VAST ELECTRIC 'SEA' EXPLORED BY RADIO

Terrific Storms in Ionosphere Cause Static, but Also Reveal Secrets of Magnetism

LINK TO SUNSPOTS SEEN

Quality of Wireless Reception Can Now Be Forecast, Dr. Dellinger Tells Engineers

The latest explorations of the vast invisible electrical "ocean" surrounding the earth, by means of "radio ships" riding the sky-waves, were reported yesterday before the annual Winter convention of the American Institute of Electrical Engineers by Dr. J. H. Dellinger of the National Bureau of Standards, Washington, D. C. The meeting is being held this week at the Engineering Societies Building, 29 West Thirty-ninth Street.

The "skippers" of these phantom "radio ships," Dr. Dellinger reported, have brought back tales of tremendous storms in the ionosphere, as the electrical ocean is known, and of terrific tides and surges, causing much annoyance to radio listeners, but at the same time supplying man with much new knowledge on the great mystery of the fluctuations in the earth's magnetism and on various types of radiations from the sun, many of which do not reach the earth.

Discovery Only Few Years Old

The ionosphere, Dr. Dellinger explained, "is a new world to which radio research and radio operations have given us access in the past few years." Its existence was not even suspected until 1901, when Marconi, by sending radio signals across the Atlantic, incidentally proved that the upper atmosphere was electrified. The waves, it was known, could not penetrate the earth, so there was only one way they could go the incredible distance, and that was by reflection from one or more conducting strata in the atmosphere. Marconi did not know there was an ionosphere without which long-distance radio transmission would be impossible.

An ionosphere storm, Dr. Dellinger reported, lasts a day or more, and usually is accompanied by a magnetic storm, i. e., a period of unusual fluctuation of terrestrial magnetism intensity.

Such storms have two phases, an initial turbulent phase and a following moderate phase. Usually only the second phase occurs in medium and low latitudes. The initial turbulent phase is confined to the auroral zone, i. e., the region around the magnetic pole in which aurora is visible, and which is usually limited to within about 20 degrees of the magnetic pole, which region is greatly extended in very severe storms.

"The turbulent phase," Dr. Dellinger reported, "consists of a violent boiling or turbulence of the entire ionosphere in the auroral zone, resulting in irregularly moving small clouds of ionization (electrified particles) and a disintegration of the normal stratification of the ionosphere from the E-layer, at an altitude of about seventy miles on up.

"Whatever causes the storm apparently plunges into the ionosphere at auroral-zone latitudes, and literally tears it up. During the turbulent period of the ionosphere storm high-frequency transmissions are very erratic, both signals and 'static' surge violently, being transmitted with good intensity for short intermittent periods, interspersed with periods of complete failure.

Characteristics of the "Storms"

"Ionosphere storms, and the magnetic storms that usually accompany them, have several characteristics the opposite of those of sudden ionosphere disturbances (and the magnetic perturbations that sometimes accompany them). The former are more intense the higher the latitude, while the latter are more intense the lower the latitude. The former occur both day and night, while the latter are confined to the day hemisphere. The former lasts one or more days, the latter usually last less than an hour.

"These two types of ionosphere irregularity occur in general independently of one another, but both are more likely to occur at times of great sunspot activity."

The causes of the ionosphere storms are not definitely known. On the other hand, the sudden ionosphere disturbances, Dr. Dellinger said, have been found to be caused by eruptions on the sun.

"Study of these effects," he said, "is arousing great interest and focusing new effort upon the study of the sun. The sudden ionosphere disturbance is the only known instance in which a specific happening on the earth follows directly from a specific random happening on the sun or other heavenly body.

"The ionosphere gives information about some of the radiations from the sun which can be studied in no other way because they are wholly absorbed in the ionosphere and do not reach the earth's surface. Such studies may eventually elucidate the nature of the eruptive processes within the sun and the causes of sunspots and the eleven-year cycle."

Dr. Dellinger described an ionosphere forecasting service recently initiated by the National Bureau of Standards. When extended, he said, this service "will make possible to predict in advance radio transmission conditions for a given time and path." The reliability of this type of prediction, he added, will surpass that of weather forecasts.