PERGAMON

Journal of Atmospheric and Solar-Terrestrial Physics 65 (2003) 497–498

Journal of ATMOSPHERIC AND SOLAR-TERRESTRIAL PHYSICS

www.elsevier.com/locate/jastp

Editorial

# Special Issue on Sprites, Elves and their global activities Frankfurt am Main, Germany, 10 September 2002

Particularly intense lightning discharges can produce transient optical emissions above thunderclouds. The most popular of these transient luminous events are denoted sprites, elves, and blue jets. As optical observations above thunderclouds continued, many more distinct emissions were reported in the scientific literature, for example sprite halos. Optical recordings on board the Space Shuttle detected sprite occurrences in many areas around the world. These reports led to observations of sprites and elves over the continents in North America, South America, Australia, Asia, and Europe but also over the Pacific Ocean. Most recently, an upward lightning discharge was discovered in the tropics near Puerto Rico and it is now evident that sprite and elve occurrences are a global phenomenon. The possible electrical shortcut between the troposphere and the ionosphere via particular intense sprites has sparked large interest to investigate the role of sprites as a missing element in the global atmospheric electric circuit and to consider in more detail lower thermospheric ionisation from intense lightning electromagnetic pulses, imaged as elves. The temporal and spatial occurrence distribution of sprites and elves on the planetary scale and their globally varying physical characteristics is of particular interest. It is expected that in the coming years, a wealth of space borne sprite observations from the International Space Station, the Space Shuttle, and the ROCSAT and TARANIS satellites will become available, and it is the major purpose of this Special Issue on 'Sprites, Elves, and their global activities' in the Journal of Atmospheric and Solar-Terrestrial Physics to demonstrate arising opportunities from further observations of sprites, elves, and intense lightning discharges in their globally varying environment, as, for example, their impact on global atmospheric chemistry.

During the first Asia-Pacific Radio Science Conference 2001 (AP-RASC '01) in Tokyo, Japan, three sessions were devoted to 'Sprites, Elves, and their global activities', specifically aimed for contributions from young researchers. This concept was strongly supported by senior scientists and the guest Editors are particularly indebted to the advise and encouragement of Zen Kawasaki and Kristian Schlegel. The resulting paper collection in this Special Issue is divided in four thematic sections: The first section is concerned with the initiation of sprites by vertical and horizontal lightning discharges and explores possible influences from the natural atmospheric composition variability on sprite initiation, which is a pioneering and hence controversial topic. The second section reports optical sprite observations in Asia and over the Pacific Ocean along with arising opportunities from optical measurements with high temporal and spatial resolution. Subsequently, ionospheric heating and electromagnetic wave propagation phenomena associated with sprites, elves, and intense lightning discharges are considered in the third section. The final fourth section is thought to be a vision of the future with space borne sprite observations on the Space Shuttle, and the ROCSAT satellite.

Sprite and elve observations on board orbiting spacecraft, such as the International Space Station, provide the unique opportunity to assess sprite and elve occurrences in remote areas of the world, for example in the tropics and over the oceans. These observations will provide an improved understanding on the physics of sprites and elves under globally variable atmospheric conditions in various environments and will reveal the role of sprites in the global atmospheric electric circuit and the role of elves for ionospheric modification.

**Table of contents**

**1. Sprite initiation**



1364-6826/03/$ - see front matter 
doi:10.1016/S1364-6826(02)00319-X

Simultaneous observations of mesospheric gravity waves and sprites generated by a midwestern thunderstorm

## 2. Optical observations

- Yukihiro Takahashi, R. Miyasato, T. Adachi, K. Adachi, M. Sera, A. Uchida and H. Fukunishi,
  Activities of sprites and elves in the winter season, Japan
- R.R. Su, H.T. Su, A.B. Chen, L.C. Lee, M. Asfur, C. Price and Y. Yair,
  Transient luminous events in the vicinity of Taiwan
- Elizabeth A. Gerken and Umran S. Inan,
  Observations of decameter-scale morphologies in sprites
- Rina Miyasato, H. Fukunishi, Y. Takahashi and M.J. Taylor,
  Energy estimation of electrons producing sprite halos using array photometer data
- E. Bucsela, J. Morrill, M. Heavner, C. Siefring, S. Berg, D. Hampton, D. Moudry, E.M. Wescott and D.D. Sentman
  $N_2(B^3\pi_g)$ and $N_2^+(A^2\pi_u)$ vibrational distributions observed in sprites

## 3. Electromagnetics

- Craig J. Rodger,
  Subionospheric VLF perturbations associated with lightning discharges
- Mitsuteru Sato, H. Fukunishi, M. Kikuchi, H. Yamagishi and W.A. Lyons,
  Validation of sprite-inducing cloud-to-ground lightning based on ELF observations at Syowa station in Antarctica
- Isamu Nagano, S. Yagitani, K. Miyamura and Satoshi Makino,
  Full-wave analysis of elves created by lightning-generated electromagnetic pulses
- Oleg V. Soloviev,
  3D modelling of VLF radio wave propagation in terrestrial waveguide allowing for localized large-scale ionosphere perturbation

## 4. Instruments

- Yoav Yair, C. Price, Z. Levin, J. Joseph, P. Israelevitch, A. Devir, M. Moalem, B. Ziv, M. Asfur,
  Sprite observations from the space shuttle during the Mediterranean Israeli dust experiment (MEIDEX)
- Jun'ichi Kurihara, K.-I. Oyama and Y. Takahashi,
  Development of a spectrometer to measure the blue components of sprites
- J.L. Chern, R.R. Hsu, H.T. Su, L.C. Lee, S.B. Mende, H. Fukunishi, and Y. Takahashi,
  Global survey of upper atmospheric transient luminous events on the ROCSAT-2 satellite

Martin Füllekrug
Yukihiro Takahashi
*Institut fur Meteorologie und Geophysik, Johann Wolfgang Goethe-Universitat, Feldbergstr 47, Frankfurt am Main 60323, Germany*
*E-mail address:* fuellekr@geophysik.uni-frankfurt.de