



*Research note*

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## INVESTIGATION OF SOLAR INFLUENCE ON THE TERRESTRIAL PROCESSES: ACTIVITIES IN SERBIA

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**Abstract:** In this contribution, we have summarized the current stage and perspective of cooperation between different scientific institutions in Serbia in the field of the investigation of the solar influences and effects on our planet. These activities involved 14 researchers from 7 institutions. The investigations are based on experimental, theoretical and numerical work and results are published in numerous papers in respected international journals. In order to make better connection and coordination of relevant activities in Serbia with international tendencies in this research field researchers participate in several international projects and programs. Bearing in mind the importance of the Sun's impact on our planet, the lives of people as well on modern technologies the general impression is that it is necessary to improve the existing infrastructure and increase the number of involved scientists. This study aims to present the current tendency of integrating contemporary research, people and technology in our country, in order to establish cooperation with other relevant groups and individuals.

**Keywords:** solar activity, climate, cooperation

### Introduction

The Earth atmosphere, as the outer edge, is under permanent influence of the cosmic rays, mainly coming from the Sun. Solar radiation is the dominant direct energy input which makes the temperature and atmosphere structure, triggering and influencing the complicated processes in nature around us. For this reason, studying and monitoring the incoming solar radiation and its variability in time are of fundamental importance for expanding knowledge and understanding complicated processes in the Earth's atmosphere which can strongly affect human health and activities, first of all in telecommunication technology. In addition, the research of possible influence of the solar radiation on natural disasters have become actual in recent time.

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In order to make better connection and coordination of relevant activities in Serbia, researchers from 7 institutions started forming the Serbian Solar-Terrestrial Research Network (SSTR Network)<sup>1</sup>. The main goals of this network relate to organizational, scientific and educational activities as well as common inclusions in various international projects and programs. At present, we participate in program of the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP)<sup>2</sup> called Variability of the Sun and Its Terrestrial Impact (VarSITI)<sup>3</sup> and the Balkan, Black Sea and Caspian Sea Regional Network on Space Weather Studies (BBC SWS Regional Network)<sup>4</sup>.

The scientific research covers experimental and theoretical work as well as numerical modeling.

### **Experimental setups and observations**

The observations relevant to the research of the scientists included in the SSTR Network are based on existing instruments in three institutions:

- Institute of Physics, University of Belgrade: very low and low frequency (VLF/LF) radio receiver stations — AbsPAL and AWESOME.
- Geomagnetic observatory GCK, Republic Geodetic Authority, Department of geomagnetism and aeronomy, Belgrade — Ionospheric, Magnetospheric and Geoelectrical Observatories and Geomagnetic survey.
- Military Academy, University of Defense, Belgrade — dipole antenna.

In future, we expect the expansion of existing facilities and inclusion of new experimental groups.

### **Research results**

The SSTR Network members investigate the solar influence in different research field from different aspects (Figure 1). We publish numerous studies relevant to solar influences on:

- Natural disasters such as forest fires and tropospheric events (Gomes & Radovanovic, 2008; Radovanović, 2010; Nikolić, Radovanović, &

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<sup>1</sup> Working title

<sup>2</sup> <http://www.yorku.ca/scostep/>

<sup>3</sup> <http://varsiti.org/>

<sup>4</sup> <http://www.bbc-spaceweather.org/>

Milijašević, 2010; Radovanović, Milovanović, Pavlović, Radivojević, & Stevančević, 2013; Malinovic-Milicevic, Mihailovic, & Radovanovic, 2015; Malinovic-Milicevic, Radovanovic, Stanojevic, & Milovanovic, 2015; Radovanović, Vyklyk, Milenković, Vuković, & Matsiuk, 2015; Radovanović et al., 2015; Milovanović, Schuster, Radovanović, Ristić Vakanjac, & Schneider, 2017; Milovanović, Ducić, Radovanović, & Milivojević, 2017; Radovanović, Gomes, Yamashkin, Milenković, & Stevančević, 2017; Vyklyuk et al., 2017).

- Ionosphere — detection of solar events, solar radiation influence on detections of other phenomena, and ionospheric plasma modeling (Nina, Čadež, Srećković, & Šulić, 2011; Nina, Čadež, Srećković, & Šulić, 2012; Nina, Čadež, Šulić, Srećković, & Žigman, 2012; Nina & Čadež, 2013; Kolarski & Grubor, 2014; Nina & Čadež, 2014; Šulić & Srećković, 2014; Kolarski & Grubor, 2015; Nina, Simić, Srećković, & Popović, 2015; Nina, Čadež, & Bajčetić, 2015; Blagojevic et al., 2016; Šulić, Srećković, & Mihajlov, 2016; Todorović Drakul et al. 2016; Nina, Čadež, Popović, & Srećković, 2017; Nina et al., 2017).
- Telecommunications — signal propagation in perturbed ionosphere (Bajčetić, Nina, Čadež, & Todorović, 2015).

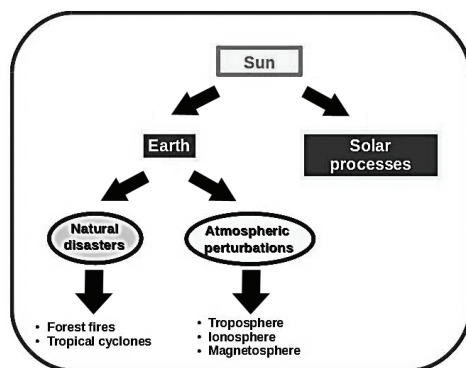


Figure 1. Schematic presentation of research fields

In addition, we study processes like solar emission in far-UV and EUV regions which strongly affect the Earth's atmosphere (Mihajlov, Ignjatović, Srećković, & Dimitrijević, 2011; Ignjatović, Mihajlov, Srećković, & Dimitrijević, 2014; Srećković, Mihajlov, Ignjatović, & Dimitrijević, 2014).

## Future Developments and Concluding Remarks

In this contribution, we have summarized the current stage and perspective of cooperation between different scientific institutions in Serbia in the field of the investigation of the solar influences and effects on our environment. Our study demonstrated the benefits of this kind of cooperation.

In the near future, we aim to further expand and improve the cooperation. Here we mean to better coordinate proposed observational campaigns, coordinate upgrade of existing scientific instruments, organize scientific workshops and meeting, etc.

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