

Southeast Asia low-latitude ionospheric network (SEALION) for monitoring ionospheric irregularities

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It is well known that the group velocity of the GPS signals are modulated by plasma in the GPS signal ray-path, and the delay time are proportional to the total electron content (TEC) between the satellite and the receiver. The delay time of the L1 signal is typically about 0.3 to 100 nsec, corresponding to the distance error of about 10 cm to 30 m. This magnitude of the error is likely to be critical for sophisticated GPS applications. Although the TEC value is determined by integrating plasma along the ray-path, the ionospheric contribution is largest, since the ionosphere is the highest plasma density region around the Earth. The influence of the ionosphere becomes critical, especially, when ionospheric irregularities are existed. The ionospheric irregularities often cause the scintillation and even the lock-off of the GPS signal. The ionospheric irregularities can occur all over the world, and they are generated by various mechanisms such as the $E \times B$ drift instability and Rayleigh-Taylor Instability.

One of the ionospheric irregularities which causes crucial errors for the GPS signal is the plasma bubble occurring in the equatorial region. It is well known that the plasma bubble consists of the various scale size of the irregularity from the order of cm to km, and sometimes it reaches the south part of Japan with moving eastward. Therefore, it is very important to monitor the occurrence and generation of the plasma bubble in an equatorial and west region from Japan.

For the purpose of monitoring and prediction of the generation and movement of the plasma bubble, the ionospheric observation network, called as the Southeast Asia low-latitude ionospheric network (SEALION), has been operated recently under agreements between the National Institute of Information and Communications Technology and the other institutes. SEALION consists of the several ionosondes, GPS scintillation monitors, GPS-TEC monitors and magnetometer. SEALION is a unique ionospheric observation network in having the conjugate observational points in the northern and southern hemispheres and in the vicinity of the magnetic equator. In this paper, we introduce the plasma bubble influence on the GPS signals, SEALION and the recent results obtained from SEALION data analysis.