Variation in propagation loss predictions due to uncertainty in topographic data

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The accuracy of any prediction of propagation loss over rough terrain will depend significantly on the available terrain data. Especially in mountainous and rural regions, the density of such data is often limited. Existing models consist of both empirical models based on statistical averages, which require little terrain data, and more accurate computational models, which require high density terrain data. This study seeks to determine how the density and accuracy of the terrain data affect the prediction of the propagation loss and to compare such predictions to various quasi-empirical models.

The approach adopted here is to compute the current induced on the terrain surface, assuming that it is a perfect electrical conductor (PEC), using the Method of Ordered Multiple Interactions (MOMI), and then to compute the field scattered by these currents and add it to the incident field produced by a line source. The terrain sampling necessary for this approach is $0.1\lambda_o$, where λ_o is the radio wavelength. Such a sampling criterion cannot be met when the topographic databases used to model the surface are only sampled at 30 meters, as is typically the case. Thus, our approach is to connect the 30 meter points using a randomly rough surface, which uses a smooth spline fit of the 30 meter data as its mean surface. The scattering is computed for each of these random connections, and the variation in the scattering is examined. Because the variation in the scattered field is a variation in the exact result due to the uncertainty in the terrain data base, this quantity cannot be reduced. Thus, this variation is fundamental and exists in any model used to predict propagation loss.