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MSc. Nelson Venegas Cordero
doctoral thesis

Bruno Dąbka

Detection of changes in river floods and flood generating mechanisms in Poland

REVIEW

Technological science, Environmental Engineering

The dissertation was prepared at the WULS, Department of Hydrology, Meteorology and Water Management in the field of environmental engineering of technological sciences. Scientific supervisor: dr hab., prof. Mikołaj Piniewski.

The review was prepared after evaluating the doctoral thesis of Nelson Venegas Cordero and 3 scientific publications based on it. **The three scientific articles submitted for the defence of the dissertation** (cited in CA WoS databases) correspond to the topic and main aim of the dissertation, the tasks and results, and integrate new methodology and environmental engineering methods for detection of changes in river extreme discharges and flood generating mechanisms in Poland. The connection between the tasks of the dissertation and the published publications and their brief summary are presented in the general description of the dissertation.

The work is detailed and well-structured and prepared according to dissertation preparation requirements. The scientific relevance and practical significance of the dissertation are based on the introduction part. The main thesis hypotheses "Climate-related drivers have a stronger influence on current trends in river flood indicators in Poland than urbanization" is supported in the thesis and in three published articles.

The main aim of the research is to evaluate flood trends for the Polish rivers and determine the influence of climate-related drivers as well as anthropogenic factors (urbanization) on river floods. Three research tasks are solved in the thesis: evaluation of changes in river floods in near-natural catchments using multiannual data; analysis of influence of climatic factors (precipitation, snowmelt, soil moisture excess) to river floods in Poland; evaluation of impact of urbanization on river floods in comparison to climatic drivers in Poland. The solution to each task is detailed in a separate high-level publication.

The results of investigations are of great scientific and practical importance. The scientists in many countries are studying trends in extreme hydrological events based on historical data. But far fewer publications have focused on the influence of climatic and anthropogenic factors on the magnitude and timing of river floods. This thesis organically explains which climatic factors have the greatest influence on river floods and whether urbanisation significantly alters flood peaks. In a future studies, the author could perhaps decouple the assessment of the influence of climatic and anthropogenic factors using multiple regression analysis or other methods.

This work is of great practical value, as the results will help to assess the most dangerous regions in Poland in terms of flood risk. It will help to plan and develop flood protection measures.

Some comments and remarks concerning the quality of Doctoral Thesis:

1. "Introduction" and "Research objectives"

All necessary parts (research relevance, aim and tasks of the research) are presented in this chapter. The scientific novelty could be clearly described. The author wrote the section "Inter-relation of the articles". This chapter describes how the material in the articles relates to the objectives of the thesis. The research work-flow between articles and objectives is very clear - each publication corresponds to a separate work objective. Brief review of scientific literature is presented in "Introduction" chapter. The author input to the topic (own contribution to the topic of the dissertation) could be underlined more clearly.

2. "Study area, data and methods".

Methodology of research is presented in the chapter "Methods". This chapter presents the research methods used to address all the objectives. The author presented Table 2 in which the main methods are described. For better understanding of the link between the methods and the objectives set, a general research scheme of the methodology could be presented. A positive aspect of the work is that for the analysis of floods the POT series were chosen, which allows to estimate not only the magnitude but also the timing of floods. Flood trends were assessed for significance using a 10% (0.1) significance level. It would add value to the work if the author had also investigated other probabilities of flooding, e.g., floods significance using a 5 and 1 %. The paired catchment approach was applied for investigation of the effect of urbanization on river floods. Procedure of paired catchment selection is described very clear in Table 3. After the selection, a series of statistical methods were applied for the four paired catchments. It is only a bit unfortunate that the selected pairs of catchments are unevenly distributed over the territory of Poland - most of them reflect the hydrological characteristics of the central and southern part.

3. "Results and discussion".

Chapter is written clearly with good illustrations. I would like to put a question to the discussion on the comparing of flood trends analysis results for two analysis periods (1956-2019 and 1981-2019). I agree that it is important to assess trends in flood magnitude in the short term, as much more data is available. I just don't know if comparing overlapping time series is a good way to understand and assess trends changes and tendencies. Clearer comparison is in the assessment of flood generation mechanisms over Poland where the time series of the periods of 1952-1985 and 1986-2020 were selected. Very interesting part of research is the evaluation of the effect of urbanization on river floods in Poland. But this part of the thesis is very brief with no explanation of abbreviations. Therefore, a better understanding of the research and its results can be gained only after reading the third article.

4. "Conclusions".

The conclusions of the dissertation correspond to the tasks set. The conclusions on the methodological level add value to the thesis.

The results of Doctoral Thesis are based on 3 articles which are published in journals cited in „Clarivate Analytics“ database „Web of Science Core Collection“ with impact factors:

- 1.Venegas-Cordero, N., Kundzewicz, Z. W., Jamro, S., & Piniewski, M. (2022). Detection of trends in observed river floods in Poland. *Journal of Hydrology: Regional Studies*, 41, 101098 (IF = 4.7).
- 2.Venegas-Cordero, N., Cherrat, C., Kundzewicz, Z. W., Singh, J., and Piniewski, M. (2023). Model-based assessment of flood generation mechanisms over Poland: The roles of precipitation, snowmelt, and soil moisture excess. *Science of the Total Environment*, 891, 164626 (IF = 9.8).
- 3.Venegas-Cordero, N., Mediero, L., and Piniewski, M. (2024). Urbanization vs climate drivers: investigating changes in fluvial floods in Poland. *Stochastic Environmental Research and Risk Assessment* (IF = 4.2).

The selected journals for paper publications are of high scientific quality (Q1 and Q2). It should be noted that Nelson Venegas Cordero is the first author of three articles. The author's contribution to all publications is essential. The material presented in the articles allows a better appreciation of the material presented in the thesis. The high level of scientific publications is confirmed by the high level of citations of the author's dissertation papers. In Scopus database, the first article has been cited 12 times and the second one 8 times during the short period. This proves that Nelson Venegas Cordero thesis is important not only for Polish researchers, but also for researchers from different countries too. The author's methodology for flood studies will extend scientific research in internationally level.

PhD student Nelson Venegas Cordero carried out a large volume of scientific investigations. The doctoral thesis “Detection of changes in river floods and flood generating mechanisms in Poland” has a high scientific value and corresponds to main requirements of doctoral dissertations (relevance, scientific novelty and originality).

The doctoral dissertation of Mr. Nelson Venegas Cordero, meets all the requirements for doctoral theses as specified in the Act of 20 July 2018 – Law on higher education and science (consolidated text of 10 March 2023, Polish Journal of Laws 2023, item 742, as amended).

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