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Impact of environmental issues on research society and topic distribution in academic interest of Wrocław (Poland) – on the 5th anniversary of the environmental seminar on meteorology, hydrology and water management

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The academic community of Wrocław is known for its high scientific activity, also in the area of research concerning disciplines related with the natural environment of man, and especially the problems of meteorology, hydrology and water management. At three public universities: the University of Wrocław (2018), the Wrocław University of Science and Technology (2018) and the Wrocław University of Environmental Sciences (2018), there are three large faculties with the profile of Earth science, environmental engineering and management, the staff of which is involved with this subject-matter and in addition educate more than 3000 students. Independently, there are also active research institutes, including the Institute of Meteorology and Water Management – National Research Institute, Wrocław Branch, the primary research objective of which is the monitoring and study of the conditions of the environment, prediction of phenomena occurring in the environment, and management of systems of warning against extreme events (Institute of Meteorology and Water Management – National Research Institute 2018).

In view of a strong need for scientific meetings, exchange of research experience and support for environmental activity, in February 2013 the Institute of Meteorology and Water Management – National Research Institute (IMWM-NRI) and the Wrocław University of Environmental and Life Sciences (WUELS) initiated cyclic meetings of scientists and students – an environmental seminar concerned with meteorology, hydrology, water management and mathematical modelling in environmental sciences. The Seminar, which from the start took place every month during the academic year, was meant also to provide subject-matter support for the newly created journal *Meteorology, Hydrology and Water Management* (first volume published in December 2013). The environmental seminar, started in 2013, was preceded by scientific meetings of two collaborating research entities – the Department of Regional Studies, IMWM-NRI, and the Department of Statistic, Faculty of Mathematics, WUELS, that took place in the years 2010-2012.

During the period from February 2013 till February 2018, a total of 45 reports were presented at the Seminar. The titles of all the reports, together with the authors and their affiliations, are given below[1].

1. *Structure of the rainfall-runoff operational model*, W. Szalińska (IMWM-NRI, Wrocław), February 2013.
2. *Processing of meteorological data (observed and forecasted) with preparation of entry to hydrological models*, P. Struzik, I. Otop (IMWM-NRI, Katowice, Wrocław), March 2013.
3. *Methods of preparing hydrological forecasts*, F. Szumiejko, M. Kasina, A. Hański (IMWM-NRI, Wrocław, Kraków, Poznań), April 2013.
4. *Analysis and forecast of water resources of Nysa Łużycka – assumptions and progress of the project NEYMO*, M. Adynkiewicz-Piragas (IMWM-NRI, Wrocław), May 2013.
5. *Methods for calculating inviolable flows in Poland*, J. Niedbała (IMWM-NRI, Kraków), June 2013.
6. *Operational hydrological model of rainfall-outflow – Implementation after the first year of research*, T. Tokarczyk (IMWM-NRI, Wrocław), October 2013.
7. *Extreme flow changes for various climate change scenarios and the Kaczawa River*, L. Kuchar (WUELS/IMWM-NRI, Wrocław), S. Iwański (WUELS), L. Jelonek (IMWM-NRI, Wrocław), November 2013.
8. *Evapotranspiration as a water balance component in the context of hydrological modeling*, L. Łabędzki (ITP, Bydgoszcz), December 2013.

[1] IMWM-NRI – Institute of Meteorology and Water Management – National Research Institute; WUELS – Wrocław University of Environmental and Life Sciences; ITP – Institute of Technology and Life Sciences; UOW – University of Wrocław; CECP GmbH – Climate and Environment Consulting Potsdam GmbH; PULS – Poznań University of Life Sciences; WUST – Wrocław University of Science and Technology; BITLS – Bydgoszcz Institute of Technology and Life Sciences; CUT – Cracow University of Technology; SU – Szczecin University; IO – Institute of Oceanology; MSTC – Meshchersky Science and Technology Centre; RAAS – Riazań Russian Academy of Agricultural Sciences; LIA – Lublin Institute of Agrophysics PAS; OUWM – Olsztyn University of Warmia and Mazury; CECP – Climate and Environment Consulting Potsdam GmbH; PIAFE – Poznań Institute for Agricultural and Forest Environment (IAFE) of Polish Academy of Sciences; LIBSRW – Leibniz Institute.

9. *Hydrodynamic numerical modelling of the Odra River for flood hazard estimation*, R. Banasiak (IMWM-NRI, Wrocław), January 2014.
10. *Management of dam reservoirs on the example of Germany, Cooperation with Institut für Wasserwirthschaft, Siedlungswasserbau und Ökologie (IWSÖ)*, R. Stodolak (WUELS), K. Thurmer (IWSÖ), M. Klich (IWSÖ), February 2014.
11. *Seasonal forecasting of meteorological conditions for Poland*, A. Jaczewski (IMWM-NRI, Warszawa), March 2014.
12. *Modeling of air quality on a regional scale*, M. Kryza (UOW), April 2014.
13. *Inviolable river flows*, J. Błachuta (IMWM-NRI, Wrocław), May 2014.
14. *Application of synthetic precipitation data for urban hydrology needs*, P. Licznar (WUST), June 2014.
15. *Downscaling global climate projections into regional climate information*, A. Spekat, W. Enke (CECP GmbH), September 2014.
16. *Assessment of the river channel geometry changes on the flow rate curve parameters using ADCP measurement devices*, M. Wdowikowski (IMWM-NRI, Wrocław), October 2014.
17. *Analysis of flood hazard and flood risk maps*, A. Malinger (IMWM-NRI, Poznań), November 2014.
18. *Model studies of CO_2 emissions on arable lands in the work of the National Center of Emission Balancing and Management (KOBiZE)*, J. Nyćkowiak (PULS), December 2014.
19. *Flood wave transformation by Poraj reservoir on the Warta River*, A. Hański (IMWM-NRI, Poznań), January 2015.
20. *Modelling of hydrology and nitrogen dynamics on a scale of a small agricultural watershed using SWAT model*, K. Smarzyńska (BITLS), February 2015.
21. *Operational hydrological model of rainfall-outflow, implementation and results*, J. Jełowicki (IMWM-NRI, Warszawa), March 2015.
22. *Hydrological droughts and their impact on water management in Poland*, M. Kępińska-Kasprzak (IMWM-NRI, Poznań), April 2015.
23. *HydroPRog: a new early warning system for water crossings*, T. Niedzielski (UOW), May 2015.
24. *Determination of flood hazard zones as a result of construction damages*, A. Bogusz (IMWM-NRI, Warszawa), October 2015.
25. *Evaluation of meteorological and agricultural drought in 2015*, L. Łabędzki (ITP, Bydgoszcz), November 2015.
26. *Hydromorphological assessment of rivers based on field surveys and satellite images*, K. Szoszkiewicz (WUELS), December 2015.
27. *Flood risk changes in Europe*, Z. Kundzewicz (PIAFE), January 2016.
28. *Application of Multidimensional Comparative Analysis (MCA) in water management*, T. Walczykiewicz (IMWM-NRI, Kraków), February 2016.
29. *Assessment of drought risk*, T. Tokarczyk (IMWM--NRI, Warszawa), March 2016.
30. *Climate change – a global problem*, J. Olejnik (PULS), April 2016.
31. *Vistula Żuławy and the direct Vistula channel to the sea*, W. Majewski (IMWM-NRI, Warszawa), May 2016.
32. *Improvement of atmospheric monitoring*, J. Zwoździak (WUELS), June 2016.
33. *Drought risk reduction in agriculture*, J. Żarski (BITLS), October 2016.
34. *Numerical simulation of a low probability flood passage through the Racibórz reservoir*, R. Banasiak (IMWM-NRI, Warszawa), November 2016.
35. *Measurement of concentrations and streams of greenhouse gases for environmental research purposes*, R. Juszczak (PULS), December 2016.
36. *Kernel probability density estimation and application*, S. Węglarczyk (CUT), January 2017.
37. *Sea-level and coastline change: competition of geological climatic and anthropogenic impacts*, J. Harff (LIBSRW), February 2017.
38. *The spatial planning and urban floods*, P. Kowalczak (IMWM-NRI, Warszawa), March 2017.
39. *Forecasting of tornadoes in Poland based on a numerical weather prediction system using the Universal Tornadic Index (UTI)*, A. Mazur (IMWM-NRI, Warszawa), April 20017.
40. *Research career in biological and agricultural sciences in accordance with the current law on academic degrees*, W. Budzyński (OUWM), May 2017.
41. *Multifractal analysis of meteorological time series*, C. Sławiński, P. Baranowski (LIA), June 2017.
42. *Modelling as the support for marine environment research*, J. Jakacki (IO), October 2017.
43. *Internal soil moisture exchange and chemistry of interstitial and ground water*, Y. Mazhayskiy (MSTC, RAAS), November 2017.
44. *A new approach to flood risk analysis*, A. Tiukało, G. Dumieński (IMWM-NRI, Wrocław), December 2017.
45. *Air quality forecasts – LIFE+/APIS-PL project – and what's next*, A. Drzeniecka-Osiadacz, M. Kryza (UOW), January 2018.

At the seminars the attendance was noted each time, which allowed to identify the fields of interest of the participants according to five categories: hydrology, water management, meteorology, mathematical modelling, and other. No trends nor cyclic character of the attendance was observed, and the number of participants varied from 11 to 97 (Fig. 1), the mean value being close to 48 persons.

The attendance at the seminars was determined with respect to the presented subject matter. The relevant information is presented in a circle chart (Fig. 2). Simple analysis shows that hydrology enjoys the greatest interest in the community (32%), followed by water management (25%), i.e. the main research profile of the institutions organizing the seminar. The problems included in the category 'Other' was dominated by problems related to climate change.

In the 5-year period under consideration (2013-2018) a total of 45 reports were presented, the subject matter distribution of which is presented in Fig. 3. The largest number of reports, at about ¼ each, were devoted to hydrology and water management. A quarter of the reports on hydrology accounted for nearly 1/3 of total attendance at the seminars. Whereas, mathematical modelling attracted the smallest attendance (over 14% of reports attracted attendance at the level of 10%). One should keep in mind, however, that the combination of research subjects of the reports and their subjective classification is of an approximate character.

The speakers presenting the reports represented research institutions of various profiles (Fig. 4). Speakers from research institutes dominated (77%), while the Universities were represented by only about 18% of the

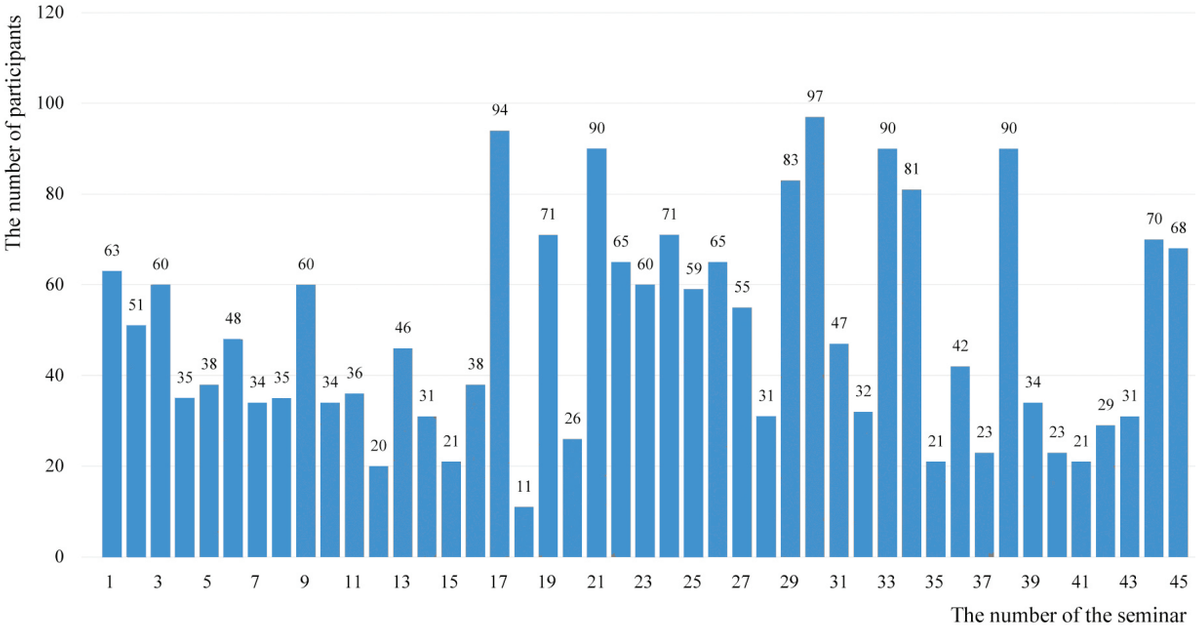

Fig. 1. Attendance at the seminars in the years 2013-2018

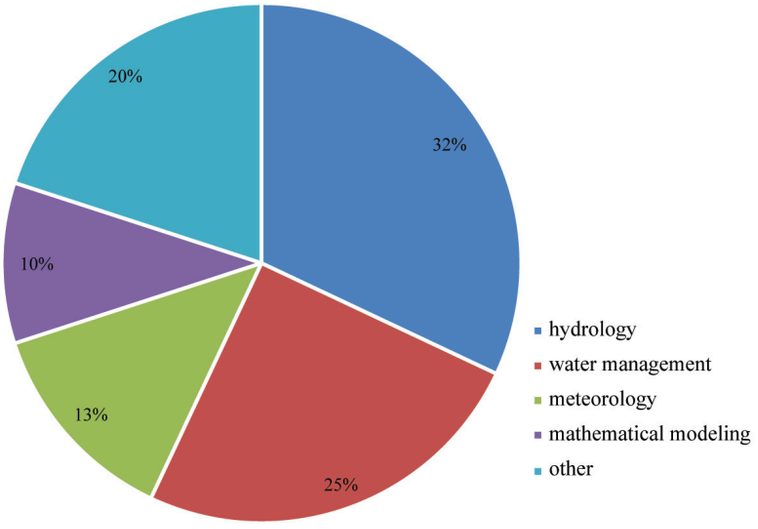

Fig. 2. Attendance at seminars according to subject matter in [%]

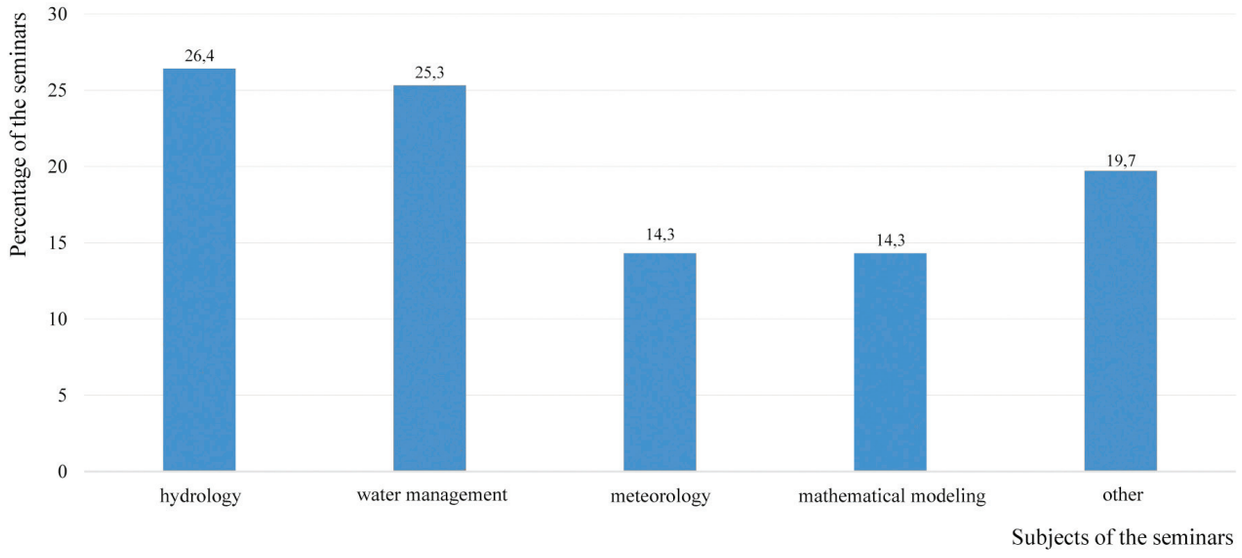

Fig. 3. Percentage distribution of subjects at the seminars in the years 2013-2018

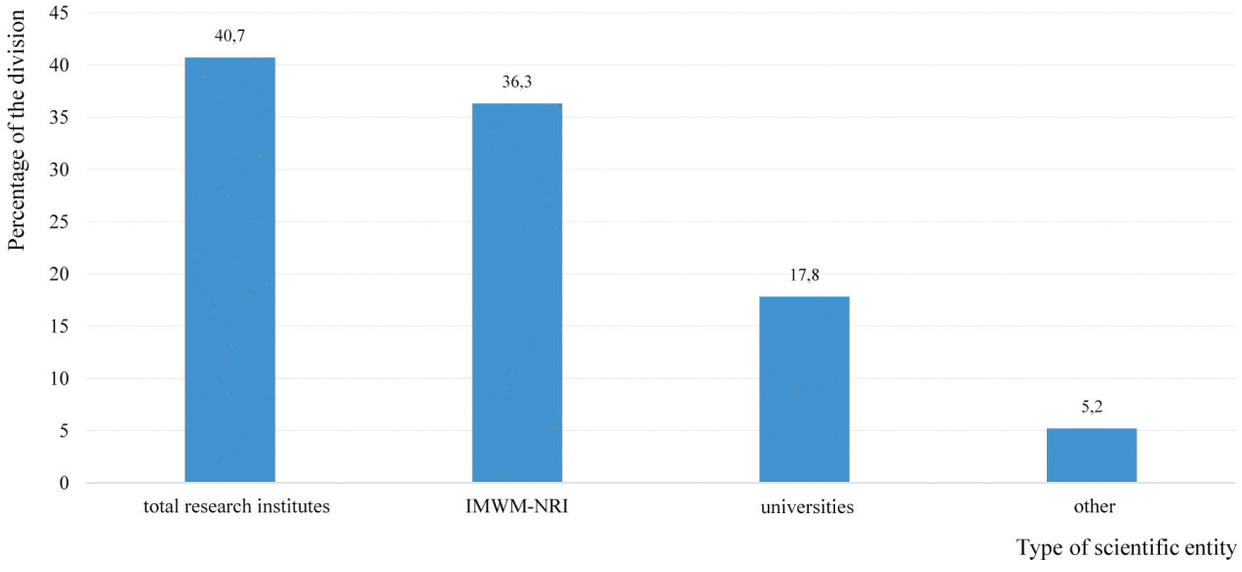

Fig. 4. Percentage of the division of speakers with regard to represented scientific entity

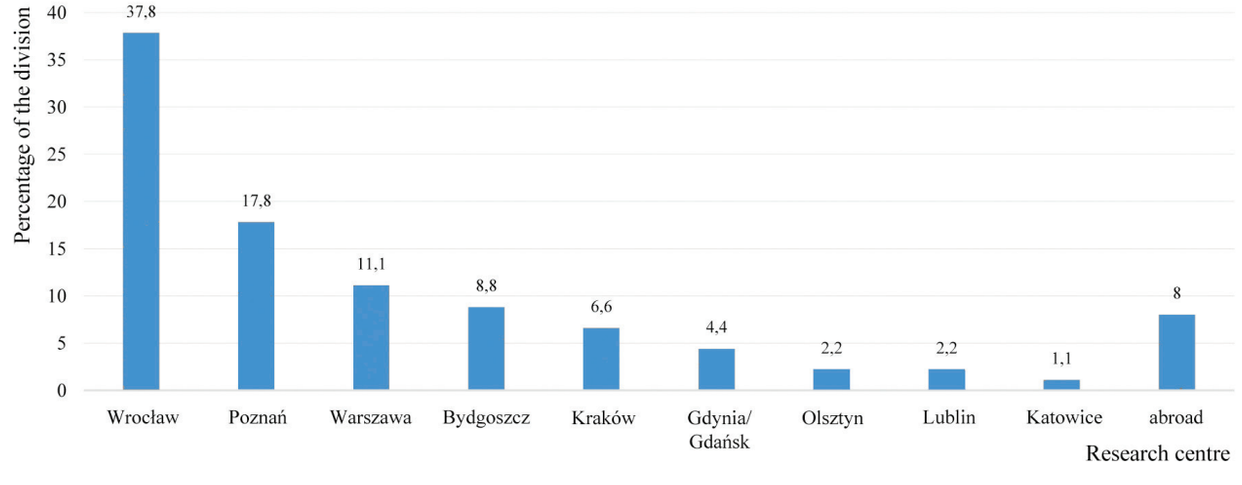

Fig. 5. Percentage division of speakers with regard to represented research and education centre

speakers. Authors from the Institute of Meteorology and Water Management – National Research Institute are separated from the total number of speakers from research institutes. Employees of IMWM-NRI had a total contribution of over 36% in the total number of presented reports.

The organized seminar had a national character (information was send by email and placed on the website of IMWM-NRI). The speakers – outstanding specialists, were invited from Polish centres of research and education as well as from abroad. The geographic distribution of the research centres of the speakers is presented in Fig. 5. Naturally, the dominant number is that of speakers from Wrocław (ca. 38%), but more than 62% of the speakers come from other centres than Wrocław (Poznań – ca. 18%, Warszawa – over 11%, and other) and from abroad – 8%.

The number of participants in the seminars included 5-10% persons from centres other than Wrocław, but no detailed statistics of attendance is given here. In conformance with the observations, it was assumed that the distribution of the participants had a uniform character and did not affect the present inference.

Summing up, it should be concluded that in the scientific community of Wrocław, concerned with environmental sciences, interests focused on hydrology and water management are dominant, while those related to the problems of meteorology are less intensively represented. Problems and engineering solutions enjoy greater popularity than mathematical modelling. This may by an implication of the floods that have afflicted many times the city, situated on 5 rivers – tributaries of the river Odra, of the notable hydrotechnical investments realized during the last 10 years within the flood protection programs (Odra-Vistula Flood Management Project Coordination Unit, 2018), and also of the educational profile of the local universities.

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