** Pixel-based fusion is performed on a pixel-by-pixel basis. It generates a fused image in which information associated with each pixel is determined from a set of pixels in source images to improve the performance of image processing tasks such as segmentation

**Feature level fusion.** Feature-based fusion at feature level requires an extraction of objects recognized in the various data sources. It requires the extraction of salient features which are depending on their environment such as pixel intensities, edges or textures. These similar features from input images are fused.

**Decision-level fusion** consists of merging information at a higher level of abstraction, combines the results from multiple algorithms to yield a final fused decision. Input images are processed individually for information extraction. The obtained information is then combined applying decision rules to reinforce common interpretation.

# Data fusion techniques (3/3)

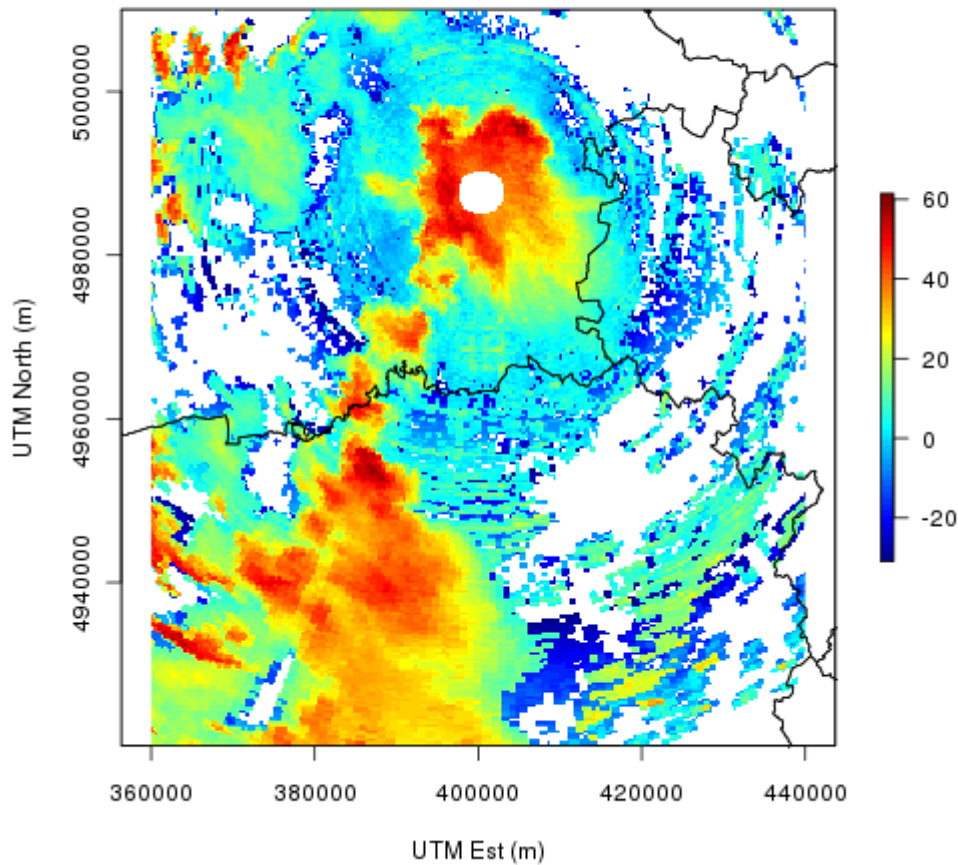
The most popular and effective methods include:

- intensity-hue-saturation (IHS), high-pass filtering, principal component analysis (PCA), different arithmetic combination(e.g., Brovey transform), multi-resolution
- analysis-based methods (e.g., pyramid algorithm, wavelet transform)
- Artificial Neural Networks (ANNs).

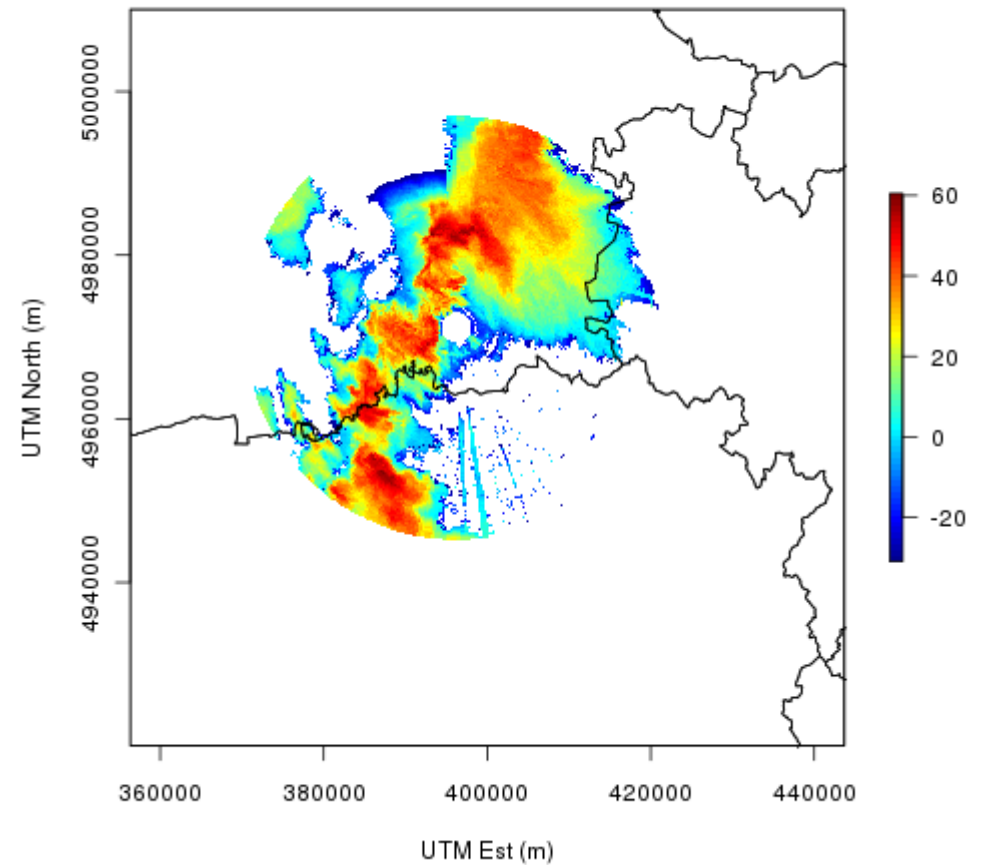
# CAPPI @ 2km

## 1<sup>st</sup> July 2009 17:00 UTC

BRIC Reflectivity CAPPI@2km [dBZ]



ARX Reflectivity CAPPI@2km [dBZ]



# Composite CAPPI @ 2km (wavelet-based)

## 1<sup>st</sup> July 2009 17:00 UTC

