РЕЗЮМЕТА НА НАУЧНИТЕ ПУБЛИКАЦИИ

за участие в за участие в конкурса за заемане на академична длъжност **доцент** по професионално направление 4.4. Науки за Земята, научна специалност „Физика на океана, атмосферата и околоземното пространство“ – секция „Физика на атмосферата“, обявен в Държавен вестник, бр. 54 от дата 4.07.2025г.

на

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B4-1 ***Bojilova R.*, 2017.** Ionospheric anomalies over Bulgaria during geomagnetic storms and their impact on some communications. *Journal of Physics and Technology*, 1(1), 18-22, ISSN 2535-0536.

This paper considers ionospheric anomalies over the territory of Bulgaria during geomagnetic storms of solar origin, illustrated by the extreme event in October 2003 (Halloween geomagnetic storm) and the storm in January 2005. The response of the ionosphere over Bulgaria is represented by data, collected by the ionospheric station in Sofia at NIGGG- BAS and values of the Total Electron Content (TEC) provided by the Center for Orbit Determination of Europe (CODE). The impact of ionospheric anomalies on radio communication frequencies in shortwave and satellite navigation is also analyzed.

B4-2 ***Румяна Божилова,* 2017**. Йоносферни аномалии по време на геомагнитни бури, предизвикващи смущения в някои видове комуникации. *Сборник с доклади от ШЕСТА НАЦИОНАЛНА КОНФЕРЕНЦИЯ С МЕЖДУНАРОДНО УЧАСТИЕ „Металознание, хидро- и аеродинамика, национална сигурност '2017“*, 299-303, ISSN 1313-8308.

В настоящата работа са разгледани аномалиите в земното магнитно поле и йоносферата по време на две силни геомагнитни бури за периодите 7-9 януари 2005г. и 6-7 август 2011 г. Акцентирано е на влиянието на тези аномалии върху някои видове комуникации и навигации. И по-конкретно на радиовръзките чрез йоносферно отражение на радиовълни от късовълновия диапазон (1.5- 30MHz) и спътниковата навигация. Влиянието върху късовълновите радиовръзки е представено от намалението на диапазона на приложимите честоти за дадено разстояние на връзката. Влошаването на точността на спътниковата навигация е представено чрез измененията на йоносферната поправка, която се определя от тоталната електронна концентрация на йоносферата.

B4-3 ***Bojilova R.*** and Mukhtarov P., **2018**. Influence of solar and geomagnetic activity on the ionosphere over Bulgaria. *Sun and Geosphere*, 13(1), 15-19, online ISSN 2367-8852, DOI: 10.31401/SunGeo.2018.01.02.

An analysis of the seasonal dependence of the ionospheric response to the geomagnetic activity and the shortterm variations of the solar radiation has been made. The research is based on the critical frequency of the F-region measurements from the ionosonde station - Sofia for the period from 1995 to 2014. The crosscorrelations and delay times between the relative values of the critical frequencies of the ionospheric F-region with the planetary

geomagnetic activity Kp-index and the solar radio flux at 10.7 cm (F10.7) for each calendar month of the year are investigated. The results can be used to create empirical models of the ionospheric parameters which depend on the variations of short-term solar and geomagnetic activity.

B4-4 ***Bojilova, R.*, 2018**. IONOSPHERIC ANOMALIES OVER BULGARIA DURING TWO GEOMAGNETIC STORMS. *Bulgarian Geophysical Journal,* 41, 14-20, ISSN 1311-753X (print)/ ISSN 2683-1317 (online).

This paper considers ionospheric anomalies over the territory of Bulgaria during geomagnetic storms - the storm on 5 April 2010 and the event on 9 March 2012. The response of the ionosphere over Bulgaria is represented by data, collected by the ionospheric station in Sofia at NIGGG- BAS. The values of the Total Electron Content (TEC) have been provided by the Center for Orbit Determination of Europe (CODE). The data for variations on Earth magnetic field are received from INTERMAGNET. It was used the station Panagyurishte (PAG) located on the territory of Bulgaria. The impact of ionospheric anomalies on radio communication on frequencies in shortwave and satellite navigation is also analyzed.

B4-5 ***Bojilova R.*** and Mukhtarov P., **2019**. Response of the electron density profiles to geomagnetic disturbances in January 2005. *Studia Geophysica et Geodaetica*, 63(3), 436-454, https://doi.org/10.1007/s11200-019-0510-6.

The ionospheric response to geomagnetic storms is usually investigated by considering the variability of the critical frequency of the F2-layer (foF2) or the total electron content (TEC) because these two parameters are directly measured by the ionosonde stations and the Global Navigation Satellite Systems (GNSS). In the present paper, however, the reaction is explored by using the vertical profiles of the electron density, N(h) , reconstructed by manually scaled ionosonde measurements at the station Sofia (42.4°N, 23.2°E). The mid-latitude ionosheric response to three geomagnetic storms that occurred in January 2005 is presented as this period has been selected because no major sudden stratospheric warming occurred during this month, and the winter 2005 is given in the literature as an example of a “normal” year. Hence the observed ionospheric response to the considered geomagnetic storms can be attributed mainly to the external forcing. Besides the traditional parameters foF2 and TEC, a particular attention is paid to the variability of the peak electron density height (hmF2). This study reveals for the first time that the main contribution to the response of the midlatitude ionosphere to moderate/intense winter geomagnetic storms is associated with significant enhancements of short-period quasi-diurnal oscillations with period of 6-7 hours observed in both foF2 and hmF2. An explanation of the main mechanisms responsible for the distortion of the diurnal ionospheric variability during these storms is offered. This result is especially important for the ground-based HF radio communications.

B4-6 ***Bojilova R., 2019***. INFLUENCE OF GEOMAGNETIC ACTIVITY ON THE IONOSPHERE CRITICAL FREQUENCIES. *Bulgarian Geophysical Journal*, 42, 3-9, ISSN 1311-753X (print)/ ISSN 2683-1317 (online), DOI: 10.34975/bgj-2019.42.1.

The present work investigates the seasonal dependence of the geomagnetic activity influences on the diurnal variability of the maximum electron concentration of the ionosphere over Bulgaria. Data from the ionosonde station Sofia for the period of 1995-2014 are used. The geomagnetic activity is described by the planetary Kp-index. The ionospheric response to the geomagnetic storms is studied by considering the relative deviation of the diurnal variability from its median course for the two ionospheric characteristics foF2 (critical frequency of the ionospheric F-region) and MUF3000 (maximum usable frequency for a distance of 3000 km). It is found that the ionospheric reaction in summer is stronger than that in winter and the time delay of the ionospheric response in winter is longer than that in summer.

B4-7 ***Bojilova R.***, Mukhtarov P., **2019**. Global and Regional Response of the Total Electron Content to Geomagnetic Storms Occurred in January 2005. Proceedings of Eleventh Workshop "*Solar Influences on the Magnetosphere, Ionosphere and Atmosphere*", 71-76, ISSN 2367-7570, DOI:10.31401/WS.2019.proc.

This study presented the global and mid-latitude ionospheric response to three geomagnetic storms occurred in January 2005: the first one on 7-8 January, the second one on 17-19 January, and the last one on 21-22 January. This period has been selected, because no major sudden stratospheric warming (SSW) occurred during this month an according to many scientists this winter is represented as an example of a background reference case corresponding to a 'normal' year. Therefore, the observed ionospheric response to the considered geomagnetic storms could be attributed mainly to the external forcing. The reaction is explored by considering N(h) profiles registered by manually scaled ionosonde measurements at station Sofia, which are used for calculating the total electron content (TEC) up to the F2-layer maximum (bottom-TEC). The full-TEC data are provided by the Center for Orbit Determination of Europe (CODE)-Bern, for the nearest point to Sofia. The basic aim of this work is to compare in detail the temporal variability of the full-TEC with bought that below (bottom-TEC) and up (top-TEC) the F2-layer maximum for each of the considered geomagnetic storms. It is found that for all investigated geomagnetic storms in January 2005 the bottom-TEC is considerably different from bought top-TEC and full-TEC.

B4-8 Mukhtarov P., ***Bojilova R.***, Andonov B., **2021**. The second G3 (Strong) geomagnetic storm in 25th solar cycle on 3-4 November 2021. *Bulgarian Geophysical Journal*, 44, 43-52, DOI: 10.34975/bgj-2021.44.4.

In this paper is analyzed the reaction of the ionosphere over Bulgaria during the G3 (Strong) geomagnetic storm on 3-4 November 2021 on the basis of data from constantly acting monitoring of the state of the ionosphere at the National Institute of Geophysics, Geodesy and Geography - Bulgarian Academy of Sciences. The global geomagnetic indices (Kp and Dst), which characterize the time development of the storm and the data for the solar wind, are presented. The model values (MAK model, working on the NIGGG website) of the global index of geomagnetic activity, which is calculated in real time from solar wind data show good agreement with definitive values of this index from global data centers. The values of

Total Electron Content (TEC) and the forecast values of the critical frequencies of the ionosphere (foF2 and MUF3000) for Bulgaria during the storm are presented. Due to the lack of data from the ionospheric station Sofia, the values foF2 and MUF3000 are calculated on the basis of TEC and are used to prepare daily forecasts for the propagation of radio waves on the territory of our country. A very good coincidence between the model values and the measured ones was reported. As a result, the reaction of the ionosphere was monitored, which in the considered interval 3-5 November and in the conditions of a geomagnetic storm is positive. An explanation of the observed behavior of the critical frequencies of the ionosphere is also purposed. All parameters discussed in this work are subject to monitoring activities under the Project "National Geoinformation Center" (NGIC) financed by the National Roadmap for Scientific Infrastructure 2017-2023.

B4-9 ***Bojilova R.*** and Mukhtarov P., **2020.** LOCAL TIME DEPEDENCE OF THE IONOSPHERIC RESPONSE TO GEOMAGNETIC DISTURBANCES OVER BULGARIA. International Multidisciplinary Scientific GeoConference: SGEM, 20(1.2), 615-622, DOI:10.5593/sgem2020/1.2/s05.078.

The dependence of the relative deviation of the critical frequencies of the ionospheric F2-layer (foF2) and the total electron content (TEC) on geomagnetic disturbances was investigated based on data from an ionosonde station at Sofia (National Institute of Geophysics, Geodesy and Geography - Bulgarian Academy of Sciences) for the period of 1995-2014. The local time dependence is presented by a Fourier decomposition including four harmonics of the diurnal course. The average daily dependencies for each calendar month were obtained. The results for the two above mentioned ionospheric characteristics are similar and show that the negative reactions are localized around 6 and 20-21 hours local time. While the negative response around 6 LT is present during the entire year that around 20-21 LT is seen only in summer and equinoxes. In winter during day- and evening-time positive reaction prevails. The seasonal behavior of the amplitudes and phases of the main Fourier components (24- and 12-hour) was presented as well; it reveals that the 24-hour component dominates in the winter months, especially well expressed in the TEC, while the 12-hour one is well seen in the summer months. The presented local time dependence of the ionospheric response on the geomagnetic activity indicates the contribution of the dynamical impact from below. This study presented the seasonal/local time dependence of the geomagnetic response seen in the basic ionospheric characteristics foF2 and TEC over Bulgaria and provided explanations for the results obtained.

B4-10 Mošna Z., Barta V., Berényi K.A., Mielich J., Verhulst T., Kouba D., Urbář J., Chum J.,Knížová P.K., Marew H., Podolská K. and ***Bojilova R.***, **2024**. March and April 2023 ionospheric storms in the period of the Solar Cycle 25. *Frontiers in Astronomy and Space Sciences*, 11, 1462160, https://doi.org/10.3389/fspas.2024.1462160.

This paper presents a deep and comprehensive multi-instrumental analysis of two distinct ionospheric storms occurring in March and April 2023. We investigate the ionospheric response in the middle-latitudinal European region utilizing ionospheric vertical sounding at five European stations: Juliusruh, Dourbes, Pruhonice, Sopron, and a reference station, San Vito. Additionally, we employ Digisonde Drift Measurement, Continuous Doppler Sounding

System, local geomagnetic measurements, and optical observations. We concentrate on the F2 and F1 region parameters and shape of the electron density profile. During the March event, a pre-storm enhancement was observed, characterized by an increase in electron density up to approximately 20% at northern stations, with minimal effect observed at San Vito. We present a novel detailed temporal and spatial description of a so-called G-condition. It was observed not only in the morning hours in the period of the increased geomagnetic activity during (and shortly after) the main phase of the storm, but also during low to moderate geomagnetic activity with Kp between 1 and 3+. Further, an alteration in the shape of the electron density profile, notably captured by the parameter B0 was observed. A substantial increase in B0, by several hundred percent, was noted during both events on the day of the geomagnetic disturbance and importantly also on the subsequent day with low-to-moderate geomagnetic activity. During both storms, the critical frequency foF1 decreased at all stations including San Vito. Changes in electron density in the F1 region indicate plasma outflow during morning hours. Distinct and persistent oblique reflections from the auroral oval were observed on the ionograms for several hours during both events and these observations were in agreement with optical observations of auroral activity and concurrent rapid geomagnetic changes at collocated stations. For the first time, we present a unique and convincing excellent agreement between the Continuous Doppler Sounding System and Digisonde Drift Measurement. The results reveal vertical movement of plasma up to ±80 m/s. Analysis of observed vertical plasma drifts and horizontal component H of magnetic field in Czechia and Belgium suggest that vertical motion of the F-region plasma is caused by ExB plasma drift.

B4-11 ***Bojilova R.,*** **2024**. FIRST RESULTS FOR INFLUENCE OF TWO GEOMAGNETIC STORMS DURING 10-12 MAY 2024 ON MID-LATITUDE IONOSPHERE. *Comptes rendus de l'Acade'mie bulgare des Sciences*, 77(10), 1485-1492, https://doi.org/10.7546/CRABS.2024.10.08.

The main idea of this study is to analyze the ionospheric anomalies in selected points related to the extreme geomagnetic storm which occurred during the period 10–12 May 2024. In the present research, data of the critical frequency of the F2 region (foF2) from the vertical sounding of ionospheric station Rome (Italy) and foF2 data for the territory of Sofia (Bulgaria) obtained by empirical modelling were used. The selection of Rome ionospheric station is related to the fact that this ionosonde is located at the geographic latitude coinciding with the latitude of Sofia, which suggests similar characteristics of the ionosphere. In order to evaluate the type of response (positive or negative), the relative deviation of the values was used, taking into account the influence of the local time for the individual points (1 hour). The results of the of the ionospheric response analysis show a well expressed negative response, more significant at Rome station. Another interesting result related to the inertia of the ionosphere is expressed in the observed response delay depending on the onset of the geomagnetic storm. From the comparison of the measured data and those obtained through the empirical model it can be seen that for the purposes of ionospheric forecasting, the model is able to describe the behaviour of the ionosphere with sufficient accuracy. The ionospheric response is supported by an additional study of the behaviour of the Total Electron Content (TEC), which response is similar to that of foF2.

Г7-1 ***Bojilova R.,*** Mukhtarov P., Miloshev N., **2022**. Dependence of the Index of Biologically Active Ultraviolet Radiation on the Season and Time of Day. *Atmosphere*, 13(9), 1455, https://doi.org/10.3390/atmos13091455.

In the present work, the data from the monitoring of the biologically active ultraviolet (UV) radiation of the Sun at the National Institute of Geophysics, Geodesy and Geography, Bulgarian Academy of Sciences for the period 2007–2021 were used. Based on the data analysis, a statistical method is proposed for determining the UV radiation index values in clear weather. As a result, estimated values of the UV-Index for each day of the year and for each hour are obtained, which can be used for predicting when reporting the cloud forecast. In the present paper, the applicability of the theoretical dependence of the UV-Index on the square of the cosine of the zenith angle of the Sun is investigated. The seasonal dependence of UV-Index values at fixed zenith angles of the Sun is discussed. Through regression analysis, the influence of the Total Ozone Column (TOC) and the concentration of particulate matter with d < 10 μm (PM10) on the UV-Index in the conditions of the city of Sofia was investigated. Explanations of the obtained results are offered.

Г7-2 ***Bojilova R.*** and Kilifarska N., **2017**. System for automated downloading of geomagnetic data from INTERMAGNET portal. *Journal of Physics and Technology*, 1(1), 23–28, ISSN 2535-0536.

Continuous monitoring of the Earth's magnetic field is motivated not only by purely scientific interest, but also by different practical applications, based on information about the geomagnetic field. Some tasks require permanent update of information about the geomagnetic field fluctuations. Others need long time series for making statistical analysis. INTERMAGNET portal provides one of the most reliable geomagnetic information. This paper describes newly created software for automatic downloading of geomagnetic data from INTERMAGNET. Besides the brief description of the software interface, some practical applications for its use are also discussed.

Г7-3 ***Румяна Божилова,*** **2017**. Автоматизирана система за събиране на геофизични данни – ПРИЛОЖЕНИЕ. *Сборник с доклади от 45-та НАЦИОНАЛНА КОНФЕРЕНЦИЯ ПО ВЪПРОСИТЕ НА ОБУЧЕНИЕТО ПО ФИЗИКА „Експериментът – основа на образованието по физика“*, 55-59, ISBN 978-954-580-367-3.

Данните от измерванията на земното магнитно поле се използват както за чисто научни цели, така и в някои практически приложения. Например началото на една геомагнитна буря е индикация за последваща поява на смущения в йоносферата, които влияят на комуникациите в късовълновия диапазон. Това обуславя необходимостта от непрекъснат мониторинг на магнитното поле. Вариациите на магнитното поле са с различна продължителност във времето, и се дължат на различни фактори, като най-основният е Слънцето и процесите, свързани с него. Геомагнитни обсерватории от цял свят предлагат своите данни свободно на потребителите чрез международната организация Интермагнет. Получаването на информация от сайта http://www.intermagnet.org/ се осъществява посредством въвеждане на необходимата информация от потребителя. Интерфейса на INTERMAGNET не предвижда тегленето на дълги редове от данни, което налага многократното въвеждане на специфичните данни за ползвателя. Това обуславя необходимостта от създаването на автоматизирана система за получаването на дълги редове от геомагнитни данни както и тяхното

ежедневното обновяване от сайта на INTERMAGNET.

Разработен е програмен продукт, съдържащ софтуер, предназначен за автоматично изтегляне на геомагнитни данни от зададен списък с геомагнитни обсерватории, участващи в INTERMAGNET. Написани са програми на езика C++, предназначени да изпълняват задачи като автоматично теглене на данни от текущия ден, а също така и на данни от предходен период. Запис на данните във файлове - в табличен текстов и бинарен формат, удобен за лесно и бързо визуализиране посредством разпространени софтуери (например Microsoft Excel). Програма за извършване на първична обработка на данните - изчисляване на средночасовите стойности на елементите на земното магнитно поле и записът им по месеци и години. Създадено е Windows приложение, обединяващо всички програми с цел улесняване работата на програмния пакет. Чрез въвеждане на необходимата информация (ДД//ММ//ГГГГ) и съответната станция, се получават нужните данни, като е предвидена и възможност за тяхното графичното представяне.

Автоматизираната система за събиране на геофизични данни се използва от научните работници в департамент "Геофизика" на Национален институт по геофизика, геодезия и география към Българската Академия на Науките за получаване на данни от геомагнитни станции от цял свят, с различно местоположение, в зависимост от разнообразните цели и задачи на научните изследвания.

Г7-4 Guineva V., Werner R., ***Bojilova R.***, Raykova L., Despirak I.V., **2021**. Mid-latitude positive bays during substorms by quiet and disturbed conditions. *Comptes rendus de l'Acad'emie bulgare des Sciences*, 74(8), 1185-1193, DOI:10.7546/CRABS.2021.08.10.

The purpose of this work is to study the midlatitude effects of substorms observed by different conditions in the solar wind. To identify the substorm activity, data from the magnetometer networks IMAGE, SuperMAG and INTERMAGNET in a certain range of latitudes and longitudes were used (31.8° - 75.2° CGMLat; 92° - 104° CGMLon). To verify the interplanetary and geomagnetic conditions, data from the CDAWeb OMNI, from the catalog of large-scale solar wind phenomena (http://www.iki.rssi.ru/omni/) and from the WDC for geomagnetism at Kyoto were taken. Two isolated substorms were chosen: 1) during quiet solar wind conditions on 6 February 2018, at 21:25 UT, AL ~ -270 nT; 2) under moderately disturbed conditions on 27 September 2020, at 19:10 UT, AL ~ -1300 nT. Quiet conditions were associated with relatively slow solar wind stream (V_X~ -400 km/s) and small values of negative Bz component of the IMF (~ -4 nT). The disturbed conditions were associated with a high-speed stream (HSS) (V_X~ -600 km/s) inside which a small coronal mass ejection (CME), consisted from two structures: SHEATH and EJECTA, was registered. It was found out, that the latitude of the bay sign conversion from negative to positive values in the case of quiet solar wind conditions, appeared at latitude of 7° higher latitudes than the one in the case of disturbed conditions. In both cases, the amplitude of the positive bays, initially increased towards the lower latitudes and after a maximum at about 50° GM latitude decreased gradually, with a difference between the minimal and maximal amplitude of about 50%. It was ascertained, that the mean positive bays amplitude in the case of disturbed conditions was about 4 times larger than that during quiet conditions.

Г7-5 Guineva V., Werner R., Atanassov A., ***Bojilova R.***, Raykova L., Valev D., **2021**. Characteristics of the midlatitude effects of different substorms. *Proceedings of the Thirteenth Workshop "Solar Influences on the Magnetosphere, Ionosphere and Atmosphere"*, 135-140, ISSN 2367-7570, DOI: 10.31401/WS.2021.proc.

Depending on the interplanetary conditions and the solar wind transients, different substorms can develop. By one classification they can be divided in ”usual“, ”expanded“ and ”polar“. The ”usual“ substorms begin and develop at auroral latitudes (~60°- ~ 71° GMLat). When the substorm onset is at auroral latitudes, but the substorm propagates to higher latitudes (>~70° GMLat), the substorm is ”expanded“. And in the case, when the substorm originates and develops at latitudes above ~70° GMLat, without expansion to South, it is ranked among the ”polar“ ones. The substorm effect at midlatitudes consists of the appearance of peaks in the X component of the magnetic field at ground, called midlatitude positive bays (MPB). A number of characteristics as conversion latitude of the magnetic bay sign, amplitude and duration of the MPB, horizontal power of the magnetic field etc., can be attributed to the midlatitude effects of substorms.
The characteristics of the midlatitude effects have been determined by data of the Bulgarian midlatitude station Panagjurishte (PAG) (~37° GMLat, ~97° GMLon) for 3 substorms: a polar substorm at 18:45 UT on 06.01.2013, a usual substorm at 22:30 UT on 31.01.2013 and an expanded substorm at 18:42 UT on 02.02.2013. The differences between the MPB characteristics for these different types of substorms have been analyzed.

Г7-6 Werner R., Guineva V., Atanassov A., ***Bojilova R.,*** Raykova L., Valev D., Lubchich A., Despirak I., **2021**. Calculation of the horizontal power perturbations of the Earth surface magnetic field. *Proceedings of Thirteenth Workshop “Solar Influences on the Magnetosphere, Ionosphere and Atmosphere”*, 159-164, ISSN 2367-7570, DOI: 10.31401/WS.2021.proc.

The substorm effect at midlatitudes is expressed by a rise and decay of the X-component of the surface magnetic field, called midlatitude positive bay (MBP). McPherron has introduced a new geomagnetic index based on the calculation of the horizontal power perturbations of the Earth surface magnetic field. In this work, a developed processing tool to determine the horizontal power of the magnetic field is presented. A main element in these calculations is the estimation of the main field by smoothed spline fits to the midnight field using 25 consecutive daily observations centred over the day in consideration. The estimated field was removed from the measurements. We used the Grubs test for detection of days with strong magnetic disturbances. Excluding the disturbed days from further calculations, the mean solar quiet day variations (Sq) were determined by averaging the field components and were subtracted from the magnetic field observations of the central day. The resulting X and Y horizontal components were high pass filtered to suppress periods longer than 3 hours. Thus, adopting the McPherron s algorithm we have calculated the horizontal power for the Panagjurishte station (PAG). In the algorithm we have incorporated procedures for gape and peak detection and removing. The MPB index is defined as the average of the horizontal power of a multitude of stations and monitors the intensity in the substorm disturbances.

Г7-7 Guineva V., Despirak I., Werner R., ***Bojilova R.***, Raykova L., **2021**. Study of mid-latitude positive bays during substorms over Scandinavia – a case study. *Proceedings of the XLIV Annual Seminar "Physics of Auroral Phenomena"*, 44(1), 28-31, ISSN 2588-0039, DOI: 10.51981/2588-0039.2021.44.006.

The purpose of this work is to study the midlatitude effects during substorms observed in different interplanetary conditions over Scandinavia. To identify the substorm disturbances, data from the magnetometer networks IMAGE, SuperMAG and INTERMAGNET in the range 31.8° - 75.25° CGMLat and 92° - 104° CGMLon were used. To verify the interplanetary and geomagnetic conditions, data from the CDAWeb OMNI (http://cdaweb.gsfc.nasa.gov/), the catalog of large-scale solar wind phenomena (ftp://ftp.iki.rssi.ru/omni/) and from the WDC for geomagnetism at Kyoto (http://wdc.kugi.kyoto-u.ac.jp/index.html) were taken.
Two isolated substorms were chosen, with different intensity: ALmin values ~ -270 nT and ~ -1300 nT, respectively. The first substorm occured on 6 February 2018, at 21:25 UT, under quiet conditions: during slow solar wind streams. The second substorm, at 19:10 UT on 27 September 2020, originated under moderately disturbed conditions: during a high-speed stream (HSS) in the solar wind, just after the passage of EJECTA by the Earth.
It was found out, that the latitude of the bay sign conversion from negative to positive values in the case of quiet solar wind conditions, appeared at latitude, 7° higher than the one in the case of disturbed conditions. In both cases, the amplitude of the positive bays, after a maximum near the sign conversion latitude decreased gradually towards the lower latitudes, with a difference between the minimal and maximal amplitude of about 50%. The magnetic bays kept their duration throughout the whole latitudinal range, ~115 min. for the first case and ~ 60 min. for the second one. It was ascertained, that the mean positive bays amplitude in the case of disturbed conditions was 4 times higher than the amplitude during quiet conditions.

Г7-8 Guineva V., I. Despirak, R. Werner, ***R. Bojilova***, L. Raykova, **2021**. Mid-latitude effects of "expanded" geomagnetic substorms: a case study. *EPJ Web of Conferences- XII International Conference "Solar-Terrestrial Relations and Physics of Earthquake Precursors"*, 254, 01004, 1-10, eISSN: 2100-014X, DOI:https://doi.org/10.1051/epjconf/202125401004.

The goal of this work is to examine the effects of the "expanded" or "high-latitude" substorms at mid-latitudes. These substorms are generated at auroral latitudes and propagate up to geomagnetic latitudes above ~70° GMLat. They are usually observed during reccurent high-speed streams (HSS) from coronal holes. To identify the substorm activity, data from the networks IMAGE, SuperMAG and INTERMAGNET, and data from the all-sky cameras in Lovozero were used. To verify the interplanetary and geomagnetic conditions, data from the CDAWeb OMNI and from the WDC for geomagnetism at Kyoto were taken. We analyzed one substorm event on 20 February 2017 at ~18:40 UT, it developed during HSS, in non-storm conditions. Some features of mid-latitude positive bays (MPB) at the European and Asian stations, and in particular at the Scandinavian meridian have been studied: the bay sign conversion from negative to positive values, the longitudinal and latitudinal extent of the MPB. The central meridian of the substorm was determined.

Г7-9 Guineva V., Werner R., Lubchich A., Atanassov A., ***Bojilova R.***, Raykova L., Valev D, Despirak, I., **2021**. Development of a substorms catalog including the MPB observed at Panagjurishte station, Bulgaria. *EPJ Web of Conferences- XII International Conference "Solar-Terrestrial Relations and Physics of Earthquake Precursors"*, 254, 01002, 1-9, eISSN: 2100-014X, DOI:https://doi.org/10.1051/epjconf/202125401002.

In this work the first results of the creation of a substorms catalog including the mid-latitude positive bays (MPB) registered at the Bulgarian station Panagjurishte (~37° GMLat, ~97° GMLon) are presented. MPB index characterizes the mid-latitude effect of substorm, which developed at auroral latitudes, and it is associated with the substorm current wedge. The work went in several lines. First, the catalog design and content were taken. Second, tools of data processing have been developed. Third, substorms during two months, namely January and February 2013 were identified. And finally, data processing was implemented and the characteristics of the positive bays were determined. The obtained data and their visualizations were put in a convenient folder and file structure, ftp positioned.

Г7-10 Guineva V., Werner R., Atanassov A., ***Bojilova R.***, Raykova L., Valev D., Despirak I., Kleimenova N., **2021**. Construction of a catalog of the magnetic variations by data of the Bulgarian station Panagjurishte. *Proceedings of the Seventeenth International Scientific conference "Space, Ecology, Safety"*, SES2021, 20-22.10.2021, Sofia, Bulgaria, 39-44, ISSN 2603-3313 (print)/ 2603-3321 (online).

Substorms represent one of the very important factors of the space weather. The substorms are observed at auroral latitudes as negative bay-like magnetic disturbances and displayed as positive bays (MPB) at midlatitudes. Recently, the special MPB index was introduced, which could demonstrate the substorm occurrence. This index was evaluated by the applying of the computed average values of the horizontal magnetic field power for a number of midlatitude stations. Here we present the creation of the new catalog of the magnetic variations including the MPB data from the Bulgarian station Panagjurishte (~37° GMLat, ~97° GMLon). This catalog is being developed for the first time and consists of two main sections. The first section presents the computed values of the X and Y magnetic components and the full horizontal power. For this, we have developed special processing tools. The second section comprises some MPB characteristics, associated with substorms, identified by data of the IMAGE meridional magnetometer chain, the IL index and the obtained horizontal power at Panagjurishte with 1-min sampling. Now the first section of the catalog is completed for some time intervals. The second section is under construction.
The catalog will be on the website of the Space Research and Technology Institute of the Bulgarian Academy of Sciences.

Г7-11 Werner R., Guineva V., Lubchich A., Despirak I., ***Bojilova R.***, Valev D., Atanassov A., Raykova L., **2021**. Determination of power perturbations of the horizontal magnetic field on the Earth surface. *Proceedings of Seventeenth International Scientific Conference: "Space, Ecology, Safety"*, SES2021, 20-22.10.2021, Sofia, Bulgaria, 34-38, ISSN 2603-3313 (print)/ 2603-3321 (online).

In 2015 Chu and later in 2017 McPherron have introduced a new index, the so called midlatitude positive bay (MPB) index, to characterize the activity of magnetic substorms at midlatitudes. In the frame of a bilateral project Bulgaria – Russia supported by the National

Science Fund of Bulgaria (NSFB) (project number КП-06-Русия/15) and RFBR (project number 20-55-18003_Болг_а) a program was worked out based in general on the algorithm developed by Chu and McPherron. A key point of the algorithm consists in the estimation and removal of the main magnetic field and the mean solar quiet day variations. For this propose 25 successive days were used in the computations, centred at the day under consideration. The so called mean Solar quiet day variations were determined by superposed epoch analysis, and were subtracted from the observations during the considered day. The power perturbations were determined by the sum of the obtained by the described processing procedure squared and high pass filtered X and Y-component variations. In a pre-processing process, new procedures for data gap and peak detection and removal were included. Highly disturbed observations were previously removed by the outlier test of Grubbs. The horizontal power perturbations for the Bulgarian magnetic observatory Panagjurishte (PAG) are determined for the whole period from 2007 up to now by our developed processing tool, described in this work.

Г7-12 Guineva V., Werner R., ***Bojilova R.***, Atanassov A., Raykova L., Valev D., **2022**. Maps of the Spatial Distribution of the Variations in the X and Y Components of the Magnetic Field at European Midlatitudes during Substorms: A Case Study. *Proceedings of Fourteenth Workshop "Solar Influences on the Magnetosphere, Ionosphere and Atmosphere"*, 22-28, ISSN 2367-7570, DOI: 10.31401/WS.2022.proc.

The goal of this work is to present the utility of maps of the magnetic field components variations to define the characteristics of the magnetospheric substorms appearance at midlatitudes. To study the spatial distribution of the magnetic field components variations during substorms, an isolated substorm in non-storm conditions, the substorm on 22 March 2013 at ~23:07 UT with central meridian over Europe has been chosen. Magnetic field data from INTERMAGNET, SuperMAG and IMAGE databases have been used. The X and Y variations due to the substorm were computed for 56 stations based on the developed programs. Maps of the spatial distribution and latitudinal and longitudinal profiles of the magnetic variations have been created and some characteristics as the line of sign conversion latitude, the central meridian, the longitudinal and latitudinal extent of the midlatitude positive bays (MPB) and the latitudinal and longitudinal dependence of the variations at three times with maxima during the maximal development of the substorm have been estimated. The central meridian is near PAG (~37°MLAT, ~97°MLON): it is at ~84°MLON during the first part of the substorm and at ~106° MLON in the final stage. The sign conversion latitude is in the range 60°-67°MLAT, the latitudinal extent – from 46° to 53°, and the longitudinal extent – from 60° to 140° during the stage of the maximal development of the substorm. These results are typical for expanded substorms.

Г7-13 Guineva V., Werner R., Atanassov A., ***Bojilova R.***, Raykova L., Valev D., **2022**. Assessment of some substorm parameters based on the midlatitude positive bays and the MPB index maxima. *Proceedings of the Eighteenth International Scientific conference "Space, Ecology, Safety"*, SES2022, 19-21.10.2022, Sofia, Bulgaria, 33-38, ISSN 2603-3313 (print)/ ISSN 2603-3321 (online).

Magnetospheric substorms effect on the ground magnetic field is expressed as negative bays at auroral latitudes and positive bays (MPB) at midlatitudes. In most of the cases the magnetic

disturbances at high latitudes are accompanied by midlatitude positive bays. The MPB index, recently introduced by McPherron and Chu, is a measure of the field aligned currents, connected to the electrojet. The magnetic disturbances during two substorms, at 23:10 UT on 22.03.2013 and at 22:49 UT on 11.05.2015 were examined in detail. The MPB index for both events was computed by data of 16 European stations. The beginning and end of the MPB index maxima were determined, based on smoothing by moving average and by inspection of the consecutive minima before and after the MPB index maximum, calculated by the first derivative of the MPB index variations. Criteria to choose the minima of the beginning and end of the MPB index maximum have been discussed and set. Some basic substorm parameters have been determined by the MPB index. The variations in the X magnetic component series from more than 30 European stations in the range 25°-55° GMlat have been studied in the same way. Graphs of the midlatitude onset delay in reference to the first onset as a function of the longitude have been constructed and analysed.

Г7-14 Werner, R., Guineva, V., Despirak, I. V., Lubchich, A. A., Setsko, P. V., Atanassov, A., ***Bojilova R.***, Raykova L., Valev D., **2023**. Statistical Studies of Auroral Activity and Perturbations of the Geomagnetic Field at Middle Latitudes. *Geomagnetism and Aeronomy*, 63(4), 473–485, https://doi.org/10.1134/S0016793223600303.

In this paper, we statistically analyzed substorm activity at auroral latitudes for 2007–2020 and its relationship with magnetic disturbances at middle latitudes using the INTERMAGNET, SuperMAG, and IMAGE magnetometer data. The appearance and development of magnetic disturbances at auroral latitudes was monitored by the IL index (similar to the AL index, but according to IMAGE data). For the 2007–2020 period, events that were observed near the meridian of the IMAGE network, in the night sector (2103 MLT), were selected. Two samples of events were used: (1) IL < –200 nT for at least 10 min, with an additional criterion for the presence or absence of positive bays at the Panagyurishte station in Bulgaria, and (2) isolated substorms observed on the IMAGE meridian according to the list of Ohtani and Gjerloev (2020). The distributions of the IL index, as well as the empirical and theoretical cumulative distribution functions, are obtained, and the of the occurrence of extreme events are also estimated. It is shown that, in general, the IL distributions are described well by exponential functions, and out of all events, events accompanied by mid-latitude positive bays were observed in ~65% of cases while their fraction increased with increasing disturbance intensity. Events with positive bays at midlatitudes of MPB and isolated substorms were better described by the Weibull distribution for extreme events. From both distributions, annual and semi-annual variations were identified: annual variations have a summer minimum and a winter maximum, and semiannual variations have maxima near the equinoxes, which is most likely due to the Russell-McPherron effect. The semi-annual variation is also shown to be more pronounced for events with accompanying mid-latitudinal positive bays.

Г7-15 Werner, R., Guineva, V., Despirak, I., Lyubchich, A., ***Bojilova, R.***, Raykova, L., Atanassov A., Valev D., **2023**. Statistical study of geomagnetic disturbances at European auroral and high latitudes. *Comptes rendus de l'Acade'mie bulgare des Sciences*, 76(4), 571–579, https://doi.org/10.7546/CRABS.2023.04.09.

Statistical studies allow probability statements about the frequency of certain events. The occurrence of magnetic substorms and their activity have been described with the help of extreme value distributions in the last few decades using the auroral electrojet indices AE, AL and AU. In this work we examined the distribution of the IL index, derived from observations at stations of the IMAGE magnetometer network. The distributions of magnetic disturbances, based on IL, were studied separately in the morning (3-9 MLT), day (9-15 MLT), evening (15-21 MLT), and night (21-3 MLT) sectors. In addition, we used the values of the IL index calculated from the meridional chains in the auroral zone (PPN-SOR) and from the chain of stations at high latitudes (BJN-NAL). The histograms, the empirical cumulative distributions and the occurrence rates were computed. It was shown that the empirical distributions could be well approximated with exponential distributions. The distribution parameters were determined from the occurrence rates. It was discovered three classes were discovered, which differ significantly by the respective distribution parameters. Structural changes in the distributions were found in the morning sector at both auroral and high latitudes. The relationship between the occurrence rate of magnetic disturbances with IL< -1000 nT and the frequency of occurrence of geomagnetic induced currents was highlighted.

Г7-16 Guineva V., Werner R., ***Bojilova R.***, Atanassov A., Raykova L., Valev D., **2023**. Spatial distribution of the magnetic disturbances at European midlatitudes during substorms: case study. *Proceedings of Science (PoS), 11th International Conference of the Balkan Physical Union (BPU11)*, Vol. 427, 188, DOI: https://doi.org/10.22323/1.427.0188.

This work is aimed to study the spatial distribution of the magnetic field components variations during substorms, when the central substorm meridian is located near the magnetic stations. Only in this case the typical for substorm changes in the signs of the magnetic components could be observed in the spatial structure. In this purpose, an isolated substorm, the substorm on 22 March 2013 at ~23:10 UT, with central meridian over Europe has been chosen. Magnetic field data from INTERMAGNET, SuperMAG and IMAGE databases have been used. The X and Y variations due to the substorm were computed for more than 40 stations based on the developed programs. Maps of the spatial distribution of the magnetic variations have been created, longitudinal and latitudinal profiles for this event have been constructed for the time of the midlatitude positive bay (MPB) maximum at Panagjurishte (PAG) and some other moments of the substorm development. Some characteristics as the line of sign conversion latitude, the central meridian, the longitudinal and latitudinal extent of the positive bays and the latitudinal and longitudinal dependence of the variations have been estimated. A local MPB index was computed for the European region, which provide information about the substorm appearance at midlatitudes from substorms, developed over Europe.

Г7-17 Guineva V.H., Werner R., Atanassov A.M., ***Bojilova R.Ts***., Raykova L.N., Valev D.T., **2023**. Determination of the parameters of midlatitude positive bays caused by magnetospheric substorms. *Proceedings of Fifteenth Workshop "Solar Influences on the Magnetosphere, Ionosphere and Atmosphere"*, 56-63, ISSN 2367-7570, DOI: 10.31401/WS.2023.proc.

Magnetospheric substorms are an important feature of the space weather. Apart of the variety of phenomena that they provoke, they influence the magnetic field at the Earth surface. Negative X-bays at auroral latitudes and positive bays in the X magnetic component at midlatitudes known as midlatitude positive bays (MPB) are observed. The study of the MPB development serves in the investigation of the solar-magnetosphere coupling during the substorm progress. At the Space Research and Technology Institute of the Bulgarian Academy of Sciences, the magnetic variations at Panagjurishte were calculated, based on data by the Bulgarian magnetic station Panagjurishte (PAG) with the main goal to determine the variations related to the substorm activity (MPB) and estimate the MPB main parameters. In this work we described the development of a processing tool to determine the beginning and end of the MPB registered at PAG. The tool is based on smoothing by moving average and by inspection of the consecutive minima of the X-component before and after the MPB maximum, calculated by the first derivative of the X variations. The MPB amplitude was obtained by the difference between the MPB maximum and the X value at the MPB beginning. Criteria to choose the minima of the beginning and end of the MPB have been specified. A minima find algorithm has been worked out and applied to specific cases. All results were made available to the scientific community by a created catalog, described also in this paper.

Г7-18 Guineva V., Werner R., ***Bojilova R.***, Raykova L., Atanassov A., Valev D., **2024**. A methodology to estimate the MPB parameters. *Proceedings of the XLVII Annual Seminar "Physics of Auroral Phenomena*", 47, 16-19, ISSN:2588-0039, DOI:10.51981/2588-0039.2024.47.003.

The midlatitude positive bays (MPB) represent a mark of the development of substorms at auroral latitudes. To have a knowledge of their parameters could serve as a tool to obtain more information about the magnetospheric substorms onset and progress. In the purpose to enable the study of the various phenomena related to the substorm disturbances and their propagation to mid-latitudes, an original catalog of the variations of the magnetic field at midlatitudes at the Bulgarian station Panagyurishte (PAG) was created for the period 2007 - 2022. The MPB parameters are part of this catalog. To estimate the MPB parameters, a special methodology was worked out. The beginning and end of the MPB's were determined, based on smoothing by moving average and by inspection of the consecutive minima before and after the MPB maximum, calculated by the first derivative of the X component of the magnetic field variations. Criteria to choose the minima of the beginning and end of the MPB have been discussed and set. For each specified case, a graphic of the positive bay with some parameters marked in it, and a file with the determined parameters and some flags, giving information about the concrete positive bay, have been created. These results can be accessed in the Catalog of the magnetic variations at the Panagyurishte station, located on the website of the Space Research and Technology Institute, BAS, Bulgaria (http://space.bas.bg/Catalog_MPB/).

Г7-19 Guineva, V., Werner, R., ***Bojilova, R.***, Raykova, L., Atanassov, A., Valev, D., **2024**. STUDY OF THE MIDLATITUDE POSITIVE BAYS AT THE MAGNETIC STATION PANAGYURISHTE DURING THE DESCENDING PHASE OF SOLAR CYCLE 24. *Proceedings of the Twentieth Anniversary International Scientific conference "Space, Ecology, Safety"*, SES2024, 22-25.10.2024, Sofia, Bulgaria, 48-54, ISSN: p-ISSN 2603 – 3313 / e-ISSN 2603 – 3321.

The effect of substorms at midlatitudes is manifested as specific oscillations in the magnetic field at the Earth surface: peaks in the North component X, known as midlatitude positive bays (MPB), and a systematic variation in the East component Y, consisting of a single cycle of sine wave. It was found out that the rate of substorm occurrence depends on the phase of the solar cycle and that most substotrms occur during the descending phase of the solar cycle. The aim of this work is to study the midlatitude positive bays, related to magnetospheric substorms that were identified at the midlatitude Bulgarian magnetic station Panagyurishte during the descending phase of solar cycle 24. Therefor 255 MPB's observed in 2017, have been examined. The interplanetary and geomagnetic conditions during these substorms have been investigated. The MPB beginnings have been compared to the onsets of the same substorms, determined by SML index data. A comparison of the number of registered MPB's during different solar cycle phases has been made. It was ascertained that during the 24 SC actually most substorms occurred during the descending phase, another, smaller maximum of the number of substorms was observed during the ascending phase, and minima during the maximum and the minimum of the SC were observed.

Г7-20 Guineva V., Werner R., ***Bojilova R.***, Raykova L., Atanassov A., Valev D., **2024**. Analysis of Substorms Related to Strong MPB at Panagjurishte Station in 2022. Proceedings of Sixteenth Workshop "Solar Influences on the Magnetosphere, Ionosphere and Atmosphere", ISSN: 2367-7570, 56-62, DOI:10.31401/WS.2024.proc.

Substorms developed over Europe are often accompanied by midlatitude positive bays (MPB) which represent peaks in the X magnetic component at midlatitudes. The present study aims at revealing the interplanetary and geomagnetic conditions under which develop magnetospheric substorms responsible for strong MPB at the Bulgarian magnetic station Panagjurishte. In this purpose, the 153 MPB's in 2022 determined as appreciable effect of auroral substorms, are examined. 14 MPB's with maximal X values greater than 20 nT are taken into account. The beginning times of these MPB's are close to the substorm onsets determined from the SML index by Newell and Gjerloev (2011), Forsyth et al. (2015) and Ohtani and Gjerloev (2020). The interplanetary and geomagnetic conditions during the studied substorms have been verified. It was found out that these substorms occurred against the background of different structures in the solar wind related to high speed streams from coronal holes or coronal mass ejections. Under such disturbed interplanetary conditions, in all studied cases magnetic storms developed, the majority of which are between the top 50 geomagnetic storms of 2022.

Г7-21 Guineva, V., Werner, R., Despirak, I., Klejmenova, N., Lubchich, A., Setsko, P., Atanassov A., ***Bojilova R.***, Raykova L., Valev D., **2023**. Results from the bulgarian-russian project on investigation of the geomagnetic disturbances propagation to mid-latitudes and their interplanetary drivers identification for the development of mid-latitude space weather forecast. *Proceedings of the Nineteenth International Scientific conference "Space, Ecology, Safety"*, SES2023, 24-26.10.2023, Sofia, Bulgaria, 47-56, ISSN 2603-3313 (print)/ 2603-3321 (online).

The main goal of the project is to implement a complex analysis of the spatio-temporal features of magnetospheric substorms and their effects at mid-latitudes depending on space weather conditions. For this purpose, studies of various phenomena related to the development of substorm disturbances and their propagation to mid-latitudes were carried out. For the first time, an original catalog of the variations of the magnetic field at midlatitudes at the Bulgarian station Panagjurishte (PAG) was created for the period 2007 - 2022. A methodology was developed and universal programs were created for processing data from European stations, obtaining maps of the spatial distribution of magnetic variations, and for calculating the midlatitude positive bay (MPB) index. The relationships between the statistical distributions of the MPB index and widely used geomagnetic indices and solar wind parameters were established. Analyses of events during quiet and disturbed geomagnetic conditions, during slow flows in the solar wind or high speed streams from coronal holes, were performed. Some cases of supersubstorms have been studied in detail. The hypothesis of the development of an additional substorm current wedge during supersubstorms was confirmed. The morphological features of the polar substorms were also studied. Catalogs of supersubstorms and polar substorms for the past 20 years have been created. Cases of occurrence of intense geomagnetically induced currents (GIC) during several strong magnetic storms were identified and analyzed. This study was supported by the National Science Fund of Bulgaria (NSFB) (project number КП-06-Русия/15) and by the RFBR (project number 20-55-18003Болг_а).

Г7-22 ***Bojilova R.***, Mukhtarov P., **2023**. Investigation of Dst variations in X component at mid-latitudes during three geomagnetic storms on February 2022. *Proceedings of Science (PoS), 11th International Conference of the Balkan Physical Union (BPU11),* Vol. 427, 185, DOI:https://doi.org/10.22323/1.427.0185.

Variations in the X component of the Earth`s magnetic field near the equator reflect the influence of equatorial ring current formed under the action of the charged particles of the solar wind. The traditional index describing this phenomenon is Dst. This index is obtainedas anaveragevalue of the variations in different magnetometric stations located at different geographic longitudes, where the influence of local time is removed. The basic aim of present work is to investigate the dependence of the responseof the X component on the local time. Due to the fact that the entry of the charged particles of the solar wind into the Earth's magnetosphere takes place in the night region of the Earth, a dependence of the response observed at a given geographic longitude on the local time must be assumed. In order to analyze Dst variations in X component at mid latitudes during three weak geomagnetic storms on February 2022, a chain of stations near the magnetic equator was considered. As a result, a methodology for reconstructing the X component is also proposed, and examples are shown for evaluating the quality of the developed model. The results thus obtained can be used to

evaluate the spread of the influence of the equatorial ring current in the conditions of geomagnetic storms on various geophysical parameters.

Г7-23 ***Bojilova R***. and Mukhtarov P., **2023**. Investigation of Dst Variations in X Component at Midlatitudes during Geomagnetic Storm on February 3, 2022. *Comptes rendus de l'Acade'mie bulgare des Sciences*, 76(2), 264-272, DOI:10.7546/CRABS.2023.02.11.

The main idea of this study is to investigate the Dst variations in the X component of the Earth's magnetic field and their latitudinal distribution in the conditions of geomagnetic disturbance on February 3, 2022. For this purpose, data from the world database of geomagnetic observatories INTERMAGNET were used. Three sectors of geomagnetic observatories were selected: (i) Eastern Europe, (ii) Western Europe, (iii) Eastern Asia. The considered stations are located at different latitudes (GLAT) but are close to each other in longitudes (GLON). For each sector, changes in the X component were considered and Sq variations were previously removed, based on data for five quiet days determined by the Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences. The results allow proposing a methodology for filtering the variations in the X component for the considered geomagnetic observatories resulting from the geomagnetic disturbance. In the concluding part of this work, an analysis of the relationship between variations in the X component and the equatorial ring current represented by Dst is proposed. The obtained linear regression coefficients for each of the sectors show the well-known dependency, expressed in the reduction of the influence of Dst on the changes in the X component as it moves from the equator to higher northern latitudes.

Г7-24 ***Bojilova R.,*** Mukhtarov P., Miloshev N., **2020.** CLIMATOLOGY OF THE INDEX OF THE BIOLOGICALLY ACTIVE ULTRAVIOLET RADIATION FOR SOFIA. AN EMPIRICAL FORECAST MODEL FOR PREDICTING THE UV-INDEX. *Comptes rendus de l'Acade'mie bulgare des Sciences*, 73(4), 531-538, DOI:10.7546/CRABS.2020.04.12.

This study presents a detailed statistical analysis of the monitoring data of the Index of biologically active ultraviolet radiation in Sofia for the period 2011–2019, performed at the National Institute of Geophysics, Geodesy and Geography (NIGGG) at the Bulgarian Academy of Sciences. In this paper, the regularities of the daily and seasonal course of the index are investigated and an empirical model is proposed for forecasting its average hourly values depending on the local time and day of the year in clear weather. The basic regularity turns out to be the dependence of the index on the cosine square of the solar zenith angle. As a result, the opportunity is presented to specify the forecast of the UV-index depending on the predicted cloudiness.

Г7-25 ***Bojilova R.***, Mukhtarov P., Miloshev N., **2023**. Investigation of the dependence of ultraviolet radiation on the day. Environmental Protection and Disaster Risks - Proceeding of the 2nd International Conference on Environmental Protection and Disaster Risks and 10th Annual CMDR COE Conference on Crisis Management and Disaster Response, *Lecture Notes in Networks and Systems*, 638, Springer, Cham, 177-187, https://doi.org/10.1007/978-3-031-26754-3_16.

By measuring the flux of ultraviolet radiation UVA (315–400 nm) and UVB (280–315 nm) in urban conditions, its dependence on the zenith angle of the Sun in clear weather was studied. Simultaneous measurements of the most important components of the atmosphere that affect the absorption of ultraviolet radiation – ozone and water vapor were performed. The dependence of the UVB index on the square of the zenith angle of the Sun has been confirmed, while the dependence of UVA is closer to the first degree of the cosine of the zenith angle, which is explained by the lower absorption of this component of the solar spectrum by the atmosphere. Measurements made not only of the radiation flux in a horizontal plane but also in a plane perpendicular to the direction of the Sun at the appropriate time allow us to assess the risk of sunburn on the skin in different positions of the human body. This can be used to improve the existing model for predicting the safe time of stay in direct sunlight.

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/гл. ас. д-р Румяна Божилова/