Project Details

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Project Title:
Solar Activity and Long-term Trends in the Ionosphere (SALTI): A Historic-data Analysis and Modeling Study

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Summary:
We propose a data analysis and modeling study of long-term changes that have occurred in the ionosphere and upper atmosphere over the last several decades. The interest in these trends has intensified after the classical modeling study by Rishbeth and Roble (1992) predicted quite dramatic changes in the thermosphere and ionosphere due to future increases in greenhouse gases. For the F2 ionospheric layer in particular, a substantial decrease of its height, hmF2, was predicted along with marginal changes in the critical frequency, foF2. The global ionospheric database consists of observations collected at nearly 200 ionosonde stations around the world over several decades. Previous analyses of the long-term changes in the ionospheric parameters have been inconclusive and even contradictory. The trend estimates cannot always be explained in terms of the model predictions possibly due to the difficulties of trend detection from the highly variable ionospheric data and due to the limitations of conventional proxies for the external drivers. Another possible explanation is the very strong influence on the ionosphere of solar and geomagnetic activity (the latter being also driven by the Sun), which in addition to cyclic and 'random " variations exhibit considerable secular trends. The science goal of this project is to advance our understanding of the mechanisms driving the long-term changes observed in the ionosphere and upper atmosphere. Our approach is unique in that it synergistically combines two critical components: (1) we will conduct a comprehensive and robust statistical analysis of the global ionospheric database to delineate the contributions due to solar and geomagnetic activity, and detect possible anthropogenic and natural long-term trends; (2) we will use a suite of advanced upper-atmospheric and ionospheric models to study the natural and anthropogenic variability using the records of greenhouse gas concentrations, geomagnetic activity, and our improved historic reconstruction of the solar ultraviolet (UV) and extreme UV radiation over the last 2 3 solar cycles. A critical comparison of the results of data analysis and theoretical modeling will provide insights into the key physical processes responsible for the observed changes in the ionosphere and upper atmosphere and will lead to development of true long-term forecasting capabilities.

Publication References:

Summary: "

Reference: Solar and Anthropogenic Effects in the Ionosphere - Akmaev, Rashid A. U CO/NOAA