Title: Assimilative specification of three dimensional ionospheric conductivity and application to global magnetosphere-ionosphere-thermosphere modeling

Abstract: System science has emerged as a promising approach to understanding the complex, coupled magnetosphere-ionosphere-thermosphere (MIT) environment. Fundamental to the success of system science in the MIT system is the ability to describe coupling phenomena, especially in the polar regions where the effects are most direct. This coupling is controlled by the ionospheric conductivity, an historically uncertain and poorly specified parameter. Advances in data analysis techniques now enable us to reconsider our understanding and modeling of this critical parameter, particularly the assumption that the ionosphere is adequately described as a two-dimensional spherical shell.

In this talk, I will make the point that advances in system science understanding, in many cases, depend on data analysis techniques capable of unifying models of geospace with our diverse and growing observational system. I present results of two powerful data analysis techniques applied to global-scale three-dimensional (3-D) ionospheric conductivities using Defense Meteorological Satellite Program (DMSP) data: 1) empirical orthogonal function (EOF) analysis, and 2) assimilative reconstruction via optimal interpolation (OI). Our findings underscore the importance of analyzing the ionosphere in 3-D and demonstrate the capability of data assimilation methods to improve understanding of the coupled MIT system.

I will also present preliminary thoughts on a more general question, “How do we incorporate new tools from the burgeoning field of applied mathematics into our existing approach to geospace system science?”
Selected references:
