Comments on X-Band Radiometric Sky Temperatures

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The following comments are offered concerning the recent paper "Meteorological Conditions and Radio Astronomy Observations at X-Band" (Venugopal, 1963).

The author's data show that fluctuations in the X-band sky temperature, as measured with a radiometer, are most common under frontal or cyclonic conditions. From this fact, he infers that the fluctuations are related to the water vapor content of the atmosphere and implies that they are caused by small-scale variations in water vapor content. This is not warranted without a consideration of the contributions made by *condensed* water, especially precipitation particles, to X-band sky temperatures.

Hogg and Semplak (1961) have measured sky temperatures in excess of 100K at 6 Gc/sec (5 cm) with an antenna directed at the zenith during rain showers, whereas temperatures below 5K are sometimes observed on clear, dry days. Theoretical considerations show that the sky temperature should increase with increased absorption along the beam, with the upper limit being determined by the temperature of the matter viewed by the antenna. The absorption in rain is a function of rainfall rate, drop-size distribution, path length through the rain, and radio frequency. In the present case, where observations at an elevation angle of 38° at 9 Gc/sec (3.3 cm) are being considered, sky temperatures of 200K could occur on occasion. Short-term variations in rainfall rate could readily lead to fluctuations in X-band sky temperature of the size observed (0.5–10K). In one instance, Hogg and Semplak (1961) noted an increase in sky temperature of 66K in about 40 seconds!

It is unfortunate that the author of the present paper limited his data to the percentage of time that fluctuations were present in the atmospheric radiation at X-band. Although the fluctuations may be the factor of prime importance to radio astronomers, as pointed out in one of the references cited (Orhaug, 1963), the observed X-band sky temperatures would have been of more than passing interest to radio meteorologists. From an examination of them, it should be possible to identify those situations in which condensed water was the major contributor to the received power. An evaluation of the remaining cases might well fail to show any significant correlation between radiometric sky temperature fluctuations and the presence or absence of surface cyclones.

The above considerations do not, in general, negate the author's conclusions concerning the choice of sites for radio astronomy observations, but do suggest that a direct consideration of rainfall statistics would be of as much, or more, value in evaluating a site as a consideration of its proximity to cyclone tracks. Of course, it would be necessary to keep in mind that condensed water along the beam can make significant contributions in some cases where no rain is recorded at the antenna site itself.

REFERENCES

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