



## Preface

## Solar Variability, Cosmic Rays and Climate: What's up?

The topic of possible relations between solar and cosmic ray variability on one hand, and Earth's climate on the other hand, is quite an acute and hotly debated topic. Sometimes it gets too much publicized and even politicized, when emotions and beliefs dominate over pure science. Therefore, balanced wordings and accurate statements are required when discussing research results in the field. Here we try to put aside political debates and to present a balanced view of some new results in the field with a focus upon the scientific results.

This *Advances in Space Research* topical issue on *Solar Variability, Cosmic Rays and Climate* presents a collection of related results from different research groups from around the world. Twenty manuscripts form the topical issue that can be divided, in accord with the title, in three major streams.

One stream is about the *Sun and its Variability*. Peculiar features of the solar surface magnetic activity during the recent solar cycle and the current one, including also the unusual solar minimum in 2008–2009 are discussed by Benevolenskaya and Ponyavina, and Ahluwalia and Jackiewicz, while Ogurtsov and Jungner analyzed the statistics of long-term solar cycle evolution. Short-term variations of the solar irradiance, which is important for the Earth's radiation budget, are discussed by Baranyi and Pap, in relation to the solar active regions, and by Bao and Xie, with respect to solar flares. Martini et al. discuss long-term changes in geomagnetic activity.

Another direction of research presented here is related to *Cosmic Rays and their Variability*. A muon detector KACST in Saudi Arabia is presented by Maghrabi et al. while 27-day variations of the cosmic ray intensity were studied by Gil et al. and by Modzelewska and Alania. A relation between cosmic ray fluctuations and geomagnetic storms is analyzed by Petukhov and Petukhov. Spectra of cosmic rays during Forbush decreases were studied by Alania and Wawrzynczak. Miroshnichenko and Gan provide a brief overview of recent achievements in understanding of the energetic particle acceleration in solar flares, while Ishkov et al. discuss fluxes of heavier species, viz. C, O and Fe, during the quiet times as well as the responsible acceleration mechanisms.

The third main stream is related to a possible relation of the solar and cosmic ray variability with *Earth's Climate*. Ziskin and Shaviv present the results of an energy balance model of Earth's climate and suggest that the solar variability contributes about 1/3 of the 20th century global warming. Cho et al. propose a statistical relation between fast-speed solar wind streams and changes in the sea-level barometric pressure. A series of papers (by Mironova et al., by Tinsley et al., and by Hebert III) deals with the cyclone/storm vorticity and its possible relation to such external drivers as solar wind, radiation belt electrons, global electric circuit, relativistic electrons, volcanic aerosols, and atmospheric circulation. Zhao and Tinsley discuss that time-dependency of the charging and of the electrical scavenging processes may be important and should be taken into account.

This collection does not pretend to cover the entire field or review its present state, but rather presents a snapshot of some developments in the field. All the manuscripts have been reviewed by at least two reviewers to secure the high quality, following the standard practice of the Journal.

My humble work on editing of this issue would be impossible without great contributions from Peggy Ann Shea, the past Editor-in-Chief and presently the Editor for Special Issues; Brian Tinsley, who convened the *Solar Variability, Cosmic Rays and Climate* session at COSPAR General Assembly in 2010, where many ideas presented here were discussed; and all the reviewers who did the hard work of assessing and improving the manuscripts. I also acknowledge useful support from the *Advances of Space Research* technical and editorial staff.

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