

#38 Received 01/16/2015

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Multiple Phase Screen Calculation of Two-way Spherical Wave Propagation in the Ionosphere

Abstract:

This paper presents a numerical solution to the parabolic wave equation for spherical wave propagation in a disturbed ionosphere. The solution uses the Fourier/split step approach where the propagation medium is modeled using multiple phase-changing screens separated by free space. The phase screens can consist of deterministic or random components describing spatial scales of any size. This solution consists of realizations of the signal (i.e., the ionospheric transfer function) after two-way propagation from a transmitter, through the medium to a target, and back. The target can be comprised of multiple, independent point scatterers. The solution is also applicable to the problem of synthetic aperture radar and is not subject to the small scene limitation, where all scatterers in the scene experience identical propagation conditions. Several examples are shown illustrating some features of the solution including reciprocity, relationship between one- and two-way (monostatic and bistatic) scintillation index, and reflection from a large target.