Is The Ionosphere Really Lower?

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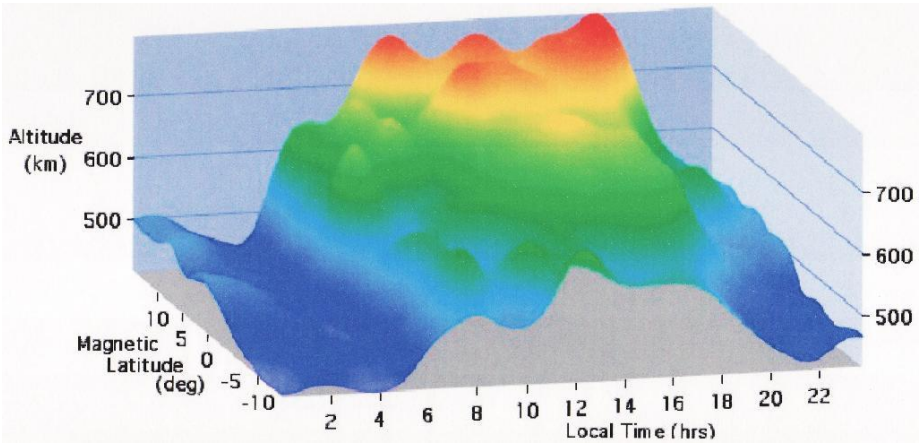
Recent press releases (two are cited at the bottom of this page) suggest that the ionosphere is lower than expected. If this were true, then one would surmise that HF propagation would be affected through shorter hops. But these press releases are somewhat misleading due to insufficient information given. Thus the goal of this paper is to give more details of the measurements, and then to answer the title question.

On April 17, 2008 the C/NOFS satellite was launched from Kwajalein Island in the Pacific Ocean. C/NOFS is an acronym for Communications / Navigation Outage Forecasting System. The mission of this satellite is to demonstrate a technique for locating and forecasting scintillations in the low latitude ionosphere, which are caused by ionospheric irregularities and lead to fluctuations in satellite-to-ground (and vice versa) communications at mostly UHF and L-band frequencies (GPS is one system affected).

The C/NOFS satellite was launched into a low inclination (13^o) elliptical orbit. Thus it hugs the equator, and its measurements are of the equatorial ionosphere – not the mid latitude or high latitude ionosphere. The apogee of the elliptical orbit is approximately 867 km and the perigee is approximately 401 km, which covers the diurnal altitude variation of the extremely dynamic equatorial ionosphere. These altitudes would generally be designated as the topside ionosphere (that portion of the ionosphere above the F_2 region peak) at mid and high latitudes. The image below is a sample measurement from the satellite.



The front axis is local time. The left side axis is magnetic latitude. The vertical axis (annotated in two places) is altitude in km. The color coding denotes the magnitude of the electron density. For this set of data, the electron density minimizes around 400 km during the night, and the maximum electron density is around 800 km during the daytime.

As stated in the press releases, the expected equatorial altitudes were 640 km (night) and 960 km (day). The lower-than-expected equatorial altitudes are what the press releases should have conveyed. Instead, the press releases made it sound as if the worldwide ionosphere was lower than expected – that is not so.

In summary, the data from the satellite is valid only for equatorial latitudes. Extrapolating these results to mid and high latitudes is not justified. In fact, ionosonde data confirms our understanding of the bottom side (what our HF propagation is dependent on) of the mid and high latitude ionosphere. Thus the impact of these high altitude equatorial measurements to our HF activities is likely to be minimal.

Space is just a little bit closer, BBC News, 21Dec08, **news.bbc.co.uk/2/hi/science/nature/7794834.stm**

NASA: Ionosphere not where it should be, UPI, 17Dec08, **www.tinyurl.com/3p2pcs**