Unusual martian ionospheric features

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MEX/VEX Radio Science Meeting
2010.08.03-04
Sugarbowl, Nevada
Typical description of vertical structure

MGS profile 0337M41A
Structure between M1 and M2

Other Double M2 Layer - i=180, orb=2453, sza=76.0, 2005-344

Two Slope Topside - i=174, orb=2435, sza=77.7, 2005-339
Structure in M2 layer

Classic Double M2 Layer - i=219, orb=2541, sza=66.2, 2006-004

Other Double M2 Layer - i=201, orb=2510, sza=69.9, 2005-360
Flat top on M2 layer

Flattop M2 layer - i=167, orb=2416, sza=79.4, 2005-334

- Flat top on M2 layer
- M2 layer
- M1 layer
Bulge in topside

Bulge -
i=301, orb=2840, sza=54.9, 2006-087

Bulge -
i=188, orb=2475, sza=73.8, 2005-350

M2 layer
M1 layer
Bulge
Bulge
M2 layer
M1 layer
Predictions of bulge

Feature not addressed in text of paper
I’m not sure what physical mechanism is responsible
Model says O2+ is dominant species at all altitudes

No bulge in ionization rate

Bulge in electron density

Figures 9 and 10 from Fox and Yeager (2006)
Topside regions

Figure 7 from Fox (2004)
• Structure between M1 and M2  
  – Not in other datasets, theoretical models  
• Structure in M2 layer (oscillations and flat top)  
  – Not in other datasets, theoretical models  
• Bulge  
  – Not discussed in papers, but perhaps visible in VL1 and some MGS profiles. Present but not discussed in Fox’s theoretical model  
• Three regions (distinct slopes) in topside  

• The presence and physical characteristics of M1 and M2 peaks are routinely used to infer properties of solar irradiance or conditions in neutral atmosphere or ionosphere  
• What do the presence and physical characteristics of these other features reveal?  
  Diagnostic?  
• Possible high profile “discovery paper”?  
• “Vertical structure of the ionosphere of Mars”  
• Need to collaborate with a theorist for interpretation