MUレーダー観測と数値モデルを用いた電離圏hmF2変動の研究

A study of the ionospheric hmF2 variations using the MU radar IS measurements and a theoretical model

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1986年から1995年までにMUレーダー観測によって得られたF層最大電子密度高度について、数値モデルとの比較がなされている。MUレーダー観測により得られた、ドリフト速度と子午面中性大気風速をモデル計算に用いることにより、観測されたF層最大電子密度高度の日変化、太陽活動度依存性、季節変化が再現されている。F層最大電子密度高度は、子午面中性大気風速の影響を強く受けていることが明らかにされている。また、酸素原子密度と中性大気・電離大気の温度のF層最大電子密度高度に対する影響も重要であることが示されている。

The ionospheric hmF2 variations, as measured over 1986-1995 by the MU radar, and as calculated with a theoretical model, are discussed. Given also are the measured ion drift velocities and the corresponding meridional neutral winds for understanding the dynamic behavior of the F2-layer. It is found that (1) hmF2 is generally higher in high solar activity (HSA) than in low solar activity (LSA), and higher in summer than in winter; (2) at HSA, hmF2 falls markedly in the morning and in the afternoon respectively, while at LSA, the hmF2 minimum occurs in the morning for summer and primarily in the afternoon for winter. In general, the measured height of the peak can be well reproduced in our modeling with the observed drift velocities and plasma temperatures as inputs. Modeling study shows that the neutral wind contributes largely to the hmF2 diurnal variations by lowering the ionization by day in winter, and particularly, for HSA; it also helps to enlarge the day-night difference of hmF2 in summer. The northward electromagnetic drifts that usually cancel the neutral effect have only a minor effect for this location of Shigaraki. Other features of the observed hmF2 variations, e.g., the HSA-LSA difference, the summer-winter difference, the morning and afternoon falls, have been explained basically by the O+ production, loss and diffusion processes influenced by atomic oxygen concentration, neutral and plasma temperatures.