# ENVIRONMENTAL CONDITIONS RESPONSIBLE FOR THE TYPE OF PRECIPITATION IN SUMMER CONVECTIVE STORMS OVER BULGARIA

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## I. INTRODUCTION

The study of the environmental conditions responsible for hail formation has fundamental significance as well as practical purpose related to weather modification activity.

The task of the present work is to determine which of the environmental conditions (atmosphere instability, surface temperature, humidity and wind) or their combinations play a major role at the formation of different type of precipitation (rain or hail) in summer. The work is directed to obtaining classification functions for the type of precipitation on the ground, which may be used for earlier decision for hail suppression operation in the Upper Thracian lowland in Bulgaria.

## II. PRESENTATION OF RESEARCH

. The environmental conditions for more than 150 days with precipitation (rain and hail) during the period May – September of 2002 – 2006 in part of the Upper Thracian lowland in Bulgaria are analyzed. The aerological soundings obtained with numerical model GFS (http://www.arl.noaa.gov/ready-bin/main.pl) and surface level meteorological data (temperature, humidity, pressure) are utilized to calculate the convective available potential energy (CAPE) and lifted index (LI). This data is also used as initial and environmental conditions for numerical simulations with very simple one-dimensional model providing information on updraft velocity profile and different microphysical characteristics presumably related to precipitation type on the ground.

Discriminant and stepwise discriminant analyses are used to determine which of the environmental conditions or their combinations are able to discriminate between rain and hail cases.

## III. RESULTS

Using only CAPE and LI the total percentage of correctly classified cases (hail or rain) was 63.6 %. By including additional conditions as maximum surface temperature and relative humidity, as well the height of 0°C, -5°C, -10°C, -15°C, and -20°C isotherms the correctly classified cases percentage increases to 68 %. Better results are obtained by combining environmental conditions and microphysical characteristics acquired by the numerical model (for example, temperature excess at 400 hPa level, layer depth with updraft velocity greater than 20-25 m/s, maximum updraft velocity and others). The total percentage of correctly classified cases (hail or rain) is 76.6 %. When only the cloud cases with free convection are considered, the obtained function classified correctly 94 % of the cases in the sample.

## IV. CONCLUSIONS

The study reveals that the impact of environmental conditions on the type of precipitation is rather complicated and anyone of the environmental parameters is not able to “determine” the type of precipitation on the ground. The use of cloud model output improve the classification of the precipitation type due to inclusion of non-linear impact of environmental conditions on precipitation formation.