## Supplementary Materials

The Harris-Priester (HP) model is based on the properties of the upper atmosphere determined using the solution of the heat conduction equation under quasi-hydrostatic conditions. While neglecting the explicit dependence of semi-annual and seasonal latitude variations, it has been extended to consider the diurnal density bulge[1][2]:



Where  and  are the unit position vector of the satellite and the unit vector to the apex of the diurnal vector, respectively;  and  are the antapex density and the apex density at a given height h, and are respectively calculated using:



where  satisfies , and



1. O. Montenbruck, E. Gill. Satellite orbits: Models, methods, and applications. Berlin: Springer; 2000.
2. I. Harris, W. Priester. Time-dependent structure of the upper atmosphere. Journal of the Atmospheric Sciences. 19 (1962) 286-301.