

The low-latitude ionospheric scintillation observation and positioning by FORMOSAT-3/COSMIC beacon receiver stations

Tung-Yuan Hsiao

¹ Nuclear Science and Technology Development Center, National Tsing Hua University, Hsinchu, Taiwan

Abstract

A radio signal traversing the ionosphere will be modified by irregularities. When received at an antenna, these signals present random temporal fluctuations in both amplitude and phase. A case of scintillation measurement of the beacon satellites was discussed in this study from three stations located in Chung-li (25.136N, 121.539E), Tsao-tun (23.981N, 120.697E), and Che-cheng (22.725N, 120.544E). The coherent beacon receiver called ionospheric tomography system (ITS) can receive the beacon signals from the Navy Navigational Satellite Systems (150 and 400 MHz) and the FORMOSAT-3/COSMIC Tri-band Beacon Transmitter (150, 400, 1066.7 MHz). The three stations in Taiwan were spaced across roughly 360 km in a north-south line. By mapping the track of the orbit of the satellite, we may recognize the localize scintillation position where the radio signals are modified by irregularities. In previous research, the height of irregularities was assumed to 350 Km, because the greatest possible height is 350 km in the F2 layer. In order to improve on this assumption, we use a mapping method to approach the realistic height and length from the multiple stations by a scintillation case near midnight. Meanwhile the spectrum analysis shows the drift velocity results of 150MHz are close to the results of 400MHz by input the height than setting the height of irregularities at 350km. By applying the mapping method, the scintillation of positioning would be confirmed what ever in F layer or in E layer.

Keywords: ionosphere, scintillation, ionospheric irregularity, beacon receiver