

External Magnetic Fields at Mars

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Abstract

Mars, as an obstacle to the solar wind, combines regions of strong crustal fields and fields generated within the conducting ionosphere to stand off the incident solar wind flow. We analyze magnetic fields data from MAVEN to understand the contribution of draped magnetic fields at Mars so that they can be separated from crustal magnetic fields.

1. Introduction

There is significant interest in the magnetic fields originating from Mars' crust. These fields contain information about the evolution of the martian magnetic dynamo in the past as well as the time history of the martian crust. Mars, as an obstacle to the solar wind, combines regions of strong crustal fields and fields generated within the conducting ionosphere to stand off the incident solar wind flow. The contribution of the external fields needs to be well-understood in order to separate that component from the component coming from the crustal fields. We perform analyses of the magnetic fields measured by MAVEN to characterize the external fields at Mars and how they vary.

2. Data analysis

We analyze magnetic fields data from MAVEN to understand the morphology of draped magnetic fields at Mars so that they can be separated from crustal magnetic fields.

To isolate the external fields, we selected data in the northern hemisphere between 235° and 285° lng. This region has no crustal anomalies according to the Morschhauser magnetic field model [1]. The MAG data are binned by solar zenith angle and altitude. The resulting average magnetic field magnitude is shown in Figure 1. Interestingly, the peak in the magnetic field strength is observed between 300-400 km altitude on the dayside. Thus MGS data from the

mapping orbits contain relatively high contributions from external fields compared to data acquired at lower altitude. On the nightside, external fields from MGS mapping data have magnitudes of 15 nT on average.

Next, we select weakly magnetized regions and subtract the crustal magnetic field from the MAVEN MAG measurements before binning and averaging the magnetic field strength. We present the inferred external fields in comparison with the unmagnetized region.

Finally, we examine a strongly magnetized region in the same manner.

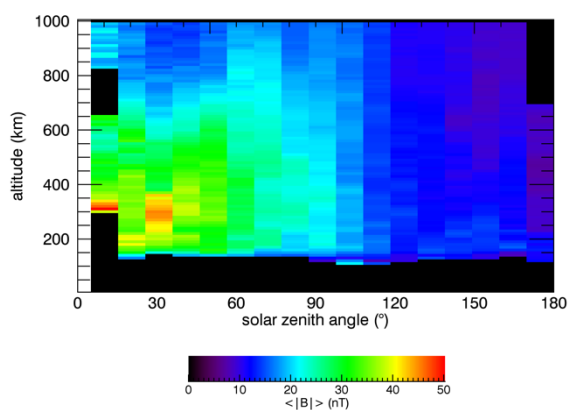


Figure 1: MAVEN magnetic field magnitude values above an unmagnetized region of the surface are shown as a function of solar zenith angle and altitude.

3. Summary and Conclusions

The analysis yields understanding of the magnitude of external magnetic fields in flight magnetometer measurements.

Acknowledgement

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References

[1] Morschhauser, A., V. Lesur, and M. Grott. A spherical harmonic model of the lithospheric magnetic field of Mars, *J. Geophys. Res. Planets*, 119, 1162–1188, doi:10.1002/2013JE004555, 2014.