A001: "Fifty Years of Ionospheric Research & Applications: 1960-2010", by John M. Goodman, RPSI

Abstract

The space age arguably began with the launch of Sputnik in the late 1950s. Everything changed from that point onward. Before that time information about the ionosphere was largely gathered from ionospheric sounders and rocket probes and inferred from radio-astronomical studies. Ham radio operators were significant contributors to our understanding of solar influences upon HF and VHF communication systems. Long-wave communication systems provided additional information about the lower ionosphere. Even Over-the-Horizon radar systems have led to some advanced concepts pertaining to ionospheric update methods as well as the use of scatter technologies for advanced remote sensing. Moon radar studies have led to information about the cislunar electron content, and these efforts gave rise to ionospheric sensing using the Faraday rotation technique. Early satellite systems led to a plethora of techniques for estimating the ionospheric electron content. Other than Faraday rotation, these include the evaluation of the dispersive Doppler and group-path-delay of satellite telemetry signals. Things were not standing still on the ground. Thomson scatter radar methods were developed, and for a time these incoherent scatter systems provided the most complete picture of the entire ionosphere, including plasma temperatures and drifts from 100 km to ~ 800 km. Advanced digital sounders were also developed. Still, topside information was very spotty. Topside sounding systems such as Alluette allowed oceanic regions to be covered, thus filling a gap left in models developed solely from the assimilation of land-based vertical incidence sounders. The launch of tactical communication systems led to an increased interest in scintillation avoidance at UHF, especially in the equatorial regimes. Eventually commercial and military systems have gravitated to the higher frequencies that are less vulnerable to ionospheric inhomogeneities. This paper will outline the progress in development of ionospheric sensors and technology enabling improved real-time modeling and forecasting of ionospheric behavior. In recent years, a plethora of space weather activities has fueled a generally positive sentiment that knowledge of the ionosphere and its variations may not forever be a limitation in the performance of telecommunication systems. The author will use the twelve volumes of IES conferences as a basis for much of the review. It will be supplemented with some personal experiences and relevant commentary.