

A CLIMATOLOGY OF LARGE HAIL IN FINLAND (1930-2006)

Jari-Petteri Tuovinen¹Ari-Juhani Punkka, Jenni Teittinen, Harri Hohti

¹*Finnish Meteorological Institute, P.O.BOX 503, 00101 Helsinki, Finland; e-mail: jari.tuovinen@fmi.fi*

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I. INTRODUCTION

The research of severe hail storms in Central Europe is already well under way but in Northern Europe very little effort has been made so far to gain knowledge of this matter. As far as the authors know, no climatological studies of large hail north of latitude 60 °N have been published. In Finland, no earlier studies of hail climatology have been made either. Still every now and then as large as tennis ball size hail occur causing locally tremendous property damage; injuring people, breaking car and house windows and destroying the wheat fields. This study views the spatial and temporal distribution of large hail in Finland from 1930 to 2006.

Finland is situated roughly between the latitudes of 60 °N and 70 °N with huge seasonal variations in weather. Hail is a typical phenomenon during summer thunderstorms basically all over the country, but often the size of the hailstones is no bigger than a pea. These kinds of events are often undetected due to the limited extent of the hail swaths and low population density in Finland (an average of 16 persons in each km²). Still almost every year large hail (2 cm or larger) is observed mainly because of the damage they cause. Increased amount of severe hail events are experienced during warm summers. The words severe hail and large hail are used as synonyms.

II. DATA

Several different methods were used to collect large hail cases in this study. Firstly, old newspapers provided valuable information especially from the older cases. Agriculture has been in the past and is still very vulnerable to severe weather phenomena. Many local newspapers were looked through via library microfilms for possible hail cases. Newspaper articles of severe weather events between 1994 and 2005 were found through with the aid of the main newspapers' internet databases.

Institute's web site (www.fmi.fi) was used for asking for both recent and historical large hail observations for the public. It proved to be an efficient way to collect hail cases, because most of the observations included a photo of either damage or hail itself. A credibility classification was done for all of the cases. Three categories, confirmed, probable and possible, were used. Confirmed reports had a picture of a hailstone with some point of comparison to its size. Many newspaper reports were classified as probable, and possible cases were those near the limit size of severe hail. Cases from all probability classes are included in this study.

Third way of getting hail reports from the recent years was through a small group of storm spotters (about 50 storm spotters). They have been cooperating with Finnish Meteorological Institute on a hail observation program since 2004. All the large hail cases are from summer months or late spring and early autumn (May to September), between 1930 and 2006. In the war years' newspapers (late 1930's and early 1940's), there were hard to find severe weather events. The hail

cases were separated from each other if the time difference between two observations was more than 15 minutes or if the distance between them was more than 20 kilometres. Altogether, 240 cases were collected of which most were classified as confirmed or probable.

III. HAIL DISTRIBUTIONS

Large hail occurs in Finland between late May and early September. The peak period of large hail in the summer is from late June to early August, when about 85 % of the cases occur (Fig. 1). The most active month is July. The largest hailstones (over 4 cm in diameter) mainly occur in July, but for the smaller hail sizes (2-4 cm) the peak period is primarily on the later half of the month.

The distribution of maximum hail size in all severe hail cases can be seen in Fig. 2. The smallest category, 2-3 cm hailstones (actually 2.0-2.99 cm) contain the largest amount of observations (45 %). About 35 % of the cases were 4 cm in diameter or larger. Giant hailstones (5 cm or larger; Ludlam 1980) has been observed in 46 cases (19 %), but only 6 % were at least 7 cm in diameter (Fig. 2). It must be remembered that this study includes only large hail cases. Hail size smaller than 2 cm is expected to be the most common one. Currently the largest known hailstone ever observed in Finland is 8 cm in diameter. It has occurred twice, in the southeaster part of the country in August 1968 and in the central part of the country in July 1972.

The diurnal distribution of large hail cases is shown in Fig. 3. During the afternoon hours (14-18 local time) and early evening (18-20 local time) large hail was most frequently observed. Around 74 % of the cases occur between local 1400 and 2000 hours. Larger hailstones (4 cm or above) occurs mainly between 1600 and 2000 hours. At night time large hailstones are rare. The afternoon and early evening occurrence has been found to be typical for large hail in the other parts of the world as well (Dessens 1986, Paul 1980, Webb et al. 2001).

Fig. 4 shows the locations of large hail observations. The density is high in Western Finland. Farming is common livelihood in this area. Farmers tend to report more easily of the damage to their fields to claim some compensation. This might have contribution to the geographical distribution. Most of the 4 cm or larger hail cases are located in the middle part of the country. The large amount of lakes in Southeaster Finland (Fig. 4) probably explains partly the area's gap of observations. In north, large hailstone observations seem to be infrequent events. In Lapland (the most northernmost county in Finland), only 16 cases are known, though the area is extremely sparsely populated (2 inh/ km²). Northernmost large hail case is found near latitude 68.5 °N. Most reports are from near the bigger cities and towns.

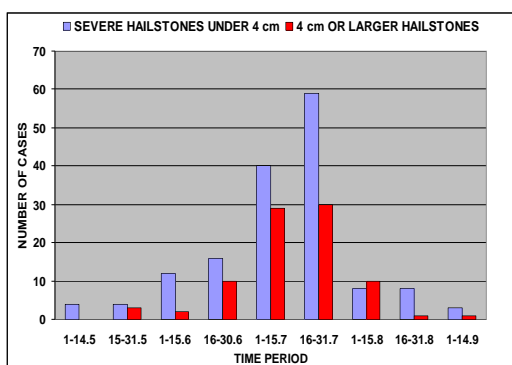


FIG. 1: Monthly distribution of large hail cases in Finland 1930-2006. Every month has been halved, starting from May and ending to mid-September. Blue bars indicate severe hailstones under 4 cm and red bars 4 cm or larger hailstones.

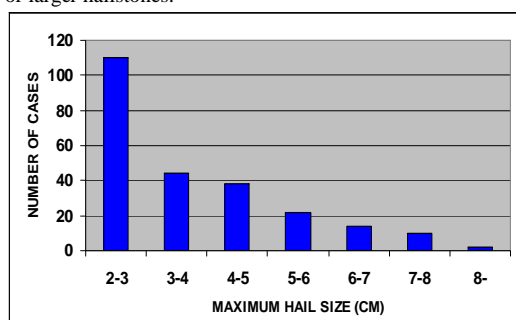


FIG. 2: Maximum hail size distribution of severe hail cases in Finland 1930-2006.

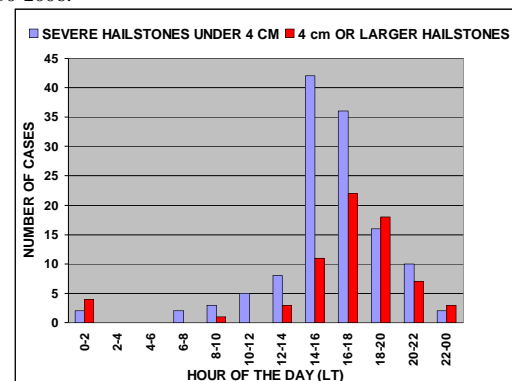


FIG. 3: Diurnal distribution of large hail cases in Finland 1930-2006.

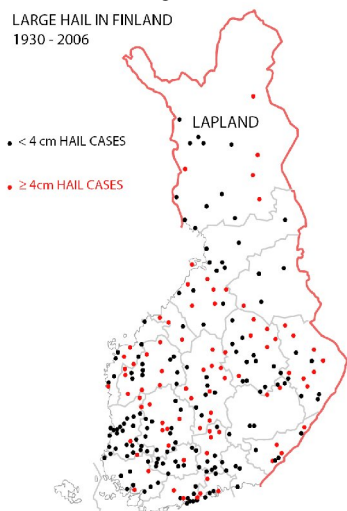


FIG. 4: The geographical distribution of large hail cases in Finland. The black dots indicate under 4 cm hailstones and the red ones 4 cm or larger hailstones. The red line is a land border with Russia, Norway and Sweden; in south and southwest Finland is surrounded by sea.

Annual distribution of large hail in Finland (1930-2006) varies notably from summer to summer (not shown). The number of observations in the 1930's and 1940's are low due to the war years. In recent years, there is some increase in the number of cases. This is mostly due to more widespread interest in severe weather events among the general public and more systematic reporting of even sub-severe hail cases by the storm spotters. On average, six to seven different large hail cases can be expected yearly. These cases occur during four to five different days (severe hail days; at least one large hail observation in Finland). Large hailstones most often occur during July (over 50 % of severe hail days).

IV. CONCLUSIONS

The climatology of large hail in Finland during a 77-year period (1930-2006) has been presented in this study. Cases were collected from old newspapers, from eyewitness observations and in recent years, from the storm spotter reports. Based on this study, large hail in Finland occurs more frequently than it is commonly believed. Almost 250 severe hail cases were found all around the country. The majority of the hail falls in Finland are sub-severe, but even a tennis ball size hail has been observed a few times. Because of the wide land area and low population density, most of the hail falls are not reported.

The season of large hail in Finland extends from May through mid-September. July and the local afternoon and early evening are the peak times of the large hail occurrence based on this study. The largest, over 4 cm hail cases occur in July and mainly in the evening hours while severe hail with maximum diameter smaller than 4 cm is observed generally little earlier in diurnal distributions. Most of the hailstones maximum diameters are smaller than 3 cm (45%). Giant hailstones of at least 5 cm include 19 % of the cases.

Most of the observations are from the western part of the Finland (agriculture-intensive area). The largest hailstones are observed in the middle and eastern part of the country, mainly near big cities. In the north, large hail is observed more infrequently, mostly due to low population density. Nevertheless, the northernmost severe hail observation is placed near latitude 68.5 °N. Usually six or seven severe hail cases occur during every summer. The amount of cases in recent years has risen, mostly due to the increase of marginally severe hail reports and due to growing interest in severe weather among the general public and the media.

V. REFERENCES

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