Longitudinal structure in the martian upper atmosphere

Paul Withers,
Steve Bougher, and
Gerry Keating

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Conclusions

• Longitudinal structure is real
• Varies with latitude, LST, and possibly season, solar cycle
• Can be used to constrain middle and lower atmospheric properties with implications for surface processes
• Will lead to improved weather forecasts for upcoming landers and aerobraking missions
Phase 2, daytime inbound densities at 130 km
Wave fit ratioed to mean for 10 degree lat bins

(Ni) Latitude

0  30  60  90  120  150  180  210  240  270  300  330  360
Calculated Longitude (E)
Dotted lines = ±1 sigma uncertainty in fit
+ = MCS data, solid line = least squares wave−5 fit,
Calculated longitude (E)

Density (kg km⁻³)

15 to 25 N, 15.1 to 15.3 LST, 1998337 to 1998347
Phase 2, all orbits in altitude range: 7800 to 8435
Wave−5 fit to outbound density at 130 km

Thanks to Bob Tolson for help with curve fitting.
Wave-5 fit to outbound density at 130km
Phase 2, all orbits in latitude range: P800 to P845
15 to 25 'N, 15.1 to 15.3 LST, 1998337 to 1998345

Density (kg km⁻³)

Calculated Longitude (°E)

+ = MGS data, solid line = least squares wave-5 fit,
dotted lines = 1 sigma uncertainty in fit
Phase 2, all daytime orbits in latitude range 141°N to 146°S to 148°N.

Wave-5 fit to outbound density at 130km.
Wave-5 fit to inbound density at 130km
Phase 2, all nighttime orbits in latitude range: P1196 to P1218
-65 to -55 'N, 1.6 to 1.8 LST, 1999028 to 1999029

+ = MGS data, solid line = least squares wave-5 fit,
dotted lines = 1 sigma uncertainty in fit
Wave-5 fit to outbound density at 130km
Phase 2, all orbits in latitude range: P578 to P614
60 to 65 'N, 16.3 to 16.7 LST, 1998268 to 1998284

+ = MGS data, solid line = least squares wave-5 fit,
dotted lines = 1 sigma uncertainty in fit
Wave-5 fit to inbound density at 130km
Phase 1, all orbits in latitude range: P149 to P179
60 to 65 'N, 11.4 to 12.1 LST, 1998057 to 1998074

+ = MGS data, solid line = least squares wave-5 fit,
dotted lines = 1 sigma uncertainty in fit