Modeling the large scale irregularities in the F region polar ionosphere controlled by the solar wind

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The high latitude ionosphere is driven by both the magnetospheric and the solar UV inputs and, therefore, quite variable and poor predictable. The electric field of magnetospheric origin and energetic particle precipitations form the main large scale irregularities in the polar F region ionosphere. Empirical models are unable to describe these complex dependencies while physics-based mathematical models can be more successful in reproducing the large scale irregularities of plasma density. A new numerical model takes into account the solar wind parameters in which the flux tubes of plasma are followed as they convect and corotate through a moving neutral atmosphere for several hours. The main output is the 3-D electron density distribution at a specified time under a specified solar wind conditions. The global features such as the tongue of ionization, plasma cavity, polar and auroral peaks are reproduced and their evolution is quantified. Model electron density profiles are compared with the radar observations.