Chelmsford Amateur Radio Society

Club Station Call Sign GØMWT

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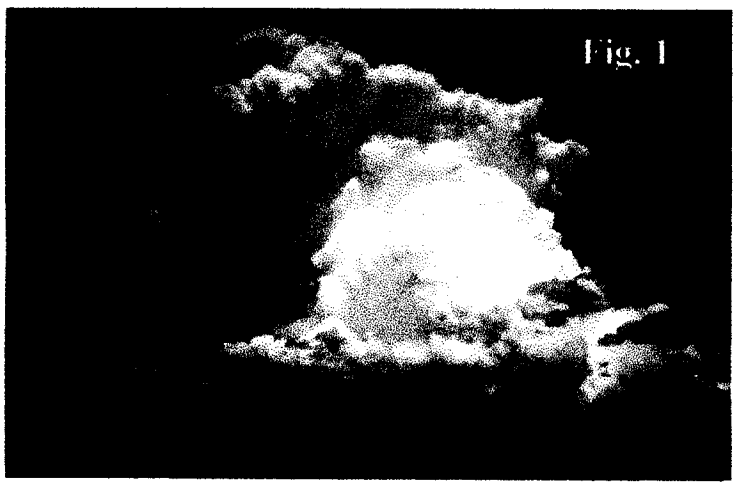
NATURAL INTERFERENCE TO RADIO SIGNALS (QRN) - Compiled by Brian, G3CVI

Hailstones, this article describes briefly how they are formed and the effects of the associated conditions on radio propagation.

Energy is required in enormous quantities hence the weather which produces hail is almost always in summer during long hot days or in equatorial and tropical regions both north and south, almost at any time.

When the atmosphere is unstable and rising air currents (especially if the air is wet or nearing saturation) reach great heights, 30,000 to 40,000 ft, one sees the familiar giant towering Cumulus clouds. Their bases commence at a few thousand feet where the temperature has fallen to the dew point. Then out comes the water vapour as minute droplets which form the cloud, (See Fig.1)

The vertical velocity of the rising air can reach 200 knots in extreme cases but 50 to 100 are commonly met by careless or luckless aviators who stray into the central column of turbulence.



Harking back to ones school days, lets us remind ourselves of the Van de Graaff generator (See Fig.2). A rubberised belt about a metre in total length and endless runs round two rollers. The lower one is driven by an electric motor the upper one being an idler. Both rollers are mounted on a rigid insulating column about half a metre high which is fixed to a heavy base and which has at its top a 15cm dia. metal dome with a well rounded lower rim. At the lower end a metal comb deposits charges onto the belt due to electron induction from earth and at the top another comb picks off the charges and deposits them onto the dome which soon in a dry laboratory, becomes very highly charged. Several hundred kilovolts can be achieved and the charge is enough to produce sparks up to 20cm long to an electrode held near to the dome.

The process occurring in our Cumulus cloud is similar to that shown in the lab experiment. Water droplets barely visible individually are carried aloft by the rising air currents and become very cold as they ascend. They soon freeze into small hailstones and at some level near the top of the cloud they fall back when the air currents are not strong enough to support them.

On their way down they are increased in size by collision and deflected outwards because they carry charges of the same polarity as the rising stones and are hence repelled by them.

Again and again the miniature stones go up and down gaining size and mass upon each occasion and leaving electric charges at the top. Their size increases rather like an onion which has concentric skins each larger than the previous one. As many as 50 skins have been recorded and the stones have weighed as much as 2 pounds.

The surface area of a spherical object varies as the diameter squared but its volume varies as the cube so there comes a time when the drag of the rising air is not sufficient to carry the stones upwards so they spill outwards and downwards to fall to the ground.

Long before the process is completed the potential difference between the lower and upper zones of the cloud becomes high enough to break down the insulation of the air and a lightning stroke occurs. It may be only within the cloud but often from earth to cloud producing the familiar forked lightning which does so much damage.

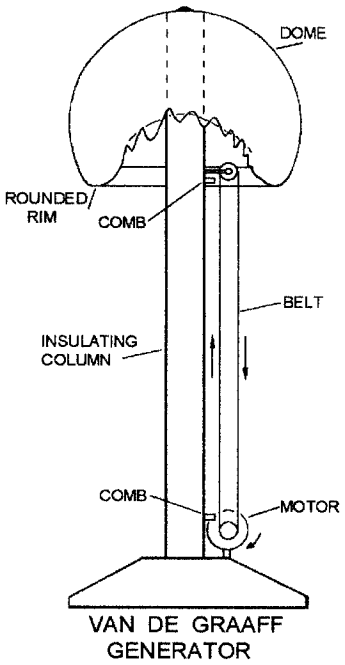


Fig. 2

As for the effect on radio propagation one could do worse than to ask any professional radio operator who flies in airliners on well defined routes how often his communications with ground stations are ruined. Here in the latitudes of the fifties we rarely get severe storms but when they are present the so called "static" usually renders radio links in the HF bands difficult if not impossible. A giant Cumulus cloud is nearly always opaque to HF radio or causes such unpredictable refraction and reflection that reliable communication is not possible in the affected region. We all are familiar with the crashes and bangs due to thunder storms and usually shut down if only for the sake of safety. There are some zones of the world where two thirds of the days in a year produce radio chaos due to such storm activity and the central American countries appear to be the chief sufferers along with the places with coastlines on the Indian Ocean.

In general, areas where cold waters flow and cause sea fogs and frequent misty weather exists, are normally free of severe storms because the incoming heat energy is less than in the hotter zones hence the big Cumulus clouds are less able to build up.

Though the forgoing is by no means an exhaustive study of the phenomena described I hope it will interest you and, as is said in all the best books, will "stimulate further reading"...May all your QSO's have silent backgrounds!!!