



Validation of an Incoherent Scatter Radar Performance Simulator

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1. Extended Abstract

Incoherent scatter radar (ISR) measurements are used to obtain an estimate of plasma parameters of the near space environment. The MIT ISR Performance Simulator (MIPS) is one simulator of this type with capabilities to model the measurement performance of ISR systems. This model attempts to capture the key details of ISR performance estimation in a manner suitable for use in computer optimization and design. Given a set of plasma parameters, a radar design, and the relative location of the ionospheric volume MIPS enables the calculation of radar performance in terms of signal to noise ratio, plasma parameter variance, and measurement speed metrics. Ionospheric parameters can be input into the model or more realistic conditions obtained using the International Reference Ionosphere (IRI) for specific times and geographical locations. For a multi-static system, each receiver and transmitter can have independent radar system parameters and they can be located in different geographic locations. Spatial coverage and performance of ISR systems can be modeled for one or more radar systems (e.g. a radar network). This mapping can be used to help understand the capabilities of both the existing network of ISR systems and how changes in that network may impact measurement of the Geospace environment. We will discuss the MIPS model in detail and give examples from efforts to validate the model. Key to the validation effort are comparisons to observations made using existing radar systems. This will include selected examples designed to highlight the performance of the model under high and low SNR conditions, for different frequencies of operation, over different altitude ranges, and for varying integration times.