AMERICAN GEOPHYSICAL UNION
EXECUTIVE COMMITTEE

American National Committee of the
International Union of Geodesy and Geophysics
and Committee on Geophysics of the
NATIONAL RESEARCH COUNCIL

WASHINGTON, D. C.

27 May 1958

AIR-MAIL

Mr. Grote Reber
Research Corporation
New York 17, New York

Dear Mr. Reber:

This letter is primarily an inquiry regarding your paper "Between the Atmospherics" which you published in the Journal of Geophysical Research for March 1958. However I want first of all to say that it has also been a pleasure to read accounts of your earlier work as found in the IRE "Proceedings" for January 1958 and in the current issue of "Reader's Digest".

I am enclosing herewith a paper which I submitted to JGR last month which indicates to some extent my interest in atmospheric electricity and the ionosphere. The peculiar electrical manifestations produced by tornadoes has interested me for some time. Not only is there a glow discharge within them but there is a "sferics" signal of increasing frequency observed (See "Sferics Readings on Windstorms and Tornadoes" by Dickson and McConahy, Bulletin of the American Meteorological Society, October 1956).

I feel now that it is definitely established that the ionosphere responds to the same mechanism at the jet stream level which brings about the violent tornado convection. The association between the passage of surface low pressure areas and ionospheric disturbances has been noticed in Australia and elsewhere (See Martyn & Pulley, Proc. Royal Soc. A, 1936, also Bannon et al., Proc. Royal Soc. A, 1940).

Thus my interest in your observations at 30KC in Tasmania. I would like very much to have further details of these data, particularly the dates and times at which you observed the unusual signals discussed in your paper under "Precipitation Static and Atmospherics".

27 May 1958

Mr. Grote Reber
Research Corporation
New York 17, New York

If possible I would also like to confer with you on these matters at your convenience. (Whether or not I could arrange a trip to Tasmania or Hawaii to see you is problematical but I should certainly like to talk it over with you, wherever you may be working at the present time).

Very truly yours,

Conrad P. Mook

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THE APPARENT IONOSPHERIC RESPONSE TO THE PASSAGE OF HURRICANE DIANE (1955) AT WASHINGTON, D. C.

The suggestion by Bauer[1] that the ionospheric response to the passage of hurricane Diane (1955) at Washington, D.C. is related to the vertical distribution of divergence in the atmosphere finds support in a study of the divergent outflow of the storm as observed on August 17 and 18, 1955[2].

According to Bauer, divergence below the ionosphere could give rise to convergence and associated subsidence in the ionosphere which would lead to an increase in electron density. According to his data, this ionospheric convergence should have occurred over Washington, D.C. on August 17 coupled with divergence below the ionosphere and above the troposphere. Unlike other hurricanes analyzed, a situation reverse from that described above occurred at Washington on the day of passage of the storm center on August 18.

The presence of divergence at 40,000 feet (between the troposphere and ionosphere) is confirmed in a detailed study of the wind data associated with the storm passage[2]. The latter analysis indicated that winds were converging in the region of heavy rainfall north of the storm center in

1 S. J. Bauer, An Apparent Ionospheric Response to the Passage of Hurricanes, J. Geophys. Res., 63, 265-269 (1958).

2 C. P. Mook, Hurricane Rains and Floods of August 1955 - Carolinas to New England, Part I, Meteorological Analysis, U. S. Weather Bureau Tech. Paper No. 26, pp. 3-21, (1956).

Virginia (near Washington, D.C.) to an altitude of 20,000 feet on the morning of August 17, 1955. Divergence above this area was occurring at 40,000 feet, coupled with a "lower" ionosphere.

By 10 a.m. (EST) of August 18 "the region of divergence had lowered to 30,000 feet and had shifted to southern New England". At that time the "dying" hurricane center, lacking strongwinds, was moving northeastward near Washington,D.C. Concurrently a major zone of convergence at the earth's surface, and possibly also in the ionosphere, was present over southern New England where heavy flood rains were reaching their maximum intensity. The ionosphere over Washington had risen[1].

Divergence associated with jet streams at the 30,000 to 40,000 foot level has also been linked to the occurrence of tornadoes and severe thunderstorms[3]. Falconer[4] has suggested that the abnormally positive electric field beneath jet streams may be the result of positive charges carried downstream from tornadoes or heavy thunderstorm concentrations associated with jet streams. The electrical effects associated with tornadoes may well be augmented by electrical currents to the ionosphere as suggested by Vonnegut[5]. The evidence here presented supports an electro-

[3] J. S. Winston, ed., Forecasting Tornadoes and Severe Thunderstorms, Forecasting Guide No. 1, U. S. Weather Bureau, Washington, Sept. 1956.

[4] See: V. J. Schaefer, Atmospheric Electricity Associated with Jet Streams, Proceedings on the Conference on Atmospheric Electricity, Geophysics Research Paper No. 42, Air Force Cambridge Research Center, p. 64 (1955).

[5] B. Vonnegut, Possible Mechanisms for the Formation of Thunderstorm Electricity, Proceedings on the Conference on Atmospheric Electricity, Geophysics Research Paper No. 42, Air Force Cambridge Research Center, pp. 169-181 (1955).

ionospheric tornado theory since it now appears that the ionospheric conducting layer can intensify and descend at a critical time to join an electrical circuit between the upper troposphere and the ground which has been established through air columns ionized by lightning discharges.

The evidence for mid-atmospheric divergence over New England, and thus for a possible lowering of the ionosphere supports Gherzi[6] who stated that the ionosphere lowers 200 miles in advance of the direction of movement of a hurricane. Hurricane Diane was observed to shift its course toward the region of 30,000 foot divergence over New England[1].

Following the above reasoning it may not be necessary to visualize a direct propagation of disturbances from the earth's surface to the ionosphere as visualized by Wexler[7] but rather it is more likely that both low level and ionospheric disturbances have a common origin at the jet stream level in the atmosphere[8].

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E. Gherzi, Ionosphere and Weather, Nature, 165, 38, 1950.

H. Wexler, A look at some suggested Solar-weather Relationships, in the Sun's Effect on the Earth's Atmosphere, Tech. Report No. 2, Institute for Solar-terrestrial Research, High Altitude Observatory of the University of Colorado, October 1956.

S. Petterssen, J. E. Dunn, and L. L. Means, Report of an Experiment in Forecasting of Cyclone Development, Journal of Meteorology, Vol. 12, No. 1, February 1955, pp. 58-67.