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## Preface

This special issue of the Journal of Atmospheric and Solar-Terrestrial Physics includes selected papers presented in the 3<sup>rd</sup> IAGA/ICMA Workshop on “Vertical Coupling in the Atmosphere-Ionosphere System”. The workshop was hosted by the Geophysical Institute, Bulgarian Academy of Sciences, and held near Varna, Bulgaria, from September 18 to 22, 2006. The Programme Committee consisted of Dora Pancheva, Franz-Josef Lübken, Jan Lastovicka, Kevin Hamilton and Robert Vincent, whereas the Local Organizing Committee was chaired by Nikolay Miloshev. The meeting was sponsored by the International Association of Geomagnetism and Aeronomy (IAGA), the International Commission on the Middle Atmosphere (ICMA), the International Union of Geodesy and Geophysics (IUGG), the International Union of Radio Science (URSI), and the US Air Force European Office for Aerospace and Development (EOARD). The 3<sup>rd</sup> IAGA/ICMA workshop was attended by 77 senior and young scientists from 17 countries, and during its 5 days, a total of 85 papers were presented from which 34 were invited contributions.

The Earth’s upper atmosphere, which includes also the ionosphere embedded in the thermosphere, is a complex physical system influenced by solar and magnetospheric processes from above, and upward propagating disturbances from below. The vertical coupling of the atmosphere/ionosphere system is caused by dynamical, aeronomical, electrodynamical, and plasma physical processes that can act alone or jointly. Understanding the details of these processes remains a major challenge for the atmospheric and space scientists. The aim of this workshop was not only to address the forcing mechanisms that originate in the lower atmosphere and play an important role in the upper atmosphere and ionosphere, but also to find solutions to some of the problems identified during the 2<sup>nd</sup> IAGA/ICMA Workshop held two years ago in Bath, UK.

The meeting brought together experts from the neutral atmosphere and ionosphere community to present and discuss their new findings and to assess/debate ongoing issues relating to theoretical, modelling and observational aspects of the mechanisms that transfer energy and momentum from the lower atmosphere to the upper atmosphere and ionosphere and vice versa. The 3<sup>rd</sup> IAGA/ICMA Workshop provided an excellent opportunity to review the progress made to date in the field of atmosphere-ionosphere physics and to identify future directions of research. Also, the interaction between the atmospheric and ionospheric scientists resulted in a better physical understanding of the coupling processes in the upper atmosphere.

To summarize the state of knowledge and to outline the most relevant research trends, the scientific programme addressed several aspects of neutral dynamics of the middle and upper atmosphere, including problems of chaos and turbulence, as well as atmospheric electricity, ionospheric electrodynamics and plasma physics. The workshop topics included:

### 1) Coupling processes in the middle atmosphere

- Stratosphere-troposphere coupling and its effect on climate change
- Coupling through planetary waves, mean flows and temperature variability
- Stratosphere-mesosphere coupling during stratospheric warming events
- Nonlinear interactions between different waves and their impact on the variability of the wave populations
- Gravity wave and tidal forcing of the middle atmosphere; new results on nonmigrating tides

- The role of dynamics, solar variability and greenhouse gasses on the chemical structure and feedback processes, including the atmospheric response to solar proton events

## 2) Coupling processes in the atmosphere/ionosphere system

- Dynamical forcing of the ionosphere from below; the mesosphere-lower thermosphere wave seeding (wave penetration and secondary wave generation) of ionospheric disturbances; dynamical control and tidal variability of mid-latitude sporadic E layers
- Thermosphere/ionosphere coupling by gravity waves
- Electrodynamical coupling and plasma instabilities; dynamical forcing of the equatorial irregularities with emphasis on equatorial Spread F.
- Electrical coupling of the atmosphere-ionosphere system; the role of lightening on transient luminous events, like sprites and elves

This special JASTP issue publishes 27 papers from those presented at the Varna Workshop. The guest editors wish to thank all the authors for their contributions, and express their gratitude to all the reviewers listed below, for their help in the evaluation of the science incorporated in the present papers. We also thank John Plane, the JASTP Editor-in-Chief, and his assistant Meta Ottevangner for their guidance throughout the evaluation process.

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