The Ionospheric Products of Taiwan Radio Occultation Process System (TROPS)

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Introduction

Taiwan Radio Occultation Process System (TROPS) is a process system including the retrieval procedure and user interface, which is developed by National Space Organization (NSPO), GPS Science and Application Research Center (GPSARC) of National Central University, and Taiwan Analysis Center for COSMIC (TACC) of Central Weather Bureau. TROPS is developing for the data analysis of FORMOSAT-7/COSMIC-2 (F-2/C-2) mission, which will launch 6 LEO satellites constellation in 2018. In this study, the ionospheric data of FORMOSAT-3/COSMIC (F-3/C) mission is used for TROPS calibration. In ionospheric retrieval procedure of TROPS, the ionospheric parameters profiles, which including the electron density and the absolute total electron content profiles, are retrieved from RO observation. The retrieval methods and processes are introduced in this paper.

TROPS System Architecture

Electron density profile retrieval results

Retrieval results

Some examples of the comparison between the retrieval electron density profiles of CDAAC (red lines) and TROPS (black lines) in DOY 302, 2013.

NmF\textsubscript{2} & HmF\textsubscript{2} comparison with CDAAC

The comparison of NmF\textsubscript{2} (left) and HmF\textsubscript{2} (right) between the retrieval results of CDAAC and TROPS in DOY 104-113, 2015. The red and black lines are the line with slope 1 and the range of one standard deviation, respectively.

Absolute total electron content retrieval results

Step 0 result (FM 1 antenna 01, P1 signal)

Step 0: Calculate pre-multipath distribution of P1 and P2

Step 1: Calculate the multipath effect of P1 and P2 code

Step 2: Find the consider range of the L1 and L2 profiles

Step 3: Calculate the medium value of the ambiguity of L1 and L2 between the consider range

Step 4: Correct the L1 and L2 by using the ambiguity calculated in Step 3

Step 5: Calculate the effect of L1 and L2 multipath profiles

Step 6: Find the consider range of the L1 and L2 multipath profiles

Step 7: Calculate the multipath of L1 and L2 by using the value from Step 7

Step 8: Correct L1 and L2 by using the horizontal baseline angle between GPS satellites and LEO antenna

Step 9: Calculate the absolute total electron content.

Absolute total electron content retrieval process

Step 0: Calculate the pre-multipath distribution of P1 and P2 code

Step 1: Correct the multipath effect of P1 and P2 code

Step 2: Smooth P1 and P2 code profile

Step 3: Calculate the ambiguity of L1 and L2 phase

Step 4: Correct the ambiguity of L1 and L2 phase with no large variation

Step 5: Correct the ambiguity of L1 and L2 phase with large variation

Step 6: Calculate TEC with code and phase

Step 7: Trimming phase-TEC by using code-TEC

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