

HD-02-6
09.12.19

Referee's Report

By Prof. Dr.Sci. Ognyan Ivanov Kounchev, IMI-BAS
Member of the scientific jury in the competition for academic position "Professor"
In professional direction 4.1., Physical sciences, scientific specialty „Meteorology“
(Stochastic modeling in meteorology and hydrology)

This review was prepared on the basis of the Order of the Director General of NIMH № ND-04-18 of 02.10.2019 and the decision of the meeting of the scientific jury of 18.10.2019. in the Republic of Bulgaria (ZRASRB), the Regulations for its implementation (PPZRASRB) and the NIMH Regulations on ZRASRB. The review consists of three parts and a conclusion.

I. Requirements for the applicant

under Art. 29 (1) and Art. 29b of the ZRASRB, Art. 60 of the PPZRASRB and Art. 56 (1), (2) and Art. 57 (1) of the NIMH Regulations on ZRASRB

From the documents which have been presented to me I found that the requirements for the applicant are fulfilled: Assoc. Prof. D.Sci. Neyko Neykov graduated with a degree in mathematics in 1976 with very good mark, holds the qualification "Master of Mathematics" in the specialty "Probability Theory and Mathematical Statistics" from the Faculty of Mathematics and Mechanics of Sofia University "Kl. Ohridski ". During the period 1993-1995 he was a free PhD student at NIMH-BAS, with scientific supervisor Assoc. Prof. Dr. D. Vandev.

In 1996 he defended his PhD thesis on Robust Methods in Multivariate Statistical Analysis before the state Specialized Scientific Council of Mathematics, Informatics and Mechanics (VAK). In 2016, he defended his Dr.Sci dissertation on "Robust Statistical Modeling by Trimming". During the 1976-1977 school year he worked as a part-time teaching assistant of mathematics at the Food Technology Institute in Plovdiv. During the period 1978-1988 he worked as a research assistant of 3rd degree at the Center of Biology, Bulgarian Academy of Sciences. In the period 1988-2000 he was a senior researcher 1st degree in NIMH, BAS. In 2000 he was elected as an associate professor, in the specialty "Statistical Methods in Meteorology and Hydrology" from the VAK Council of Mathematics, Informatics and Mechanics. Since 2007 he has been the head of the Forecasting Models and Systems group, and since 2017 a head of the Non-standard Forecasts group at the Department of Forecasting and Information Services, NIMH.

Participates and leads research and operational projects from the NIMH scientific plan for the development of stochastic models of daily precipitation, stochastic models of hourly concentrations of fine particulates, carbon and nitrogen dioxide, fog occurrence, significant wave height risk assessment at Black Sea coast stations.

He is a member of the Scientific Council of NIMH, BAS since 2008, member of the Bulgarian Statistical Society, member of the International Association for Computational Statistics (IASC), and on the board of directors of IASC for European section in the period 2008-2012. He was elected member of the International Statistical Institute (ISI).

From the examination of the submitted materials on the competition, I do not find any violations in the procedure for eligibility of the applicant to the competition and accept the materials for review.

II. Requirements for the scientific research and R&D activities

Art. 29 (1), item 1, item 3, item 4, item 5, item 6, (2) and (3), art. 29b (1) of ZRASRB, Art. 60 (1), item 3, item 4, item 5, (2) and (4) of the PPZRASRB, art. 56 (1), item 1, item 4, item 5, item 6, item 7, (2), (3) of the NIMH Regulations

From the scientific papers of Assoc. Prof. N. Neykov, submitted to me by the competition procedure jury, I have found that they do not repeat the publications used for obtaining the scientific degree "PhD", "Dr.Sci." and for acquiring an academic position "Associate Professor". The following are provided: 1) a list of scientific works; 2) references to citations of his scientific works; 3) references for participation and management of research and applied projects of the NIMH scientific plan, international and with funding from external organizations; 4) expanded reference to the results achieved for each of the scientific papers and major contributions; 5) a statement of fulfillment of the minimum requirements for occupation of the academic position "Professor".

Scientific publications. The list of scientific papers submitted by Assoc. Prof. D.Sci. N. Neykov contains 25 titles, one of which is a monograph.

The monograph "Stochastic daily precipitation model for Bulgaria" is co-authored with Assoc. Prof. Pl. Neytchev. It was published in 2019 and consists of 257 pages. A co-author-distribution protocol is presented, in which the authors declare equal contribution for the authorship of the monograph.

The publications with numbers:

1. [16], [2,3] and [5,9,10] have been published in refereed peer-reviewed journals without SJR, respectively, in Pliska. Stud. Math. Bulgar., Bulg. J. Physics and Bulg. J. Meteo. Hydrology;
2. [7,8,11,14] have been published in international journals with SJR;
3. [17] was published in Proceedings of a National Conference;
4. [15] has been published in the proceedings of international conferences;
5. [4,6,12,13,18,19,20,21] are book chapters with ISBN;
6. [22,23,24] are project reports between DFG and BAS;
7. [25] is a review of a monograph.

The publication [21] is written in Russian and the rest is in English.

Citations of scientific publications: Seven of the publications have been cited 56 times in the world-famous Scopus and Web of Science databases. The following is a breakdown of the citations of the publications with their respective numbers:

1. [7] (SJR-Q1) is cited 7 times in Scopus;
2. [8] (SJR-Q2) is cited 2 times in Scopus;
3. [11] (SJR-Q3) cited 6 times in Scopus;
4. [12] (WoS, SJR) cited 3 times in Scopus;
5. [14] (SJR-Q1) is cited 11 times in WoS;
6. [18] (Scopus) is cited 2 times in WoS;

7. [19] (Scopus SJR) is cited 25 times in Scopus.

Participation and project management. Assoc. Prof. D.Sci. N. Neykov has managed: 1) three (3) NIMH scientific plan projects; 2) two (2) BAS EBRD projects with DFG (Göttingen University) and the Finnish Academy of Sciences; 3) four (4) projects with external funding.

He participated in the

4) one (1) NIMH scientific plan project; 5) one (1) NSF project; 6) three (3) COST actions as a member of the Management Board; 7) working team of one (1) COST action; 8) fourteen (14) projects with TU Vienna, TU Delft, TU Lisbon; 9) five (5) projects with external funding.

According to item 3) from this list it is evident that Assoc. prof. N. Neykov satisfies the requirement of the NIMH Regulations on ZRASRB, Art. 56 (1), item 5, for the management of at least two (2) projects with external financing.

The reference and the number of points on the individual indicators given in the Summary Table show that the applicant fulfills the minimum national requirements for occupying the academic position of "professor".

SUMMARY TABLE

On the quantitative and qualitative indicators OF the SCIENTIFIC PRODUCTION under Art. 1a (1) and (2) of the PPZRASRB and Art. 2 (4) of the NIMH Regulations on ZRASRB

of Assoc. Prof. Dr.Sci Neyko Mateev Neykov

Group of indicators	For participation in the competition for Professor	
	Number of scores of the candidate	Necessary minimum scores
A	50	50
Б	100	—
B	100	100
Г	205	200
Д	112	100
E	555	150
Sum	1122	600

Research and application activities. The research of Assoc. Prof. D.Sci. N. Neykov is in several directions, the basis of which are the probabilistic-statistical methods for modeling and analysis of data in meteorology, hydrology and environmental protection, as follows:

- 1) Development of stochastic daily precipitation models in Bulgaria (publications with numbers 1, 2, 3, 6, 7, 8, 9, 13, 15, 16, 17, 23, 24);
- 2) development of methodology for extreme values analysis (publications with numbers 5, 14, 18, 19);
- 3) stochastic modeling of NO₂ hourly concentrations (publication number 10);
- 4) analysis of data in the field of hydrogeology (publications with numbers 4, 12);

5) analysis of data from psychophysiological and biochemical experiments (publications numbered 11, 21);

6) robust statistics (publication number 20).

The monograph [1] is devoted to stochastic daily precipitation models. Chapter 2 of the monograph outlines the methodology for modeling daily precipitation amounts. From probability and statistics point of view, this methodology is based on modeling the distribution of a random process, which is a mixture of a discrete and continuous probability distributions. Modeling this mixture by data is reduced to modeling two one-dimensional autoregressive time series with discrete (one is binary) and right-skewed distributions, using the apparatus of generalized linear models.

The remaining chapters of the monograph are an illustration of this methodology in development of specific models, with or without the use of meteorological predictors, based on a large number of NIMH network stations located in areas with different physical and geographical characteristics on the territory of Bulgaria. In chapters 3 and 4 a stochastic climate model, joint distribution of daily minimal and maximal temperatures, and daily precipitation totals, is developed to simulate synthetic time-series data. The minimal and maximal temperatures are modeled by Gaussian autoregressive models with lag 1, the precipitation occurrence of previous day and appropriately defined atmospheric indices of the NCEP / NCAR reanalysis as predictors. In publication [24], respectively Chapter 6, the expectation and the shape parameters of the gamma distribution are modeled by a finite Fourier series, i.e. post-processing of a gamma distributed autoregressive model. According to the authors (Khedhaouiria et al, 2018), this contributes to the methodology of stochastic daily precipitation modeling.

In paper [7], a hybrid distribution between the Weibull distribution and the tail of the Pareto distribution is developed in order to model the daily precipitation totals over the entire spectrum of values.

The publications [6, 8, 9, 13, 15] are devoted to the development of a spatial (regional, group) model of the daily precipitation by means of inhomogeneous hidden Markov model with finite number of states.

Some of the results in the articles and monograph on stochastic modeling of the daily precipitation model are original and have no analogues in the scientific literature in Bulgaria and, in my opinion, in the world literature.

Using the methods of simulation modeling, the publication [14] examines the behavior of the robust Wilks statistical test for identifying inconsistent station data when estimating regional distribution parameters for extreme values, by grouping station data in a region. The robust Wilks test is at the heart of publications [18, 19] that focus on flood risk assessment based on the annual maximum runoff of more than 200 rivers in Western and Central Europe and the occurrence of significant wave (Hs) heights in the North Sea at selected points of the coast of the Netherlands. It should be noted that the idea of a robust alternative to the Wilks test was proposed in N. Neykov's review [25] of the Hosking and Wallis monograph (1998).

Publication [10] is devoted to the stochastic modeling of hourly NO₂ concentrations with the Tweedie distribution. Publication [4] is about change-point detection of the annual flow of 8 karst springs in northwestern Bulgaria. The hydrochemical data concerning the quality of groundwaters in the Upper Thracian, part of the European reference aquifers are analyzed using standard statistical techniques. The research is funded by FP7 of the European Commission.

Teaching Activity. Assoc. Prof. N. Neykov lectures on Generalized Linear Models and Extreme Values Models for the students in the Master's Programs in Probabilities, Operational Research and Statistics and Mathematical Modeling in Economics, FMI, Sofia University. "Cl. Ohridski "since 2006. The lecture hour is 30 hours of lectures and 15 hours of a laboratory workshop on data analysis using R language He has delivered lectures on Statistics for PhD students and researchers at the NIMH within the framework of a project under the Operational Program "Human Resources Development", as well as lectures on "Statistical Modeling in Meteorology and Hydrology". The courses are completed with an exam and certification. He has taken an intensive course in Robust Statistics and its Applications lectures to students from the Doctoral Program in Statistics at the University of Turin.

Contributions. The author's summary of the scientific works of Assoc. Prof. N. Neykov is comprehensive and reflects the main results in the publications.

As a recapitulation, we can say that the contributions are clearly formulated: classes of stochastic daily precipitation models with and without meteorological predictors were developed based on data from the NIMH's network of stations uniformly covering the territory of Bulgaria for the period 1960-2010 yrs. A stochastic climate model of daily minimal and maximal temperatures, and daily precipitation totals is developed for stations Kneja and Sadovo. A stochastic daily precipitation model is developed for Ihtiman station, based on a hybrid distribution between the Weibull distribution and the tail of the generalized Pareto distribution. Classes of spatial (regional) daily precipitation models are developed based on (non)homogeneous hidden Markov models with finite number of states. A robust analogue of the Wilks statistical test for the detection of discordant stations in the formation of homogeneous groups of stations is proposed in order to estimate the parameters of the regional extreme values distribution within the regional frequency analysis widely used in hydrology and climatology.

It should be noted that the models created by N. Neykov (some with co-authors) can be applied for modeling a wide range of real processes and phenomena from practice, which defines them as a significant contribution to the modern methods of Applied Statistics.

III. Opinions, recommendations and notes

I have not identified any essential errors, inaccuracies or omissions in the materials presented.

I recommend the authors of the monograph [1] to illustrate the unknown model parameters estimation in Chapters 3, 4, 5, and 6 using standard statistical procedures from the free software environment R. I am convinced this will widen the range of readers and users of the monograph.

Conclusion

The examination of the submitted materials for the competition did not reveal any violations in the procedure. All the requirements of Art. 29 (1), (2), (3), Art. 29b (2), (3) of ZRASRB, Art. 60 (1) (2) and (4) and Art. 61 (1), (3) of the PPZRASRB Art. 56 (1), item 1, item 4, item 5, item 6, item 7, (2), (3) of the NIMH Regulations on ZRASRB.

The scientific publications of Assoc. Prof. N. Neykov have been referenced in the world-renowned databases of scientific information Scopus and Web of Science and have received recognition, which is referred to by positive quotations from foreign authors. The results achieved, the contributions to the science and the practical implementation give me reason to

say that Assoc. Prof. N. Neykov is a leading specialist in the field of stochastic modeling in meteorology, hydrology and the environment. I believe that his scientific activity is highly appreciated and I suggest that the members of the Distinguished Jury be awarded the academic title Professor of Assoc. Prof. Neyko Mateev Neykov.

Date: 3.12.2019 г.
Sofia

Referee: