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Thermospheric wind and electromagnetic drift influence on the night-time ionosphere-plasmasphere interaction

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The ionosphere-plasmasphere interaction at the night side had been modeled by using the global numerical Upper Atmosphere Model (UAM). The global distributions of the electron density and the geomagnetic field-aligned plasma fluxes have been calculated with and without taking into account the thermospheric wind induced field-aligned ion transport and the electromagnetic drift of the plasma. The initial ionosphere and plasmasphere were supposed as fully depleted.
The model calculation without wind and drift shows that the H+ fluxes at the 1000 km directed from the plasmasphere to the night-time ionosphere are maximal at the subauroral latitudes ($\sim 55° \div 60°$) at the end of first twenty-four hours period of the integration. They form the enhanced electron density regions (EEDR's) in the F2-layer of the ionosphere at these latitudes due to the peculiarities of the geomagnetic field geometry. The vertical component of the field-aligned plasma pressure gradient decreases because of the inclination of the geomagnetic field decreases by the passage from subauroral to lower latitudes. The high-latitude geomagnetic force tubes are practically depleted due to the volumes of these tubes increase steeply. It results that the effectivity of the plasmasphere as a source of the plasma for the night-time ionospheric F2-layer are maximal at the subauroral latitudes after one day filling of the initially depleted plasmasphere.
The further periodic process of the filling and depletion of the plasmasphere results in decrease of the subauroral EEDR's and forming of the similar regions at the middle latitudes ($\sim 40° \div 45°$) by the end of third twenty-four hours period of the integration.
The model calculation with taking into account the magnetospheric origin electromagnetic drift of the plasma results in displacement of the high-latitude sides of the subauroral EEDR's to the lower latitudes. This effect has been explained by the forming of the main ionospheric through at the high latitudes.
The calculation with taking into account the thermospheric wind induced field-aligned ion transport shows that the middle-latitude EEDR's appear by the end of first day of the integration. The neutral wind hastens the process of the middle-latitude EEDR's forming due to the joint action of the plasma flows from the plasmasphere and the wind induced equatorward and upward transportation of the ionospheric plasma along the geomagnetic field lines.