Ensemble model forecasting for MDSS

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Overview of modeling system

- A configurable forecast modeling system
- Very high resolution, multiple models
- Ensemble forecasting
- Hot-start initialization

Ensemble modeling

- Premise: given a number of (imperfect) forecasts of an imperfectly-observed predictand (the atmosphere), an ensemble of those forecasts *can be* a better predictor than any single ensemble member
- Multiple forecasts can be used to create probabilities for key predictands
  - subfreezing temperatures, winds over 25 mph, etc.

Ensemble products

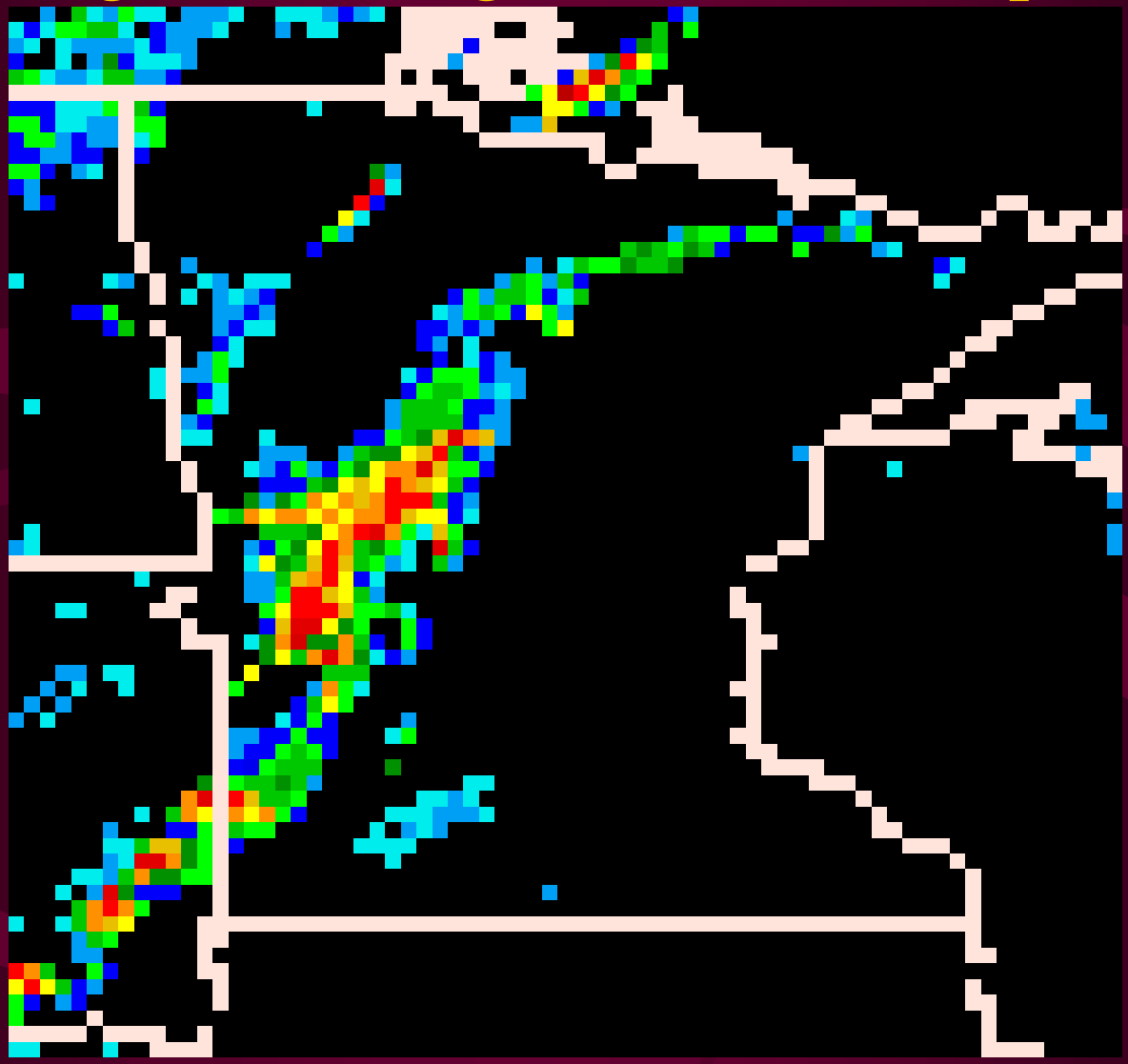
- State variables: t, $\vec{V}$, rh, etc., and variance
- Categorical probability of precipitation (PoP), probability of precipitation type (PoPT)
- Probabilities of key forecast variables
  - *e.g.*, t < 32F, $\vec{V}$ > 25 kt, etc.

Configuration this winter

- Three models, three LBC source models, total of nine ensemble members
  - models: MM5, RAMS, WRF
  - LBC sources: AVN, Eta, RUC
- Four 48-hour forecasts per day
  - 12-km grid
- High-resolution nests
  - 4-km grid
  - Only out to 12 hours

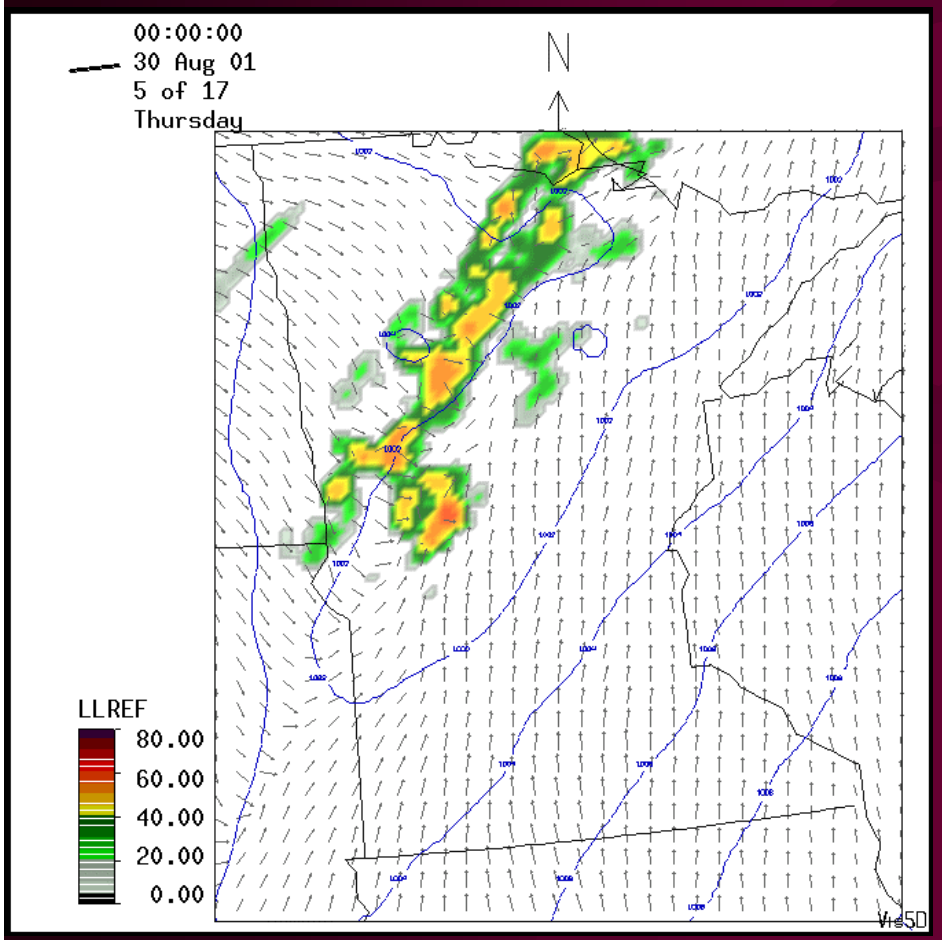
Example:

Radar image from August 29, 2001, 5 pm CDT

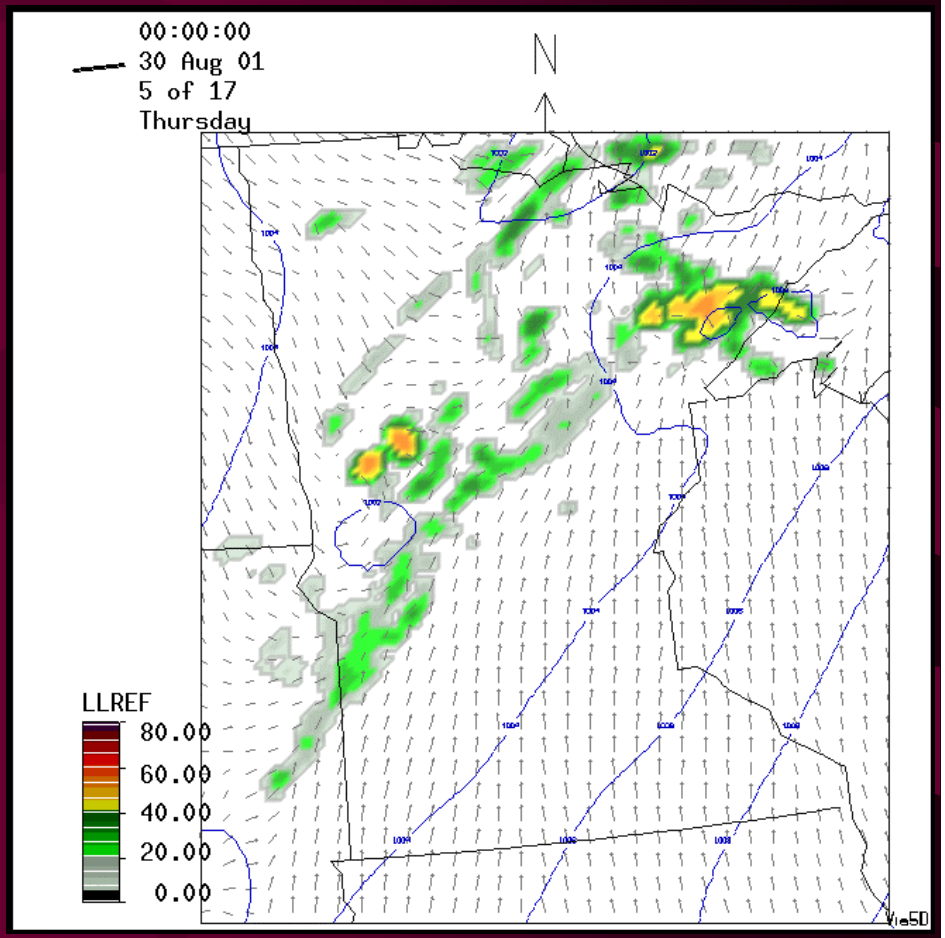


12-hr "radar" forecasts from 5 am, August 30

MM5/AVN



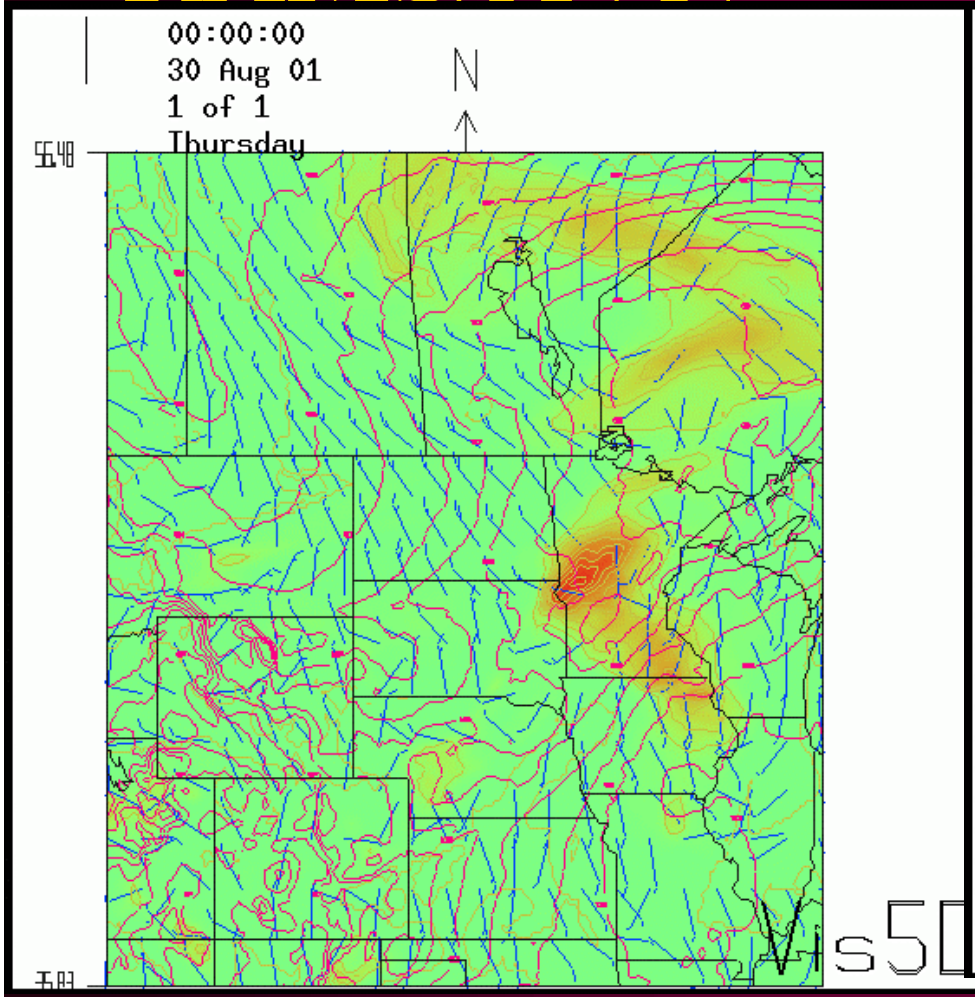
MM5/Eta



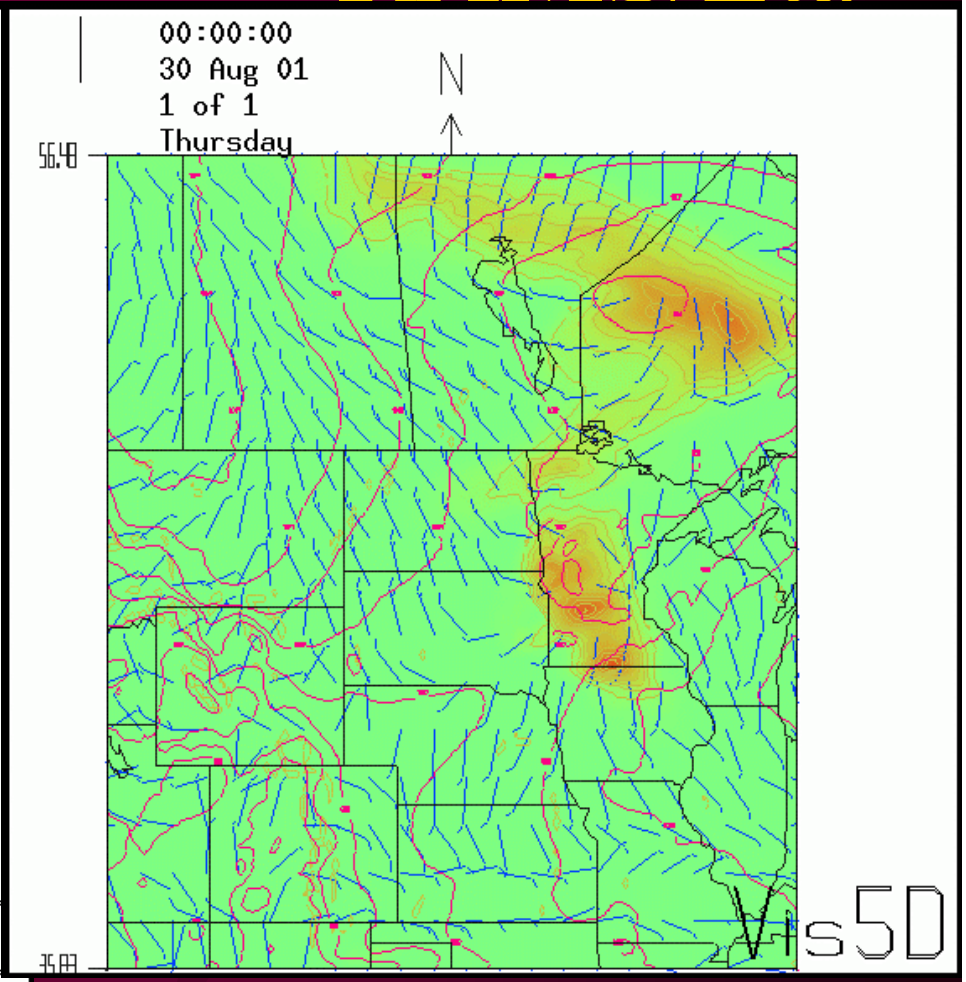
12-hr precip accum forecasts

from 5 am, August 30

RAMS/AVN



RAMS/Eta



Hot start initialization

- Model starts with active cloud/precip processes
- Skillful very-short-range (< 1 h) cloud and precipitation forecasts
  - traditional init methods take 2-3 hrs to spin up
- Very efficient with computer resources

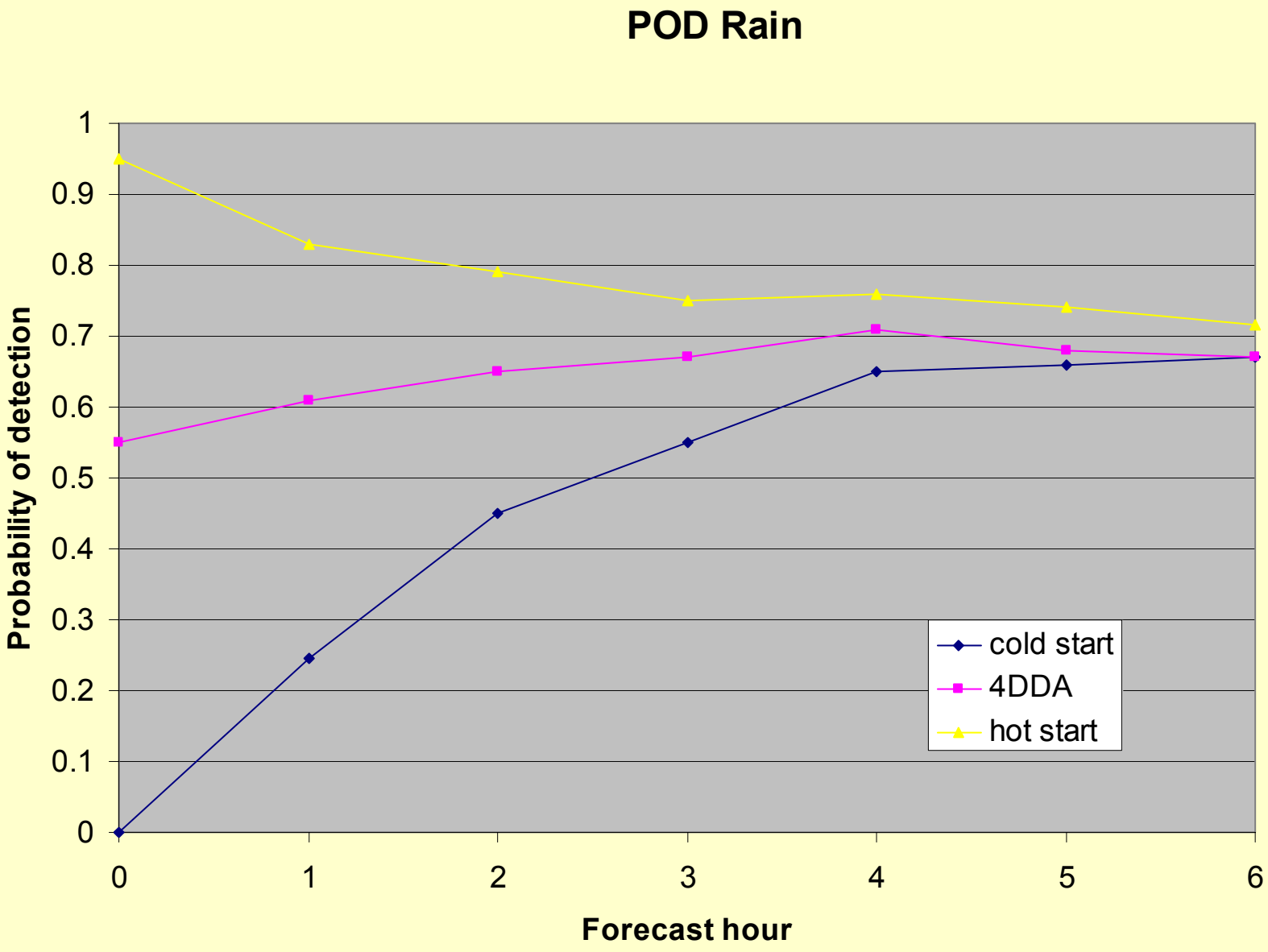
How it works

1. LAPS 3-d analysis of clouds, cloud types, precip, precip types
2. Estimates of in-cloud vertical velocity (lookup table)
3. Variational adjustment of horizontal winds to support vertical motions
4. Adjust vapor field to ensure saturation in clouds

Verification

- 37 cases from late winter, early spring in Colorado
- Compare forecasts to LAPS analyses
- State variables also show improvement

Verification



"Tailored Numerical Weather Forecast System"

- MDSS technology component
- FSL deliverable in FY02
  - Hardware spec
  - Software download or cd
    - data assimilation, models, postprocessing, etc.
  - Configure via GUI

"Tailored Numerical Weather Forecast System" page 2

- Outputs
  - RWFS-specific
  - Familiar graphics
- No IP restrictions except optional products (IDL, RAMS, etc.)
- Run remotely or locally