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Stormy Weather in the Ionosphere

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Notes and Comment

Stormy Weather In The Ionosphere

IONOSPHERIC storms have already been described in detail in a previous article.[1] Briefly, it will be recalled that we are living, not under an open sky as it seems, but under an invisible many-layered ceiling of electricity. This ceiling is called the ionosphere. The principal layers of this ceiling, the ones that noticeably affect radio communication, are four in number, named D, E, F1 and F2 respectively, distributed in that order in ascending altitudes from 60 to 300 kilometers above the ground. Now and then, these layers experience violent changes. When this happens, we have an ionospheric storm, often causing radio fade-outs, garbled broadcasts or freak receptions.

One such storm took place on 28 June 1957. That is to say, the storm was detected on that day at the Baguio ionospheric station of the Manila Observatory and at the Muntinglupa magnetic station of the Bureau of Coast and Geodetic Survey. It seems that the rest of the world did not notice it until after a day or two, according to early dispatches of the Associated Press and the International News Service.[2]

Abnormal conditions began to appear just before 4:00 A.M. (Philippine time, corresponding to 8:00 P.M. of the previous day, Greenwich time) with a magnetic disturbance detected at Muntinglupa. (See Fig. 1.) At about 8:00 A.M., a probing radio beam

[1] J. J. Hennessey S.J. PHILIPPINE STUDIES IV (1956) 29-317 and sources cited therein.

[2] *Manila Daily Bulletin* 3 July 1957 p. 24 col. 2 and *Manila Times* 2 July 1957 p. 15 col. 2.

emitted at Baguio was observed to be bouncing off the F^2 ceiling from an exceptionally high altitude, over 1000 kilometers. At half past nine, the lower D ceiling began to thicken with charged atomic dust, thus smothering radio beams below 6 megacycles. (See Fig. 2.) This thickening reached its peak at 11:15 when fade-outs were noticed below 8 megacycles.

At about 1:00 P.M. sporadic clouds of electricity, hovering around 115 kilometers above the ground, began to appear, disappear and reappear erratically. Sometimes these clouds were densely packed, and at other times there would be just a thin wisp. These sporadic E-ionizations, as they are called,[3] kept up their hectic behaviour late into the night, quieting down just before midnight. (See Fig. 3) At one period of their erratic dance, from 5:00 to 8:00 P.M., billions of ions, under the influence of a strong geomagnetic disturbance, were gyrating madly in such a tightly packed space and at such a fast tempo that frequent collisions were inevitable.[4] As a result, radio signals attempting to pass through were either crippled or killed. By midnight, most of the storm indications had subsided.

Three days later, what might be called a "repeat performance" took place, but somewhat mitigated in intensity. Again at sunset time, there was that pronounced livening up of the tempo of ionic gyrations at the 125 kilometer level. Likewise, the density of the F2 layer reached a peak, once at midday and again at midnight.

On July 3 the storm hit again but with considerably less energy. The sunset revel of ions came and went within the one brief hour before 5:00 P.M.. The high F^2 ceiling was hardly touched.

What caused these storms? It was the sun, many experts agreed.[5] During these months of intense solar agitation, fre-

[3] S. K. Mitra *The Upper Atmosphere* (Calcutta 1952) pp. 318-321.

[4] *Op. cit.* 183, 259, 261, giving detailed mathematical treatment of collisional frequency.

[5] Way back in 1877, Father Angelo Secchi S.J. had observed and recorded huge eruptions of metallic gases from below the sun's surface, and established their effects on the earth's magnetism in his two-volume classic *Le Soleil.* Today, this is the universally accepted explanation of many terrestrial phenomena. See Chapman and Bartels *Geomagetism* (Oxford 1951) Vol. I pp. 165-193, etc.

quent eruptions are expected to occur on the surface of the sun, belching out clouds of hydrogen and calcium and metallic gases, intensely hot and magnetic and radioactive. As a matter of fact, one or two such regions were observed to be highly agitated just about the same time as the ionospheric storms. These regions were kept under a round-the-clock vigilance by an IGY chain of observers all around the world, armed with a massive array of spectrohelioscopes, telescopes, solar-radio recorders, ionosondes, magnetographs and cosmic-ray detectors.

Many more storms of this nature are expected during the next fifteen months. That is one reason why this period was declared the International Geophysical Year.[6] It is hoped that by co-ordinating and concentrating the attention of many minds together on the phenomena of solar-terrestrial interactions[7] such as these storms, we may find the solution to many intriguing geophysical puzzles.[8]

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[6] J. J. Hennessey S.J. PHILIPPINE STUDIES IV (1956) 535 ff. and sources cited therein.

[7] S. K. Mitra *op. cit.* 325-330, 479-481, 637-638.

[8] On the explanation of sunspots and the mechanism of the sun, see Father Miller's article elsewhere in this issue.

Fig. 1
MAGNETIC INTENSITY - H
Muntinglupa, June 28

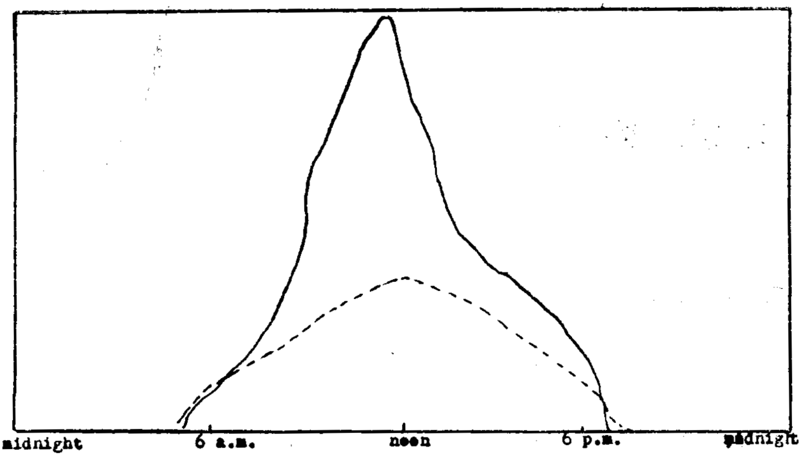

Fig. 2. Ion Density of D-region. Baguio.
Normal days: .... Storm, 28 June ————

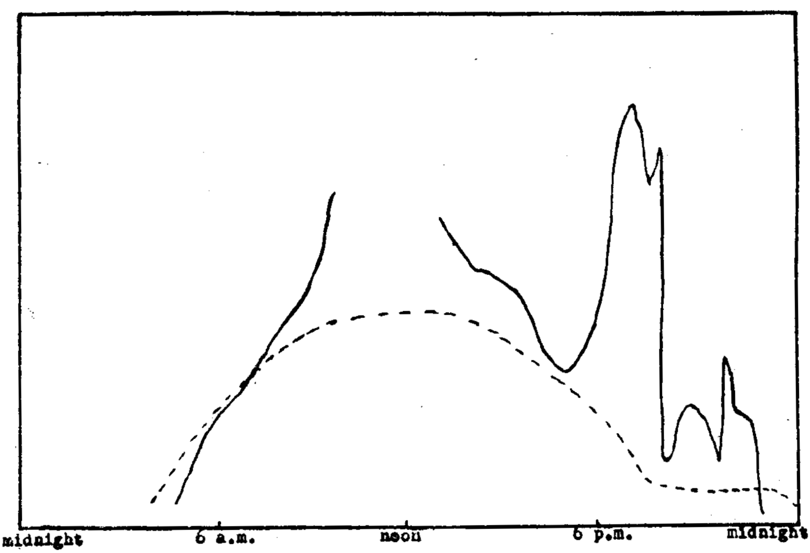

Fig. 3. Blanketing Thickness of E-layer. Baguio.
Normal days: .... Storm, 28 June ————