

OPINION

on a dissertation prepared in fulfilment of the requirements for acquiring the educational and scientific degree of “Doctor”

in the professional field 4.1 Physical Sciences (Meteorology)

under a defense procedure in the Faculty of Physics

of Sofia University St. “Kliment Ohridski” (SU)

The opinion has been prepared by Assoc. Prof. Dr. Tanja Nikolova Dreischuh of the Institute of Electronics, Bulgarian Academy of Sciences, in her quality of a member of the scientific jury appointed by Order No. RD 38-188/25.04.2023 of the Rector of the University of Sofia.

Dissertation Topic: A complex approach to the research of atmospheric aerosols

Dissertation Author: Viktoria Lyubomirova Kleshtanova

I. General description of the presented materials

1. Information on the presented documents

The doctoral student Viktoria Kleshtanova has presented a dissertation, an author’s summary in Bulgarian and English, an autobiography, a diploma for the educational-qualification degree of Master of Science, a declaration of authorship, a table of the recommended requirements and a reference for lack of plagiarism (protocol and opinion). Full text copies have also been provided of four publications whose results are included in the dissertation.

The dissertation comprises a total of 111 pages and consists of ten chapters and a list of references. Of those, the first three chapters discuss the topicality of the problem and the dissertation objectives, the state-of-the-art of the problem studied and the methodology and the data sources used; the last two chapters contain the conclusions, the scientific contributions claims and the referenced publications. A total of 129 sources are quoted, including six internet sites. The results are suitably illustrated by means 50 figures and 7 tables.

The author’s summary has been prepared in compliance with the legal requirements and reflects correctly and exhaustively the dissertation’s structure, content, results, and contributions.

The documents provided by the candidate adhere to the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria, the Regulations on the Implementation of the Act on Development of the Academic Staff in the Republic of Bulgaria and the Rules on the Conditions and Procedure for Acquiring Science Degrees and Holding Academic Positions in Sofia University “St. Kliment Ohridski”.

2. Brief CV of the candidate

Viktoria Kleshtanova graduated in 2018 from the Faculty of Physics of Sofia University “St. Kliment Ohridski” with the degree of MS in Meteorology, together with the additional qualification of a Teacher of Physics and Astronomy. On January 10, 2019, she was enrolled as a full-time doctoral student in Faculty of Physics of SU; in the period April 01, 2021 – April 01, 2023, she was an extramural doctoral student in the Faculty of Physics of SU, and then delisted with the right of defense. Since January 16, 2021, she has been employed in the Forecasts and Information Service Department of the Meteorological Forecasts Sector of the Bulgarian National Institute of Meteorology and Hydrology (NIMH), first as a Weather Forecaster and then as an Assistant Professor.

Viktoria Kleshtanova has been the Coordinator of three projects under different stages of the National Research Programme “Young scientists and postdoctoral students” financed by the Ministry of Education and Science of Bulgaria. A list has been included in the materials presented concerning participation in the work program implementation of one COST-Action and two research projects funded by Bulgarian sources.

3. General characteristics of the candidate’s scientific achievements

The dissertation work is dedicated to a systematic study of the cloud condensation nuclei (CCN) based on experimental data collected at the Basic Environmental Observatory (BEO) Moussala in the period January 01, 2016 – December 31, 2016. In view of fulfilling this objective, specific problems have been formulated. Solving them has led to finding regularities in the distribution of CCNs concentration and linking this distribution with the corresponding synoptic situations and the atmospheric circulation over Bulgaria. The dates have also been established of extremely high and extremely low CCNs concentration.

The dissertation is based on four scientific publications, two of them published in specialized journals having impact factor (Journal of Atmospheric and Solar-Terrestrial Physics, Comptes Rendus de l’Académie Bulgare des Sciences); one, in a journal with impact rank (AIP Conference Proceedings); and one, in a journal without IF/IR (Bulgarian Journal of Meteorology and Hydrology). One preprint from the journal Crystals is quoted in section 10.2.1. of the dissertation, but has not been included in the materials presented. The results obtained have been reported at six national scientific forums. These science metrics data clearly demonstrate the dissertation’s scientific value and the topicality and importance of the studies carried out and the results obtained. Bearing in mind the fact that Viktoria Kleshtanova is the first co-author of all publications and reports, I conclude that her contribution to obtaining and reporting the research results is evident.

The scientific publications included in the dissertation are as follows: one in a journal of quartile Q2 (group I); one in a journal of quartile Q3 (group II); one journal with SJR but no impact factor (group III); and one in a Bulgarian journal. These correspond to and exceed the minimal national requirements (pursuant to Art. 2b, paragraphs 2 and 3 of the Act on the Development of the Academic Staff in Republic of Bulgaria) and the Additional Requirements of SU “St. Kliment Ohridski” for acquiring the educational-scientific degree ‘Doctor’ in professional field 4.1 Physical Sciences.

The jury has been provided with an opinion issued using the procedure of preventing plagiarism in diploma/dissertation works and a protocol from a dissertation originality review, both certifying that following a check performed by means of the Electronic System of Plagiarism Prevention of SU “St. Kliment Ohridski”, the similarities found in doctoral student Victoria Kleshtanova’s dissertation are in compliance with the respective norms and regulations and bear no characteristics of plagiarism.

4. Characteristics and assessment of the candidate’s educational activities

No data has been provided concerning educational activities as no such are required by the Act on Development of the Academic Staff in the Republic of Bulgaria, the Regulations on the Implementation of the Act on Development of the Academic Staff in the Republic of Bulgaria and the Rules on the Conditions and Procedure for Acquiring Science Degrees and Holding Academic Positions in Sofia University “St. Kliment Ohridski”.

5. Scientific and scientific-applied achievements contained in the provided materials

The atmospheric aerosols are among the significant climatological factors determining the atmosphere’s thermal and radiative balances, the formation of clouds, fogs and precipitations, as well as the chemical and photochemical processes taking place in the atmosphere. They have both direct and indirect impacts on the ecosystems’ functioning and balance. By way of their multifaceted and strong effects and influences, the aerosols in their complex manifestations determine to a large degree the atmospheric air quality, which is why they are the object of extensive and diverse worldwide studies. Investigating the spatial and temporal distribution in the atmosphere of the aerosols taking part in the aerosol-cloud interactions (the cloud condensation nuclei) is of particular importance in the development of numerical meteorological models. The results presented in the dissertation are the first of this kind in Bulgaria. In my view, this is an undeniable proof of the topicality and the societal importance of the dissertation’s subject and objectives.

A good impression is made by the thorough presentation in the second chapter of the state-of-the-art of the studies on the problem, as supported by an exhaustive list of references. A special focus is placed on the CCN research conducted in Bulgaria’s neighboring countries in the Balkan Peninsula. The third chapter deals with the methodology and the data sources used. In my opinion, the doctoral

student is well acquainted with the research on the topic in questions and the results obtained by other research teams, as well as with the methods and approaches needed for achieving the set objectives.

The studies conducted and the results that can be characterized as scientific contributions are discussed in the next five chapters. Without doubt, the dissertation contains scientific and scientific-applied contributions. The behavior is considered of CCNs concentration in specific synoptic situations typical for the summer and winter periods. These have been selected in regard with the maximal concentrations measured for the particular month. In the synoptic situations analysis, the candidate has used maps of the Global Forecasting System (GFS), maps of atmospheric reanalysis provided by the National Centers for Environmental Prediction and the National Center for Atmospheric Research of the USA (NCEP/NCAR Reanalysis), together with data on the wind speed and direction collected by the Moussala Synoptic Station of the NIMH and by the BEO Moussala. Achieving a correct analysis was made possible by the candidate's work in the Forecasts and Information Service Department of the Meteorological Forecasts Sector of NIMH. The circulation of the air masses over Moussala Peak affecting the results of the CCNs concentration measurements is studied in terms the backward transport trajectories obtained by the HYSPLIT Global Model of the National Oceanic and Atmospheric Administration (NOAA) of the USA. A trajectory grouping is also applied in accordance with some operative practices used at HIMH. As a result, a correlation was found between the CCNs concentration maxima measured in 2016 at Moussala Peak and the corresponding synoptic situations and backward transport trajectories. Relationships are also established between the CCNs concentration extrema and the atmospheric circulation types, following the Jenkinson-Collison weather-type classification. By approximating the data on the CCNs concentration's minimal, maximal and the mean diurnal values, the parameters are determined of Twomey law. A correlation is established between a Twomey equation parameter and the temperature at Moussala Peak and in Borovets resort.

6. Critical remarks and recommendations

The dissertation is a complete and logically constructed work. It is written in good Bulgarian with a minimal number of punctuation errors. I have no critical remarks.

7. Personal impressions

I have not met personally the doctoral student Viktoria Kleshtanova; my impressions are formed solely via the documents provided and on her presenting her work at the preliminary defense that took place in the Meteorology and Geophysics Chair of the Faculty of Physics of the University of Sofia. These, however, convinced me that she is already a well-established young scientist in the field of meteorology who is familiar with the scientific literature and the contemporary problems to

be solved in this field; moreover, she possesses the skills needed to conduct scientific research, interpret the results obtained and present them at scientific forums and in specialized publications.

8. Conclusions

Having acquainted myself thoroughly with the presented dissertation, the author's summary and the other documents provided, and bearing in mind the importance of the scientific contributions contained in them, **I hereby confirm** that the scientific achievements are in full compliance with the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria, the Regulations on the Implementation of the Act on Development of the Academic Staff in the Republic of Bulgaria and the Rules on the Conditions and Procedure for Acquiring Science Degrees and Holding Academic Positions in Sofia University "St. Kliment Ohridski" in what concerns her being awarded the educational and scientific degree "Doctor". In particular, the candidate's work satisfies the minimal national requirements for the professional field in question, while no plagiarism has been detected in the presented dissertation, the author's summary and the scientific publications.

Therefore, I positively assessed the dissertation presented.

II. GENERAL CONCLUSION

Based on the above, **I recommend** that the scientific jury award **the educational and scientific degree "Doctor"** in the professional field 4.1 Physical Sciences (Meteorology) to Viktoria Lyubomirova Kleshtanova

June 23, 2023

Opinion prepared by:

(Assoc. Prof. Dr. Tanja Dreischuh)