Estimating plasma fluxes in the equatorial ionosphere using tomographic images

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Time derivatives of F-region electron density are estimated from a series of radio tomographic (RT) cross-sections obtained from close in time satellite passes during Autumn 1994 in the region of equatorial anomaly (EA). Typical examples of temporal variations are described and shown. Derivatives of the morning cross-sections are mostly positive and evening sections derivatives are negative except for postsunset enhancement cases. Determination of time derivative from experimental RT data allows the calculation of fluxes in the F-region after taking into account appropriate boundary conditions and data about photochemical reactions that can be obtained from model calculations and/or by another independent method. In some cases the effect of photochemical reactions and boundary fluxes can be neglected which greatly simplifies the problem. In particular, at altitudes higher than 300 km the influence of photochemical reactions is insignificant. During morning and evening hours the vertical components of fluxes noticeably exceed the horizontal ones, therefore one can neglect the integral flux through side boundaries compared to the flux through the bottom boundary. The flux through the top boundary (about 1000 km) is also much less than the flux through the bottom. For morning and evening hours a method is proposed for calculation of vertical integral or average fluxes. Examples are given of determination, from experimental data, of average vertical fluxes in the meridional cross-section in the region of equatorial anomaly. A technique is also proposed for calculation of two-dimensional potential fluxes from experimental RT data. Examples are presented illustrating the determination of two-dimensional plasma fluxes in meridional cross-section in the region of EA from experimental data. These methods make it possible to carry out a comparison of the fluxes calculated from models and those calculated from experimental data. In the future it seems promising to develop combinations of complementing each other approaches that are based on the analysis of experimental RT data and model approaches with mutual verification.