Usefulness of Bright Band Climatology in South Central Canada.

Sudesh Boodoo, Norman Donaldson.
Cloud Physics and Severe Weather Research Section.
Environment Canada.
Email: Norman.Donaldson@ec.gc.ca

OBJECTIVE

In absence of knowledge of the melting layer height in day to day operations, can we rely on melting layer climatology for vertical profile of reflectivity corrections of radar data? Past experience indicated that the bright band height might be so variable that climatology would not be very useful.

DATA

The Canadian Meteorological Centre (CMC) regional weather model was used as a source of melting level heights from 1999-2005. The Model Output Location Time Series (MOLTS) data format provides data on all model levels for a 36 hour forecast data starting at 00 UTC. Surface Pressure, rainfall rate and dry bulb temperature on 58 levels is available for each hour.

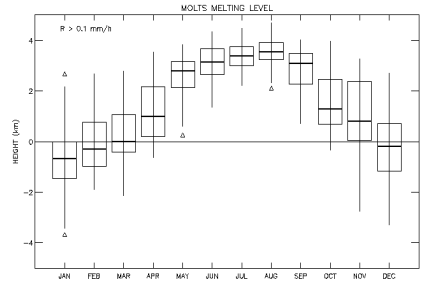
For our climatology only the first 24 hours of the model forecast are used. The selected grid point of the model coincided with a 915 MHZ wind profiling radar located at Egbert, Ontario (43.96N,79.57W) 70km northwest of Toronto. The wind profiler data was used to verify the model melting levels.

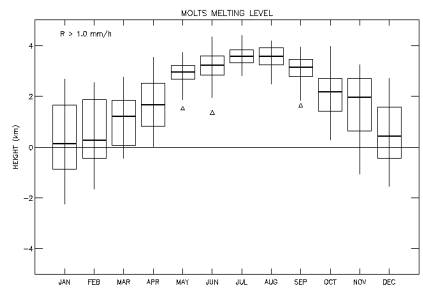
ANALYSIS

The height of the 0° C isotherm was interpolated form the MOLTS temperature profile when model forecast rain rate was at least 0.1 mm/hr or 1.0mm/hr. In instances of multiple 0° C crossings, the upper height was chosen. When the entire temperature profile was below freezing, extrapolation using a lapse-rate of -6.5°C/km was used to get the height of the 0°C isotherm below the ground.

Whenever wind profiler data was available (4-6 minutes at 105 metre resolution), it was used to estimate the bright band height to compare with the MOLTS estimates of the 0°C isotherm, It is noted that the bright band height may be a few hundred metres below the 0°C isotherm from the model.

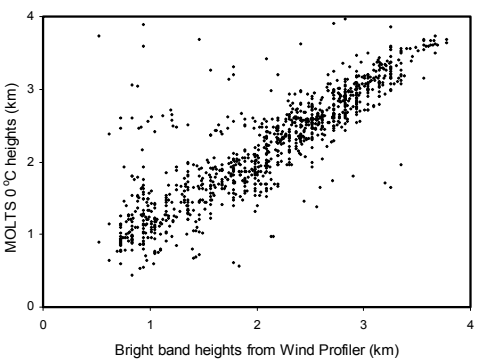
MELTING LEVEL CLIMATOLOGY



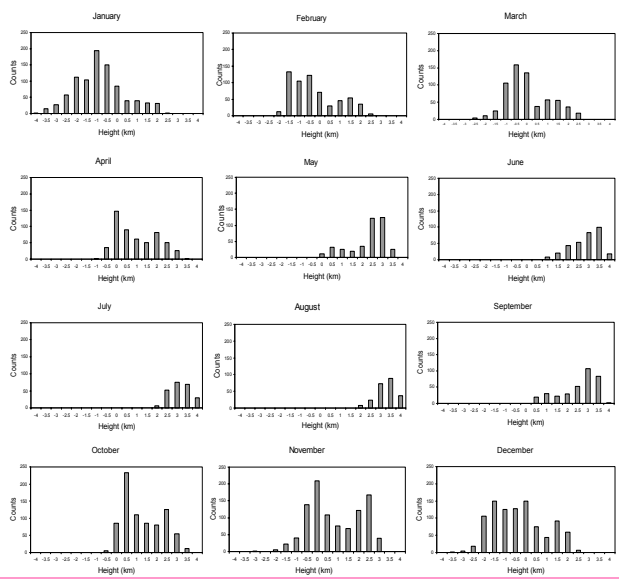


The plots above show the monthly distributions of 0°C heights for the period 1999-2005, for surface rain rates at 0.1 and 1.0 mm/hr. The horizontal thick lines represent the monthly median melting level heights. The boxes represent data from the 1st to 3rd quartiles and the whiskers show data from the 12.5 to 87.5 percentiles. In winter at the lower rain-rate threshold median melting levels are below ground but slightly above ground at the higher rain-rate threshold. The difference between the rain-rate thresholds is largely due to proportionally lighter precipitation in cold air masses.

RESULTS – NWP vs Profiler



Scatter plot of bright band heights from the wind profiler versus the MOLTS 0°C heights show a relatively good 1:1 correspondence. A least absolute deviation regression fit gives a slope of 0.95. The intercept is about 100m and mean absolute deviation is roughly 200m.



Frequency plots of MOLTS 0°C heights are shown in the above plots. Overall the distributions of the 0°C heights show large spread in all months, with the least in summer. In summer the 0°C heights are above 1.5 km, whereas in winter months they are variable from ground up to 2.5 km.

CONCLUSION

There is very little benefit to using a static climatological vertical profile of reflectivity correction in our region. The large variations of the heights of the 0°C levels and hence the melting levels would offset any gain due to bias reduction because of the large variances of the melting level heights.

Good comparison of the wind profiler with the MOLTS data, suggests that MOLTS may be used as good surrogate of melting levels in absence of other information, on daily operations.

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