Modeling The Thermospheric Response To Solar Flares

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Abstract. [1] Measurements of the incoming solar extreme ultraviolet (EUV) irradiance now allow models to be driven at higher temporal resolution and with better accuracy than with proxy‐based models. Using solar irradiance measurements from the Solar EUV Experiment (SEE) instrument to drive the Global Ionosphere‐Thermosphere Model, the global thermospheric response to the 28 October 2003 and 6 November 2004 solar flares is presented.

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Experiment (SEE) instrument to drive the Global Ionosphere-Thermosphere Model, the global thermospheric response to the 28 October 2003 and 6 November 2004 solar flares is presented. The model indicates that the thermospheric density at 400 km can increase by as much as 14.6% in under 2 hours because of the flare and takes 12 hours to settle to

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The model indicates that the thermospheric density at 400 km can increase by as much as 14.6% in under 2 hours because of the flare and takes 12 hours to settle to close to a nominal state. Intense dayside heating launches nightward propagating gravity waves that transport energy efficiently to the nightside at velocities near the local sound speed plus the bulk wind velocity.

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Merely said, the modeling the thermospheric response to solar flares is universally compatible considering any devices to read. A High Spatial Resolution Study of the Thermospheric Response to a Discrete Auroral Arc-R. W. Eastes 1989 A sequence of three high latitude passes by the De-2

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Modeling the thermospheric response to solar activity using the NORAD satellite catalogue ... In particular, we examine the ability of current atmospheric models to reproduce the response of the thermospheric density field to variations of solar activity on short (days) through long (solar cycle) timescales.

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We conduct observational and modeling studies of thermospheric composition responses to weak geomagnetic activity (nongeomagnetic storms). We found that the thermospheric O and N 2 column density ratio (∑O/N 2) in part of the Northern Hemisphere measured by Global‐scale Observations of the Limb and Disk (GOLD) exhibited large and long‐lived depletions during weak geomagnetic activity in May and June 2019.

~~The Two‐Dimensional Evolution of Thermospheric ∑O/N2 ...~~

ionospheric response, but the thermospheric response was 20 min faster for the disk‐ center flare. Model simulations of I/T responses to an X17 flare on 28 October 2003 were consistent with measurements of TEC and neutral density changes. Citation: Qian, L., A. G.

~~Flare location on the solar disk: Modeling the ...~~

To simulate the response, a coupled thermosphere ionosphere model was driven by an empirical substorm model designed to follow the various phases of the substorms. By tuning the magnitude of the energy injection and, in one case, rotating the spatial distribution of the sources, both the wave features on the day and nightside, and the neutral density holes were reproduced.

~~Modeling thermospheric neutral density waves and holes in ...~~

Thermospheric response to ion heating Our aim is to use the model described above to reproduce the neutral density enhancements observed by Lühr et al. (2004) . An issue of key importance is how to introduce the heating necessary to cause thermospheric upwelling.

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Modeling the Ecological Response of a Temporarily Summer-Stratified Lake to Extreme Heatwaves . by Weiyu Chen 1,2,*, Anders Nielsen 2, Tobias Kuhlmann Andersen 2,3, Fenjuan Hu 2, Qingchuan Chou 2,4,5, Martin Søndergaard 2, Erik Jeppesen 2,3 and Dennis Trolle 2,3. 1.

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Modeling the thermospheric response to solar flares - NASA/ADS In particular, we examine the ability of current atmospheric models to reproduce the response of the thermospheric density field to variations of solar activity on short (days) through long (solar cycle) timescales.

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Here we address this question by exploring theoretically the processes that determine the MLT wind response to storms at middle latitudes. During the early phase of the storm, the middle‐latitude upper thermospheric wind changes are greater and occur earlier than those in the MLT region.

~~A Modeling Study of the Responses of Mesosphere and Lower ...~~

Published by the American Geophysical Union as part of the Geophysical Monograph Series, Volume 201. Modeling the Ionosphere-Thermosphere System brings together for the first time a detailed description of the physics of the IT system in conjunction with numerical techniques to solve the complex system of equations that describe the system, as well as issues of current interest.

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Only recently have studies been performed to quantify the thermospheric response to flares using observations and modeling [e.g., Sutton et al., 2006; Liu et al., 2007; Pawlowski and Ridley, 2008 ...

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Published by the American Geophysical Union as part of theGeophysical Monograph Series, Volume 201. Modeling the Ionosphere-Thermosphere System bringstogether for the first time a detailed description of the physicsof the IT system in conjunction with numerical techniques to solvethe complex system of equations that describe the system, as wellas issues of current interest. Volume highlights includediscussions of: Physics of the ionosphere and thermosphere IT system, and thenumerical methods to solve the basic equations of the ITsystem The physics and numerical methods to determine the globalelectrodynamics of the IT system The response of the IT system to forcings from below (i.e., thelower atmosphere) and from above (i.e., the magnetosphere) The physics and numerical methods to model ionosphericirregularities Data assimilation techniques, comparison of model results todata, climate variability studies, and applications to spaceweather Providing a clear description of the physics of this system inseveral tutorial-like articles, Modeling theIonosphere-Thermosphere System is of value to the upperatmosphere science community in general. Chapters describingdetails of the numerical methods used to solve the equations thatdescribe the IT system make the volume useful to both activeresearchers in the field and students.

A sequence of three high latitude passes by the De-2 spacecraft has been studied using high spatial resolution data from several instruments to investigate the local thermospheric response to a discrete auroral arc. Three passes, orbits 1847, 1848, and 1849, which occurred on 6 December 1981, cross an isolated, discrete arc in the evening auroral oval. Observations of neutral winds, ion winds, neutral densities, energetic electron spectrum, and neutral temperatures were examined at a spatial resolution of approximately approx. 8 km. The observations illustrate the response of the thermosphere to the local insertion of energy and momentum and provide the basis for a more critical test of the various theoretical models that have predicted local thermospheric phenomena. The results are presented and discussed in relation to the predictions of three such local models.

One of the most significant results to emerge from this contract is the systems theory approach to thermospheric dynamics which was developed as part of the Dissertation research of Mihail Codrescu, a Ph. D. student supported by AFOSR. The basic components of the computational approach are a piecewise linearization method capable of preserving nonlinear features of a dynamical system (in this case, the NCAR TIGCM), and a response function 'library' consisting of quasi-steady state and sample response functions characteristic of the system. A typical usage would be approximating the dynamical thermospheric response to an arbitrary change in forcing by performing a specialized convolution between the specified forcing and an appropriate set of response functions from the 'library'. This methodology may provide the basis for computationally efficient real-time (operational) predictions without on-line use of a TIGCM.

Published by the American Geophysical Union as part of the Geophysical Monograph Series, Volume 44. Existing models of the plasma distribution and dynamics in magnetosphere / ionosphere systems form a patchwork quilt of different techniques and boundaries chosen to define tractable problems. With increasing sophistication in both observational and modeling techniques has come the desire to overcome these limitations and strive for a more unified description of these systems. On the observational side, we have recently acquired routine access to diagnostic information on the lowest energy bulk plasma, completing our view of the plasma and making possible comparisons with magnetohydrodynamic calculations of plasma moments. On the theoretical side, rising computational capabilities and shrewdly designed computational techniques have permitted the first attacks on the global structure of the magnetosphere. Similar advances in the modeling of neutral atmospheric circulation suggest an emergent capability to globally treat the coupling between plasma and neutral gases. Simultaneously, computer simulation has proven to be a very useful tool for understanding magnetospheric behaviors on smaller space and time scales.

The Earth's atmosphere is often portrayed as a thin and finite blanket covering our planet, separate from the emptiness of outer space. In reality, the transition is gradual and a tiny fraction of the atmophere gases is still present at the altitude of low orbiting satellites. The very high velocities of these satellites ensure that their orbital motion can still be considerably affected by air density and wind. This influence can be measured using accelerometers and satellite tracking techniques. The opening chapters of this thesis provide an excellent introduction to the various disciplines that are involved in the interpretation of these observations: orbital mechanics, satellite aerodynamics and upper atmospheric physics. A subsequent chapter, at the heart of this work, covers advances in the algorithms used for processing satellite accelerometry and Two-Line Element (TLE) orbit data. The closing chapters provide an elaborate analysis of the resulting density and wind products, which are generating many opportunities for further research, to improve the modelling and understanding of the thermosphere system and its interactions with the lower atmosphere, the ionosphere-magnetosphere system and the Sun.

The NATO ASI held in the Geophysical Institute, University of Alaska Fairbanks, June 17-28, 1991 was, we believe, the first attempt to bring together geoscientists from all the disciplines related to the solar system where fluid flow is a fundamental phenomenon. The various aspects of flow discussed at the meeting ranged from the flow of ice in glaciers, through motion of the solar wind, to the effects of flow in the Earth's mantle as seen in surface phenomena. A major connecting theme is the role played by convection. For a previous attempt to review the various ways in which convection plays an important role in natural phenomena one must go back to an early comprehensive study by 1. Wasiutynski in "Astro physica Norvegica" vo1. 4, 1946. This work, little known now perhaps, was a pioneering study. In understanding the evolution of bodies of the solar system, from accretion to present-day processes, ranging from interplanetary plasma to fluid cores, the understanding of flow hydrodynamics is essentia1. From the large scale in planetary atmospheres to geological processes, such as those seen in magma chambers on the Earth, one is dealing with thermal or chemical convection. Count Rumford, the founder of the Royal Institution, studied thermal convection experimentally and realized its practical importance in domestic contexts.

Measurements from the accelerometer experiments on four low-altitude satellites (S3-1 and Atmosphere Explorer-C, -D, and -E) have been combined to produce an empirical model of the neutral mass density from 140 to 240 km. Data from over a 8000 orbits are analyzed using the least-squares method of multiple linear regression. The resulting model gives density as a function of solar flux (for flux values 60 to 130 units), geomagnetic activity, day of year, local time, latitude and altitude. It provides a more accurate fit to the measured data than other available atmospheric models. Three commonly used models are evaluated by comparison of their predicted density variations with those of this empirical model.

Published by the American Geophysical Union as part of the Geophysical Monograph Series, Volume 87. This volume provides a review of progress made in recent years in experimental and theoretical investigation of the upper mesosphere and lower thermosphere and coupling between these regions and the ionosphere. Detailed study of the mesosphere/lower thermosphere/ionosphere (MLTI) region has historically been difficult because of its relative inaccessibility to direct measurement techniques and the complex and highly coupled processes which occur there. Although we have still not successfully unraveled all these complex interactions, we have made significant recent progress toward a fuller understanding of the basic state of the MLTI and of the dominant wave and coupling processes. This monograph includes a set of tutorial papers, which review our current understanding of aspects of the MLTI. These tutorials are interspersed with a selection of papers describing research progress on various topics of current interest in this region. The book should therefore be useful both to the newcomer, as an introduction to this field of research, and to the more experienced researcher, providing an overview of research in progress as well as a convenient reference collection of papers describing our current understanding.