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Meridional thermospheric winds as inferred from multipoint ionosonde observations

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An ionosonde network was established in the Southeast Asian area. The network consists of a meridional chain and an equatorial pair. Three ionosondes are along the magnetic meridian of 100 deg.E, two of them are at the magnetic conjugate points in Northern Thailand and West Sumatra, Indonesia, and the other is near the magnetic equator in Malay Peninsula, Thailand. The fourth ionosonde is also near the magnetic equator in Vietnam but separated by 6.3 degrees towards east from the meridional chain. As a preliminary data analysis, ionospheric height variations at the three stations of the meridional chain were examined, which shows that the coordination of the network has a great potential in studying ionosphere/thermosphere dynamics.

Ionospheric height differences between the northern and southern conjugate points in nighttime, which is a good measure of transequatorial thermospheric wind, were compared with those predicted from model calculations taking account of the HWM93 thermospheric wind model. For this purpose, the virtual height at 2.5 MHz was scaled from the ionogram at the three stations with a 15-minute interval. Model calculations were conducted to obtain the height of electron density of 7.75e4 (1/cm**3), which corresponds to 2.5-MHz reflection point, by solving a continuity equation. The vertical EXB drift velocity that is required as an input parameter to the model run was adjusted to fit the model results and the observations at the equatorial station, Chumphon. The comparison between the observed and modeled height variations at the low-latitude conjugate stations, Chiang Mai and Kototabang, shows a reasonable agreement depending on the season. During the northern solstice season, the difference between the observations and model calculations indicates that thermospheric winds varies more dynamically than the HWM93 model such that a higher order term of the diurnal variations is significant. The HWM93 model represents only terdiurnal and lower order variations, while the observations indicate existence of strong quarterdiurnal component from October to March. This component is insignificant from May to August, and both the observed and model calculated height variations exhibit a better agreement. The significance of transequatorial winds is the suppression of Rayleigh-Taylor instability that is responsible for onsets of plasma bubbles and equatorial spread F (ESF). The transequatorial wind is found to be quite strong after sunset during northern solstice due to the significant quarterdiurnal component, which well explains the observed seasonal morphology of ESF and related phenomena.