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**Space Geodetic Techniques for Remote Sensing the Ionosphere**

Abstract:
Space geodetic techniques, such as Very Long Baseline Interferometry (VLBI), Global Navigation Satellite Systems (GNSS), satellite altimetry missions, and Low Earth Orbiting (LEO) satellites have contributed extensively to remote sensing and modeling of the ionosphere in the last decade. VLBI is a differential space geodetic technique which is capable of deriving absolute ionosphere parameters, i.e. Vertical Total Electron Content (VTEC) for each station. GNSS Dual-frequency observations have played a classical role for development of Global Ionosphere Maps (GIM). GIM are developed using the GNSS ionospheric observable L4 or the so-called geometry-free linear combination of simultaneous observations at two carriers L1 and L2. Nevertheless, when studying the ionosphere globally, the fact that GNSS stations are in-homogeneously distributed around the world, with large gaps particularly over the oceans should be taken into account; this fact reduces the precision and reliability of the GIM over these areas. On the other hand, dual-frequency satellite altimetry missions provide information about the ionosphere precisely above the oceans; and furthermore GNSS Radio Occultation (RO) measurements aboard LEO (Low Earth Orbiting) satellites provide great number of globally distributed information of the ionosphere. An important contribution of the GNSS RO data is the provision of vertical information on the electron density distribution. Therefore, this technique can also be used for the investigation of the layered structure of the ionosphere. Prominent examples are detailed studies of vertically thin ionospheric phenomena, like sporadic E layers. All in all, combining different space geodetic techniques for developing the ionospheric maps would significantly improve the accuracy and reliability of the developed model, as the combined model uses the advantages of each particular method and provides a more accurate result than the result from each single technique. This paper presents a general overview of the ionospheric investigations using the space geodetic techniques.