Automatic CB detection for METAR messages in Finnish Meteorological Institute

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(Dated: April 23, 2013)

I. INTRODUCTION

The information of the existence of Cumulonimbus cloud (Cb) is very important for aviation. Cb cause gusty winds and thunder, which may lead to disaster during the take-off and landing. Therefore Cb shall be observed in the vicinity of airport (ICAO Annex 3).

The standard way of dissemination is through METAR messages. Traditionally these messages are constructed manually from human observations. However, training observers and having staff in three shifts is costly and not feasible especially at airports, which have less traffic. And observing Cb only by viewing at the aerodrome is not without its problems. For instance, Cbs embedded in frontal system are often invisible for human observers. Therefore, automatization of this process is a growing trend.

The operational automatic detection of Cb for METAR in Finnish Meteorological Institute, based solely on radar data, is presented. Furthermore the status of the ongoing research to strengthen the quality and availability of the observations will be highlighted.

II. THE CURRENT RADAR-BASED CB DETECTION

Polar volume radar data of 500 m radial and one degree azimuthal resolution is used for the Cb detection. Doppler filtered data of each elevation is first postprocessed using dedicated anomaly removal filter (Peura 2002). Possible Cb range gates are recognized by using two distance dependent reflectivity thresholds. The amount and vertical consistency of passed range gates are then checked before acceptance as detected Cb. The process is repeated every five minutes, and detections in radar network are combined to create final Cartesian Cb detection grid of 1 km resolution.

III. FUTURE PLANS

Radar data itself is, arguable, the most suitable data source for the Cb detection, but other data sources could be of complementary nature. We explore the possibility to substitute and add value to radar-based detection with satellite products from EUMETSAT's Nowcasting Satellite Application Facility (NWCSAF) program.

First, satellite products could be used to minimize the number of false alarms and misses: Even simple cloud masks can help in radar anomaly removal and reduce the number of false alarms. More advanced products, such as Convective Rainfall Rate or Rapid Development Thunderstorms, might be useful in detecting Cb, especially jointly with lighting data. However, these products are not designed for Cb detection per se, so use of derived cloud physical properties (such as cloud optical thickness, effective radius, and cloud phase) can more beneficial for Cb detection (Henken et. al 2011).

Second, the Cb detection based only on satellite products could be used even when parts of the radar network are momentary unavailable, and outside the coverage of radar network.

IV. REFERENCES

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