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Sokobanja, Serbia, September 25-29, 2020

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ACTIVITIES OF SERBIAN SCIENTISTS IN EUROPLANET

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Abstract. The Europlanet Society, an organization which promotes the advancement of European planetary science and related fields, has 10 hubs. The Serbian Europlanet Group (SEG) is included in the Europlanet South Eastern European Hub (ESEEH) and, currently, has 20 active scientists.

In this work, we present activities of SEG. Primarily, we describe two Europlanet workshops organized in the Petnica Science Center: "Geology and geophysics of the solar system bodies" and "Integrations of satellite and ground-based observations and multi-disciplinarity in research and prediction of different types of hazards in Solar system" that occurred in 2018 and 2019, respectively, and the Europlanet session during XII Serbian-

Bulgarian Astronomical Conference that occurred in Sokobanja 2020. In addition, we present other activities that were primarily aimed at connecting SEG members coming from six institutions as well as the promotion of the Europlanet and ESEEH organizations.

1. INTRODUCTION

The Europlanet society is an organization which promotes the European planetary science and related fields. Its aims are to support the development of planetary science at a national and regional level, particularly in countries and areas that are currently under-represented within the community, and early career researchers who establish their network within the Europlanet: the Europlanet Early Career (EPEC) network (https://www.europlanet-society.org/early-careers-network/).

Two Europlanet projects (the Europlanet 2020 Research Infrastructure and the Europlanet 2024 Research Infrastructure (RI)) are funded through the European Commission's Horizon 2020 programme. The first one, lasting 4 years, ended 2020, while the second one runs for four years from February 2020 until January 2024. The latest is led by the University of Kent, UK, and has 53 beneficiary institutions from 21 countries in Europe and around the world, with a further 44 affiliated partners. It provides free access to the world's largest collection of planetary simulation and analysis facilities, data services and tools, a ground-based observational network and programme of community support activities.

The Europlanet consists of 10 Regional Hubs:

- Benelux
- Central Europe: Austria, Czech Republic, Hungary, Poland, Slovenia and Slovakia
- France
- Germany
- Ireland and UK
- Italy
- Northern Europe: Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Norway and Sweden
- Southeast Europe: Bulgaria, Croatia, Cyprus, Greece, Romania, and Serbia
- Spain and Portugal
- Switzerland

As one can see, Serbia is one of, current six countries included in the Southeast European Hub that is established in 2019.

More information about organization and activities of this society can be found at the website https://www.europlanet-society.org/.

2. SERBIAN EUROPLANET GROUP

The Serbian Europlanet Group (SEG) currently consists of 20 members from 6 institutions. Details of members and activities of SEG can be found at

https://www.europlanet-society.org/europlanet-society/regional-hubs/southeast-europe/.

The main activities of Serbian scientists in the Europlanet were:

- Organization of two Europlanet meetings and one session,
- Establishing of SEG webpage,
- Participations in the Europlanet science congresses and meetings,
- Participations in the Europlanet NA1 Expert Exchange Program, and
- Participations in the Europlanet commities.

In this paper we describe these activities and present scientific research of SEG members related to the Europlanet fields.

3. EUROPLANET MEETING ORGANIZATIONS

Serbian scientist organized two Europlanet workshops in Petica Science Center near Valjevo in Serbia:

- "Geology and geophysics of the solar system bodies" (24 June– 1 July, 2018), and
- “Integrations of satellite and ground-based observations and multidisciplinarity in research and prediction of different types of hazards in the Solar system” (10-13 May, 2019),

and Europlanet session during the XII Serbian-Bulgarian Astronomical Conference (XII SBAC) in Sokobanja, Serbia 25-29 September, 2020.

3.1. Europlanet workshops

3.1.1. Workshop in Geology and Geophysics of the Solar System

The workshop took place in Petnica Science Center, Petnica, Serbia (23 June – 1 July 2018) and further details can be found at http://petnica.rs/planetary2017. It was designed to cover a wide range of topics related to the formation, structure and dynamics of the Solar System and aimed to attract students and young researchers of various backgrounds and of different levels of experience in the fields of planetary sciences and space exploration. The workshop attended 43 participants, of which 24 PhD, 13 master and 6 undergraduate students. They were from 19 different home countries, including 15 from Eastern Europe, 3 from Russia and 4 from Northern Afrika. Other participants came from as far as India, Australia, and USA. The scientific organizers of the workshop were Dr. Katarina Miljkovic (Curtin University, Australia), Dr. Ana Cernok (The Open University, UK) and Dr. Matija Cuk (SETI Institute, USA), supported by the local organizers Dusan Pavlovic (Petnica Science Centre, Serbia) and Andrea Rajsic, deputy (University of Belgrade, Serbia). In total, there were 14 lecturers (7 female and 7 male). Although there was only one lecturer from a Serbian institution (University of Bel-

grade), there were 5 other lecturers (including the organizers) who were originally from Serbia. This planetary sciences workshop was supported by the Europlanet 2020 RI NA1 (Innovation through Science Networking) Task 5 (Coordination of ground-based observations) and Europlanet 2020 RI NA2 (Impact through outreach and engagement).

3.1.2. Workshop in Hazards in the Solar system

This workshop was focused on integrations of satellite and ground-based observations and multidisciplinarity in research and prediction of different types of hazards in the Solar system. The main of this meeting was connection of young researchers and scientists from under-represented countries, and experts in corresponding scientific fields. The organizer was the Geographical Institute "Jovan Cvijic" of Serbian Academy of Sciences and Arts. The chairs of the Scientific committee were Aleksandra Nina, Milan Radovanović from Serbia and Giovanni Nico from Italy. In this committee participated 11 scientists from 9 countries. Aleksandra Nina and Milan Radovanović were co-chairs, and Gorica Stanojević, Vladimir Čadež, Dejan Doljak, Vladimir Srećković and Dragoljub Štrbac were members of the Local Organizing Committee. The meeting attended 33 participants (of which 11 early career scientists) from 8 European countries: Bulgaria, Croatia, Greece, Hungary, Italy, Russia, Ukraine and Serbia. Their research fields relate to different theoretical and observation areas as well as to data sciences. In addition, two participants were from industry. This event was supported by the Europlanet 2020 RI NA1 - Innovation through Science Networking, Task 2: Scientific working groups (Europlanet 2020 RI has received funding from the European Union's Horizon 2020 research and innovation programme under grant No. 654208) and the Ministry for Education, Science and Technological Development of Republic of Serbia. More information about this event can be found at http://www.gi.sanu.ac.rs/site/index.php/en/activities/conferences-organisation/998-hazards-sos.

3.3. Europlanet session organised by SEG

Serbian scientists organized a Europlanet session during XII Serbian-Bulgarian Astronomical Conference (SBAS 12) that was held in Sokobanja from 25-29 of September 2020 (see Popović et al. 2020). Several lectures were held, a discussion, as well as the report of work of our group in the previous period was presented. At this Europlanet special session and during SBAC 12, possible directions for expanding cooperation were discussed with Bulgarian colleagues and also with colleagues from Europlanet Southeast HUB countries.

3.4. Participations in the Europlanet Science Congresses

Serbian scientists participated at the Europlanet Science Congresses (EPSC). The number of participants from Serbia is increasing. 7 scientists from Serbia participated in the EPSC-2020 and presented 3 lectures.

Figure 1: Participants of the workshop "Integrations of satellite and ground-based observations and multidisciplinarity in research and prediction of different types of hazards in the Solar system" held in Petnica Science Center on 10-13 May, 2019 (photo: Veljko Vujičić). From left to right:
Upper row: Konstantinos Kourtidis (Greece) , Pál Gábor Vizi (Hungary), Jelena Petrović (Serbia), Anđelka Kovačević (Serbia), Duško Borka (Serbia), Gorica Stanojević (Serbia), Zorica Marinković (Serbia), Bratislav Marinković (Serbia) and Dejan Doljak (Serbia);
Middle row: Georgi Simeonov (Bulgaria), Inna Pulinets (Russia), Bozhidar Srebrov (Bulgaria), Dejan Vinković (Croatia), Yaroslav Vyklyuk (Ukraine), Pier Francesco Biagi (Italy), Aleksandra Kolarski (Serbia), Lelica Popović (Serbia), Nikola Veselinović (Serbia) and Zoran Mijić (Serbia);
Bottom row: Predrag Jovanović (Serbia), Vesna Borka Jovanović (Serbia), Sergey Pulinets (Russia), Milan Radovanović (Serbia), Aleksandra Nina (Serbia), Vladimir Srećković (Serbia), Giovanni Nico (Italy), Milan S. Dimitrijević (Serbia), Luka Č. Popović (Serbia), Nataša Todorović (Serbia), Slavica Malinović-Milićević (Serbia) and Dragoljub Štrbac (Serbia).

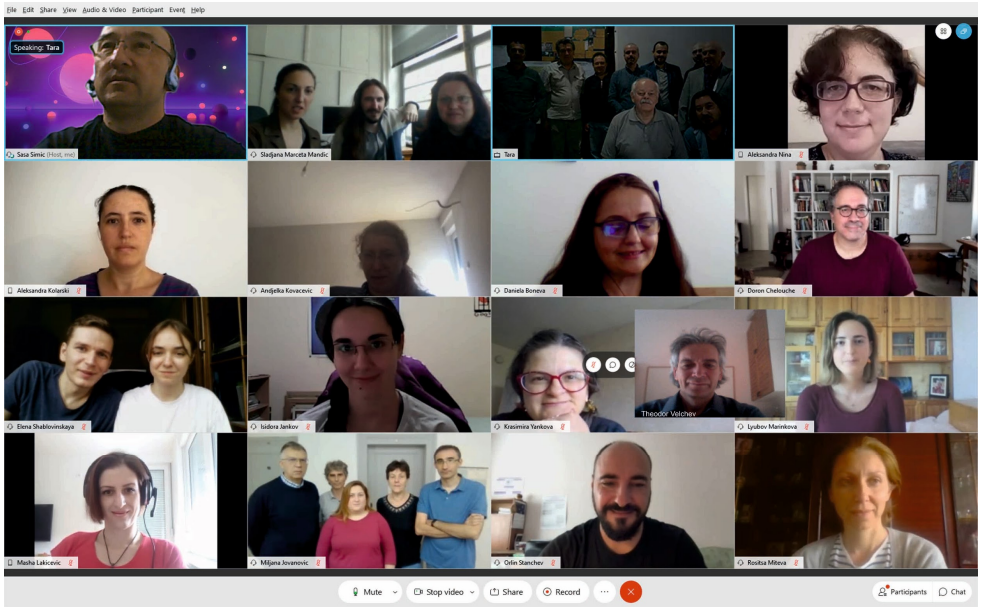

Figure 2: Participants of the 12th Serbian-Bulgarian Astronomical Conference held in hotel Moravica, Sokobanja (Serbia) from 25-29 September 2020. It was a blended conference where a small number of participants were present in Sokobanja (shown on third panel of first raw).
First row: Saša Simić (Serbia), Jelena Kovačević Dojčinović (Serbia), Đorđe Savić (Serbia), Sladjana Marčeta-Mandić (Serbia), Dejan Urošević (Serbia), Luka Č. Popović (Serbia), Nikola Petrov (Bulgaria), Ljube Bojevski (North Macedonia), Milan S. Dimitrijević (Serbia), Saša Topić (Serbia), Georgi Simeonov (Bulgaria), Ognyan Kunchev (Bulgaria), Vladimir Srećković (Serbia), Aleksandra Nina (Serbia);
Secon row: Aleksandra Kolarski (Serbia), Andjelka Kovačević (Serbia), Danijela Boneva (Bulgaria), Doron Chelouche (Israel);
Third row: Eugene Malygin (Russia), Elena Shablovinskaya (Russia), Isidora Jankov (Serbia), Krasimira Yankova (Bulgaria), Theodor Velchev (Bulgaria), Lyubov Marinkova (Bulgaria);
Fourth row: Maša Lakićević (Serbia), Rade Pavlović (Serbia), Goran Damljanović (Serbia), Miljana Jovanović (Serbia), Zorica Cvetković (Serbia), Milan Stojanović (Serbia), Orlin Stanchev (Bulgaria), Rositsa Miteva (Bulgaria).

3.5. Participations in the Regional Hubs Meetings

On the 4th and 5th June 2019, in Hotel Gellért, Budapest the Regional Hubs Meeting was organized by Melinda Dósa from Wigner RCP with the presence of the representatives from the Europlanet Society, Benelux Hub (represented by Ann Carine Vandaele, vice-president of Europlanet Society), Central European Hub,

France, Italy, Northern European Hub, Spain & Portugal and Southeast European Hub, in total there were 23 researchers present. After the participants introduced themselves, the talk by Anita Heward, communication officer, was given on the Role of the hubs in the Europlanet Society and building a sustainable future from Europlanet 2020 RI. Following discussion was about the importance of widening.in Europlanet. The focus of the meeting was on Planetary science – technology – industry synergy: aims and possibilities & Towards a strategy definition. As a result of this meeting the participation and formal enrollment in Europlanet Society by Serbian researchers has been substantially increased.

3.6. Participation in the Europlanet NA1 Expert Exchange Program

Supported through the Europlanet NA1 Expert Exchange Program, Dr. Alena Zdravković, curator of the Mineral and Rock Collection of the Faculty of Mining and Geology in Belgrade, Serbia, visited The Open University in October 2017 to work with Dr. Ana Cernok and other experts in meteorite science. During this visit, six meteorite samples from the Marquis de Mauroy collection of the Mineral and Rock Collection (01. Lancon, 02. Bath, 03. Powder Mill Creek, 04.Morrisyown Hamblen, 05. Merceditas and 06. Hex River, with numbers representing a handing number at the Open University) were used for polished thin- and thick-section preparation at the Open University, Milton Keynes, UK. Lancon and Bath are fragmented chondrite meteorites, Powder Mill Creek and Morrisyown Hamblen are mesosiderites, and Merceditas and Hex River are iron meteorites. Since the meteorite samples belong to a very old collection, dating from 1899, due to inadequate equipment and unprecise preparation facilities in the laboratory of Faculty of Mining and Geology in Belgrade, those kind of samples were never used for utilizing cut and polishing preparations. This visit aimed at meteorite thin-section preparation was an important milestone for this Serbian collection. It was the first such opportunity to open and present the collection to an international scientific community. More importantly, those are the only thin sections of meteorite samples available at Belgrade University, and will therefore serve as precious teaching material for students educating, as well as for initiating meteorite research.

3.7. Participations in the Europlanet committees

As a member of the Southeastern European Hub Committee, Aleksandra Nina participated in two teleconferences and one meeting of the Selection committee for Europlanet funding.

3.8. Other activities

Lecture during XIX Serbian astronomical conference (19 SAC) held at the Serbian Academy of Sciences and Arts in Belgrade, from October 13 – 17, 2020 (see Kovačević et al. 2020).

4. SOME STUDIES OF SEG MEMBERS

SEG members are scientists in four research fields: astronomy, geophysics, physics and geography. Here we present a few research that are in Europlanet areas.

4.1. Astronomy

4.1.1. The functional relation between mean motion resonances and Yarkovsky force on small eccentricities

We examined asteroid's motion with orbital eccentricity in the range (0.1, 0.2) across the 2-body mean motion resonance (MMRs) with Jupiter due to the Yarkovsky effect. We calculated time delays dt_r caused by the resonance on the mobility of an asteroid with the Yarkovsky drift speed. We derived a functional relation that accurately describes dependence between the average time lead/lag dt_r, the strength of the resonance SR, and the semimajor axis drift speed da/dt with asteroids' orbital eccentricities in the range (0.1, 0.2). We analysed average values of dt_r using this functional relation comparing with obtained values of dt_r from the numerical integrations. On the basis of the obtained results and analyses, we conclude that our equation can be used for the 2-body MMRs with strengths in the range $[1.3\times10^{-8}, 2.2\times10^{-4}]$, for Yarkovsky drift speeds in the range $[2.6\times10^{-4}, 2\times10^{-3}]$ au/Myr and for asteroids' orbital eccentricities in the range (0.1, 0.2) (Milić Žitnik 2020a).

4.1.2. The specific property of motion of resonant asteroids with very slow Yarkovsky drift speeds

We examined the specific characteristics of the motion of asteroids with very slow Yarkovsky drift speeds across the 2-body MMRs with Jupiter, whose strengths cover a wide range. It was found that the test asteroids with very small Yarkovsky drift speeds moved extremely rapidly across MMRs (order of magnitude 10^{-5} au/Myr or less). This result may indicate that, below a certain boundary value of da/dt asteroids typically move quickly across MMRs. From the obtained results, it is concluded that the boundary value of the Yarkovsky drift speed is 7×10^{-5} au/Myr (Milić Žitnik 2019).

4.1.3. The relationship between the 'limiting' Yarkovsky drift speed and asteroid families' Yarkovsky *V*-shape

We examined the relationship between asteroid families' *V*-shapes and the 'limiting' diameters in the (a, $1/D$) plane. Following the recently defined 'limiting' value of the Yarkovsky drift speed at 7×10^{-5} au/Myr, we decided to investigate the relation between the asteroid family Yarkovsky *V*-shape and the 'limiting' Yarkovsky drift speed of asteroid's semi-major axes. We have used the known scaling formula to calculate the Yarkovsky drift speed in order to determine the inner and outer 'limiting' diameters (for the inner and outer *V*-shape borders) from the 'limiting' Yarkovsky drift speed. The method was applied to 11 asteroid families of different taxonomic classes, origin type and age, located throughout the Main Belt. Our main conclusion is that the 'breakpoints' in changing *V*-shape of the very old asteroid families, crossed by relatively strong MMRs on both sides very close to the parent body, are exactly the inverse of 'limiting' diameters in the a versus $1/D$ plane. This result uncovers a novel interesting property of asteroid families' Yarkovsky *V*-shapes (Milić Žitnik 2020b).

4.1.4. Improvement of modelling of atmospheres using A&M data

We continued to work on topics of modelling various atmospheres (using new software packages and supercomputers) and diagnostic of the astrophysical (terrestrial and space) and laboratory plasma using A&M datasets e.g. rate coefficients, Stark broadening parameters, line profiles (the shape of atomic spectral lines in plasmas contains information on the plasma parameters, and can be used as a diagnostic tool), etc. Results which are of interest for Europlanet community are presented in our recently published papers (see e.g. Ignjatović et al. 2019, Srećković et al. 2020, Majlinger et al. 2020, Dimitrijević et al. 2020) as well as in database MolD http://servo.aob.rs/mold (Marinković et al. 2019) hosted on SerVO at AOB.

4.1.5. Correlation of solar wind parameters with cosmic rays observed with ground station

It has been well known for more than half a century that solar activity has a strong influence on galactic cosmic ray (GCR) flux reaching Earth (anti-correlation). Coronal mass ejections (CMEs) structure and shockwave can additionally modulate GCRs, which could results in a transient decrease in observed GCR intensity, known as Forbush decrease (FD). These FDs can be detected even with ground muon detector (Savić et al. 2019). Variation of GCR can be analyzed correlating in situ measurement of the particles species present in solar wind with ground observations. Correlation between the 1-hour variations of GCR and several different one-hour averaged particle fluxes was found during FDs and it de-

pends on energy of the particles of the solar wind as well as cut-off rigidities of secondary cosmic rays detectors on ground.

4.1.6. Habitability of exoplanets

Balbi, Hami and Kovačević (2020) present a new investigation of the habitability of the Milky Way bulge, that expands previous studies on the Galactic Habitable Zone. This work discusses existing knowledge on the abundance of planets in the bulge, metallicity and the possible frequency of rocky planets, orbital stability and encounters, and the possibility of planets around the central supermassive black hole. The paper focuses the two aspects that can present substantial differences with respect to the environment in the disk: (i) the ionizing radiation environment, due to the presence of the central black hole and to the highest rate of supernovae explosions and (ii) the efficiency of putative lithopanspermia mechanism for the diffusion of life between stellar systems. Authors devised analytical models of the star density in the bulge to provide estimates of the rate of catastrophic events and of the diffusion timescales for life over interstellar distances.

This article has been published as an invited contribution in the Special Issue "Frontiers of Astrobiology" edited by Manasvi Lingam.

Another concern for habitability is the presence of the supermassive black hole in the Galactic center, but also in nearby Active galactic nuclei, that could have resulted in a substantial flux of ionizing radiation during its past active phase, causing increased planetary atmospheric erosion and potentially harmful effects to surface life as shown by Wisłocka, Kovačević, Balbi (2019).

The goal of this paper is to improve our knowledge of the erosion of exoplanetary atmospheres through radiation from supermassive black holes (SMBHs) undergoing an active galactic nucleus (AGN) phase.

Authors extended the well-known energy-limited mass-loss model to include the case of radiation from AGNs. In the paper was calculated the possible atmospheric mass loss for 54 known exoplanets (of which 16 are hot Jupiters residing in the Galactic bulge and 38 are Earth-like planets, EPs) due to radiation from the Milky Way's (MW) central SMBH, Sagittarius A* (Sgr A*), and from a set of 107 220 AGNs generated using the 33 350 AGNs at $z < 0.5$ of the Sloan Digital Sky Survey database.

It was found that planets in the Galactic bulge might have lost up to several Earth atmospheres in mass during the AGN phase of Sgr A*, while the EPs are at a safe distance from Sgr A* (>7 kpc) and have not undergone any atmospheric erosion in their lifetimes. It was also found that the MW EPs might experience a mass loss up to 15 times the Mars atmosphere over a period of 50 Myr as the result of exposure to the cumulative extreme-UV flux FXUV from the AGNs up to $z = 0.5$. This work was featured in famous *Forbes Magazine* in their section Innovation.

4.2. Geophysics

4.2.1. Investigation of a possible new type of lower ionosphere precursor of earthquakes

Analysis of the signal transmitted in Italy and received by the AbsPAL receiver in Belgrade in the period around the earthquake that occurred in the vicinity of Kraljevo on November 3, 2010 indicated a change in the amplitude of the signal less than an hour before this event. Although this change has not been reported in the literature, an additional study of several earthquakes indicates the existence of this change in other cases as well. The first study of this phenomenon is presented in Nina et al. (2020), and a broader statistical analysis is underway.

4.2.2. Modelling of solar X-ray flare influence on propagation of satellite signals

Due to the low electron density, the unperturbed D-region has practically no effect on the propagation of satellite signals. Therefore, it is generally not involved in modeling of signal propagation path or, if it is, its influence is given by analytical expressions based on observational data from higher altitudes. In Nina et al. (2020b), it is shown that during intense perturbations of this ionospheric layer due to the influence of solar X-ray flares (they do not perturb significantly higher ionospheric layers except when their intensity is very strong) it is necessary to include observational data for the D-region in modeling the propagation of satellite signals.

4.2.3. Satellite radar technique for atmospheric water vapor measurement and modelling effects of the ionospheric disturbances

Atmospheric water vapor measurement can be carried out in many different ways. One of the techniques for observing and measuring atmospheric water vapor is through satellite radars, precisely the Synthetic Aperture Radar (SAR) used and carried on the platform of many active satellites. In Radović (2020) are introduced four of such satellites and the water vapor modelling technique called SAR Interferometry is described as well. Along with the above mentioned in Radović (2020) it is demonstrated how neglecting the ionospheric disturbances that can occur during the satellite radar measurement of the water vapor can influence the modelling of certain parameters which are connected to the measured atmospheric water vapor.

4.2.4. Remote sensing of the atmospheric aerosol

Atmospheric aerosol plays one of the most important roles in climate changes and environmental issues through direct (scattering and absorption of solar and

terrestrial radiation) and indirect (modification of cloud condensation nuclei through aerosol-cloud interaction) effects. In Mijić and Perišić (2019), study the relationship between satellite aerosol optical depth (AOD) measurements by Moderate Resolution Imaging Spectroradiometer (MODIS) and PM (Particulate Matter) concentrations data set from the Belgrade region was investigated. The preliminary results showed that AOD retrieved from a satellite sensor can be considered as a good proxy for ground observed PM mass concentrations. Within the EARLINET (European Aerosol Research Lidar Network) network a stand-alone lidar-based method (Papagiannopoulos et al. 2020) for detecting airborne hazards for aviation in near real time (NRT) is developed. In addition, Belgrade lidar station has been involved in ESA ADM-Aeolus mission (the first high-spectral resolution lidar in space) Cal/Val activity through validation of L2A products of aerosol and cloud profiles of backscatter, extinction and lidar-ratio.

4.2.5. Atmospheric disturbances due to severe stormy weather over Balkan region

Strong release of energy by atmospheric lightning discharges induced ionization changes along the propagation path of several Very Low Frequency (VLF) radio signals that had been received and recorded by Absolute Phase and Amplitude Logger (AbsPAL) system located in Belgrade (44.85^{o} N, 20.38^{o} E), at the Institute of Physics Belgrade, University of Belgrade, Serbia. Increased ionization is apparent in the perturbation of the signal amplitude and phase delay with respect to regular undisturbed ionospheric conditions. Integrated ground-based observations were performed with the aim to find coincidence and possible relationship between phenomena of VLF signal perturbations, optically documented Transient Luminous Events (TLEs) and documented lightning stroke events, during the stormy night of 27th-28th of May, 2009. The survey enclosed data from three independent sources: 1) VLF signal records from Belgrade Institute for Physics database, 2) video records of sprite events from ITALIAN METEOR and TLE NETWORK (I.M.T.N.) database and 3) detected lightning strokes from European Cooperation for Lightning Detection (EUCLID) network database. In most cases, the correspondence between VLF perturbations and CG strokes and on the other hand, VLF perturbations and TLE events, was found. In some cases the correspondence between all three phenomena was found (Kolarski 2019, 2020).

4.3. Physics

4.3.1. V. Čelebonović has been working on the problem of impact craters on the surfaces of solid planetary and satellite bodies. He showed that using standard solid state physics and measured properties of the craters, one can derive various parameters of the impactors. The calculations were checked on several known examples, and the agreement is reasonable.

4.3.2. The role of electron induced dissociation in the comet's coma and the findings during Rosetta spacecraft mission have been the subject of investigation published in Marinković et al. (2017). Data needs for modelling electron processes in cometary coma and their influence on the interpretation of the observed data by Rosetta instruments, have been discussed together with the currently available data and databases, where BEAMDB (Belgrade Electron/Atom(Molecule) DataBase - http://servo.aob.rs/emol) is given as an example (Marinković et al. 2019).

4.4. Geography

4.4.1. Our research was devoted to the determination of the causal relationship between the flow of particles that are coming from the Sun and the hurricanes Irma, Jose, and Katia. As a result of the preliminary analysis, using 12,274,264 linear models by parallel calculations, six of them were chosen as best. The identified lags were the basis for refinement of models with the artificial neural networks. Multilayer perceptrons with back propagation and recurrent LSTM have been chosen as commonly used artificial neural networks. Comparison of the accuracy of both linear and artificial neural networks results confirmed the adequacy of these models and made it possible to take into account the dynamics of the solar wind. Sensitivity analysis has shown that F10.7 has the greatest impact on the wind speed of the hurricanes. Despite low sensitivity of pressure to change the parameters of the solar wind, their strong fluctuations can cause a sharp decrease in pressure, and therefore the appearance of hurricanes (Vyklyuk, et al. 2019).

4.4.2. Forest fires that occurred in Portugal on 18 June 2017 caused several tens of human casualties. The cause of their emergence, as well as many others that occurred in Western Europe at the same time remained unknown. Taking into account consequences, including loss of human lives and endangerment of ecosystem sustainability, discovering of the forest fires causes is the very significant question. The heliocentric hypothesis has indirectly been tested, according to which charged particles are a possible cause of forest fires. We must point out that it was not possible to verify whether in this specific case the particles by reaching the ground and burning the plant mass create the initial phase of the formation of the flame. Therefore, we have tried to determine whether during the critical period, i.e. from 15–19 June there is a certain statistical connection between certain parameters of the solar wind and meteorological elements. Based on the 2 hourly values of the charged particles flow, a correlation analysis was performed with hourly values of individual meteorological elements including time lag at Monte Real station. The application of the Adaptive Neuro Fuzzy Inference System models has shown that there is a high degree of connection between the flow of protons and the analysed meteorological elements in Portugal. However, further verification of this hypothesis requires further laboratory testing (Radovanović et al. 2019).

5. CONCLUSION

In this paper we present activities of Serbian scientists in the Europlanet. We describe two Europlanet workshops organized in the Petnica Science Center: "Geology and geophysics of the solar system bodies" and “Integrations of satellite and ground-based observations and multi-disciplinarity in research and prediction of different types of hazards in Solar system” that occurred in 2018 and 2019, respectively, and the Europlanet session during XII Serbian-Bulgarian Astronomical Conference that occurred in Sokobanja 2020. In addition, we present other activities that were primarily aimed at connecting SEG members coming from six institutions as well as the promotion of the Europlanet and ESEEH organizations. Several studies relevant for the Europlanet research fields are presented in the second part of this paper.

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