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

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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

Pea
Grape
Walnut and golf ball
Baseball and larger
15-km GEM MODEL

Gridded T, Td & ω; K-F scheme

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

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 hail map of $D_x$ after applying lightning mask

- POD = 100%; FA = 34% N = 52%

Forecast hail map of $D_x$ after applying convective precip. mask

- POD = 76%; FA = 18% N = 70%
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

CAPE = 2200 J kg\(^{-1}\)
CIN = -75 J kg\(^{-1}\)
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.
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