Announcement of a Special Issue of *Advances in Space Research* on

Advances in Artificial Neural Networks for Solar Radiation Forecasting: Incorporating Solar X-rays, Particle Events, and Radio Emissions

Papers are invited for a special topical issue of *Advances in Space Research* (ASR) entitled **"Advances in Artificial Neural Networks for Solar Radiation Forecasting: Incorporating Solar X-rays, Particle Events, and Radio Emissions".**

Solar radiation forecasting is a critical task for the effective management of power grids and renewable energy systems. Advances in artificial neural networks (ANNs) have made it possible to develop accurate and reliable solar radiation forecasting models that can incorporate various solar parameters such as solar X-rays, particle events, and radio emissions. These parameters have a significant impact on solar radiation, and their inclusion in forecasting models can improve the accuracy of predictions. Solar X-rays are a type of electromagnetic radiation emitted by the sun, and they are an important parameter to consider when forecasting solar radiation. X-ray emissions from the sun are related to solar flares, which are intense bursts of energy that can cause disturbances in the Earth's atmosphere. Particle events, which include solar energetic particles (SEPs) and coronal mass ejections (CMEs), can also impact solar radiation levels. SEPs are high-energy particles that can cause significant disruptions in Earth's magnetic field, while CMEs are large bursts of plasma and magnetic fields that can cause geomagnetic storms. On the other hand, Radio emissions from the sun, such as those in the microwave and radio frequency ranges, can also be used to predict solar radiation levels. These emissions are related to solar activity and can be used as a proxy for solar flares and other events that can impact solar radiation.

Incorporating these parameters into artificial neural networks based solar radiation forecasting models can significantly improve their accuracy. Artificial neutral networks (ANNs) are a type of machine learning algorithm that can learn patterns and relationships in large datasets. By training on historical solar radiation data along with X-ray, particle event, and radio emission data, ANNs can learn to predict future solar radiation levels with high accuracy. One approach to incorporating these parameters is to use them as additional input features to the ANN model. For example, an ANN model for solar radiation forecasting could be trained on historical solar radiation data along with X-ray, particle event, and radio emission data for the same time period. The model could then use this information to predict future solar radiation levels. Another approach is to use a multi-step forecasting model, where the ANN model predicts solar radiation levels at multiple time steps into the future. This can be useful for predicting the impact of solar flares and other events that can cause sudden changes in solar radiation levels.

Despite the many advances made in artificial neural networks for solar radiation forecasting, there are still some limitations that need to be addressed. One limitation is the availability and quality of input data. In order for ANN models to be accurate, they require large amounts of high-quality data. However, data on solar X-rays, particle events, and radio emissions can be challenging to collect and may contain errors. Additionally, there may be gaps in the data due to technical issues or other factors, which can reduce the accuracy of forecasting models. The special issue aims to showcase the latest approaches, techniques, and methodologies that have been developed to incorporate solar X-rays, particle events, and radio emissions into forecasting models, and how they

have improved the accuracy of the forecasts. Additionally, the special issue also aims to highlight the challenges and limitations of using ANNs for solar radiation forecasting and discuss ways to overcome them.

The list of topics to be included are the following:

- Impact of particle events on solar radiation forecasting accuracy
- Developing hybrid ANN models for forecasting solar radiation levels
- Real-time solar X-ray data into ANN models for improved forecasting
- Investigating the impact of data quality on ANN-based solar radiation forecasting
- Optimizing Hyperparameters in Artificial Neural Networks for Enhanced Solar Radiation Forecasting Performance
- Integrating Satellite Imagery with Solar Radiation Forecasting Models using Artificial Neural Networks
- Multi-objective Optimization of Artificial Neural Networks for Solar Radiation Forecasting with Uncertainty Estimation
- Recent Developments in the Application of Artificial Neural Networks to Model and Forecast Solar Particle Events
- ANN models for predicting sudden changes in solar radiation levels caused by solar flares
- Future of Artificial Intelligence for Solar Radiation Forecasting

Papers must be submitted electronically to https://www.editorialmanager.com/AISR. To ensure that all manuscripts are correctly identified for inclusion into the special issue, authors must select **"SI: ANNSRF"** when they reach the "Article Type" step in the submission process.

The general format for submission of papers can be found on the *ASR* Elsevier web site at http://www.journals.elsevier.com/advances-in-space-research/

Submitted papers must be written in English and should include full affiliation postal addresses for all authors. Only full-length papers will be considered for publication, subject to peer review by a minimum of two reviewers. There are no page limits although the length of the paper should be appropriate for the material being presented. While the deadline for submissions is **15 January 2024**, papers will be published electronically as soon as they are accepted. The printed issue will be assembled within a reasonable time with late papers being printed in regular issues of ASR. All articles will be typeset at no cost to the author; there is a charge for printing color figures; there is no charge for color figures on the electronic version.

Dr. R.K. Saket (saketvardhan12@gmail.com) and **Dr. Saad Mekhilef (smekhilef@swin.edu.au)** are the Guest Editors for this special issue. Questions can be directed to Dr. Saket and Dr. Makhilef or to the Co-Editor for Special Issues, Dr. Peggy Ann Shea (sssrc@msn.com).