

# Thunderstorm-related extreme weather in Armenia

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## I. INTRODUCTION

The monitoring of severe convective weather from severe thunderstorms with hail, straight-line winds, tornadoes, flash floods, and lightning is very difficult due to its local character. Armenia is a climatically diverse region. About 90% of all territory has height more than 1000m above sea level and 40% of the territory has more than 2000m above sea level. The average level of territory is 1830m, the maximum height is about 4090m, the minimum is about 373m.

The climate varies both vertically and horizontally. Various climate zones, everlasting snow caps and glaciers, warm humid subtropical forests and humid semi-desert steppes.

The average annual temperature for the territory of the republic is 5.5 0C, the absolute maximum temperature +43 0C, and minimum -42 0C..

Eighty meteorological stations worked in the territory of the RA in different periods of time, dynamics of their quantity adjustment are set forward. Now the meteorological network of Armstatehydromet consists of 45 meteorological and 3 specialized stations, 5 of which have a series of data for hundred and more years.

Hydrometeorological Dangerous Phenomena (HDP) typical to the territory of Armenia have been studying in this work: flood, hail, abundant precipitation, strong winds. It come obvious the tendencies of their change have been evaluated.

## II. PRESENTATION OF RESEARCH

The broken relief, and different climate zone existence on small territory is reason for development of strong convection.

By another hand Armenia is influenced by the western air waves, which are typical of subtropical zone: In summer the territory of Armenia is all influenced by the Middle East heat cyclone, which is more obviously observed in July. With the low pressure of that period the circulation of the atmosphere is weakened. And local processes are produced like convection. The mountainous relief forms active atmosphere circulation, the cold air waves which enter the Southern Caucasia, cross the Caucasian chain of mountains from West or East. Crossing over the Black Sea and Caspian Sae the waves are partly transformed and the amount of humidity was increased.

Researches concerning heavy rain, strong wind, hail and flood for the period 1975-2007 years were made. 46 hydrometeorological station's data for 1975-2007 were analysed as well as synoptical and baric maps of surface, satellite images.

The study has shown that the the amount of hailing days during 1990-2009 increased for 2-3 days in compered with 1975-1990. Especially the growth is obvious in north-east region (Lori-Tavush). Along with altitude rising the hail

days average quantity also increasing by gradient 1day/200m. The hail, thunder and heavy rain frequency is higher in May-June but most hazardous from July to August, The most hailing time is 13:00-20:00 max at 17:00, but in Ararat valey at 19:00-21:00.

Days of heavy precipitations (20mm and more) are increasing all over the Armenia. In 1990-2005 the amount of precipitations increased for 1-3 days in compared with 1975-1990.

In Lori-Tavush, Ararat Valley and Syunig the growth of precipitations is more obvious 2-4 days. Data analysis on dengerous phenomena make it clear that during the recent years the size of the hail has enlarged.

According to survey results in Ararat region (main agriculture area of Armenia) in the considered period the most frequent disasters wear: heavy rain, hail, landslides and floods.

Case study: This year unusually intense hails were recorded in Shirak, Ararat, Lori, Tavush and Sevan areas and caused significant economic losses. August 7th, in Artik in afternoon hail of 5-6 cm was observed, in Tsakhadzor 2,5 cm, in Vanadzor 2,8 cm, in Dilidjan 2,3 cm and in Tashir heavy rain of 30mm/12h.

The synoptic condition was the following.

On **see level** Armenia was located in the northern part of tropical termal cyclone, from which frontal cyclone is parted towards the Northern parts of Iraq.

In the centre of the cyclone the atmosphere pressure was about 997-998mb. The frontal wave is spread from west to east. It observed the pressure fall by 4.8-5mb/3h.

On 850mb surface the centre of the cyclone is in Diarbeqir region. The territory Armenia located in the frontal part of the cyclone in the southern streams. The difference of the temperature between west of the Armenia and the Eastern parts of Black Sea was 8-100C. On 500mb surface map the difference of temperature was about 5-6. The analises shown that cold and humid air advection from Asia Minor to the Republic was observed. On satellite images at 20:00 cumulo-nimbus clouds were formed. In all cases of synoptic situation, when Armenia located in the southern streams and cold air there is on east of Black sea, severe convection is developed on second part of day.

### III. RESULTS AND CONCLUSIONS

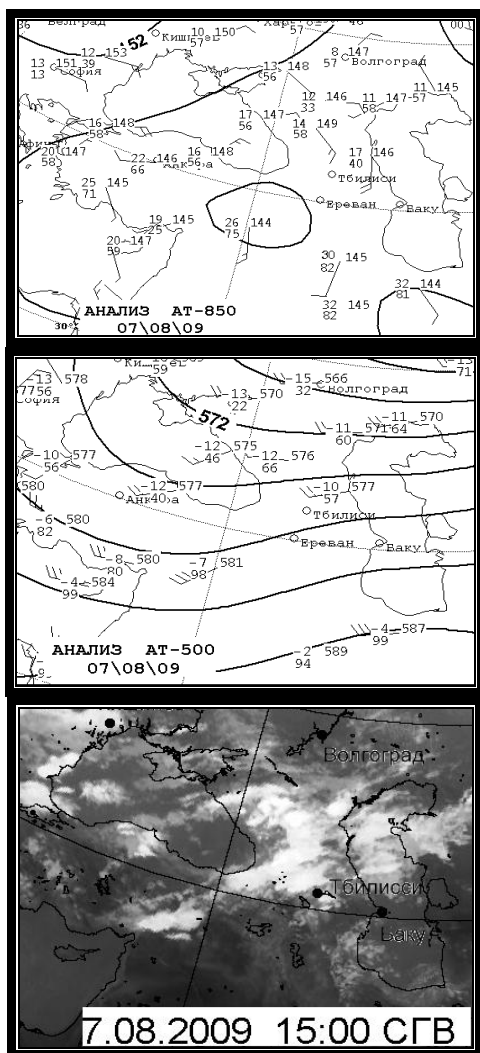
In this work it is shown that the average amount of hail, straight-line winds, flash floods, and heavy rainfalls was risen. Along with altitude rising the hail days average quantity also increasing by gradient 1day/200m. The most observed hail affected area are Shirak, Lori, Tavush. The severe convective weather frequency is higher in May-June but most hazardous from July to August, The most observed time is 13:00-20:00,max at 17:00, but Ararat region at 19:00-21:00. In last years the diameter of hails The observed heavy rain and hail were caused by the appearance of the frontal wave, a difference of temperature on the territory of Armenia and the Black Sea regions on 850mb surface, on 500mb surface high labina, on HT500/1000mb surface with properly expressed frontal zone. Besides all these phenomena, convective activity at noon times was also an important matter for heavy rains and hail. tones has risen, the diameter of hailstones sometimes reaches 6 cm.

### IV. ACKNOWLEDGMENTS

I would like to thank all persons who have been involved in this work from observers as well as the scientists. Armstatehydromet's weather forecasting and climatological departments. Without their effort, this work couldn't be completed.

### V. REFERENCES

- Alexandryan G. 1962 Meteorology, Yerevan, 96-104.
- Zubyan G. 1969 The Atmosphere of Armenia, Yerevan 87-99.
- Hayrapetyan N. 1980 The hail preventing in Armenia. Sulakvelidze G. Hevy rainfalls in mountain countries on example of aucasus 1988. Climate proofing studyin Ararat Marz of Armenia, Yerevan 2006
- Giaiotti D. B., Stel F., 2006: Environmental Variables Affecting the Hailstone Size Distribution at the Ground. *Atmos. Res.*, 20 109-112.



The weather condition under influence cold from west

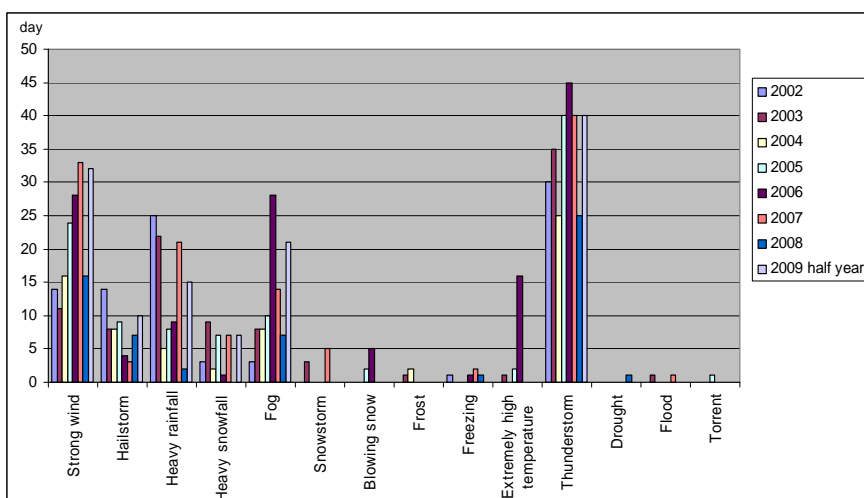


Fig. 1 Main disasters in Armenia during 2002-2009

