REVIEW

by Prof. Dr. Plamen Iliev Ninov

Member of the scientific jury in a competition for occupying the academic position of "Professor" in the section in the "Surface and Groundwater" section of the "Hydrology" Department of the National Institute of Meteorology and Hydrology

Professional field 5. Technical sciences, professional direction 5.7. Architecture, construction and geodesy, scientific specialty "Engineering hydrology, hydraulics and water management"

The competition was announced in the State Gazette, issue No. 81 of 03.10.2025.

This review has been prepared on the basis of an Order of the Director General of NIMH No. ND-05-33 of 01.12.2025 and in execution of Order No. ND-05-37/05.12.2025 and the decision of the scientific jury adopted at the meeting held on 12.12.2025. It complies with the requirements of the Act on the Development of the Academic Staff in the Republic of Bulgaria (ADASRB), the Regulations for its Implementation (RIADASRB), and the NIMH Regulations under ADASRB.

I. Requirements for the candidate

Pursuant to Art. 29 (1) and Art. 29b of ADASRB, Art. 60 of RIADASRB, and Art. 56 (1), (2) and Art. 57 (1) of the NIMH Regulations under ADASRB

Associate Professor Dr. Elena Kirilova Bojilova is the sole candidate in the competition. She was born in 1966. She graduated from the University of Architecture, Civil Engineering and Geodesy – Sofia (1985–1990) as a civil engineer, specialty Hydromeliorative Construction. She obtained a Master degree in Hydrological Engineering from the International Institute for Infrastructures, Hydraulics and Environmental Engineering in Delft, Kingdom of the Netherlands. She was awarded the educational and scientific degree Doctor in the scientific specialty "Engineering Hydrology, Hydraulics and Water Resources Management" No. 28574 of 01.08.2003 after successfully defending a doctoral dissertation entitled "Applicability of Disaggregation Models under the Conditions of River Runoff in Bulgaria."

The candidate held the position of Assistant professor, consecutively grades III, II and I, at the National Institute of Meteorology and Hydrology – Bulgarian Academy of Sciences, Sofia (1992–2007). Her main activities and responsibilities were related to analysis of hydrological data, regional hydrological analyses (Yantra and Tundzha river basins, etc.), study of the dynamics of selected river basins in the country (Tundzha, Yantra, etc.), schemes for the use of water resources in the Tundzha and Yantra basins; mathematical modeling of the Yantra River catchment and application of the model for short-term forecasts, extreme characteristics with different return periods, and hydrological modeling.

After gaining a competition, she assumed the scientific position Associate professor, grade II, with appointment act No. 24734 / 23.01.2008, approved by Protocol No./date: 9-07 / 22.11.2007, and from January 2011 – Associate Professor in the scientific section of the "Hydrology" Department of NIMH-BAS (appointment act: 54 / 12.11.2012, effective as of 03.01.2011). During the period 2013–2015 she was a representative of NIMH and of the country as a Seconded National Expert at the European Research Council. From 2016 to the present she has headed the scientific activities in the section "Surface and Groundwater" at the Hydrology Department. As of March 2025 she has been appointed Deputy Director General of NIMH for "International Activities and Projects."

A commission chaired by Assoc. Prof. Dr. Irena Ilcheva, Deputy Director General for Scientific Activities of NIMH, carried out a review of the materials submitted for the competition on 03.12.2025

and found no violations of the procedure. A similar review was conducted by the members of the scientific jury, as a result of which the candidate was admitted to participate in the competition.

II. Requirements for research and applied research activity

Art. 29 (1), items 1, 3, 4, 5, 6, (2) and (3), Art. 29b (1) of ADASRB; Art. 60 (1), items 3, 4, 5, (2) and (4) of RIADASRB; Art. 56 (1), items 1, 4, 5, 6, 7, (2), (3) of the NIMH Regulations under ADASRB

The scientific production of Assoc. Prof. Dr. Elena Bojilova submitted for review meets the requirement that publications used for the acquisition of the scientific degree Doctor and for the academic position Associate Professor are not repeated. In addition to scientific publications, information on citations, reports on participation in and leadership of scientific and applied research projects—internal, international, and externally funded—has been provided. A detailed report on the tasks performed and the summarized contributions has also been submitted. Additionally, a report on the fulfillment of the minimum requirements for occupying the academic position "Professor" has been presented.

SUMMARY TABLE

OF THE VOLUME AND TYPE OF SCIENTIFIC OUTPUT pursuant to Art. 1a (1) and (2) of RIADASRB and Art. 2 (4) of the NIMH Regulations under ADASRB

A group of metrics	Professor (min. requirements)	Professor (challenger points)
А	50	50
Б	-	-
В	100	100
Г	200	300
Д	100	300
Е	150	260

From the presented table it can be seen that in the assessment of the candidate's research and applied research activity, the total number of points in all indicator groups is equal to or significantly exceeds the minimum requirements.

Assessment by indicator groups

Group А includes the doctoral dissertation defended by the candidate, with points equal to the minimum required.

Group Б is applicable only in the case of a defended dissertation for Doctor of Sciences. As no such dissertation has been defended, the number of points is 0, which corresponds to the minimum requirement.

From **Group В** points are accumulated from indicator 3 – Habilitation thesis – scientific monograph. Assoc. Prof. Bojilova has submitted for participation in the competition a published monograph entitled "Yantra River – Hydrological Analyses and Modeling of River Runoff", 2024, ISBN 978-619-7739-10-7, Neofeedback Publishing House, 234 pp.

The monograph is a synthesis of Assoc. Prof. Bojilova's research work related to the Yantra River, covering a period of more than 20 years. In essence, it is a scientific work entirely within the field of hydrological research. The monograph examines the dynamics of river runoff through various approaches (statistical and probabilistic) and methods (empirical and theoretical probability curves,

flow-duration curves, regression equations, etc.). The analysis is based on annual runoff and the distribution of water volumes by months and seasons, minimum and maximum runoff described by their frequency and probability of occurrence, and other hydrological parameters. The study is based on available information from the hydrometric monitoring network of the National Institute of Meteorology and Hydrology within the river catchment.

The monographic work is divided into two main parts: the first part addresses the hydrology of the Yantra River catchment, while the second part is devoted to river runoff modeling. The intra-annual distribution of river runoff within the catchment is studied, starting with monthly and moving to seasonal distribution. The monthly distribution of river runoff in terms of runoff layer is analyzed. The monthly and seasonal distribution of maximum water discharges is examined. Information on flood waves that have passed through the Yantra River basin is analyzed and presented. Flood waves are defined with a beginning - the moment of sharp increase in discharge and an end - the date of intensive recession. The analysis allows comparability with previous studies.

Characteristics of minimum runoff in the Yantra basin have been determined. The monthly frequency of minimum daily discharges in the basin has been defined for the longest possible available observation period. The recurrence of minimum runoff has been analyzed. The methodology for environmental flow has been applied. The concept of environmental flow defines the water volume ensuring conditions for sustainable and safe functioning of aquatic ecosystems.

The second section addresses the modeling of hydrological systems. A brief theoretical review of rainfall–runoff models is presented. Two main models for modeling the runoff of the Yantra River are proposed: modeling of river runoff using a distributed-parameter model Hydro-BEAM (Hydrological Basin Environmental Assessment Model) developed at Kyoto University, and modeling using a semi-distributed-parameter model. The applicability of the Hydro-BEAM model has been tested under conditions of long-term simulation of river runoff for the Upper Yantra basin: Yantra River – Veliko Tarnovo, Cholakovtsi district. The rainfall–runoff process for the entire Yantra River catchment up to its confluence with the Danube River has been modeled using a semi-distributed-parameter model with HEC-GeoHMS and HEC-HMS. The following have been carried out: long-term simulation of river runoff with calibration and verification periods within 1985–2005; event modeling (a historical flood wave has been modeled). The inter-annual distribution of runoff has been modeled for the following water conditions: extremely wet year (1.0% probability, 2004/2005), very wet (25% probability, 1990/1991), average water availability (50% probability, 1998/1999), moderately dry (75% probability, 1985/1986), and dry (95% probability, 2000/2001). At present, the model adapted in this way is used in the operational practice of NIMH for daily forecasting of river runoff of the Yantra River.

I assess the presented monograph positively—it represents an in-depth hydrological study of a large and complex Bulgarian river basin. I allowed myself a more extensive presentation of the conducted studies and obtained results, as I believe that the monographic work "Yantra River – Hydrological Analyses and Modeling of River Runoff" is the most significant factor among the materials submitted for the competition, substantiating the candidate's claim for the academic position of Professor. In addition to specific results, the monograph also has methodological significance as an example of a comprehensive hydrological study of a river catchment.

From **Group Г** – Scientific publications in journals that are refereed and indexed in internationally recognized databases of scientific information, 40/n or distributed proportionally on the basis of a contribution protocol, the candidate Assoc. Prof. Bojilova has presented 14 publications in this group, accumulating over 300 points. Thirteen of them are in English, and only one is in Bulgarian. They have been presented at scientific forums or in periodical journals where publications are indexed in international scientific databases, or they are book chapters.

Under Scientific publications in non-refereed journals with scientific peer review or in edited collective volumes, 20/n or distributed proportionally on the basis of a contribution protocol, Assoc. Prof. Bojilova has submitted one publication.

The topics of the scientific publications are quite diverse, although all publications fall within the above-mentioned scientific themes—quantitative assessment of water resources and runoff regimes under conditions of drought and climate variability. Issues related to resource assessments, regime characteristics, extreme runoff conditions (maximum and minimum runoff), methodological issues related to assessment techniques and computational technologies, and modeling studies are addressed. In the presented papers, the various topics are interwoven in different ways. Very conditionally, it may be assumed that eight publications deal primarily with hydrological analyses, four with methodological issues and a regionalization approach, and three publications with hydrological modeling. It is important to note that these are mainly scientific publications refereed and indexed in internationally recognized databases of scientific information. It is also essential to emphasize that their subject matter coincides with the topic of the announced competition.

For each paper in Group Г, the corresponding number of points is indicated, and their total exceeds the minimum required number. I accept the publications presented in Group Г as satisfying the minimum requirements for the position of Professor of Hydrology.

Group Д is devoted to citations and is represented by three indicators (indicators 12, 13, and 14). Assoc. Prof. Bojilova has presented her citations under each of these indicators: citations or reviews in scientific journals refereed and indexed in internationally recognized databases of scientific information or in monographs and collective volumes; citations in monographs and collective volumes with scientific peer review; and citations or reviews in non-refereed journals with scientific peer review. The total number of points in this group exceeds 300, which far surpasses the required 100 points.

The final **Group E** contains indicators related to leadership and participation in research and educational projects. Assoc. Prof. Bojilova demonstrates significant activity, with the total number of points across all indicators - 260 points, again exceeding the required number of 150 points.

The indicator for participation in a national scientific or educational project is represented by ten research projects, most of which are significant for hydrological practice and for the needs of the Ministry of Environment and Water. In general, they address topics related to long-term average annual water discharge and the updating of regression relationships for resource assessment; minimum average monthly discharge at 95% probability; determination of hydrological characteristics using a developed methodology for determining environmental flow under Bulgarian conditions; adaptation and application of an approach for drought research - identification, characterization, and regionalization of droughts and low-flow conditions in support of drought risk management plans and early warning systems; assessment of hydrological characteristics of reservoir catchments listed in Annex 1 of the Water Law - long-term average annual water discharge and, where data are available, minimum average monthly discharge with 95% probability, etc. The activity is mainly focused on the catchments of the Yantra and Tundzha rivers, with some of the listed activities having been updated for new periods in connection with the implementation of the Water Act and their management by the relevant state administrative authorities. The total number of points (E18) is 120 points.

The candidate in the competition presents two participations in international scientific projects:

"Assessment of Climate Change Impact on the Elements of the Hydrological Cycle, Regional Hydrological Cooperation of the Danube Countries in the Framework of IHP – UNESCO, Report: 'Hydrology and Water Resources Management in the Danube Catchment – Structures, Players, Projects, Financial Resources'," a project of the UNESCO International Hydrological Programme, 2002–2005; and "Hydrological Study for the Development of Flood Risk Management and Management Plans," funded by the Operational Programme "Environment" 2014–2020, 2019–2020. The total number of points (E19) is 40 points.

Assoc. Prof. Bojilova has led three national scientific or educational projects, as follows: "Assessments of River Runoff in Bulgaria Using Disaggregation Models," 2000–2002; "Application of Certain Mathematical Models for Studying the Rainfall–Runoff Process in Selected Catchments

Located in Bulgaria," No. 1 297, 2010–2012; and "Field Testing and Studies of Groundwater in the Sarmatian Aquifer with the Aim of Creating a Monitoring Network for Studying the Age and Recharge of Groundwater," 2021, with a total number of points (E20) of 60 points, as well as one international scientific or educational project—"Hydrological Analysis of the Phases of River Runoff in the Basins of the Rositsa River (middle reach) and the Yantra River (lower reach), 2024" with (E21) – 60 points.

A sufficient number of projects involving Assoc. Prof. Bojilova have been presented, differing in scope and significance in terms of the results obtained. Overall, however, a positive assessment can be given of the candidate's project work in her capacity as a hydrologist-researcher with her own scientific and applied results and practical value for society.

Two of the projects presented by Assoc. Prof. Bojilova, in which she is the project leader, are externally funded, namely "Field Testing and Studies of Groundwater in the Sarmatian Aquifer with the Aim of Creating a Monitoring Network for Studying the Age and Recharge of Groundwater" and "Hydrological Analysis of the Phases of River Runoff in the Basins of the Rositsa River (middle reach) and the Yantra River (lower reach)."

In her documentation, Assoc. Prof. Bojilova has also presented a report on the results of her research and applied research activities - a report on scientific contributions. Her overall activity is primarily within the scope of the topic of the announced competition—quantitative assessment of water resources and runoff regimes under conditions of drought and climate variability.

In her report, Assoc. Prof. Bojilova has presented the following three main scientific and applied scientific contributions:

- Regional hydrology;
- Hydrological modeling;
- Participation in the development of a technological approach for determining water resources by water bodies.

In the contributions related to Regional Hydrology, it is evident that, in addition to the Yantra River - on which a monograph has been published - the candidate has also developed a number of hydrological topics related to the Tundzha River basin, as well as rivers from the Danube basin, such as the Ogosta and the rivers west of it, the Iskar and the Osam. The research topics include resource assessments, minimum and maximum runoff, and environmental flow. There are grounds to assume that the accumulated experience would allow the already mastered methodological approaches to be successfully applied to other river basins in Bulgaria, i.e., the scope of regional hydrology could be expanded.

Hydrological modeling encompasses Assoc. Prof. Bojilova 's long-term work with the HEC models (Hydrologic Engineering Center of the United States Army Corps of Engineers – USACE), among the most widely used models in the world for solving significant hydrological problems, as well as the adoption of the ARMA model, which is new to Bulgaria.

In the third group of contributions - "Participation in the development of a technological approach for determining water resources by water bodies" - the candidate demonstrates a technological approach for determining the water resources of surface water bodies using a hydrological monitoring network that does not cover a number of water bodies, i.e., water bodies not included in observation networks. The determined water resources by water bodies have been provided by the Ministry of Environment and Water for the purposes of water management and refer to the catchments of the Tundzha and Yantra rivers. In addition to resource assessments by water bodies, such assessments are also carried out at water abstraction points in the two river basins.

I agree with the contributions formulated in this way. I also accept the thematic summarization of the contributions, considering the first two to be more significant. The report provides a detailed explanation of each of these contributions, as well as the related publications.

III. Opinions, recommendations and remarks

I have known Assoc. Prof. Dr. Elena Bojilova for many years. I value her professionalism, her work capacity, and her aspiration toward new knowledge. We have worked together on several projects, and she has always been precise and reliable. An important characteristic of the candidate is also her collaborative nature and her ability to work well with colleagues. I have no recommendations or critical remarks.

Conclusion

From the review of the materials submitted for the competition, no procedural violations have been found. The requirements of Art. 29 (1), (2), (3), Art. 29b (2), (3) of the ADASRB; Art. 60 (1), (2), and (4) and Art. 61 (1), (3) of the RIADASRB; and Art. 56 (1), items 4, 5, 6, 7, (2), (3) of the NIMH Regulations under ADASRB have been complied with.

Based on my review of the candidate's documents for the competition and the assessment of the publications she has presented, I give a clear and unequivocal evaluation that Assoc. Prof. Dr. Elena Bojilova fully deserves to be awarded the academic position of "Professor", and I call upon the other members of the esteemed scientific jury to join in this assessment.

REVIEWER:

/ Prof. Dr. Plamen Ninov /