Longitudinal structure in the martian upper atmosphere

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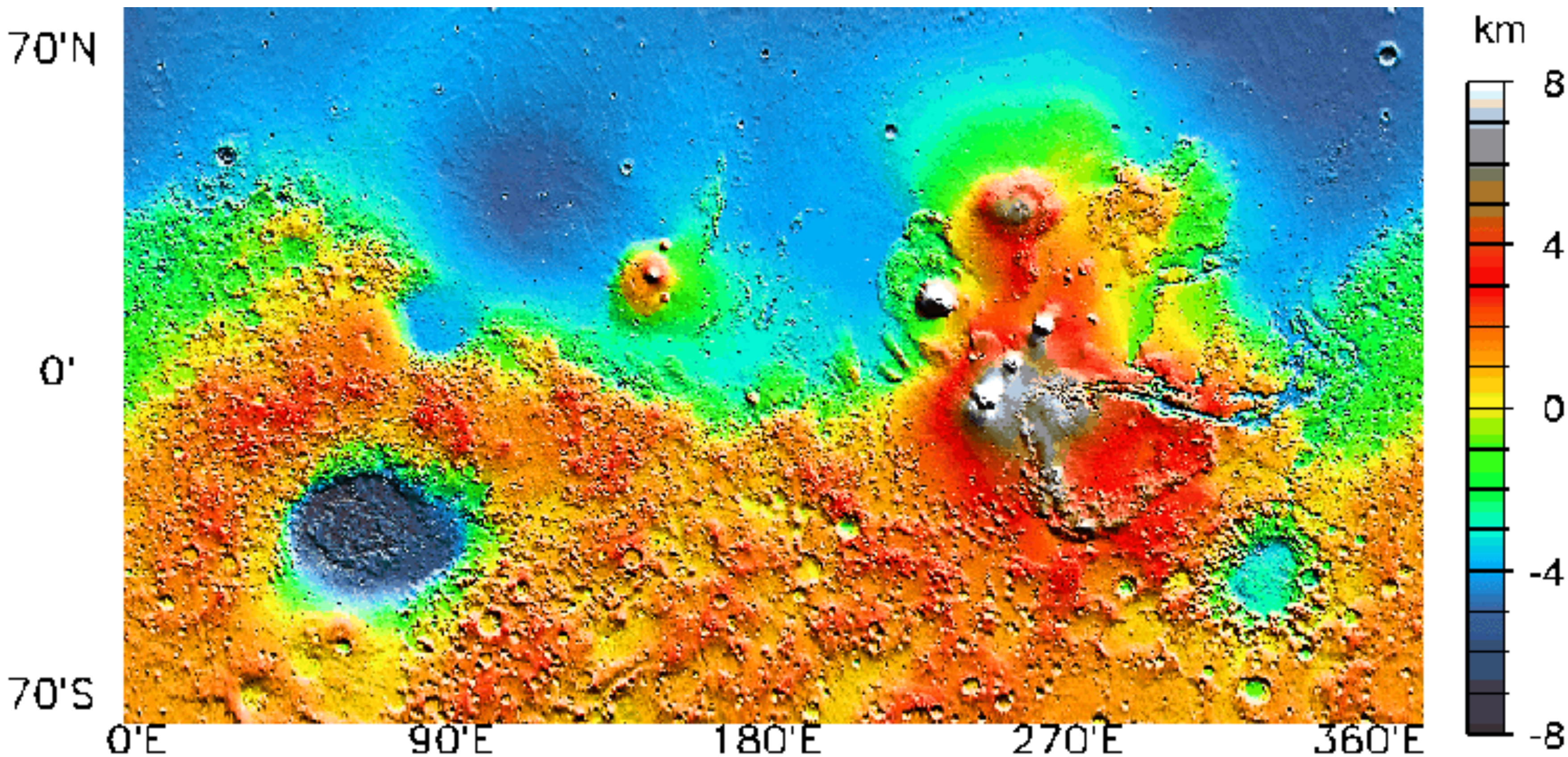
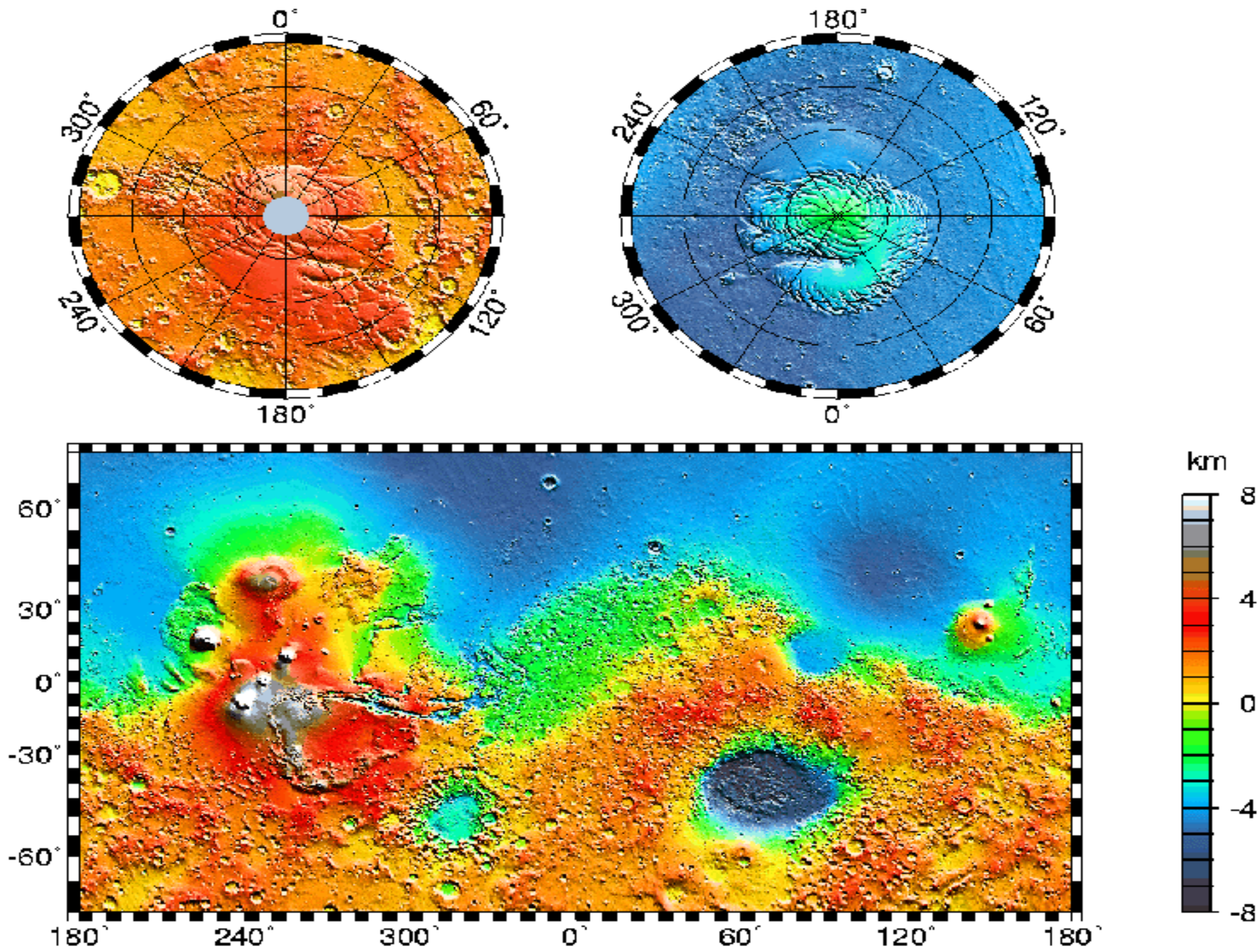
Conclusions

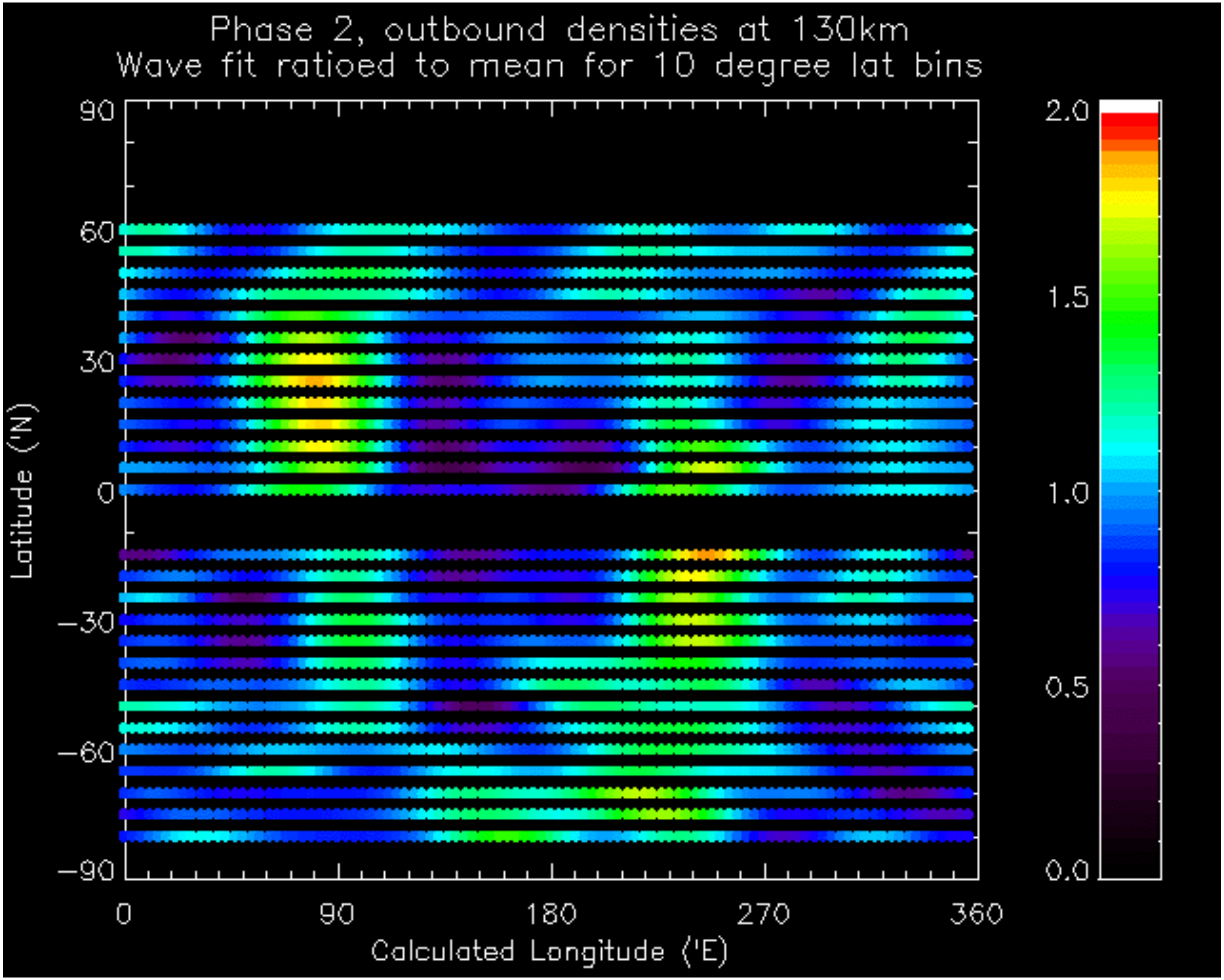
- Longitudinal structure is real
- Varies with latitude, LST, and possibly season, solar cycle
- Can be used to constrain middle and lower atmospheric properties with implications for surface processes
- Will lead to improved weather forecasts for upcoming landers and aerobraking missions

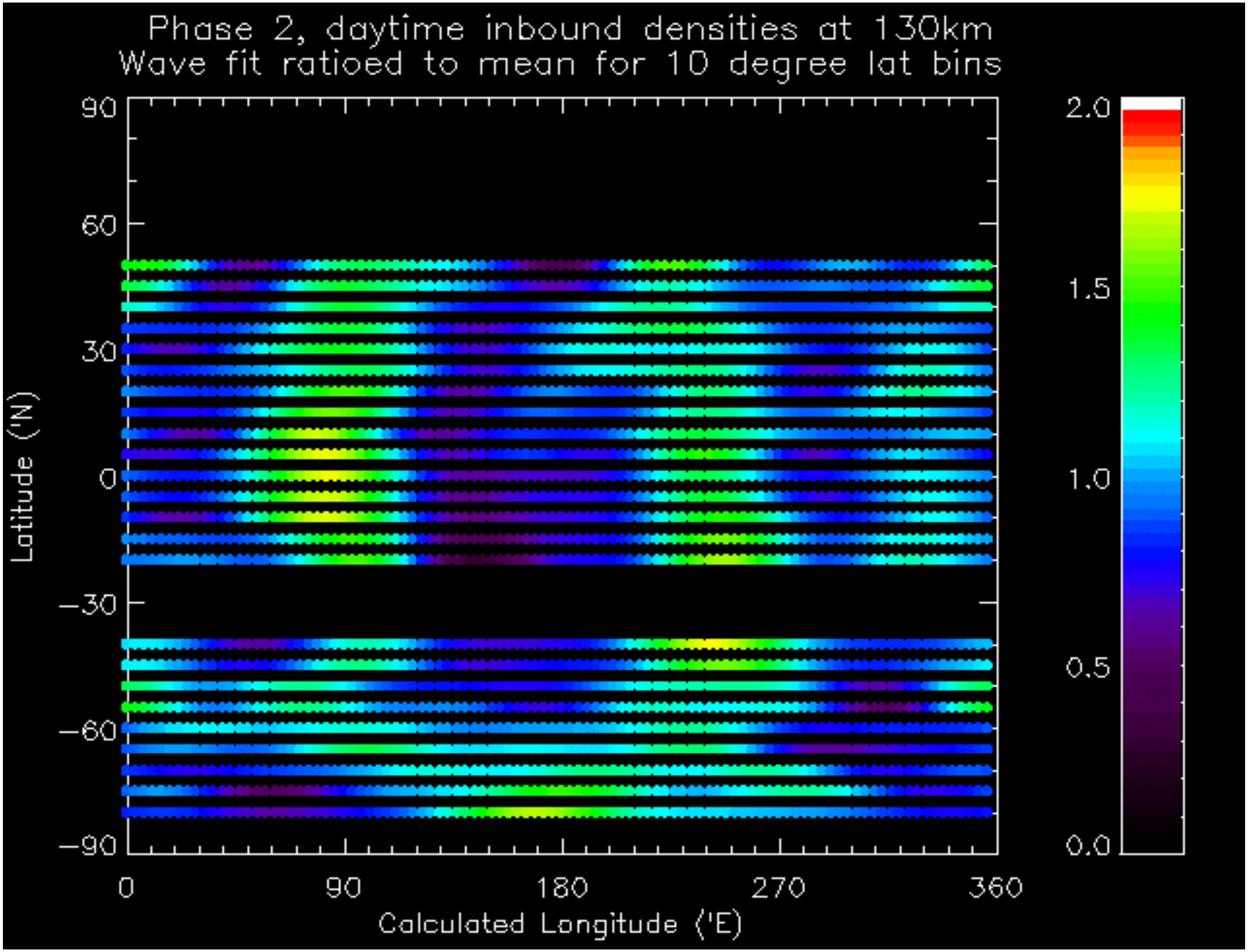


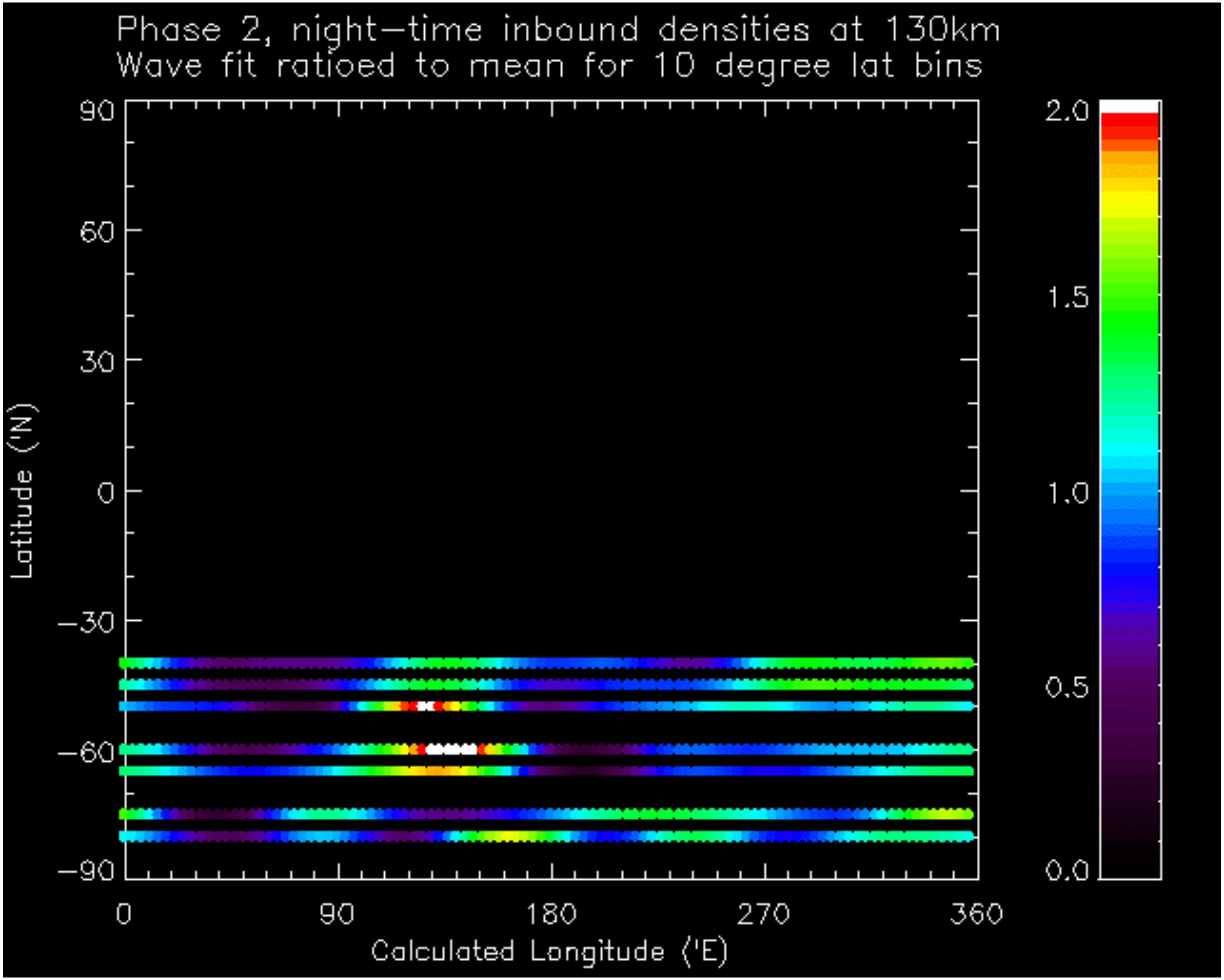
Smith, Zuber, et al topography, Science, 1999



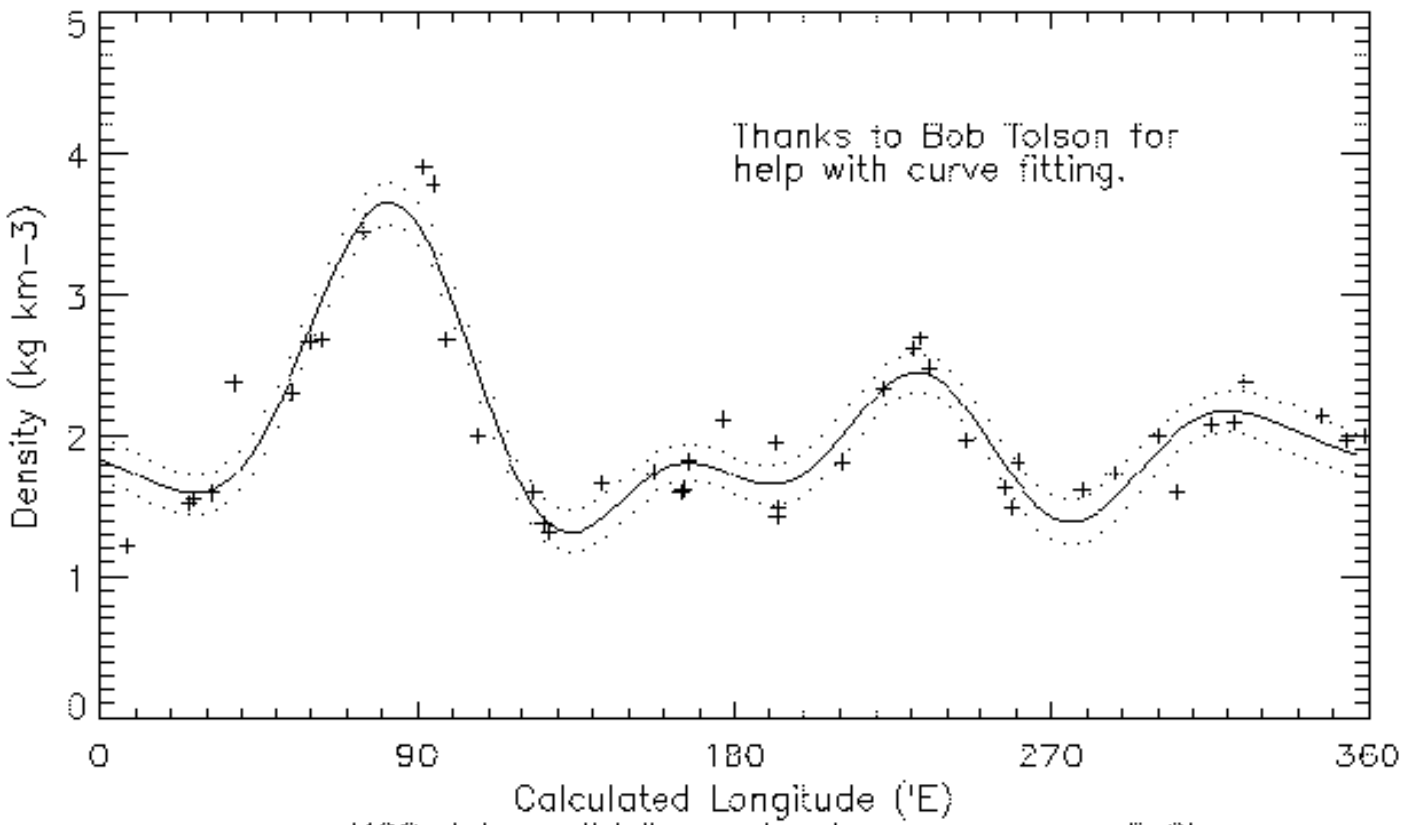
0°
300°
60°
240°
120°
180°
180°
240°
120°
300°
60°
0°
60°
30°
0°
-30°
-60°
180°
240°
300°
0°
60°
120°
180°
km
8
4
0
-4
-8


Phase 2, outbound densities at 130km
Wave fit ratioed to mean for 10 degree lat bins
Latitude ('N)
90
60
30
0
−30
−60
−90
0
90
180
270
360
Calculated Longitude ('E)
2.0
1.5
1.0
0.5
0.0

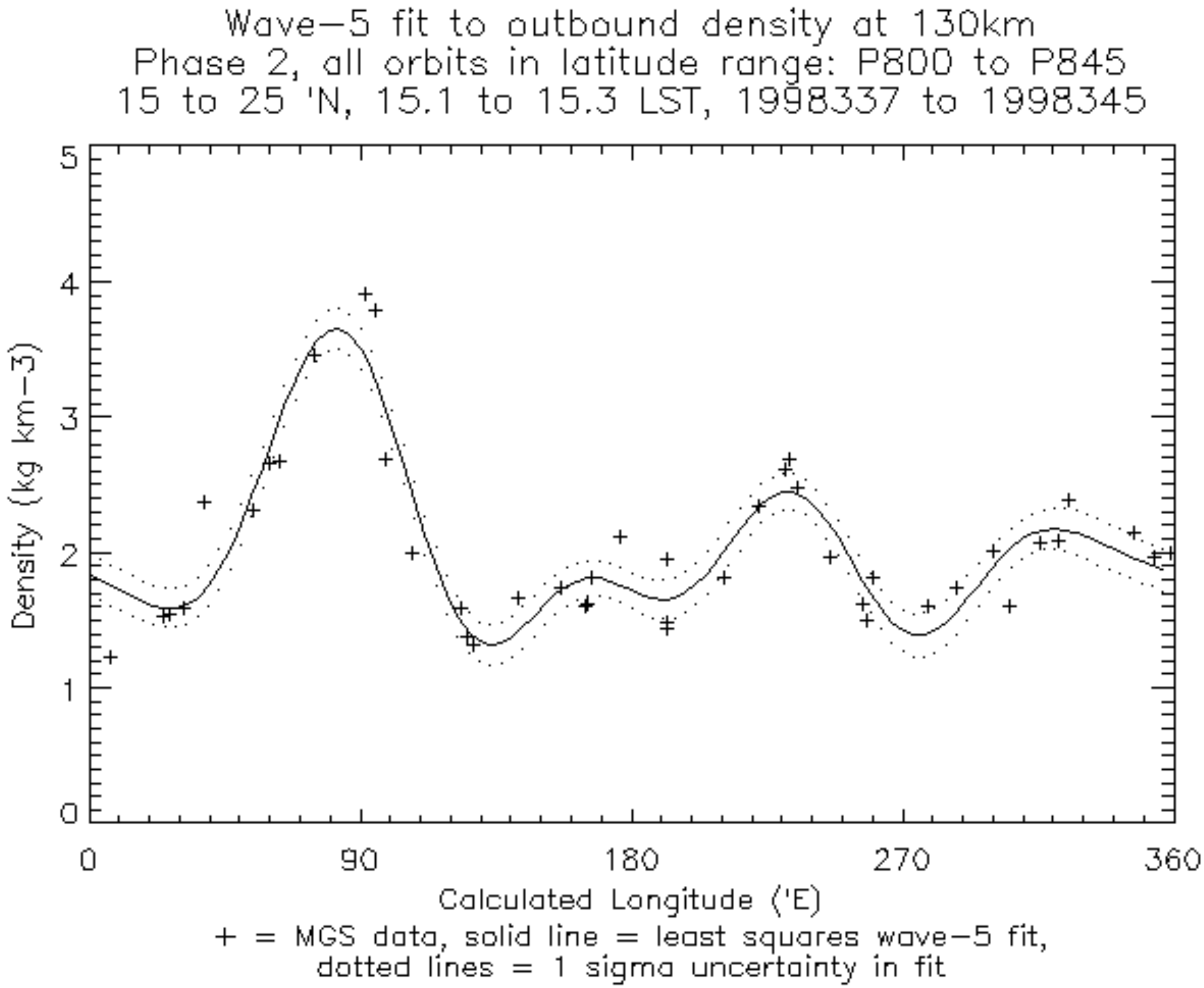

Phase 2, daytime inbound densities at 130km
Wave fit ratioed to mean for 10 degree lat bins
Latitude ('N)
90
60
30
0
−30
−60
−90
0
90
180
270
360
Calculated Longitude ('E)
2.0
1.5
1.0
0.5
0.0


Phase 2, night-time inbound densities at 130km
Wave fit ratioed to mean for 10 degree lat bins
Latitude ('N)
90
60
30
0
-30
-60
-90
0
90
180
270
360
Calculated Longitude ('E)
2.0
1.5
1.0
0.5
0.0

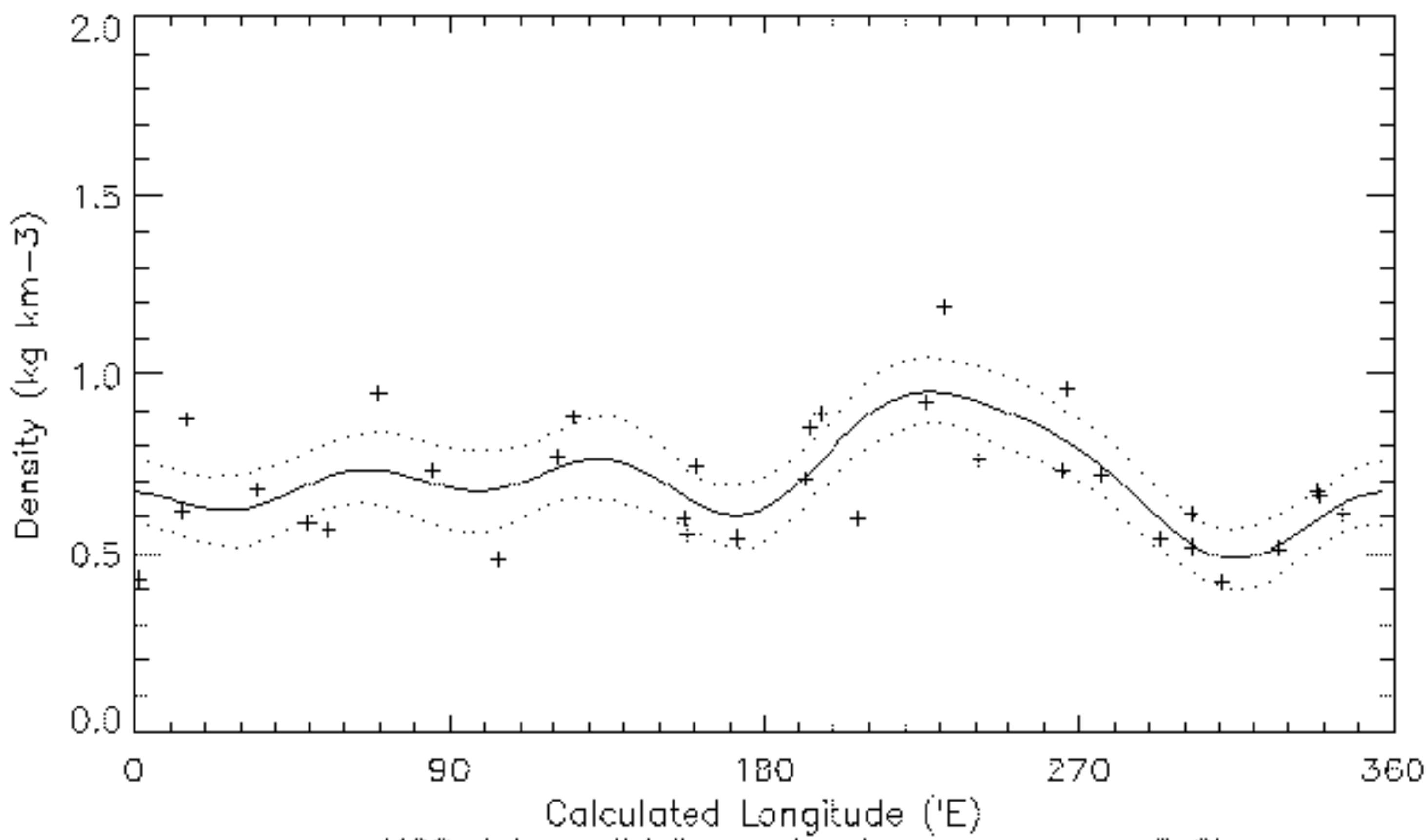
Wave–5 fit to outbound density at 130km
Phase 2, all orbits in latitude range: P800 to P845
15 to 25 'N, 15.1 to 15.3 LST, 1998337 to 1998345



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

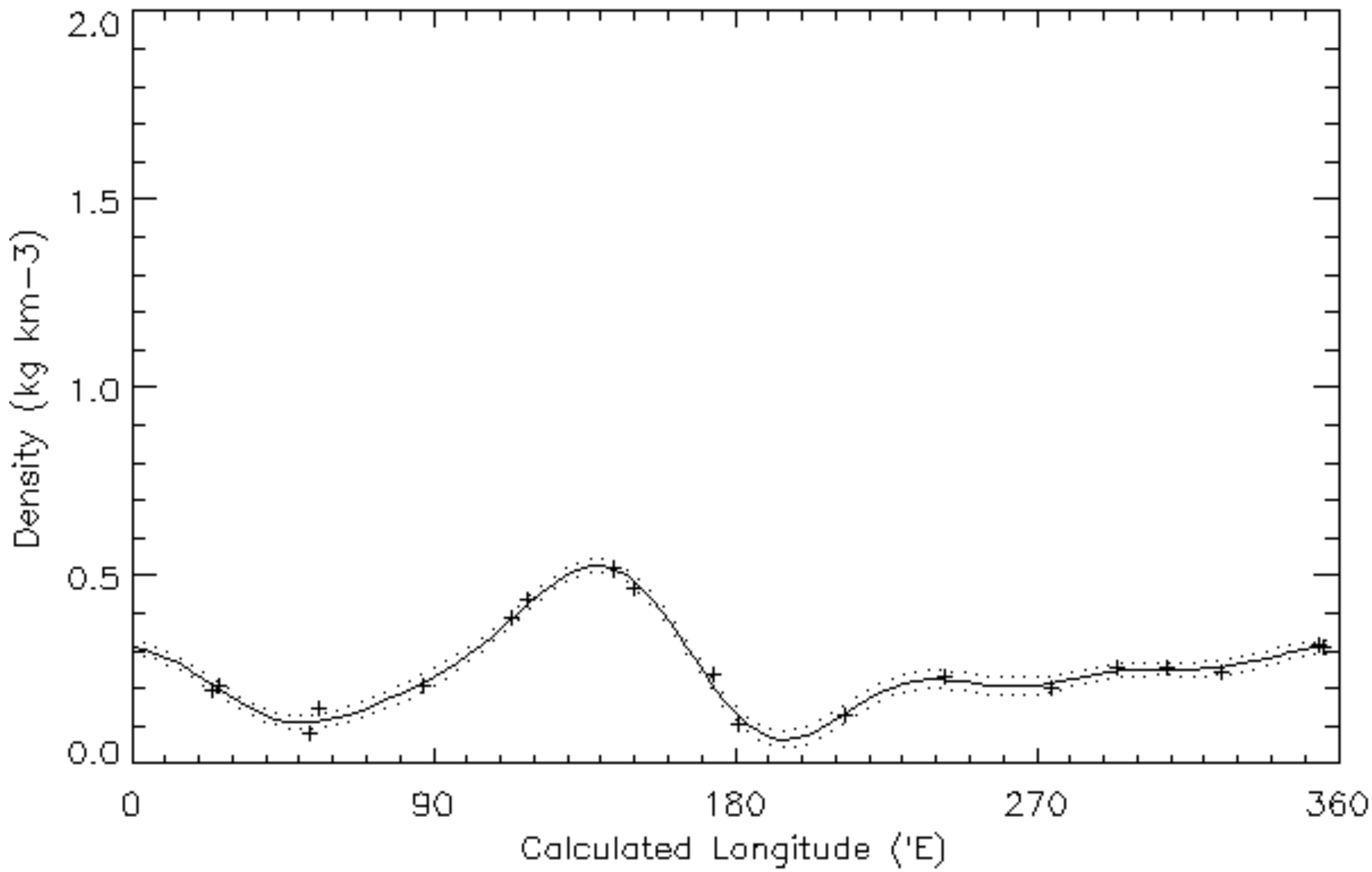

Wave−5 fit to outbound density at 130km
Phase 2, all orbits in latitude range: P800 to P845
15 to 25 'N, 15.1 to 15.3 LST, 1998337 to 1998345
Density (kg km−3)
0
1
2
3
4
5
0
90
180
270
360
Calculated Longitude ('E)
+ = MGS data, solid line = least squares wave−5 fit,
dotted lines = 1 sigma uncertainty in fit

Wave−5 fit to outbound density at 130km
Phase 2, all daytime orbits in latitude range: P1136 to P1173
−65 to −55 'N, 14.7 to 14.8 LST, 1999022 to 1999025



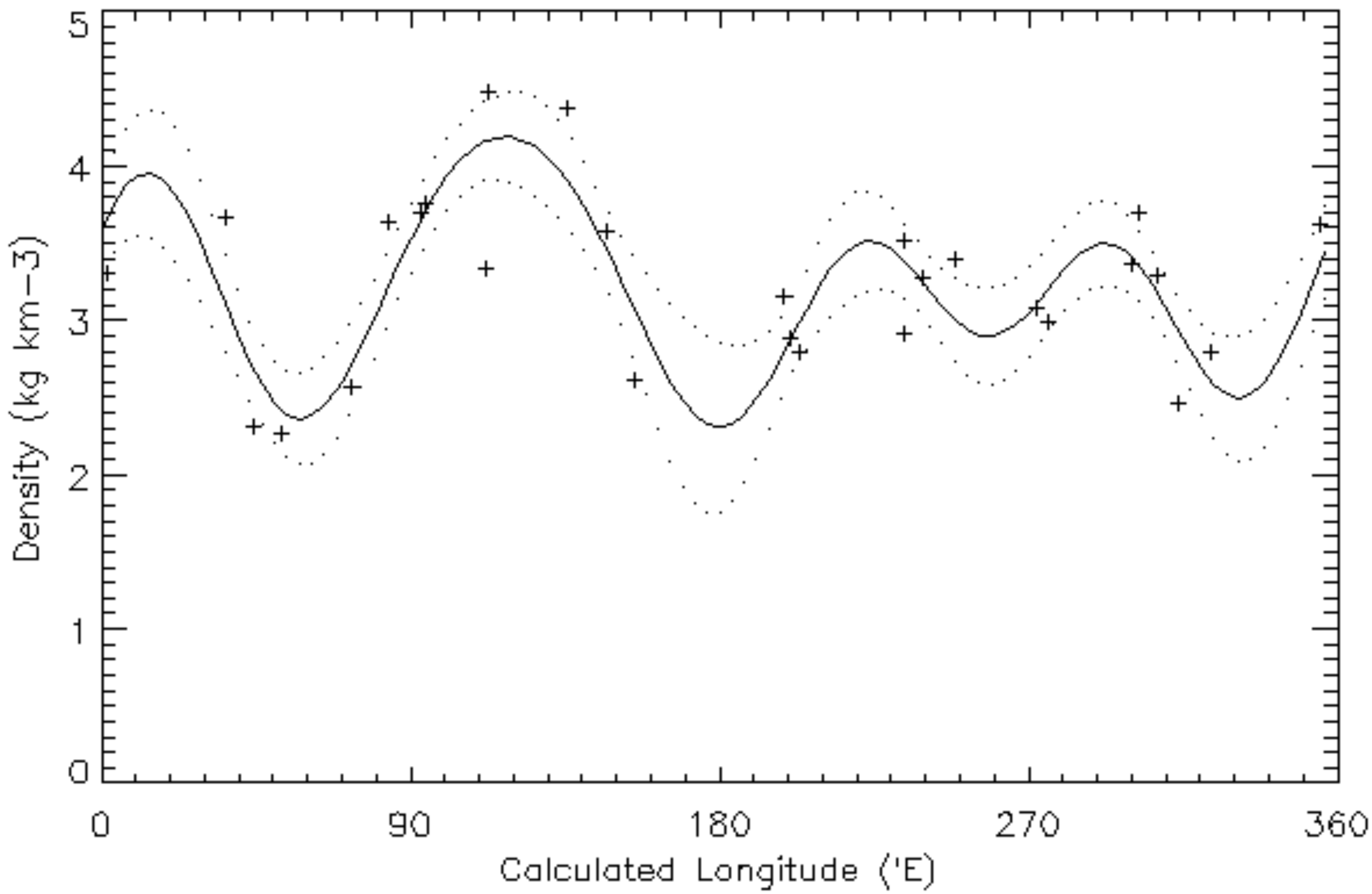
+ = MGS data, solid line = least squares wave−5 fit,
dotted lines = 1 sigma uncertainty in fit

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



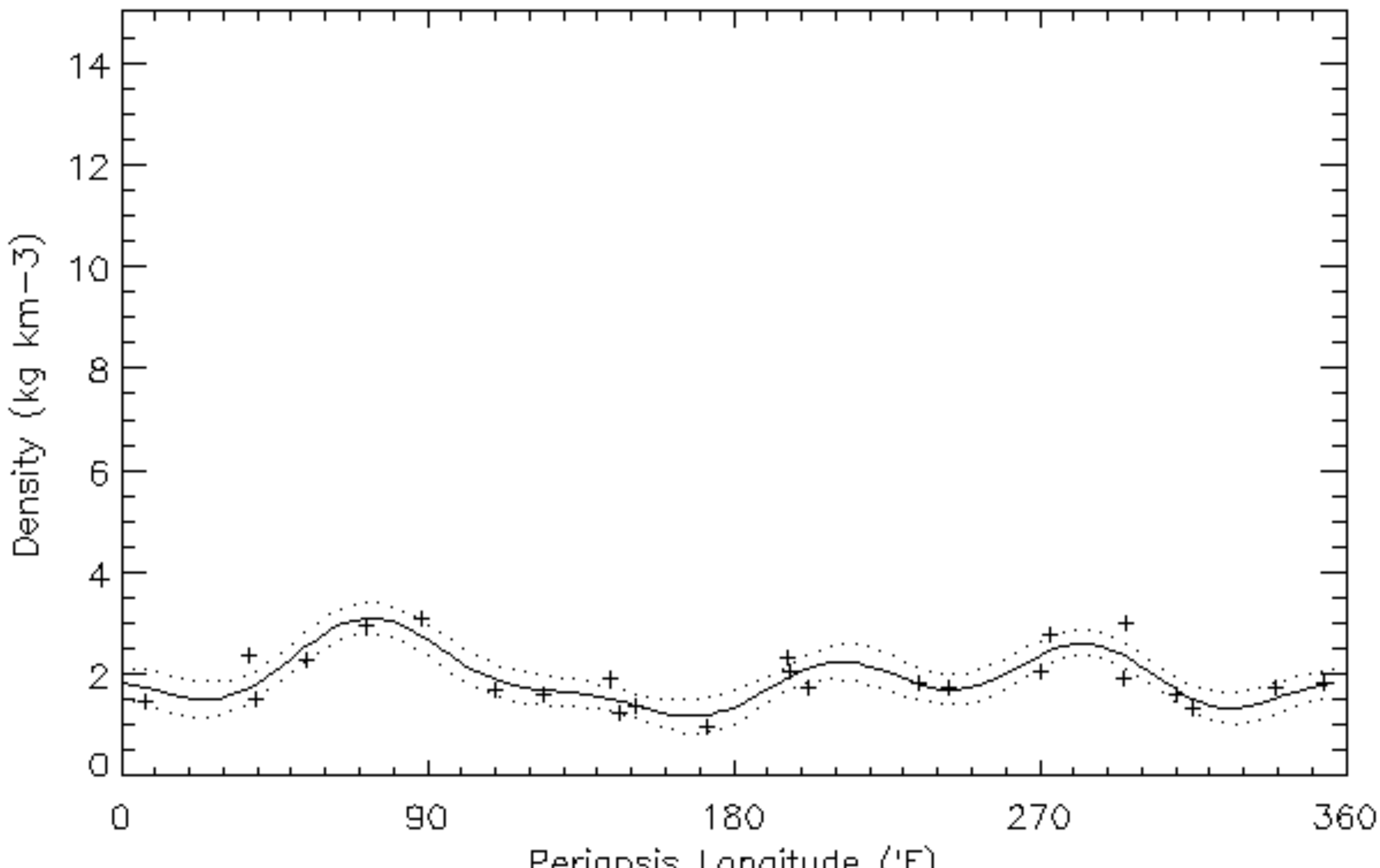
+ = MGS data, solid line = least squares wave−5 fit,
dotted lines = 1 sigma uncertainty in fit

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