



Quadrennial Report

for the period

2016-2020

and

Research Plan

for the period

2020-2024

Contributors:

Canjevac I, Frolova N, Karthe D, Winde F, Zaharia L

Compiled:

Winde F

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1 Quadrennial Report for 2016-2020

1.1 Composition of Steering Committee

The leadership of the Commission changed end of 2015 following a brief period of uncertainty regarding the continuation of the Commission after several founding members retired from Commission. Through email ballot, the then Vice Chair was unanimously elected Chair by the SC-members and subsequently appointed by the General Assembly at the IGC in Beijing. A new SC was subsequently constituted, and its members approved by the Executive Committee of IGU in 2016.

Details of members currently serving on the steering committee (SC) are given in the table below:

Function	Name	Country, gender	SC since	max. to	Institution	Portfolio
Chair	Prof. Dr. habil. Frank Winde	South Africa, male	2012	2024	North-West University, Vanderbijlpark Campus, Geography and Environmental Studies, PO Box 1174, Vanderbijlpark, 1900; Extraordinary Professor Wismut GmbH, 09117 Chemnitz, Jagdschänkenstraße 29, Tel. +49 151 2571 3237, Skype: frank.winde, frank.winde@gmail.com	Management and admin, Membership/recruitment, website/ public visibility
Vize chair	Prof. Dr. Natalia Frolova	Russia, female	2012	2020	Lomonossov State University, Moscow, Department of Hydrology, Faculty of Geography, GSP-1, 119991, Leninskie Gory, MSU. Phone: +7 (495) 939-15-33 frolova_nl@mail.ru	Meetings + archiving
Vice-Chair	Prof. Dr. Chansheng He	USA, male	2012	2020	Western Michigan University. Wood Hall, Department of Geography, Western Michigan University, 3234 Wood Hall, Kalamazoo, MI 49008-5424. Phone: (269) 387-3425 Fax: (269) 387-3442 chansheng.he@wmich.edu	Publications + reporting
Member	Dr. Ivan Canjevac	Croatia, male	2012	2020	University of Zagreb, Faculty of Science, Department of Geography, Marulicev trg 19/II, 10000 Zagreb, Croatia, canjevac@geog.pmf.hr ; Tel. 0038514895424, Fax 0038514895440, Skype name: naumovac canjevac@geog.pmf.hr	Collaboration + outreach
Member	Dr. Daniel Karthe	Mongolia, male	2016	2024	Environmental Engineering Section German-Mongolian Institute for Resources and Technology (GMIT) GMIT Campus, 2nd Khoroo, Nalaikh, Mongolia Email: karthe@gmit.edu.mn	Membership + recruitment
Member	Prof. Dr. Liliana Zaharia	Romania, female	2016	2024	University of Bucharest, Faculty of Geography 1 Nicolae Balcescu Blv., 010041, Bucharest, Romania, Tel: + 40-21-305 38 22, Fax: + 40-21-315 30 74, zaharialil@yahoo.com ; zaharialili@hotmail.com	Proposed: Meetings + archiving
Member	Prof. Dr. Lanhui Zhang	China, female	2016	2024	Lanzhou University, College of Earth Environmental Sciences, Guanyun Building 0912, TianshuiNan Road 222, Lanzhou City, zip code: 730000, Gansu Province, China, Tel/Fax:010 931 8912805 lhzhang@lzu.edu.cn	Proposed: Publications + reporting
Member	Dr Julia Hall	Austria, female	2017	2025	Vienna University of Technology, Institute of Hydraulic Engineering and Water Resources Management, Austria, Tel. 4315880122322, 1040 Vienna, Karlsplatz 13/222-2 hall@hydro.tuwien.ac.at	Collaboration + outreach
Member	Prof. emer. JAA Jones	UK, male	2002	open ended	Institute of Geography and Earth Sciences, University of Wales, Aberystwyth. tonyandjenjones@btinternet.com	honorary SC-member

Currently, the Commission operates without a secretary leaving nearly all administrative work and duties (such as processing of membership applications, reporting to IGU, updating of website, endorsements, grant applications etc.) almost exclusively to the chair.

1.2 Objectives of the Commission

The objectives of the Commission guiding its activities over the reporting period are as follows:

The Commission strives to provide a recognised platform for international scientific exchange of physical and human Geographers as well as scientists from other disciplinary backgrounds sharing insights, knowledge and data on water- sustainability in its broadest sense. This includes natural and human impacts on the availability and quality of water and their implications for sustainable water use at local, regional and global scale. The Commission specifically encourages the dialogue between physical and human water sciences including economic, cultural, legal and medical aspects to arrive at a comprehensive understanding of natural and man-made factors governing water sustainability. A focus is on water-stressed areas worldwide encouraging and fostering mutually beneficial collaboration between scientists from developing and developed nations. The Commission aims to interpret “sustainability” in the widest possible sense, including the sustainability of the environment in the face of water development work as well as the sustainability of water resources. It aims to foster links between the human and physical aspects of water management, with specific concern for the sustainability of water resources and for the impacts of water management on the environment. The Commission holds regular international conferences, circulates a regular newsletter to registered corresponding members, and maintains a website displaying pertinent information. The Commission also aims to support collaborative and multidisciplinary research amongst its members. Current focal points of the Commission’s research include but are not limited to the following topics:

- Climatic and meteorological impacts on water resources
- Water in urban environments
- Groundwater management
- Water availability in arid and semi-arid regions
- Impacts of mining on surface and groundwater
- Hydrological processes and extreme events
- Integrated catchment and water resource management
- Water pollution and health
- Hydro – GIS (Geographical Information Systems)

1.3 Activities

A. Membership development

Even though several hundred of addresses were listed on the e-mail circulation list end of 2015 there was little response or active participation by most recipients.

To consolidate membership and facilitate active involvement in the activities of the Commission a template was designed and sent out to listed members capturing personal details, affiliation, and research interests. Only those members timely returning the filled-in template retained membership. Certificates of Membership were introduced and sent out on request.

All member profiles are now displayed on the Commissions website. Since 2016 the number of members registered in this way grew by 41 to a total of 59 in 2020 (as of 28 August). This includes 19 female and 38 males representing 26 countries on six continents.

New members were recruited by existing members, joined at conferences and, increasingly, requested membership via the revamped website. To encourage active participation a new clause was introduced and is displayed on the website stipulating a set of minimum activities for retaining membership.

B. Meetings

Over the reporting period a total of six conferences were organised by members of the Commission of which:

- two were Annual Meetings organised exclusively by the Commission (**Baikal 2017, Bucharest 2019**); both meetings included extensive field trips on hydrological topics,
- two meetings were held in conjunction with larger IGU events (**33rd IGC Beijing 2016; IGU Regional Conference Quebec 2018**) with dedicated sessions of the Commission and associated field trips, partly organised by the Commission
- two were organised by SC-members on specific themes (IGU-Thematic Conference on Practical Geography, **Moscow 2018**; International Conference on sustainable use of abandoned mines, **Johannesburg 2017** jointly hosted by the National Academies of Science of Germany and South Africa).

All events were in detail reported on in the respective annual reports of the Commission. In addition, the Commission held four *Business Meetings* during the conferences in Beijing, Baikal, Quebec and Bucharest.

In preparation of the planned IGC in **Istanbul 2020** detailed proposals for sessions and associated abstracts were submitted to the LOC of the IGC. Information on the cancellation of the event due to the corona pandemic was distributed to members in due time. Preparations for the event, now postponed to 2021, are currently underway.

In addition, prof. Frolova coordinated the preparation of the 4th Conference on World's Large Rivers planned to take place in August **2020 in Moscow** (Russia), which for the same reason, was postponed to 2021

C. Networking/ Collaboration

This section distinguishes between joint activities of members *within the Commission* (internal collaboration) and collaboration of the Commission *with external entities* such as international organisations and institutions (*external collaboration*).

Regarding *internal collaboration*, several activities occurred including:

- joint publication of three special issues on work of the Commission in international peer-reviewed journals (*Croatian Geographical Bulletin*, *Ecosystem Health and Sustainability*; *Geography Environment Sustainability*),
- international collaborative research project AMIPHYR on methods to quantify human impact on hydro-morphology of rivers between Romanian, Croatian and French members (Universities of Bucharest, Zagreb and Grenoble)
- Research visits of members (Prof. He visiting Prof. Zaharia in Romania), application for Fulbright visit of Prof. He to Prof. Winde in South Africa, Prof. Opp visiting Prof. Winde in South Africa etc.
- Supporting grant applications and promotions of members through endorsement letters from the chair (Prof. Ch. He: 3 x applications, Prof. L. Zaharia: 2 x applications, Dr. G. Morosanu 2 x applications, Dr. O. Fashae: 1 x application)
- Pre-peer review of manuscripts of members intended for submission to English-speaking international journals (6 x)
- Joint publications by two or more members of the Commission (a selection is provided in this report)
- Preliminary discussion of possible Commission projects (Hydrological glossary, textbook on Hydrogeography, joint use of software on hydrograph separation provided by M. Kireeva, data acquisition of crowd-sourced data from members for improving remote-sensing based soil moisture forecasts initiated of research of prof. He and his colleagues in arid parts of NW China)
- Support for local media reports of members on international water issues (e.g. water crisis Cape Town, water quality Baikal)
- For all commission meetings themes of sessions were designed and submitted abstract reviewed by members of the SC

External collaboration:

Joint projects of the Commission or its individual members include the following international organisations (*associated projects*):

- UNESCO (*Mining impacts on water and health in Africa*; *World's Large Rivers Conference*)
- WHO-IARC (World Health Organisation, International Agency for Research on Cancer, UN; *Health effects of environmental uranium exposure*)
- IAHS (International Association of Hydrological Sciences; *FRIEND: Flow Regimes from International Experimental and Network Data; meeting of the Low-Flow Group Freiburg, Germany, October 2017*)
- IAEA (International Atomic Energy Agency, UN; *Global inventory of uraniferous mine waste deposits*)

D. Publications

Newsletters and reports

- 3 x newsletters circulated; 3 x annual reports submitted to the General Secretary of IGU
- 2 x Quadrennial reports (2012-2016; 2016-2020; Winde F (2017): Water Sustainability. Quadrennial report of the Commission for Water Sustainability 2012-2016. International Geographical Union Bulletin, 65-66 (2015-2016), 344-353)
- 2 x reports to funding agencies of conferences and
- 1 x an extended response to a request for feedback on the Quebec conference 2018

Special editions

- *HRVATSKI GEOGRAFSKI GLASNIK/ Croatian Geographical Bulletin* (2016)
Proceedings of Dubrovnik meeting (2014), Lead: I. Canjevac
- *Environmental Health and Sustainability* (2018)
“Water Sustainability and Watershed Ecosystem Health”, Lead: Ch. He
- *Geography Environment Sustainability* (2020)
“Water sustainability at global, regional and national levels», Lead: Prof. N. Frolova

Much of the work relating to this special issue (submissions, review procedure, editing etc.) fell into a time with limited physical contact due to restrictions related to the Corona pandemic. With two planned conferences being postponed this special edition was an important part of maintaining communication and active collaboration among members.

Joint papers by Commission members

(selection; red – Members of Commission)

Blöschl G, **Julia Hall**, Juraj Parajka, Perdigão Rui A.P, Bruno Merz, Berit Arheimer, Aronica Giuseppe T., Ardian Bilibashi, Ognjen Bonacci, Marco Borga, **Ivan Čanjevac**, Attilio Castellarin, Chirico Giovanni B., Pierluigi Claps, Károly Fiala, **Natalia Frolova**, Liudmyla Gorbachova, Ali Gül, Jamie Hannaford, Shaun Harrigan, **Maria Kireeva**, et al. Changing climate shifts timing of European floods. *Science*. 2017. 357 (6351). P. 588-590. DOI: 10.1126/science.aan2506

Frolova N.L., **Kireeva M.B.**, **Magritckiy D.V.**, Bolgov M.B., Kopylov V.N., **Hall J.**, Semenov V.A., Kosolapov A.E., Dorozhkin E.V., Korobkina E.A., Rets E.P., Akutina Y., Dzhamalov R.G., Efremova N.A., Sazonov A.A., Agafonova S.A., Belyakova P.A. Hydrological hazards in Russia: origin, classification, changes and risk assessment. *Natural Hazards*. 2017. 88. № 1, p. 103-131 DOI ^ 10.1007/s11069-016-2632-2

Agafonova S.A., **Frolova N.L.**, Krylenko I.N., Sazonov A.A., Golovlyov P.P. Dangerous ice phenomena on the lowland rivers of European Russia. *Natural Hazards*. 2017. 88. № 1, p 171-188 DOI: 10.1007/s11069-016-2580-x

Rets E., Chizhova Ju N., Loshakova N., Tokarev I., **Kireeva M.B.**, Budantseva N.A., Vasil'chuk Yu K., **Frolova N.**, Popovnin V., Toropov P., Terskaya E., Smirnov A.M., Belozerov E., Karashova M. Using isotope methods to study alpine headwater regions in the Northern Caucasus and Tien Shan. *Frontiers of the Earth Science*, 2017. 11, № 3, p. 531-543 DOI: 10.1007/s11707-017-0668-6

Čanjevac, I., **Orešić, D.** (2018): Changes in discharge regimes of rivers in Croatia, *Acta Geographica Slovenica – Geografski Zbornik* 58 (2), 7-18. DOI: 10.3986/ags.2004

Zaharia, L., Costache, R., Prăvălie, R. **Ioana-Toroimac, G.**, 2017, Mapping flood and flooding potential indices: a methodological approach to identifying areas susceptible to flood and flooding risk. Case study: the Prahova catchment (Romania), *Front. Earth Sci.*, 1-19, DOI:10.1007/s11707-017-0636-1 (Impact factor 0,760) <https://link.springer.com/article/10.1007/s11707-017-0636-1>

Moroșanu G.A., **Zaharia L.**, **Ioana-Toroimac G.**, 2017, Changes in forest and water management in the upper Jiu River Catchment (Romania): possible effects on the hydro-sedimentary dynamics, *17 th International Multidisciplinary scientific Geoconference – SGEM 2017, Conference proceedings*, volume 17, Water Resources, Forest, Marine and Ocean Ecosystems, Issue 32, 749-756, ISSN 1314-2704,DOI: 10.5593/SGEM_GeoConference (ISI indexed).

Ioana-Toroimac G., **Zaharia L.**, Minea G., **Moroșanu G.A.**, 2017,Using a multi-criteria analysis to identify rivers with hydromorphological restoration priority: Braided rivers in the south-eastern Subcarpathians (Romania),*Science of the Total Environment*, 599–600 (2017) 700–709 (Impact factor 2015/2016: 3,976) 10.1016/j.scitotenv.2017.04.209 <http://www.sciencedirect.com/science/article/pii/S0048969717310616>

Khundzhua D. A., Kharcheva A. V., **Krasnova E. D.**, Gorshkova O. M., Chevel K. A., Yuzhakov V. I., **Patsaeva S. V.**., 2016.

Absorption and fluorescence of hydrophobic components of dissolved organic matter in several Karelian lakes with stratified structures. Proceedings of SPIE - The International Society for Optical Engineering, SPIE, the International Society for Optical Engineering (Bellingham, WA, United States), v. 9917, pp. 99170R-1-99170R-7 DOI: 10.1117/12.2229856; * participant Istomino meeting

Vasil'chuk Yu K., **Frolova N.L., Krasnova E.D.**, Budantseva N.A., Vasil'chuk A.C., Dobrydneva L.V., Efimova L.E., Terskaya E.V., Chizhova Ju N., 2016. Water Isotopic-Geochemical Composition in the Trekhsvetnoe Meromictic Lake on the White Sea COSAT. *Water Resources*, v. 43, № 5, pp. 828-838 DOI: <https://doi.org/10.1134/S0097807816050110>

Winde F, Kaiser F, **Erasmus E** (2017): Exploring the use of deep level gold mines in South Africa for underground pumped storage schemes. *Renewable and Sustainable Energy Reviews*, 78, 668-682, <http://dx.doi.org/10.1016/j.rser.2017.04.116> (IF 2016: 6.798, Q1)

Winde F, **Erasmus E**, Geipel G (2016): Uranium contaminated drinking water linked to leukaemia – revisiting a case study from an arid sheep farming area in South Africa. *Science of the Total Environment*, 574, 400-421, September, doi 10.1016/j.scitotenv.2016.09.035 (IF 2015: 3.976, Q1)

Winde F, Hoffmann E, Espina C, Schüz J (2019): Mapping and modelling human exposure to uraniferous mine waste using GIS-supported virtual geographical environments. *Geochemical Exploration*, 204, 167-180, <https://doi.org/10.1016/j.gexplo.2019.05.007>, IF (2019): 2.858

ZHANG, Lanhui, Chansheng HE*, Xiao Bai, Yi Zhu. 2017. Physically-based adjustment factors for precipitation estimation in a large arid mountainous watershed, Northwest China. *Journal of Hydrologic Engineering* 22(11):04017047, DOI: 10.1061/(ASCE)HE.1943-5584.0001576(SCI).

ZHANG , Lanhui, Chansheng HE*, Jinlin Li, Yong WANG, Zhongfu Wang. 2017. Comparison of IDW and physically-based IDEW method in hydrological modelling for large mountainous watershed, Northwest China. *River Research and Applications*, DOI: 10.1002/rra.3147 (SCI)

ZHANG, Lanhui, Xin JIN, Chansheng HE*, Baoqing ZHANG, Xifeng ZHANG, Chen ZHAO, Jinlin LI, Jie Tian and Carlo DeMarchi. 2016. Comparison of a concept model and a physically-based model for hydrological modeling of a mountainous watershed in arid Northwest China. *Journal of Hydrologic Engineering (SCI)*, 21(5): 04016007, DOI: 10.1061/(ASCE)HE.1943-5584.0001313.

Zaharia L.,Ioana-Toroi mac G., Cocoş O., Ghiţă F.A. Mailat E, 2016, Urbanization effects on the river systems in the Bucharest City region (Romania). *Ecosystem Health and Sustainability*2:11, e01247, DOI:10.1002/ehs2.1247, ESA/ESC Open Access Journal, ISSN: 2096-4129 (Print) 2332-8878 (Online), Taylor & Francis Online <http://onlinelibrary.wiley.com/doi/10.1002/ehs2.1247/full>

Kaiser F, **Winde F, Erasmus E** (2018): Storing energy in disused mines: comparing pumped water and compressed air-based technologies. *International Journal of Mining and Mineral Engineering*, vol. 9, no. 3, 177-195

Vasilchuk Y, **Frolova N**, Kasimov N, **Winde F**, Budantseva N, Chizhova J, Efimova L, Krasnova E, Terskaya E, Tokarev I, Vasilchuk A (2018): Isotope stratification of meromictic Lake Terkhtzvetnoe at the White Sea coast (Russia). *International Journal of Limnology*, 54 (23), 9 pages, <https://doi.org/10.1051/limn/2018012>

Zaharia, L., Ioana-Toroi mac, G., Morosanu, G., Galie, A., Moldoveanu, M., Čanjevac, I., Belleudy, P., Plantak, M., Buzjak, N., Bočić, N., Legout, C., Bigot, S., Ciobotaru, N (2018): Review of national methodologies for rivers' hydromorphological assessment: A comparative approach in France, Romania, and Croatia. *Journal of environmental management*, 217 (1), 735-746.

Čanjevac, I., Orešić, D (2018): Changes in discharge regimes of rivers in Croatia. *Acta Geographica Slovenica*, 58 (2), 7-18.

Orešić, D, Čanjevac, I., Maradin, M (2017): Changes in discharge regimes in the middle course of the Sava River in the 1931-2011 period. *Prace Geograficzne* 151, 93-119

Karthe, D.; Chifflard, P.; Cyffka, B.; Menzel, L.; Nacken, H.; Raeder, U.; Sommerhäuser, M. & Weiler, M. (2017): Water research in Germany: from the reconstruction of the Roman Rhine to a risk assessment for aquatic neophytes. *Environmental Earth Sciences* 76:549

Gabriela Ioana-Toroi mac, Liliana Zaharia, Gianina Neculau, Gabriel Minea (2020): IMPACT OF CHANNEL INCISION ON FLOODS: A CASE STUDY IN THE SOUTH-EASTERN SUBCARPATHIANS (ROMANIA). *GES*, 13 (2), 17-24

Dmitriy V. Magritsky, Natalia L. Frolova, Olga M. Pakhomova (2020): POTENTIAL HYDROLOGICAL RESTRICTIONS ON WATER USE IN THE BASINS OF RIVERS FLOWING INTO RUSSIAN ARCTIC SEAS. *GES*, 13 (2), 25-34

Maria B. Kireeva, Ekaterina P. Rets, **Natalya L. Frolova**, Timothy E. Samsonov, Elena S. Povalishnikova, Andrey L. Entin, Ivan N. Durmanov, Alexander M. Ivanov (2020): OCCASIONAL FLOODS ON THE RIVERS OF RUSSIAN PLAIN IN THE 20TH–21ST CENTURIES. *GES*, 13 (2), 84-95

E. Website

The website has been extensively overhauled regarding design, structure and contents. A new address has been purchased (www.igu-water.org) in order to make the site easier to remember and omit any advertising reference to the hosting company (WordPress). Newly added items and functionalities include:

- Research profiles of members
- Composition of steering committee
- Archives of conferences and presented papers (where available)
- Links to international water institutions and hydrological online glossaries
- E-mail contact facilities for visitors wishing to join the Commission
- Rules on membership
- Announcements of upcoming conferences and events
- Obituaries, acknowledgment of awards, retirement etc. of members

- News archive

Yet, challenges on high-frequency updating remain as resources such as time, required information etc. are not always readily available.

2 Research plan for 2020-2024

2.1 Proposed composition of Steering Committee

In accordance with statutory requirements of IGU there are 3 x members of the current SC whose maximum term expires end of 2020 (marked red). Apart from reaching the end of allowable terms there are also aspects regarding size and structure of the SC, portfolio aspects, regular input, attendance of meetings, change of personal circumstances etc. to be considered. While preliminary discussion on the best way forward have been taken place via email, it is proposed to wait with any concrete decision until physical (i.e. not only virtual) meetings are possible again to finalise some of the more sensitive aspects. Some proposals for possible replacements as suggested by members are listed in the table below (blue).

Function	Name	Country, sex	SC since	to	Institution	Portfolio
Chair	Prof. Dr. habil. Frank Winde	South Africa, male	2012	2024	North-West University, Vanderbijlpark Campus, Geography and Environmental Studies, PO Box 1174, Vanderbijlpark, 1900; Extraordinary Professor Wismut GmbH, 09117 Chemnitz, Jagdschänkenstraße 29, Tel. +49 151 2571 3237, Skype: frank.winde, frank.winde@gmail.com	Management and admin, Membership/recruitment, website/ public visibility
Vice Chair	Prof. Dr. Natalia Frolova	Russia, female	2012	2020	Lomonosov State University, Moscow, Department of Hydrology, Faculty of Geography, GSP-1, 119991, Leninskie Gory, MSU. Phone: +7 (495) 939-15-33 frolova_nl@mail.ru	Meetings + archiving
Vice Chair	Prof. Dr. Chansheng He	USA, male	2012	2020	Western Michigan University. Wood Hall, Department of Geography, Western Michigan University, 3234 Wood Hall, Kalamazoo, MI 49008-5424. Phone: (269) 387-3425 Fax: (269) 387-3442 chansheng.he@wmich.edu	Publications + reporting
Member	Dr. Ivan Canjevac Prof. Danijel Orešić	Croatia, male,	2012 CWS memb. since 2016	2020	University of Zagreb, Faculty of Science, Department of Geography, Marulicev trg 19/II, 10000 Zagreb, Croatia, canjevac@geog.pmf.hr ; Tel. 0038514895424, Fax 0038514895440, Skype name: naumovac canjevac@geog.pmf.hr	Collaboration + outreach
Member	Prof. Dr. Daniel Karthe	Mongolia, male	2016	2024	German-Mongolian Institute for Resources and Technology (GMIT), Environmental Engineering Section GMIT Campus, 2nd Khoroo, Nalaikh, Mongolia Email: karthe@gmit.edu.mn	Membership + recruitment
Member	Prof. Dr. Liliana Zaharia	Romania, female	2016	2024	University of Bucharest, Faculty of Geography 1 Nicolae Balcescu Blv., 010041, Bucharest, Romania, Tel: + 40-21-305 38 22, Fax: + 40-21-315 30 74, zaharialil@yahoo.com ; zaharialili@hotmail.com	Proposed: Meetings + archiving
Member	Prof. Dr. Lanhui Zhang	China, female	2016	2024	Lanzhou University, College of Earth Environmental Sciences, Guanyun Building 0912, TianshuiNan Road 222, Lanzhou City, zip code: 730000, Gansu Province, China, Tel/Fax:010 931 8912805 lhzhang@lzu.edu.cn	Proposed: Publications + reporting
Member	Dr. Julia Hall	Austria, female	2017	2025	Vienna University of Technology, Institute of Hydraulic Engineering and Water Resources Management, Austria, Tel. 4315880122322, 1040 Vienna, Karlsplatz 13/222-2 hall@hydro.tuwien.ac.at	Collaboration + outreach
Member	Prof. emer. Tony Jones	UK, male	2002	open ended	Institute of Geography and Earth Sciences, University of Wales, Aberystwyth. tonyandjenjones@btinternet.com	honorary SC-member

Generally, we believe that it is in the best interest of the continued work of the Commission to not only take formal requirements into account but also levels of past and current engagement, frequency, importance and

relevance of input, leadership qualities and experiences among others. We, therefore, argue in favour of an option where terms of deserving members can be expanded if approved by the majority of SC-members. Also, activities of SC-Members in their respective portfolios should be analysed to find the optimum fit between personal strengths and expertise and the area of responsibility.

2.2 Proposed objectives of the Commission

The objectives of the CWS remain essentially the same as in the past 4 years with some modifications (**red**).

Objectives

The Commission strives to provide a recognised platform for international scientific exchange of physical and human Geographers as well as scientists from other disciplinary backgrounds sharing insights, knowledge and data on water- sustainability in its broadest sense. This includes natural and human impacts on the availability and quality of water and their implications for sustainable water use at local, regional and global scale. The Commission specifically encourages the dialogue between physical and human water sciences including economic, cultural, legal and medical aspects to arrive at a comprehensive understanding of natural and man-made factors governing sustainability and resilience of water systems. A particular focus is on water-stressed areas worldwide where we foster mutually beneficial collaboration between scientists from developing, **emerging** and developed economies. The Commission also aims to support collaborative and multidisciplinary research amongst its members and with international organizations. Current focal points of the Commission's research include but are not limited to the following topics:

- Anthropogenic impacts on water sustainability
- Groundwater management
- Climatic and meteorological impacts on water resources
- **Sustainability and resilience of water systems** in arid and semi-arid regions
Hydrological processes and extreme events
- **Fluvial morphology and dynamics**
- Integrated catchment and water resource management
- Water pollution and health
- Hydro-GIS
- **Water-energy–food-nexus**

2.3 Research / activities

A. Membership development

- As identified previously, it will be a continued focus of the Commission to further grow the proportion of *young* scientists among members. Promising examples over the past four years include the attraction of doctoral students or young post-docs from Romania, South Africa, China and Russia to name but a few.

- Also, the policy of attracting *female* scientists and researchers with a non-natural science background as well as practitioners from relevant water sectors will further be pursued.
- Member from *countries facing water scarcity* (such as the Middle East, Northern/ Southern Africa for example) are also to be targeted.
- *Means* of attracting members include word of mouth by current members as perhaps most important way, actively inviting identified colleagues to meetings of the Commission, advertising the work of the Commission on the website, providing support in research grant and travel applications etc. In addition, a review of listed members regarding the stipulated 2-year-non-activity rule is to be conducted to avoid accumulating non-active members as happened in the past.

B. Meetings

Even before the Corona pandemic limited travelling and physical presence at conferences the Commission proposed to explore the use of digital communication as a means to increase participation of members who cannot afford overseas travelling on regular basis. With the surge in tele-communication software developed and released during the corona pandemic this might be now an even more viable and acceptable option which the Commission intends to increasingly make use of in future meetings.

In addition, acknowledged experts on topics relating to water sustainability including UNESCO-Chairs of Hydrology are to be targeted by personal invitations to present at Commission meetings.

For conferences, the Commission generally strives to include hydrological topics of local relevance to attract scientists from the host nation.

For the period ahead the following meetings are envisaged:

34th IGC, Istanbul 2021

- proposals for dedicated sessions of Commission as submitted for 2020 will be retained for 2021
- members are informed of regarding re-submission of abstracts etc.
- two newly joined Turkish members may be asked for organising thematic field trip(s)

Conference on world's large rivers, Moscow 2021

- also postponed to 2021
- will be actively supported by UNESCO, IAHR, IAHS as well as the Commission

Regional IGU conference, Paris 2022

- proposed to coincide with annual meeting of the Commission, including a business meeting
- Proffs. Canjevac and Zaharia may contact long-term French collaborators (including one member of the Commission) to organise thematic field trips

Annual Commission Meeting 2023

- Venue still to be determined based on members' proposals trying not to re-select past venues
- as usual, a focus will be on extended field trip
- One option, proposed by Prof. Karthe, is to organise a joint meeting between the Commission and the Working Group of Hydrology in Germany to facilitate networking among the groups with a view towards establishing long-term collaboration among members.

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- Commission will be holding dedicated sessions as well as a business meeting
- Topics for sessions will also consider local relevance (e.g. peat hydrology etc.)

C. Projects and Collaboration

Joined projects that started in 2018/19 are set to continue. This includes:

(i) Textbook on Hydrography

- originally proposed by Prof. Karthe as addressing a gap in literature he identified preliminary discussions were held via e-mail as well as at the meeting in Bucharest regarding the merits of the project and its pros and cons as well as technical details. With Prof. Karthe soon moving to the UN-University in Dresden (Germany) (the Commission congratulates him on this appointment) he anticipates to shed much of the current administrative work load that inhibited progress on the textbook project.

(ii) Improving algorithm for hydrograph separation

A software developed in Russia and introduced to the Commission by Dr. Kireeva (Moscow State University) for separating fluvial run-off components from flood hydrographs is made available to members via a link. The aim is to improve the robustness of the algorithm through informed feedback from specialist users.

(iii) Ground-truthing satellite data

Inspired by work of Prof. He and his colleagues in arid China trying to calibrate satellite-based soil moisture data using on-site field measurements the chair proposed to apply the developed methods to various environment for increasing the set of relevant data. The project was announced in the newsletter following the Bucharest meeting and received positive initial response, *inter alia*, by Prof. Schnug from Germany offering to serve as facilitator of collaboration with a remote sensing specialist in the agricultural field.

(iv) Map projects of Commission members

Core idea is to use freely available software (Google Earth) for mapping the spatial extent and main contents of water-related research projects conducted by Commission members. Required inputs are to be provided in standardised template format capturing information such as kml/kmz files of projects of members, main aims and objectives, duration, funding agency and associated publications. The compiled GE database will be available on the website and open to all visitors aiming to initiate and facilitate collaboration with scientists working on similar projects elsewhere, or on different projects in the same area.

(v) Other

In continuing with past activities envisaged collaboration also includes mutual research visits of members at their respective institutions including guest professorships, joint supervision of students, exchange of students and post-graduates, creating shared data bases, joined grant applications (e.g. of members from BRICS countries) etc.

In addition, existing links to international bodies such as ICSU, WMO, IWRA, IMWA, UNESCO-IHP, ICOLD, IAEA are to be maintained and expanded.

D. Publications

In contrast to the previous practice of mainly publishing books the Commission in 2016 decided to increasingly shift attention towards supporting joint papers of members in peer-reviewed journals e.g. by mutually assisting each other with (language) editing, internal pre-reviews etc. The number of joint papers listed in this report is proof of the successful implementation of this strategy. In addition, we envisage to continue publishing Special Issues on selected topics like the three issues we managed to complete in the preceding period.

E. Website

One of the challenges of any website is the need for frequent updates. Running parallel to normal work duties with no support of a dedicated website administrator this can be challenging at times.

Issues needing attention relate to the following:

- updating member profiles where affiliation or contact details changed and new publications appeared
- completing the archive of past meetings
- making presentations given at meetings available on the website
- a compilation of publications by members with annual updates

As part of branding the Commission the use of the Commission's logo by members is encouraged.

