PCG32-P10 Room:Convention Hall Time:May 26 18:15-19:30

Effect of the terrestrial ionosphere for the lunar radio occultation observation

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The existence of the lunar ionosphere is an open question of the Moon. The lunar ionosphere was found by radio occultation observations of spacecraft, such as Luna 19, Luna 20, and SELENE (Vasilyev et al., 1974; Vyshlov et al., 1976; Imamura et al., 2012). However, the estimated electron densities of several hundreds to 1000 cm-3 are much larger than theoretical estimation (Daily et al., 1977). Although several kinds of theories have been proposed to explain the existence of the lunar ionosphere (Daily et al., 1977, Savich 1976, Stubbs et al., 2011), inadequate quality and quantity of the present data prevent to qualify the origin of the lunar ionosphere.

Principal factor of inadequate data is the terrestrial ionosphere. The amplitude for fluctuation of total electron content (TEC) of the terrestrial ionosphere is similar or larger than the TEC of the lunar ionosphere. The cause of the lunar ionosphere cannot be derived without removal of the terrestrial ionosphere.

Imamura et al. (2012) removed the terrestrial ionosphere by a polynomial fitting method. If we assume the lunar ionosphere exists under a certain altitude (for example 30 km), the time series of observed TEC can be divided to two parts depending on whether the radio signal paths the lunar ionosphere or not. Before the occultation starts, named A-part, only the terrestrial component of the TEC is included in the observed TEC. On the other hand, both of the terrestrial and lunar components are included in the occultation period, named B-part. To remove the terrestrial component of B-part, the observed TEC of A-part is fitted by polynomial function and extrapolated to B-part. The lunar TEC had been estimated by this method in SELENE mission. However, the polynomial approach was ineffective when the fluctuation of the terrestrial ionosphere was large (Imamura et al., 2012).

In this presentation, the effect of the terrestrial ionosphere for the radio occultation observation is estimated by using SELENE-derived terrestrial TEC data. The error of the polynomial fitting and extrapolation of above method is evaluated, and the possibility of the detection of the lunar ionosphere is discussed. The optimal configuration of the radio occultation observation is also considered for future exploration. Appropriate orbital elements are discussed to collect sufficient data set. We focus on a solar zenith angle dependency of observation that is a key parameter to derive a mechanism for generating the lunar ionosphere. Furthermore, we start to search the lunar ionosphere by using other data set of SELENE. That is the VLBI data obtained in VRAD mission. Both of S-band and X-band signals from sub satellite of SELENE, Vstar, were received at four ground stations of VERA. The result will be shown in the presentation.

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