

THE EDMONTON HAILSTORM OF 2004: INTEGRATING HAIL, CONVECTIVE PRECIPITATION AND LIGHTNING FORECASTS

Julian Brimelow ¹, Gerhard Reuter ¹, William Burrows ², Bob Kochtubajda ²,
David Patrick²

¹ University of Alberta



² Meteorological Service of Canada, PNR



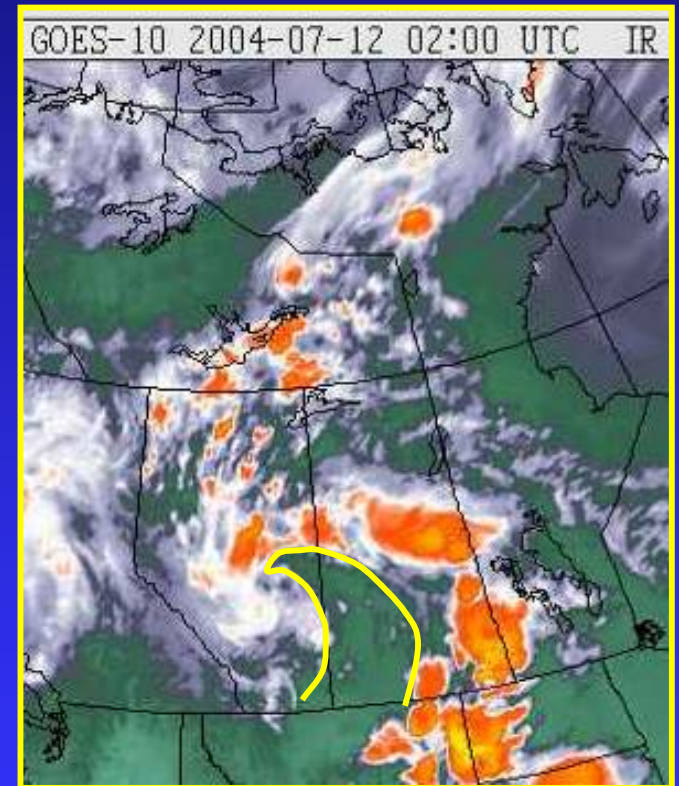
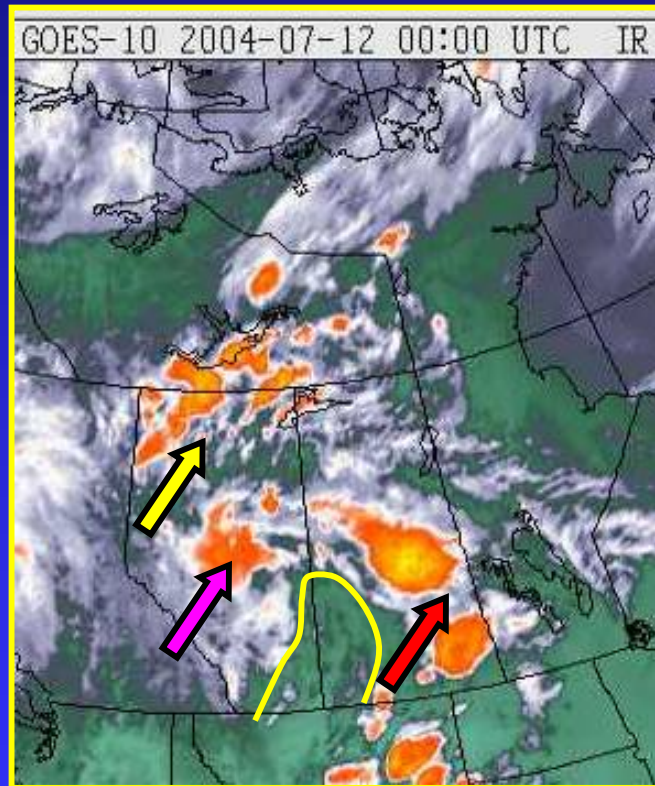
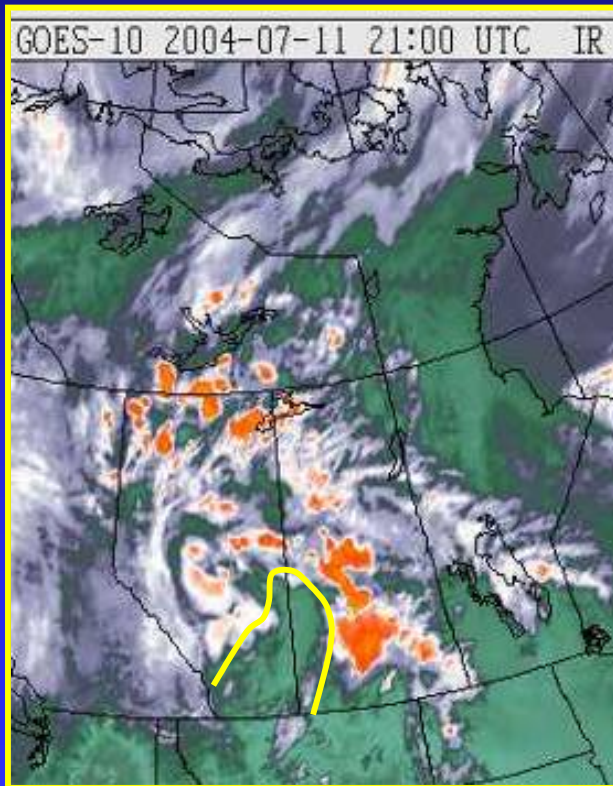
INVESTIGATING WAYS TO IMPROVE HAILCAST

- HAILCAST has been used successfully to forecast D_x , recently started producing spatial forecasts of D_x using prognostic NWP soundings
- Brimelow et al. (2005) demonstrated that maps of D_x produced using prognostic GEM soundings showed promising skill
- HAILCAST/GEM technique tended to forecast hail over a larger area than was observed by weather radar
- Hail was sometimes forecast on days when no storms were observed
- HAILCAST and the statistical lightning forecast technique of Burrows et al. (2005) were run operationally for summer of 2004
- Case studies were identified for the purpose of determining the viability of using forecast convective precipitation (CP) and probabilistic lightning fields from GEM to identify areas of convective activity in advance

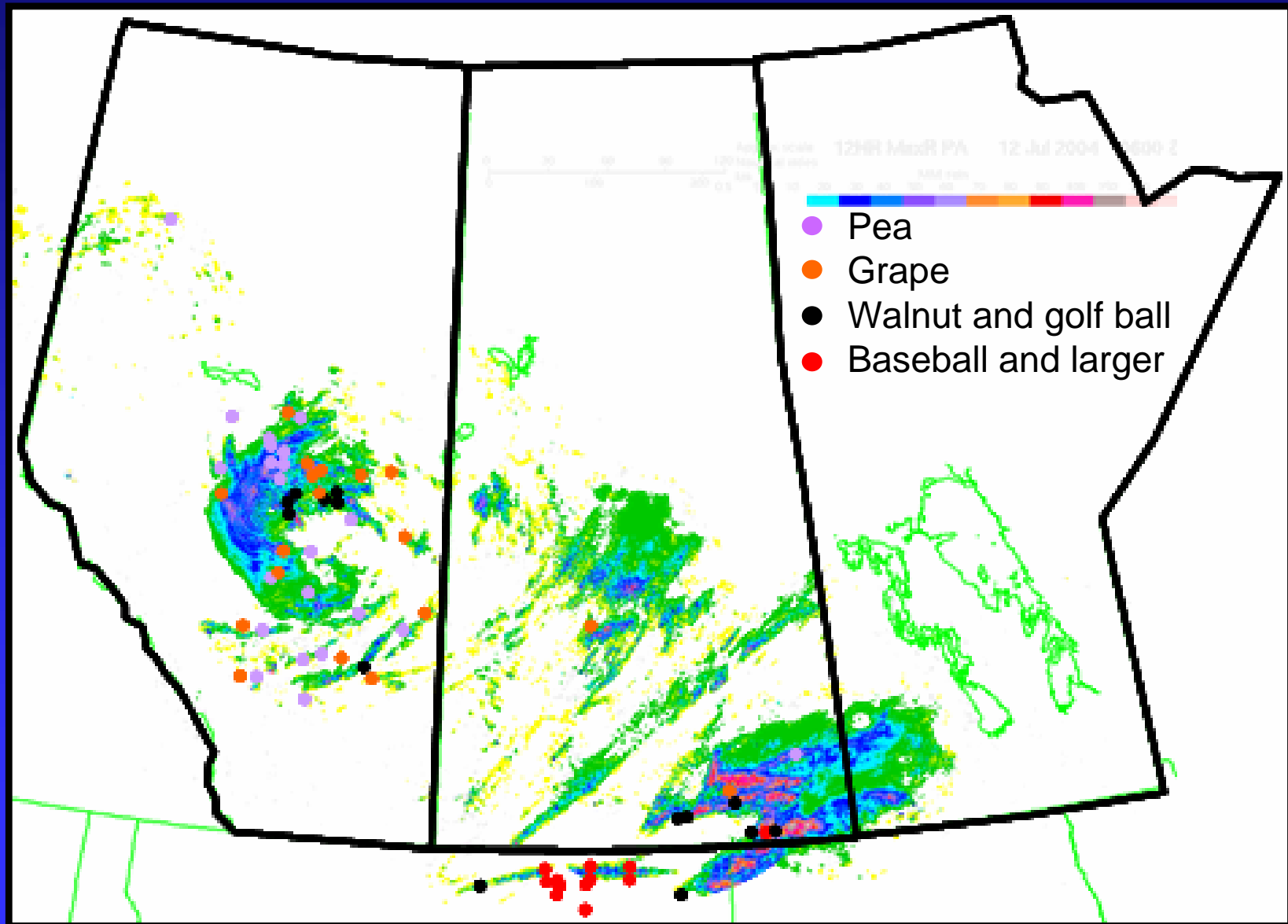
THE EDMONTON HAILSTORM OF 11 JULY 2004



IR SATELLITE IMAGES OF STORM EVOLUTION



SURFACE HAIL REPORTS AND RADAR-DERIVED STORM TRACKS

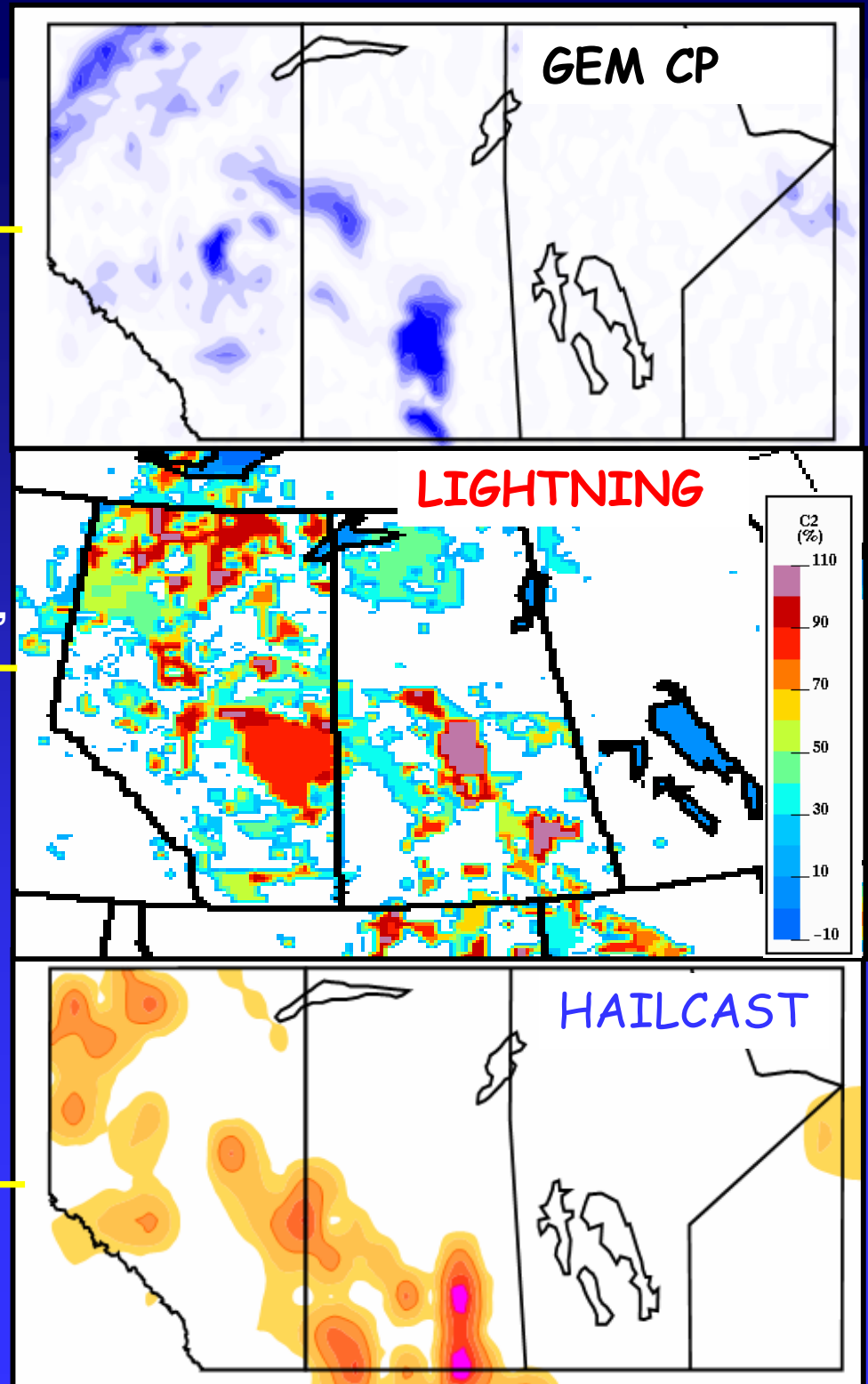


Gridded T, Td & ω ;
K-F scheme

15-km GEM MODEL

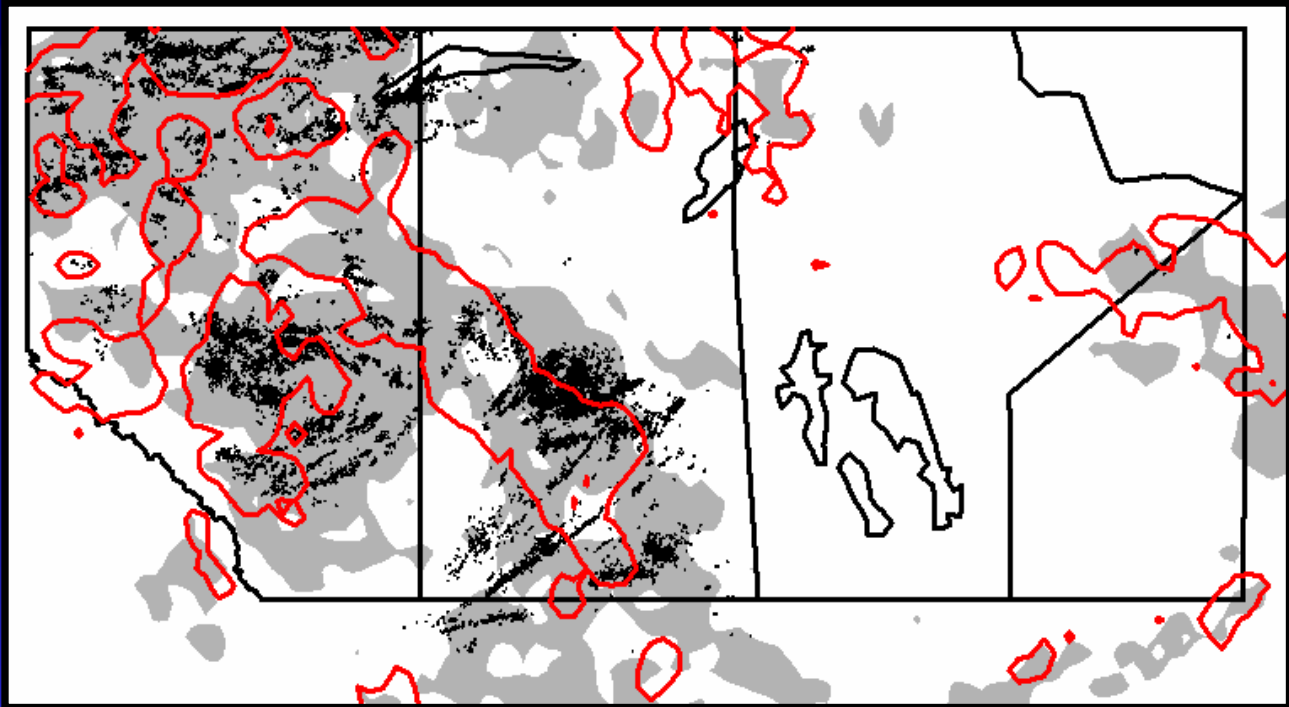
Gridded moisture,
convection & ω ;
Tree-Structured
Regression

Profile of T, Td and wind;
cloud and hail model

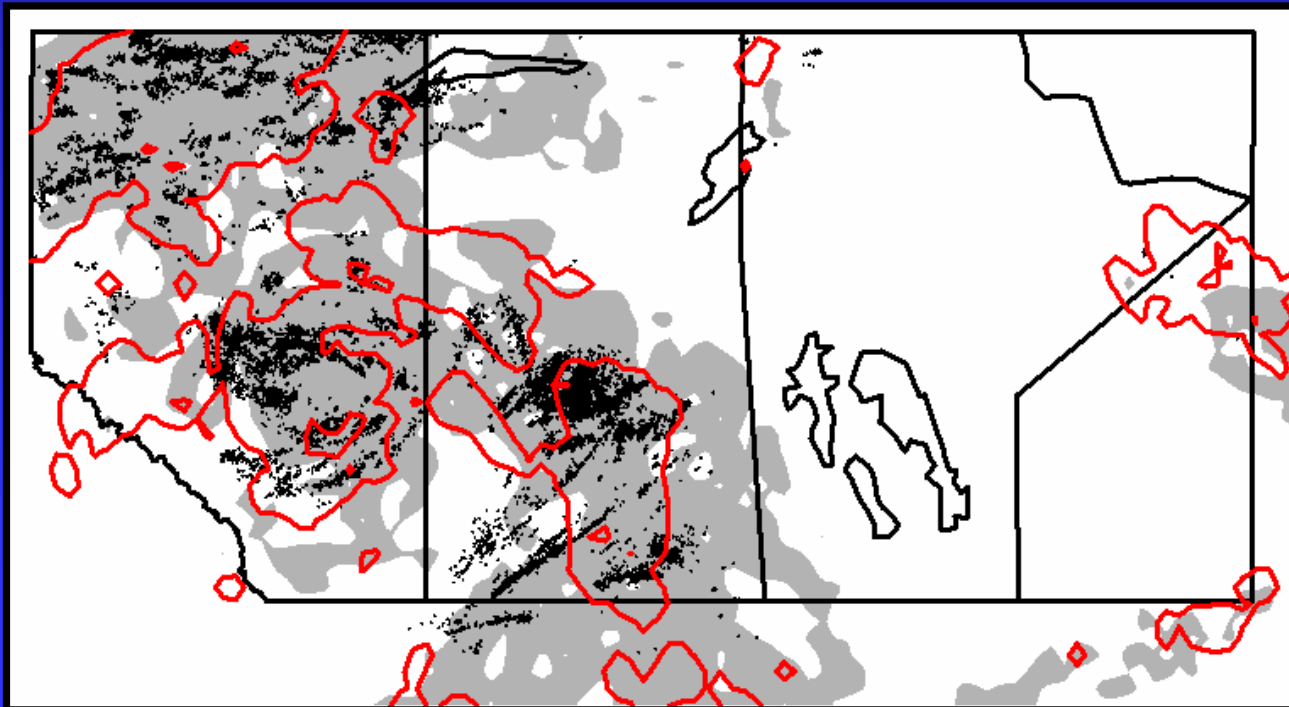


**Forecast lightning and
CP from 18Z to 00Z**

— Accum. CP ≥ 0.2 mm
■ Prob. lightning $\geq 30\%$

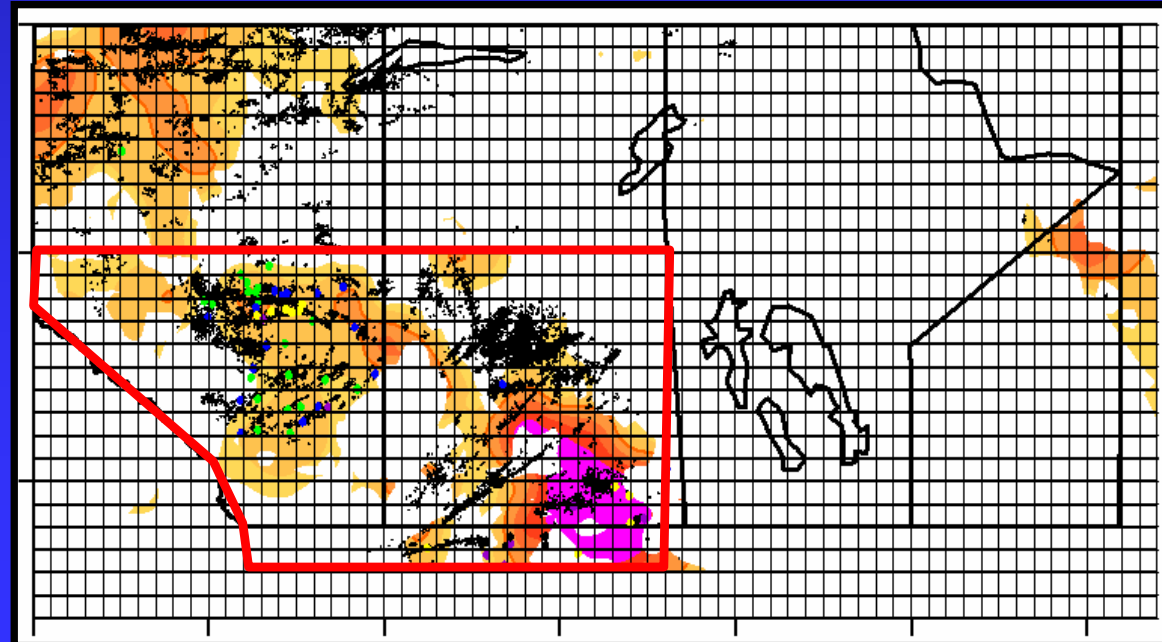
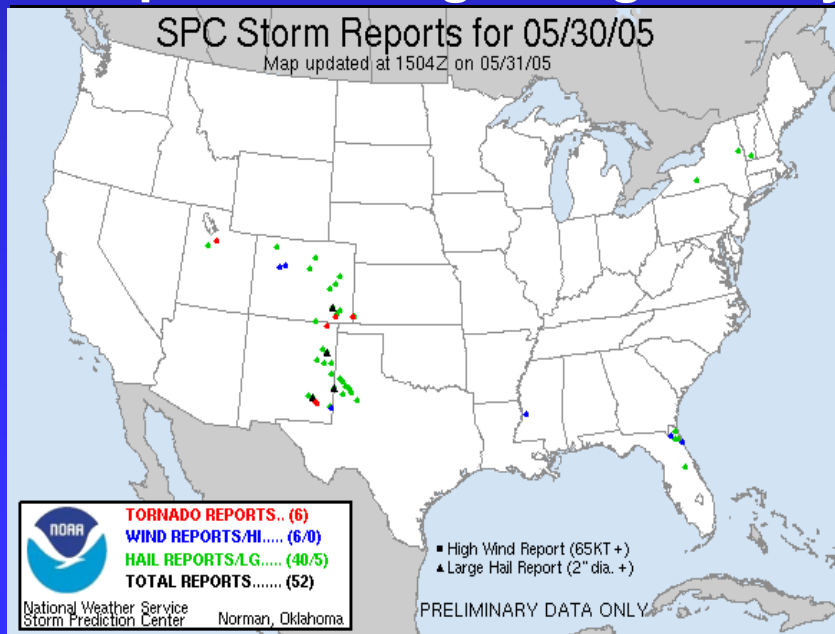


**Forecast lightning and
CP from 21Z to 03Z**

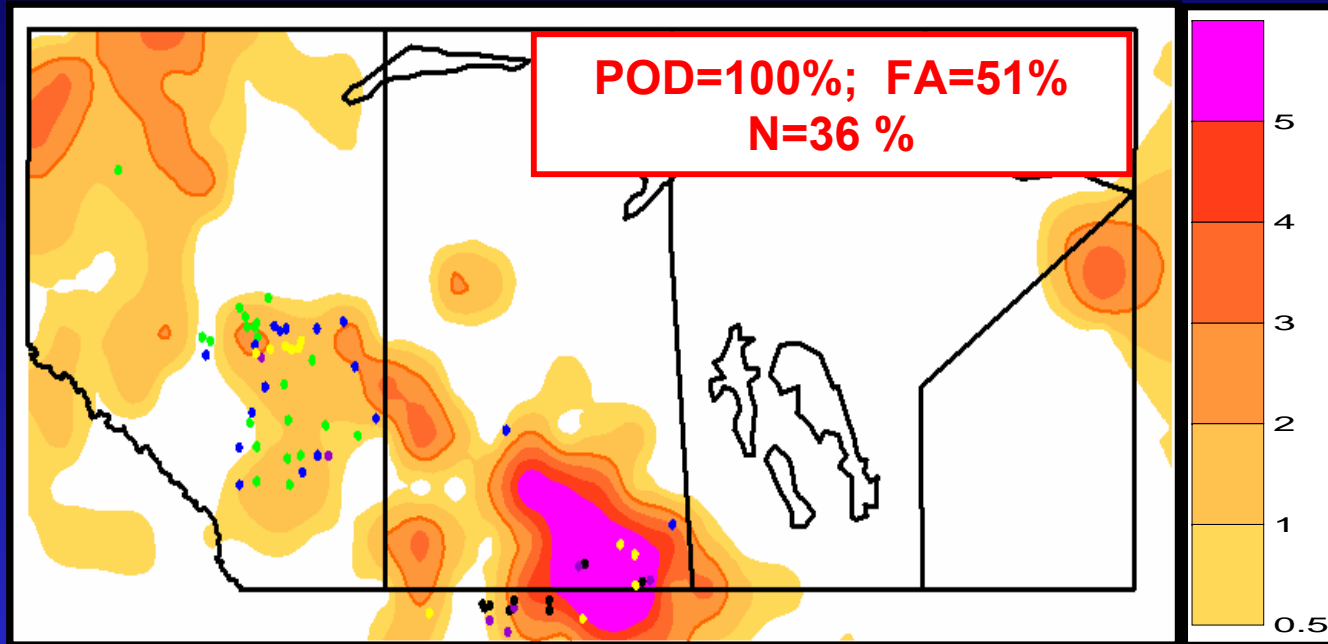


VERIFICATION METHODOLOGY

- Create spatial masks of those areas where CP (or lightning) **is not expected** during a 6-hr period centered on 21Z or 00Z
- Use these masks to exclude areas where HAILCAST is predicting hail, but deep convection is not expected to develop
- Compare forecast areas of lightning and CP with observed lightning activity
- Compare masked and unmasked HAILCAST maps with observed hail reports and lightning activity

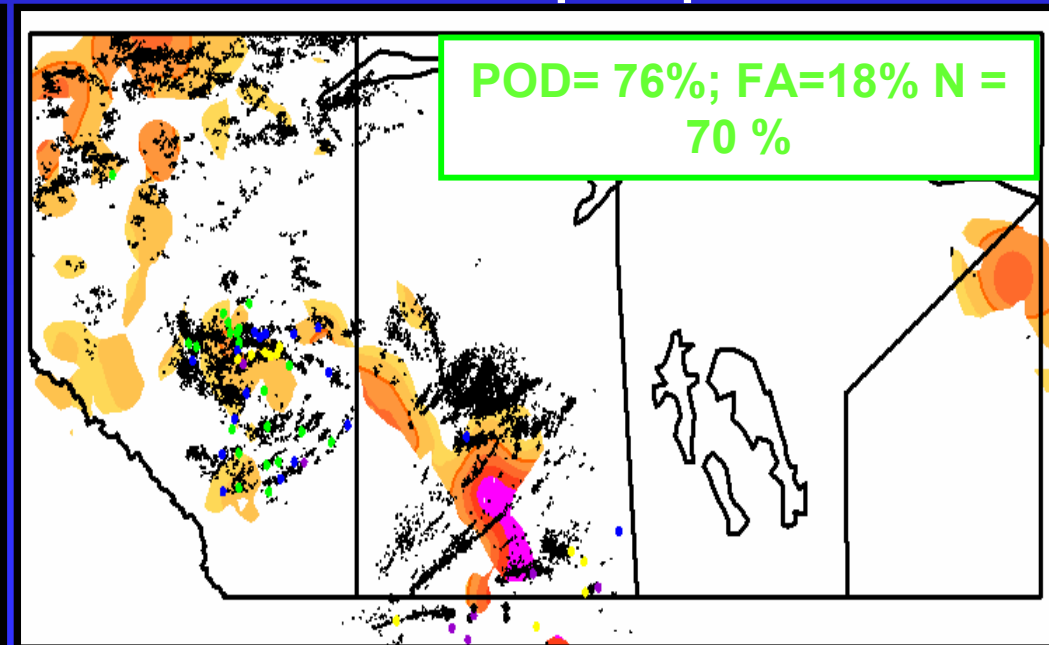
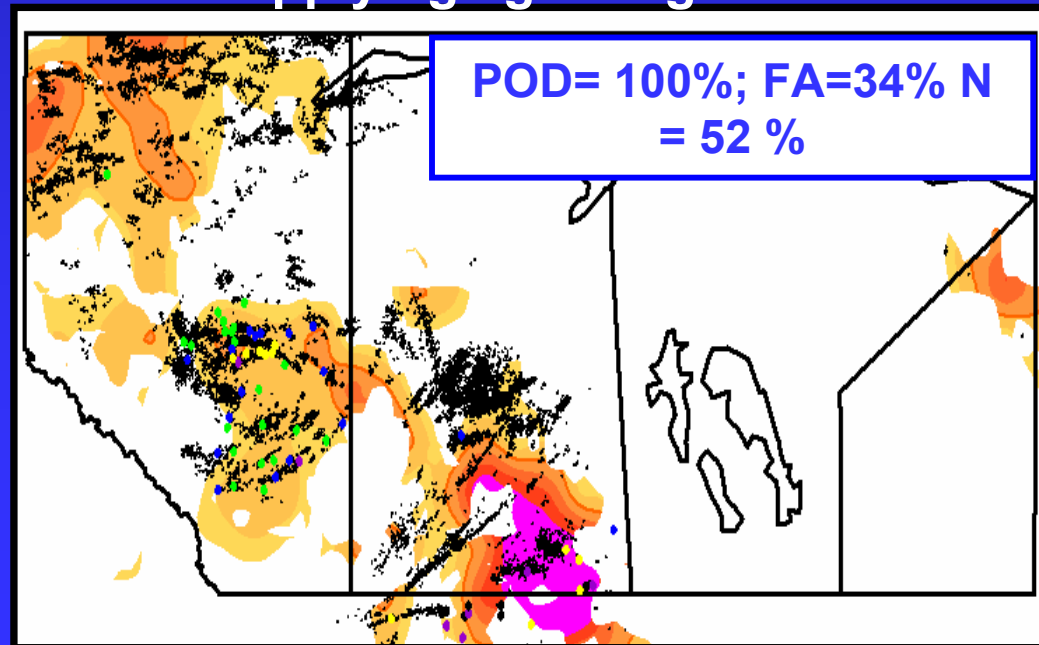


FORECAST MAXIMUM HAIL DIAMETER AT 21Z



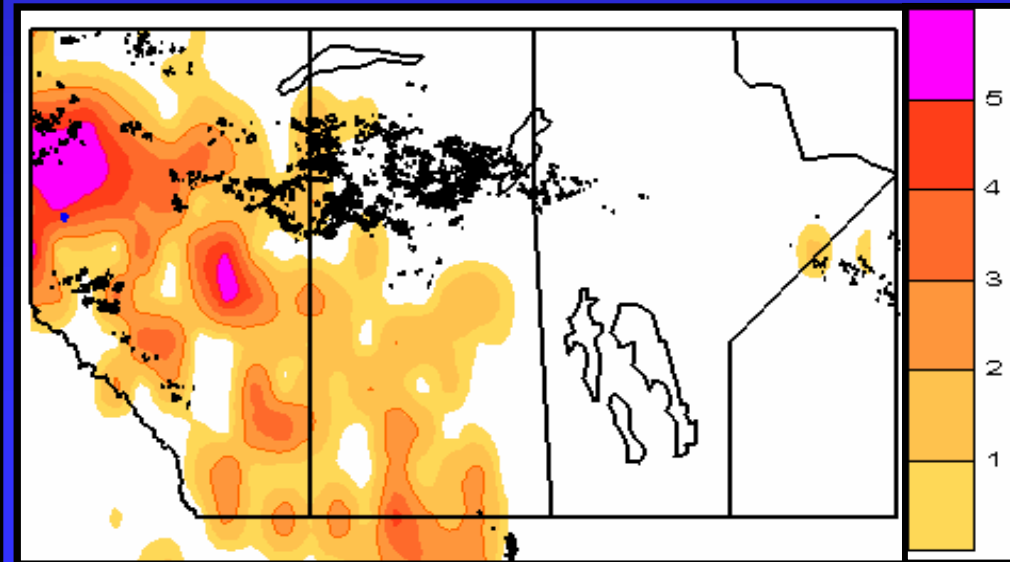
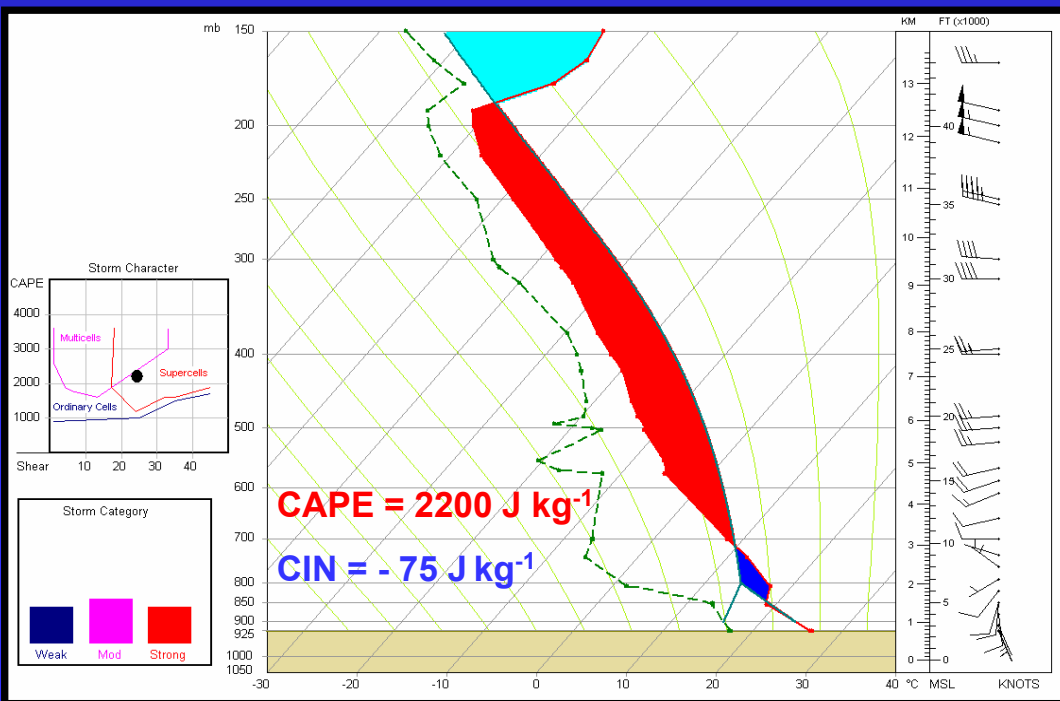
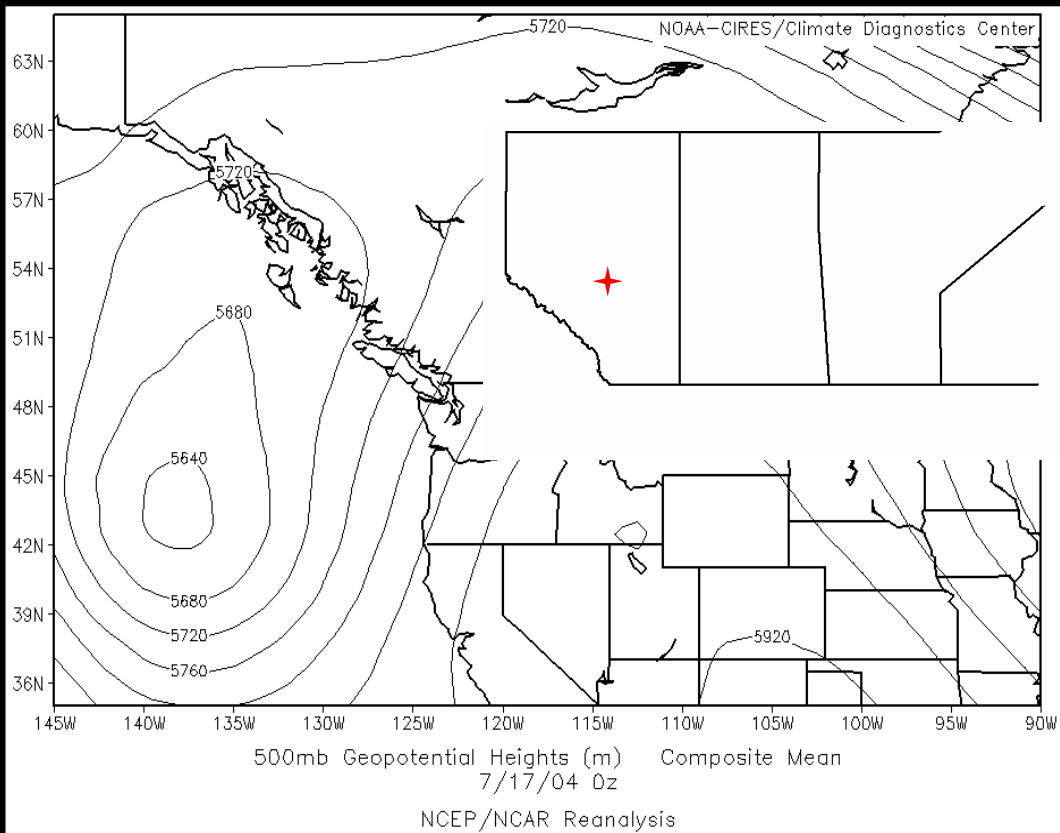
Forecast hail map of D_x after applying lightning mask

Forecast hail map of D_x after applying convective precip. mask



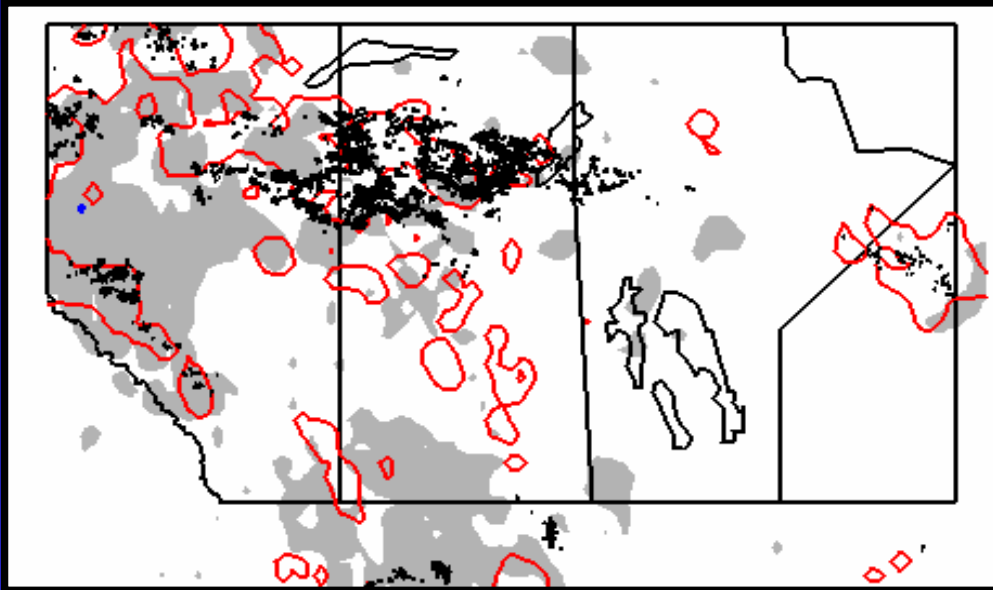
EXAMPLE OF A FORECAST GONE WRONG: 16 JULY 2004

- Upper-air circ. dominated by a ridge
- Airmass very unstable over southern AB and SK
- HAILCAST forecast severe hail over a large area
- No storms developed over the plains
- Storms developed over foothills

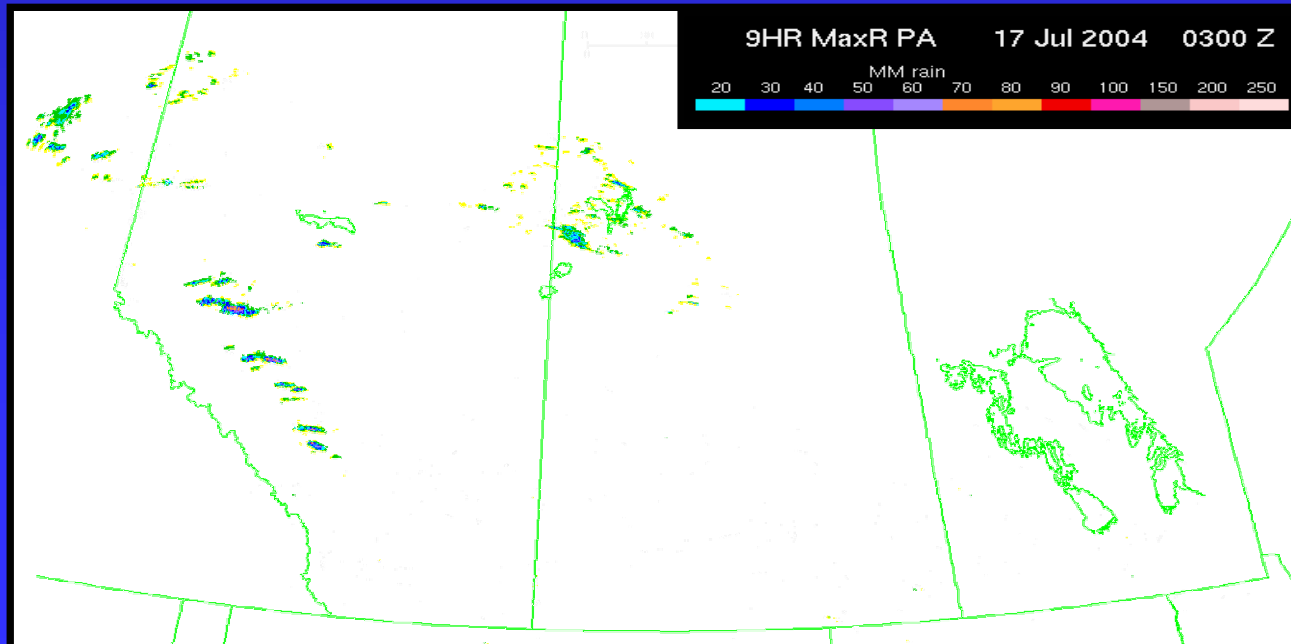
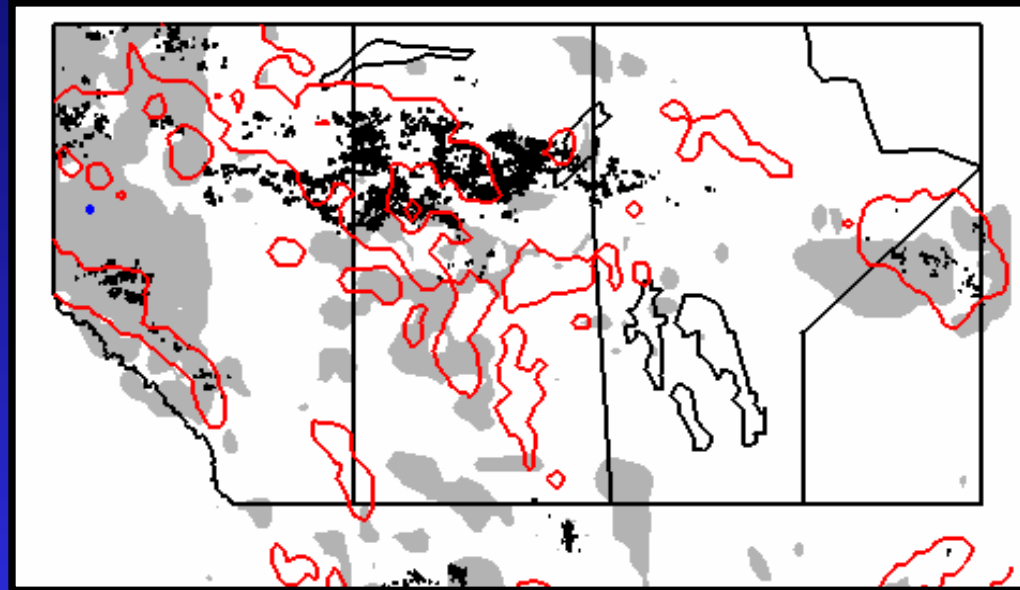


FORECASTS FOR 16 JULY 2004

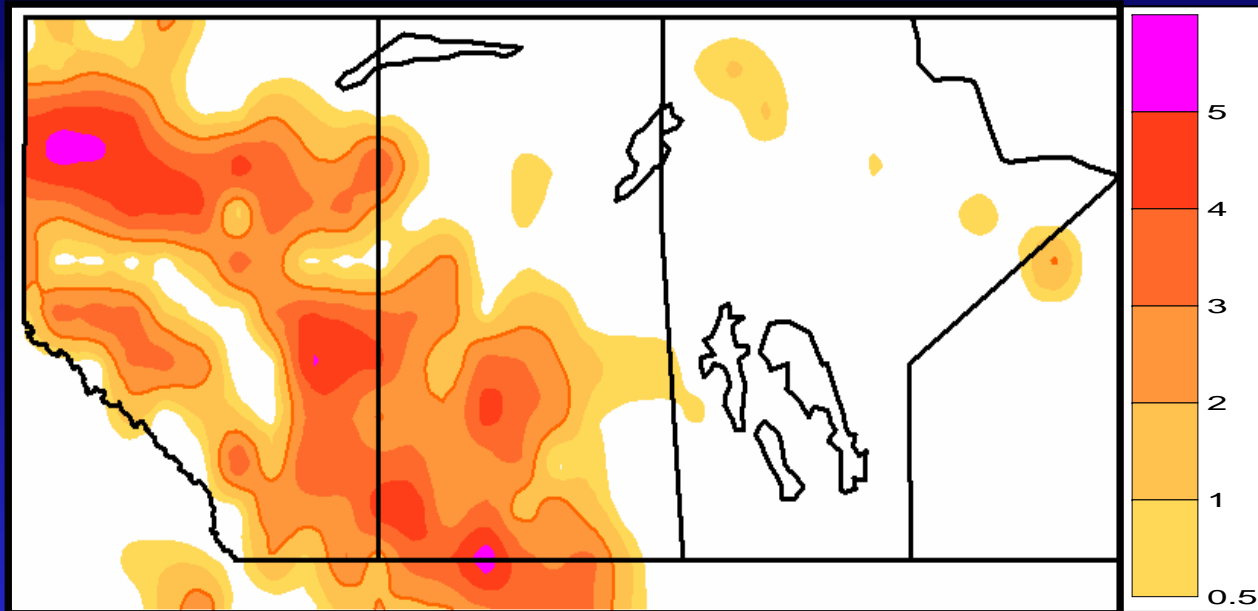
Forecast lightning and CP from 18Z to 00Z



Forecast lightning and CP from 21Z to 03Z

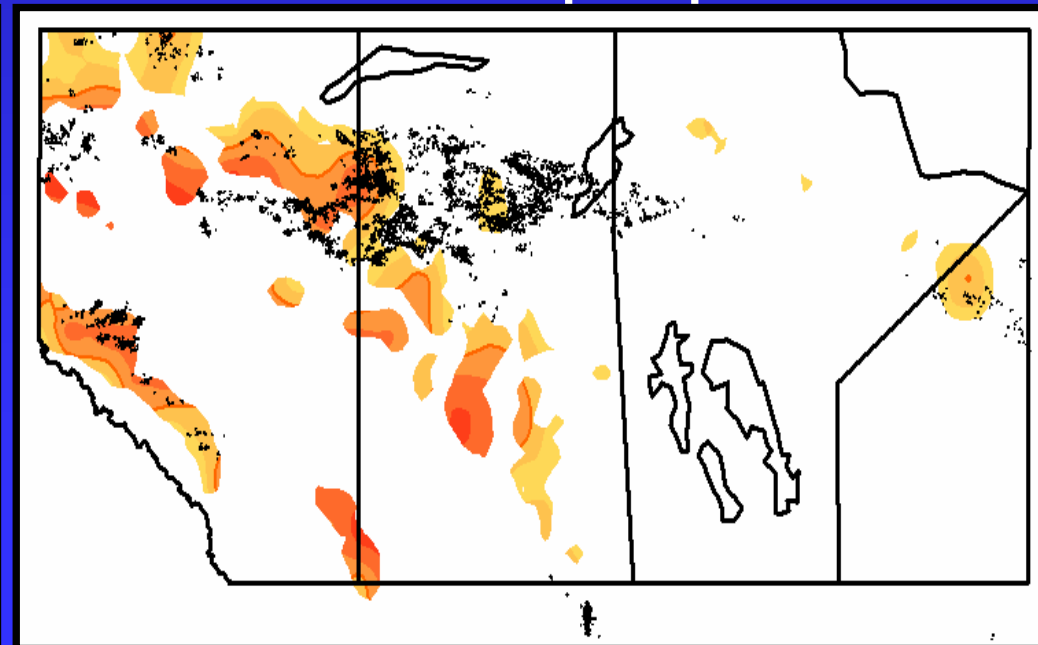
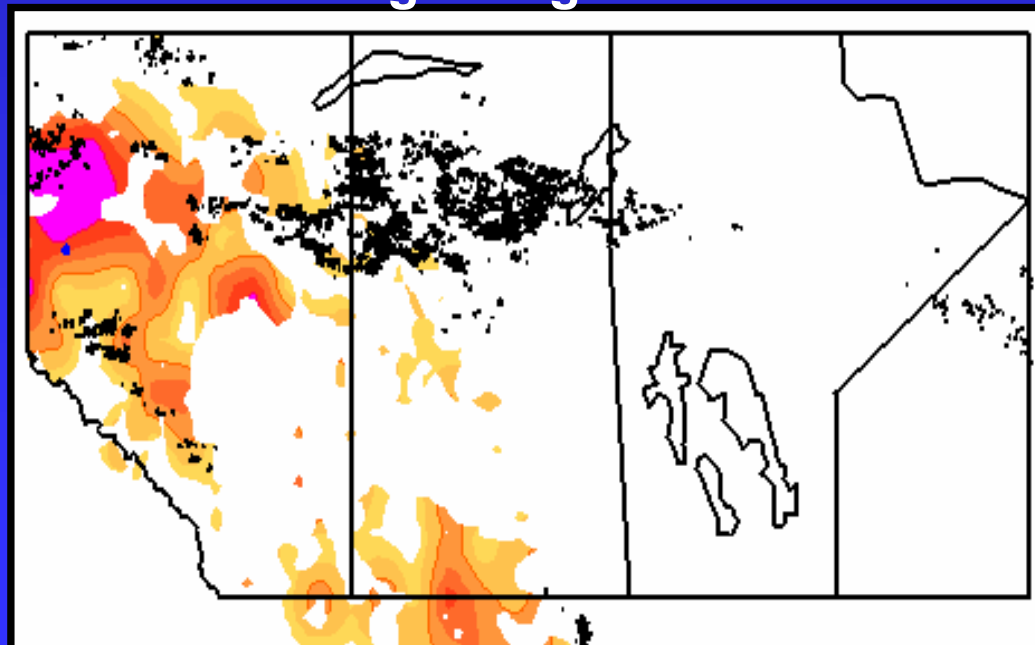


FORECAST MAXIMUM HAIL DIAMETER AT 21Z



Forecast map of D_x after applying lightning mask

Forecast map of D_x after applying convective precip mask



CONCLUSIONS

- **Accepting hail forecasts only over areas where CP (or lightning) was predicted reduced the number of false alarms, while retaining a high POD**
- **Similar findings were made for two other days, we plan to test methodology for more cases**
- **Daily composite radar mosaic maps would be very useful for identifying storm activity over remote areas and for soliciting reports of severe weather**

ACKNOWLEDGEMENTS

- This research was supported by CFCAS grants