Ionosphere of Mars: Miscellaneous stuff

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Mariner 9 profiles recovered!
Comparing M1 and M2 layers
(Katy Fallows)

![Graph showing altitude vs. electron density. The graph includes lines labeled 'MGS Data', 'M2 Chapman fit', 'M1 Chapman fit', and 'Profile fit'.]
Average in 0.5° SZA bin

M2: \[ N = (1.69 \pm 0.09) \times 10^{11} \times \cos(\chi)^{0.45 \pm 0.03} \]

M1: \[ N = (0.67 \pm 0.07) \times 10^{11} \times \cos(\chi)^{0.40 \pm 0.06} \]
Average in 0.5° SZA bin

M2: \[ Z_{\text{peak}} = 129.15 + 6.02 \ln(\text{Ch}(\chi)) \]

M1: \[ Z_{\text{peak}} = 104.34 + 3.00 \ln(\text{Ch}(\chi)) \]
M1: \( H = 0.13 + 1.41 \times N \)

M2: \( H = 14.61 + -0.34 \times N \)

SZA: 74° – 75°
How Chapmanlike?
(Zachary Girazian)

\[ N_o = \sqrt{\frac{F}{\alpha eH}} \]

\[ N_o H^{0.5} \propto F^k \quad k \text{ should be } 0.5 \]

Morgan et al. (2008) MARSIS
What is best proxy for F?

MEX data for SZA < 80

Caution!
Best fit value for k keeps changing whenever we modify anything
Preliminary at best
Response to solar flares

Lollo et al. manuscript submitted to JGR-Space Physics on 22 November
What happens if we add H-species into our model?

Uncertainties in H₂ content and in a key reaction rate ($H^+ + H_2 \rightarrow H_2^+ + H$)

For some regions of parameter space, we find OH+ and related species dominant at high altitudes

Differs from the usual O₂+ and O+ dominance

Preliminary!
MARSIS gets blacked out during solar energetic particle (SEP) events
Simulations for an SEP event with and without photoionization. Dashed line is simple approximation (I think it does very well!)

Enhanced plasma at 70-100 km
Enhanced TEC
Massive radio wave absorption for MARSIS

Sheel et al. manuscript submitted to JGR-Space Physics on 15 Dec. (Needed some complicated simulations from Haider’s group)