Ionospheric F-region plasma density topography maps using OI 777.4 nm all-sky images

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Observations of the OI 777.4 nm nightglow emission using an all-sky imaging system and ionospheric sounding using a Canadian Advanced Digital Ionosonde (CADI) have been recently carried out at São José dos Campos (23.21^{o}S, 45.86^{o}W) and Brazópolis (22.53^{o}S, 45.57^{o}W), respectively. The OI 777.4 nm emission comes mainly from the radiative recombination process (O^+ + e $\rightarrow$ O* + O*) followed by radiative process (O*(5P) $\rightarrow$ O*(5S) + hν (λ = 777.4 nm). It is known that to a good approximation the peak electron density is proportional to $(J_{7774})^{1/2}$, where $J_{7774}$is the vertical column emission rate. Using the near simultaneous optical imaging and ionospheric sounding observations on four selected geomagnetically quiet nights without any presence of large-scale plasma depletions, we have obtained the linear correlation coefficient (β) between the F-region peak electron density and OI 777.4 nm emission intensity. Using β and OI 777.4 nm emission images, topography maps of F-region plasma density have been obtained for several nights, both with and without plasma bubbles. The topography maps are then used to study the dynamics of the equatorial ionospheric anomaly as well as plasma depleted regions. Some of the topographic maps show the equatorial ionospheric anomaly region having high foF2 values of the order of 15-17 MHz with the surrounding areas having much lower foF2 values in the range of 8-12 MHz. Also, the presence of plasma bubbles in the topographic maps on some nights show that the foF2 values in plasma depleted regions are about 50% lower than the surrounding regions.