applied sciences

MDPI

Editorial

New Challenges in Exploring Solar Radiation: Influence, Consequences, Diagnostics, Prediction

Vladimir A. Srećković

Institute of Physics Belgrade, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia; vlada@ipb.ac.rs

1. Introduction

The study of solar-influenced space weather and, consequently, extreme weather events, climate change, protection, and preservation are of particular interest in modern science because they are acknowledged as being important for sustainable development [1–5]. As a result, a high-priority question in this increasingly technological world is whether we can predict the extent of the impact of intense solar radiation on the Earth, the human population, electronic devices, and telecommunications, and, furthermore, whether we can assess the consequences. The answer to this two-part question is not straightforward; it is highly complex. Consequently, the research requires a multidisciplinary approach, along with the application of various models from the different areas of science and industry [6,7]. As a result, it was necessary to connect the theory with the experimental research that produces the data, and the people who use it. For this reason, a call was issued for submissions of suitable papers for this specific Special Issue.

This Special Issue brings together new findings in the area of solar radiation, its influence, and diagnostics. This will advance our knowledge in this area so we can better comprehend its significance for upcoming investigations, using cutting-edge equipment, and it will examine the current state of knowledge in this field of research.

2. Published Papers

Strong solar radiation can produce increased ionization in the terrestrial atmosphere and change its structure. In addition, increased solar radiation has the potential to cause diverse unavoidable catastrophic events by causing abrupt ionospheric disturbances that may affect satellite signals, as well as devices on the ground.

The focus of the series of papers [8–10] within this Special Issue is on the study and prediction of the impact of intense solar radiation on the Earth, and the analysis of atmosphere plasmas and their parameters. The authors of [8] have developed an empirical model of the lower ionosphere plasmas density, and have provided a simple approximative formula for electron density. The manuscript offers an extension of the electron-density modeling in the daytime, solar flare-perturbed ionosphere. Further, in the paper of Srećković et al. [9], the authors introduce a novel modeling approach and give data and plasma coefficients needed for describing and modeling this medium under intense solar radiation. They also provide a simple expression for electron density plasmas. The paper by Kolarski et al. [10] conducted a thorough examination and analysis of the lower ionospheric response to sudden solar flares during the day, and lightning-induced electron precipitation during the night. The authors stated that the data and results are useful in modern society for Earth observation, telecommunication, and other applications.

The energy crisis and the adaptation of the global energy structure encourage the development of renewable energies, particularly solar energy. In the next series of works, attention was focused on solar devices and modeling. Huang et al. [11] suggested an analytical method for calculating and enhancing the performance of a multi-mirror combination solar dish collector. In this work, a new optical model was specifically presented, and it can be used to evaluate and improve the optical performance of a combined solar dish system.

Citation: Srećković, V.A. New Challenges in Exploring Solar Radiation: Influence, Consequences, Diagnostics, Prediction. *Appl. Sci.* **2023**, *13*, 4126. https://doi.org/10.3390/app13074126

Received: 8 March 2023
Accepted: 19 March 2023
Published: 24 March 2023

It is known that photovoltaic systems are an excellent solution to high energy demand. One of the methods of increasing the output of photovoltaic systems is to increase the amount of solar radiation falling on a photovoltaic panel using optical devices. In the paper by Alqurashi et al. [12], a simulation of a low concentrated photovoltaic system is conducted using the COMSOL Multiphysics software package. The authors stated that this will make it easier to design and test models before they are manufactured.

3. Conclusions and Future Research Initiatives

Overall, the submission of appropriate papers to this Special Issue was open to all members of the scientific community. The papers in this issue have all been rigorously peer reviewed, with each submitted paper having a minimum of two reviewers.

We conclude that the presented studies necessitate the collaboration of experts in the fields of natural, data, and social sciences, as well as programmers, engineers, and other experts engaged in a wide range of related fields. One of the goals of this Special Issue is to present both the differences between these fields, as well as the need for collaborative efforts to better understand the related problems.

We expect this Special Issue to be impactful for the entire scientific community, and even useful for education.

Acknowledgments: I appreciate the opportunity to organize this Special Issue 'New Challenges in Exploring Solar Radiation: Influence, Consequences, Diagnostics, Prediction'. I would also like to express my appreciation to all authors for contributing their ideas and experiences to this Special Issue, as well as to the referees for their objective evaluation and useful recommendations. Finally, I want to give a special thanks to the editorial team of *Applied Sciences* for their continuous support, and assistance on the publication of this issue.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Shamshirband, S.; Mohammadi, K.; Yee, L.; Petković, D.; Mostafaeipour, A. A comparative evaluation for identifying the suitability of extreme learning machine to predict horizontal global solar radiation. *Renew. Sustain. Energy Rev.* **2015**, *52*, 1031–1042. [CrossRef]
2. Davidson, B. *Weatherman's Guide to the Sun*, 3rd ed.; Space Weather News, LLC.: New York, NY, USA, 2020.
3. Srećković, V.A.; Šulić, D.M.; Vujčić, V.; Jevremović, D.; Vyklyuk, Y. The effects of solar activity: Electrons in the terrestrial lower ionosphere. *J. Geogr. Inst. Cvijic* **2017**, *67*, 221–233. [CrossRef]
4. Kostylev, V.; Pavlovski, A. Solar power forecasting performance–towards industry standards. In Proceedings of the 1st International Workshop on the Integration of Solar Power into Power Systems, Aarhus, Denmark, 24 October 2011.
5. Kannan, N.; Vakeesan, D. Solar energy for future world:-A review. *Renew. Sustain. Energy Rev.* **2016**, *62*, 1092–1105. [CrossRef]
6. Nina, A.; Srećković, V.A.; Radovanović, M. Multidisciplinarity in Research of Extreme Solar Energy Influences on Natural Disasters. *Sustainability* **2019**, *11*, 974. [CrossRef]
7. Škoda, P.; Adam, F. *Knowledge Discovery in Big Data from Astronomy and Earth Observation*; Elsevier: Amsterdam, The Netherlands, 2020.
8. Srećković, V.A.; Šulić, D.M.; Ignjatović, L.; Vujčić, V. Low Ionosphere under Influence of Strong Solar Radiation: Diagnostics and Modeling. *Appl. Sci.* **2021**, *11*, 7194. [CrossRef]
9. Srećković, V.A.; Šulić, D.M.; Vujčić, V.; Mijić, Z.R.; Ignjatović, L.M. Novel Modelling Approach for Obtaining the Parameters of Low Ionosphere under Extreme Radiation in X-Spectral Range. *Appl. Sci.* **2021**, *11*, 11574. [CrossRef]
10. Kolarski, A.; Srećković, V.A.; Mijić, Z.R. Response of the Earth’s Lower Ionosphere to Solar Flares and Lightning-Induced Electron Precipitation Events by Analysis of VLF Signals: Similarities and Differences. *Appl. Sci.* **2022**, *12*, 582. [CrossRef]
11. Huang, W.; Shen, F.; Sun, L.; Zong, C. Performance Prediction and Optimization of Multi-Mirror Combined Solar Dish Collector. *Appl. Sci.* **2022**, *12*, 2347. [CrossRef]
12. Alqurashi, M.M.; Ganash, E.A.; Altuwirqi, R.M. Simulation of a Low Concentrator Photovoltaic System Using COMSOL. *Appl. Sci.* **2022**, *12*, 3450. [CrossRef]