



Numerical modeling of the ionosphere behavior on the Indian longitudinal chain of stations for quiet equinoctial conditions in a minimum of solar activity

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On the basis of the Global Self-consistent Model of the Thermosphere-Ionosphere-Protonosphere system (GSM TIP), developed in WD IZMIRAN, calculations of the ionosphere behavior on the Indian longitudinal chain of stations Trivandrum (8.5°N, 77.0°E), Ettayiapuram (9.2°N, 78.0°E), Kodaikanal (10.5°N, 77.5°E), Annamalainagar (11.4°N, 79.5°E), SHAR (14.0°N, 80.0°E), Hyderabad (17.4°N, 78.6°E), and Alibag (18.6°N, 72.9°E) have been carried out. This model is founded on the numerical integration of the quasi-hydrodynamic equations of the continuity, motion and heat balance of the neutral (O₂, N₂, O) and charged (the molecular ions and atomic ions O⁺ and H⁺) particles including processes of electromagnetic connection as united system within the range of heights from 80 km above a surface of the Earth up to geocentric distance $\sim 15R_E$. In the model the discrepancy of geographic and geomagnetic axes of the Earth is taken into account. The new block of the ionospheric electric field calculation is included in the model in which the decision of the three-dimensional density conservation equation of a full current in an ionosphere $\nabla \vec{j} = 0$ is carried out by its reduction to the two-dimensional one by integration on the thickness of a current-carrying layer of an ionosphere along geomagnetic field lines on which the electric field does not vary. Thus the composition and the temperature of a neutral atmosphere are calculated on the model MSIS-90 and only the effects of a dynamo field generated by thermospheric winds were considered. The calculations were carried out for quiet equinoctial conditions in a minimum of solar activity 22.03.1983 ($F_{10,7}=70$).

The calculations have shown that the F3-layer of the ionosphere is formed in rather narrow belt of geomagnetic latitudes in a vicinity of geomagnetic equator. So, at sta-

tions Hyderabad and Alibag, residing for geomagnetic latitude $\Phi = 7^\circ$, F3-layer is not formed in general. For other stations the most long-lasting period of F3-layer existence with the critical frequency, exceeding foF2, accounts for station Trivandrum, residing in a southern geomagnetic hemisphere at geomagnetic latitude $\Phi = -1.1^\circ$. For the stations, residing for station Trivandrum closer to geomagnetic equator (Ettayiapuram and Kodaikanal) and farther (Annamalainagar and SHAR), duration of such period decreases. The received calculation results fit satisfactorily with observation data and model calculation results of other researchers. The F3-layer exists at early morning hours approximately with 05 LT up to 07 LT. As to G-layer, which is formed by H^+ ions at heights ~ 1000 km in our calculations it exists for all considered stations of a longitudinal chain with 21 LT till local midnight. The critical frequency of the G-layer is much less foF2, therefore the G-layer can and should be observed only by the method of the ionosphere sounding above from artificial satellites of the Earth.