SEALIONイオノゾンデ観測による低緯度電離圏/熱圏ダイナミクス

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Ionosphere/thermosphere dynamics at low latitudes as deduced from SEALION meridional ionosonde chain

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Multipoint ionosonde observation was conducted to study ionosphere/thermosphere dynamics in Southeast Asia. For this study, data from three ionosonde stations aligned at 100 deg. E were analyzed. Two of them are near the magnetic conjugate points in northern Thailand and West Sumatra, Indonesia, and the other is near the magnetic equator in the middle of Malay Peninsula, Thailand; these are three of five SEALION (Southeast Asia low latitude ionospheric network) ionosonde stations. The F-layer critical frequency (foF2), the propagation factor (M3000F2), and the F-layer virtual height (h'F) were scaled at 15-min intervals for the three stations.

The ionospheric height is closely related to the thermospheric dynamics (neutral drags) as well as electromagnetic forces (EXB drifts) and chemical processes (productions and losses). In the previous study (Maruyama et al., J. Geophys. Res., 113, A09316, 2008), nighttime ionosphere/thermosphere dynamics was discussed using h'F in connection with the midnight temperature maximum. As h'F strongly depends on the chemical process during daytime, it is better to examine the peak height (hmF2) if we want to extend the ionosphere/thermosphere dynamics study over entire day. hmF2 was determined from M3000F2 using the modified Shimazaki's formula. The peak height obtained by this method is less accurate near the magnetic equator because the electron density vertical profile around the peak is greatly distorted from the parabolic distribution and the formation of an additional layer (sometimes called the F3 layer) around midday. The study is mostly focused on the peak heights at the low-latitude conjugate points.

The height difference between the two stations is a good indicator of the transequatorial neutral wind, because the equatorward wind in one hemisphere lifts the ionosphere up, while the poleward wind in another hemisphere lowers it. The diurnal variation of the transequatorial wind inferred from the height differences is examined for various seasons. We found that there exists a strong terdiurnal component, even stronger than the semidiurnal component, through the March/September equinoxes and December solstice (analysis for the June solstice under way at the present moment). On the other hand, an empirical wind model HWM93 predicts a quite small terdiurnal component, being a large discrepancy between the model outputs and the observations. Equinoctial asymmetry, or difference between the September and March equinoxes, in the feature of transequatorial wind was also clarified and was ascribed to the difference in the amplitude of semidiurnal component. In September, the semidiurnal amplitude is as large as diurnal one, while in March, the semidiurnal amplitude is smaller than any other components. The largest difference in the wind velocity is seen in afternoon to evening hours and a northward wind is strong in September, which suggests a possible connection of transequatorial wind with the plasma bubble onsets with higher rate in March than September in this longitude area.