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The Jovian thermospheric response to multiple solar wind shocks

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Abstract

Recent work presented in [1, 2] emphasised the importance of incorporating time-dependence in magnetosphere-ionosphere-thermosphere coupling when simulating this aspect of the Jovian system. We extend their model by simulating the response of thermospheric heating and aurorae to multiple shocks in the solar wind, by employing a configurable magnetosphere model coupled to an azimuthally symmetric general circulation model. We compare the ensuing response of thermospheric heating and cooling rates, and the resulting auroral signatures of these transient compressions and expansions of the Jovian magnetosphere (up to 40 Jovian radii) over a period of a few Jovian rotations. We find that Joule heating increases significantly, whilst heating due to ion drag, as well as atmospheric cooling rates, show large variations, dependent on the prescribed 'size' of the imposed transient event. This leads to local temperature increases, up to order $10\,\mathrm{K}$, and an increase in the rate of equatorward transport of heat [3], which persists spatially from the auroral regions of the model down to $40\,^{\circ}$ latitude.

References

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