EMS7/ECAM8 Abstracts,
Vol. 4, EMS2007-A-00206, 2007
7th EMS Annual Meeting / 8th ECAM
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A case of Severe Convection, with Hail and heavy rain: Convective Train Effect

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I. INTRODUCTION

On the 5th September 2004, Cantabria, in the central coast of the north of Spain, was affected by severe thunderstorms. These storms were persistent and they caused heavy rainfall, with torrential intensity (more than 60 mm/h). As remarkable data, there was hail with 45-60 mm in diameter.

II. PRESENTATION OF RESEARCH

Radar imagery, in “normal operational mode”, is depicted for appreciating the storm’s severity, with “echoes in balcony form” in the vertical profile image (CMI), from the radar.

They also show, a sequency of echotop imagery (i.e. maximum high risen for echoes of 12 dbz or more). These images allow us to appreciate the strong vertical development in some convective cells, what rise values of more than 14 Km high.

In addition, we present some VIL images (Vertical Integrated Liquid), that show high values in the convective cell with hail.

The system evolution was in getting into a “convective train” form, defined as “ a determined place on the surface is affected by different, and successive, convective

cells that, in their trajectory, and in their biggest activity phase, affect the same place. It seems as if the structure was stationary ".

ECHOTOP: (Radar C- band; beam elevation: 0.5º; Coverage in "normal operational mode": 240 Km in radio Res: 2Kmx2Km; Wave length: 5 cm). It represents, by a colours code, the height (Km) which echoes bigger or equal of 12 Decibel. This image shows the vertical development in a cloudy system.

CMI : (Radar product in "normal operational mode"). It represents a plain projection of echoes that are in a plane perpendicular to the surface, searching the maximum reflectivity on each point (x,y) and in North- South direction (X,Z) and West-East: (Y,Z). This product allows one to visualize the thickness of a cloudy system, the echoes distributions in vertical direction, etc.

VIL: (Radar product, in "normal operational mode"). This product: Vertical Integrated Liquid, is created by integrating the reflectivity over all height levels in an XYZ volume. The water content per unit of volume is a function by the reflectivity and represented in Kg/m^2 . High values of VIL can alert the existence of hail, at least not too far from radar, even though the **VIL density (VIL/ECHOTOP**) seems to be better for this aim.

TOOL FOR CONVECTIVE DIAGNOSIS: This tool provides a display in four panels containing a map of Spain, where there is an enhanced image of the geographic areas of advantageous deep convection, and the type of convection that can happen. These areas are delimited in base of exceeding threshold for some variables, that was derived from numerical models, for each forecast time.

III. RESULTS AND CONCLUSION

The forecasting of hail is directly related with the existence of strong vertical shear and instability, in addition to sub melting water in middle levels. Some of this variable are available in post-process from meteorological models, soundings, etc, that are used in daily forecasting. However, there is another kind of variables, whose evaluation and availability is more difficult.

In order to make a hail forecast, it is necessary to make both instability synoptic situation and other auspicious ingredients for severe convection..

With this aim, we can use "Tool for Convective Diagnosis ", created in STAP, INM and available daily in the forecast office. The sounding is a real and very useful source of information for detecting advantageous variables such as: Vertical Shear, Dry line in 700 Hpa level, etc.

All of them give the forecaster the possibility of make a forecast and sending warnings about the possibility for severe hazards, like hail or heavy rainfalls.

However, in the case of hail, the best solution is to pay special attention to radar surveillance, because it allows us to know the type of convection that is taking place, with images ten minutes at time ("echoes in balcony form". High Echotop, High VIL values). The VIL Density (Vil/ Echotop) is a derived product that can be more appropriate than VIL of the day, for hail forecasting.

IV. REFERENCES

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