Comparative analysis of synoptic and thermodynamic conditions of the formation and development of hail clouds in different regions.

M.Barekova (1), V. Makitov (2)

1. High-Mountain Geophysical Institute, Nalchik, Russia
2. Weather Modification Inc., Fargo ND, USA

(bmv22@rambler.ru / Phone +7-8662-470455)

Typical synoptic conditions that affect the formation of hail clouds are considered in light of more accurate prediction of storm's severity and meso-regions of their formation. Special attention is paid to regions where hail suppression projects or radar observations have been conducted for many years. The influence of orography with meridian or latitude orientations of mountain ridges on the trajectories of hail cells is studied for each region.

Our data-base consists of many-year radar observations of hail thunderstorms and corresponding meteorological data collected during scientific and operational projects conducted in Northern Caucasus (Russia), the provinces of Mendoza (Argentina) and Alberta (Canada), as well as some particular data on hail clouds in other regions. Meteorological and geographical features of the regions are compared and seasonal and diurnal variations of the atmospheric convection are considered.

The analysis of synoptic situations leading to the development of most severe hail clouds has been conducted for each region. The most frequent trajectories of intense hail cells have been analyzed along with their lengths, directions, and the frequency of repetitions. The hail cell velocities have been calculated as well. Results of the statistical analysis of the main thermodynamic parameters of the atmosphere for days with long-lived hail cells are presented.

Our analysis of the distributions of the trajectories of supercell and long-lived cells of multicell hail clouds in Northern Caucasus shows four main groups. The groups contain 64% of well-organized multicell processes and 86% of supercells. The forecast delineation of hail processes for a particular meso-region is possible only for the **I** and **II** trajectory groups. For group **I** of hail processes, the zones of low-altitude instability are oriented along with the major ravine of the Main Caucasus Ridge and coincide with hail-paths on the ground. For hail processes of group **II,** we have obtained either altitude orientations of the zones of low-altitude potential instability or the localizations of the zones are biased toward the high-maintain regions. The forecast delineation of the trajectory groups **I** and **II** allows for more accurate definition

of the “meso-region of development” and for obtaining the likelihood of a trajectory on a particular day. Taking into consideration the average repetition of a particular group, the forecast for **I** and **II** trajectory groups contains 70% of supercells and 52% of long-lived cells of multicell processes.

Our forecast method for obtaining the meso-region of hail process development is based on the analysis of low-altitude potential instability zones. For the province of Mendoza, the forecast delineation is possible only for hail processes in the Northern and Southern oasises that constitute 28.9% of the days with hail processes.