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ТЕМАТИЧЕСКИЙ РЕФЕРАТИВНЫЙ СБОРНИК № 2-2

“Radiowave Beyond the Horizon Propagation”
(«Дальнее тропосферное распространение радиоволн»)

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"Propagation Over Parabolic Terrain: Asymptotics and Comparison to Data"

Analysis of radio propagation over varying, clutter-covered terrain was carried out aiming at prediction of power received by a terminal immersed in clutter, with the transmitter placed above clutter. The need for such prediction arises, for example, in planning and assessing coverage and interference in radio communications. Following a general formulation of the problem, particular solutions were found when the terrain has constant curvature. Asymptotic evaluation yielded compact expressions both for parabolic valleys and ridges. In both cases, ray-optical term dominated for short ranges, while a single mode dominated at large ranges. Strong focusing was found to occur in valleys, while ridges produced strong blockage beyond the ??horizon??. The resulting procedure for predicting pathloss over varying terrain is therefore to apply the formulae using the terrain curvature extracted from terrain files. In comparison to measured power across a valley, mean errors of less than 1 dB were found, a marked improvement over standard terrain-unaware models that produce a mean error of 30 dB. [C1]

"Feasibility study of radio links using evaporation duct over sea off Malaysian shores"

This study presents the feasibility of beyond-the-horizon radio links using evaporation duct over sea off Malaysian shores. Optimum frequency verses height, link budgeting and range analysis is studied with the help of Advance Refractive Effects Prediction System (AREPS). Results give a good indication that using off-the-shelf radio equipment with few meter antenna height, a reliable and cost effective maritime communication system can be attained. [C2]

"Concurrent Operation of Two Over-the-Horizon Radars"

By exploiting the reflective and refractive nature of high-frequency (HF) radiowave propagation through the ionosphere or the conducting sea surface, over-the-horizon radar (OTHR) systems perform wide-area surveillance at long range well beyond the limit of the horizon of conventional line-of-sight (LOS) radars. Improved characterizations of the targets can be achieved by using multiple OTHRs operating simultaneously as compared to a single OTHR operating alone. In this paper, we consider concurrent operations of two OTHR systems that occupy the same frequency band with different chirp waveforms. The objective is to respond to the advanced wide-area surveillance needs without reducing the wave repetitive frequency. For this purpose, a new cross-radar interference cancellation technique is developed and its effectiveness is verified through both analytical and simulation results [C3]

"Gaussian approximation for correlation function of apparent antenna pattern over beyond-the-horizon tropospheric path"

It is well known that in free space the signal amplitude variation at the output of the receiving antenna, located in a far zone, is similar to the scanning transmitting antenna pattern (AP). In the case of wave scattering over a beyond-the-horizon path the amplitude becomes a random function and corresponds to the apparent antenna pattern (AAP). As a rule, the observed AAP is wider than the AP, so estimation of relative AP broadening has become a conventional method for its description. There have been some attempts to classify AAPs according to the character of the distortions. From the statistical point of view the correlation function contains more information. The objective of this paper is to test the possibility of using a bivariate Gaussian function to represent the limiting form of the correlation function for a narrowbeam antenna under the condition of multiple wave scattering. This gives a simple way to write down the Karhunen-Loe`ve expansion in terms of the set of the orthonormal Hermite functions and the set of eigenvalues [C4]

"EM wave scattering by a turbulent medium using a random Cn 2 model"

A new approach of the problem of electromagnetic wave scattering by a turbulent medium is described. The authors show that, in the troposphere, one can model the refractive index structure constant Cn2as a random

function. The probability density function of the received power, scattered by the medium, is then determined. The method is applied to UHF tropospheric beyond line of sight radio links. Results are compared with those given by a fairly accurate semi empirical model for such links: NBS 101. A good agreement is obtained for large antennas and for frequencies greater than 3 GHz [C5]

"A model for trans-horizon propagation in the low-VHF band"

The authors identify the dominant mode of propagation on BLOS (beyond line of sight) paths up to 400 km in range at frequencies in the low-VHF band as tropospheric reflection. The CCIR model which is the most widely used troposcatter loss prediction model consistently gave optimistic values for the long term transmission loss compared with the measured loss at 47 MHz over channels between 100 km and 400 km in length. The main reason for this was because although the measured instantaneous signal levels were in rough agreement with predicted values, the time that the signal was present was not i.e., it was present for less than 50% of the time. This was especially true when the system was operating on the upper range limit of the propagation mechanism. The major limitation of the current theoretical tropospheric reflection models is that because they assume static atmospheric conditions, the short term fading, which is caused by the movement between reflecting layers is not taken into account [C6]

"A PC-based UHF propagation study in an urban environment"

A small-scale study to evaluate the principal modes of propagation for an experimental, beyond-the-horizon UHF link is presented. The propagation channel was characterized statistically in several ways. The data collected exhibited characteristics of both troposcatter and diffraction modes of propagation, with heavy influence from anomalies such as aircraft reflections and ducting. The movement of weather fronts through the region influences the runways used by aircraft, and thus the degree of fading due to aircraft. Weather fronts also influenced the principal mode and characteristics of propagation. The correlation between meteorological conditions and the degree of fading observed was biased by the heavy air traffic and the large beamwidth receiver antenna used [C7]

"Within the horizon propagation measurements over sea at 10.5 GHz"

Results of a within-the-horizon propagation experiment at 10.5 GHz conducted along a 9.9-km low-altitude path in the Netherlands area of the North Sea are given. The objective was to investigate the effects of the evaporation duct on low-altitude propagation within the horizon region in order to validate the propagation model program RPE (radiation parabolic equation). This program predicts the path loss as a function of evaporation duct height for propagation over the sea within and beyond the horizon region. The experiment was performed in the period 7 June-11 July 1989. A one-month test period was chosen to get propagation data for a variety of weather conditions. The North Sea propagation experiment clearly demonstrated that the within-the-radio-horizon evaporation duct can have a significant impact on low-level propagation at X-band. It was found that the accuracy of the predictions improved considerably when the height of the sea level used in the propagation model RPE was adjusted for sea roughness. Predictions using the adjusted sea-level were, on the average, loss levels in the range from 128 to 152 dB [C8]

"Influence of strong-anisotropic fluctuations of the refractive index on the beyond-the-horizon propagation of SHF"

The author presents a technique for investigating the influence of layered fluctuations of the refractivity on transhorizon radio-wave propagation in an evaporation duct. Numerical calculations show that these fluctuations have a significant influence on the transhorizon propagation. It is found that the mean intensity of the EM field considerably exceeds that in the case of an undisturbed waveguide and decreases along the earth's surface more slowly. The field distribution obeys the logarithmic normal distribution [C9]

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