SOME MODELS FOR RAIN AND CLOUD ATTENUATION OF MILLIMETER WAVES

E. J. Dutton, H. T. Dougherty, and D. C. Hyovalti*

In the first section of this report, rainfall observational data are processed by least-squares curve-fitting to call attention to some of the desirable aspects of such fitting. The curve-fitting techniques are illustrated for annual rainfall and worst-month rainfall distributions, but are as readily applicable for distributions of rain-caused attenuation or scattering.

The second section of this report discusses the analysis of specific rain attenuation data observed at Huntsville, AL at 28.8, 57.6, and 96.1 GHz. These data are used to construct the third part of a CONUS-wide climatology for use in obtaining the distribution of specific attenuation at geographic locations within these zones. The other two climatic-zone analyses have been described in earlier reports, so that with this report, this rather broad-scale analysis is now complete.

The third section of this report concerns the examination of the feasibility of determining zenith cloud attenuation distributions at millimeter-wave frequencies, basically using radiosonde observations as the main indicator of cloud location and occurrence, supplemented to some degree by other weather data. A 5-year sample for Washington, DC, is examined and results presented.

Recommendations are then made for needed additional work on both the CONUS rain attenuation climatology and for extended cloud attenuation analysis.

Key words: climatology; cloud attenuation; curve fitting; distributions; millimeter waves; rain attenuation

1. LEAST-SQUARE SUMMARIES OF RAINFALL

Historically, a wide variety of models have been proposed for both the distributions of rainfall and its effects upon radio-wave propagation. Although these generally conform to expectations suggested by theory, they are largely empirically derived. Consequently, the models often result from curve fitting to observational data, but it is surprising how seldom they are reported with any description of, or reference to, the curve-fitting process.

* E. J. Dutton and D. C. Hyovalti are with the Institute for Telecommunication Sciences, National Telecommunications and Information Administration, U. S. Department of Commerce, Boulder, CO 80303-3328.

H. T. Dougherty (formerly with the Institute for Telecommunication Sciences) is now with the Colorado Radio Research Company, Westminster, CO.