OPINION

of a dissertation

for the acquisition of the educational and scientific degree "PhD"

in professional direction 4.1 Physical Sciences,

by defense procedure at the Faculty of Physics

of Sofia University "St. Kliment Ohridski" (SU)

The review was prepared by: **Prof. Georgi Kostadinov Gadjev, PhD, NIGGG-BAS**
in his capacity as a member of the scientific jury
according to Order No. RD 38-127 / 16.03.2023 of the Rector of Sofia University.

Topic of the dissertation: "Climate changes and projections for the 21st century in the region of the Black Sea and the Balkan Peninsula"

Author of the dissertation: Mirna Matov

I. General description of the presented materials

1. Data on the submitted documents

The candidate Mirna Matov has submitted a dissertation and an Author's abstract, as well as the mandatory tables for Physics from the Regulations for the conditions and procedures for obtaining scientific degrees and holding academic positions at SU "St. Kliment Ohridski". A total of 19 other documents (in the form of official notes and certificates from an employer, project manager, funding organization or project contractor, references and testimonials, awards and other relevant evidence) supporting the applicant's achievements are also presented.

I do not find any omissions and/or inaccuracies in the applicant's documents.

The documents submitted by the candidate for the defense correspond to the requirements of the ŽRASRB, PPZRASRB and the Regulations for the terms and conditions for acquiring scientific degrees and occupying academic positions at SU "St. Kliment Ohridski".

2. Applicant data

PhD student Mirna Matov, in 2016, obtained the bachelor's degree in "Astrophysics, Meteorology and Geophysics" at the University of St. Kliment Ohridski". In 2018, she obtained the Master's degree in "Meteorology" at the Faculty of Physics of the SU, and a year later in 2019, she began her doctoral studies in the same specialty there.

3. General characteristics of the candidate's scientific achievements

The results of the doctoral student in the presented dissertation are in the field of Climatology, as she makes a comprehensive analysis of climate changes concerning temperature, precipitation, sea level pressure and surface wind for the Black Sea region and the Balkan Peninsula in the 21st century using the output data from the Aladin 5.2 regional climate model simulations for two of the RCP scenarios (4.5 and 8.5) defined in AR5. At the beginning, an evaluation of the error of the used model was made, as far as the researched parameters in the dissertation are concerned. Data from the ECMWF ERA-Interim meteorological analysis were used for the comparison.

The conditions for glaciation in the Black Sea from 1950 to the present day, the changes in the centers of influence for the modern and future climate - the Siberian maximum and the Mediterranean depression, and the expected change in winds - have been studied.

The results obtained by the candidate describe excellently and to a high degree, the investigated characteristics of the reference and future climates.

a) the scientific publications included in the dissertation meet the minimum national requirements (according to Art. 2b, paras. 2 and 3 of ZRASRB) and, accordingly, the additional requirements of SU "St. Kliment Ohridski" for the acquisition of the educational and scientific degree "PhD" in the relevant scientific field and professional direction;

b) scientific publications included in the dissertation work do not repeat those from previous procedures for acquiring a scientific title and academic position;

c) there is no proven plagiarism in the submitted dissertation and abstract.

4. Characterization and assessment of the candidate's teaching activity (if there is a requirement for this in Regulations for the terms and conditions for acquiring scientific degrees and occupying academic positions at SU)

No reference has been submitted for the candidate's educational and pedagogical activity, but for the current procedure, it is not necessary to make such an assessment.

5. Content analysis of the scientific and scientific-applied achievements of the candidate contained in the materials for participation in the competition

A trend of temperature increase and pressure decrease was established for the Balkan peninsula-in-Black Sea region under RCP4.5 and RCP8.5 scenarios for the three future periods studied in the dissertation.

The candidate updates the classification of the intensity of winters through the severity index of published data for the 20th century, and for the first time satellite observations have estimated the area and duration of freezes in the Black Sea after 2006;

It has been established that frosts in the northern part of the Black Sea are related to specific synoptic conditions, not necessarily related to low winter temperatures.

It has been established that the influence of the Mediterranean depression during winter conditions in the Black Sea region is significant due to the influence of the seasonal centers of action Siberian maximum and Mediterranean minimum.

It is found that under the RCP4.5 scenario, the Mediterranean center of action decreases in intensity until the end of the 21st century (winter pressure in the Mediterranean shows an increasing trend).

It was found that under the RCP4.5 scenario, the frequency of gale force events will increase until the end of the 21st century.

From the results presented in the dissertation and the six contributions defined by the candidate, it can be seen that they lead to the enrichment of existing knowledge in the field of climatology and, in particular, the analysis of climate and climate changes for the Balkan Peninsula and the Black Sea region. As part of the scientific results, they were applied in practice by the World Bank in the compilation of the National Disaster Risk Profile in Bulgaria in Chapter 4 Climate Change and Disaster Risk.

A check of the applicant's numerical indicators shows that she has – 1 citation, one publication with an impact factor of 3.11, SJR 0.661 (Scopus Q2); one publication with SJR 0.733 (Scopus Q2); and one publication in the proceedings of an international conference included in the national reference list of NACID. The candidate made a significant contribution to the collective publication *Black Sea Freezing and Relation to the Winter Conditions in 2006–2021*, as lead and corresponding author.

6. Critical notes and recommendations

Concerning:

- - analyzes and summaries – the correctly obtained results are analyzed in detail;
- - methodical level – is at the required level. But there is a lack of a clearly defined methodology for determining the winter severity index (WSI), in its description on page 42 of the dissertation;
- - accuracy and completeness of the results - they are comprehensive.

From chapters 1. Relevance of the problem and 2. Methodology and data sources, it can be seen that the candidate has a good literary awareness in every respect on the topic of the dissertation.

7. Personal impressions of the candidate

I have excellent personal impressions of the candidate. In my opinion, she is a purposeful, hard-working, talented and dedicated young scientist who has a successful scientific career ahead of her.

8. Conclusion

After having familiarized myself with the presented dissertation work, Abstract and other materials, and based on the analysis of their significance and the scientific and scientific-applied contributions contained in them, **I confirm** that the scientific achievements meet the requirements of ZRASRB and the Regulations for its application and the relevant Regulations of the SU "St. Kliment Ohridski" **for acquiring the educational and scientific degree "PhD"**. In particular, the candidate satisfies the minimum national requirements in the professional field and no plagiarism has been found in the dissertation, abstract and scientific works submitted for the competition.

I give my positive evaluation of the dissertation work

II. GENERAL CONCLUSION

Based on the above, **I recommend** the scientific jury to award **the educational and scientific degree "PhD"** in professional field 4.2 Physical sciences to Mirna Matov.

12.06.2023 Prepared the opinion: .....

(Prof. Georgi Gadzhev, PhD)