

IAHS

Report on the First Biennium of Panta Rhei

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Panta Rhei was launched in July 2013, during the IAHS General Assembly held in Gothenburg. The visibility of Panta Rhei, after 2 years from its start, is excellent, with several researchers involved from all over the world. The first biennium has been dedicated to shaping the structure of the initiative. The call for Research Theme (RTs) and Working Groups (WGs), that was issued at the end of 2013, resulted in the formation of 30 WGs which are addressing 11 RTs. The full list of WGs is available at <http://www.iahs.info/pantarhei/?q=node/25>. They involve about 300 scientists from several countries and 5 continents. This success of Panta Rhei is a confirmation of the popularity of IAHS and its scientific decades, which effectively promote the involvement of young scientists and stimulate educational and research initiatives in hydrology. This report presents a first summary of the activity of Panta Rhei, by also highlighting its first research results.

THE STRUCTURE OF PANTA RHEI

For the Biennium 2013-2015, during the General Assembly held in Gothenburg, The IAHS Bureau nominated the following officers:

- **Chair:** Alberto Montanari (University of Bologna)
- **Target Leaders:**
 - Target 1 - Understading:** Hilary McMillan (National Institute of Water and Atmospheric Research, New Zealand - Leader), Magdalena Rogger (Vienna University of Technology, Austria - Co-Leader)
 - Target 2 - Estimation and prediction:** Hafzullah Aksoy (Istanbul Teknik Üniversitesi, Turkey - Leader), Dominic Mazvimavi (University of the Western Cape, South Africa - Co-Leader)
 - Target 3 - Science in Practice:** Giuliano Di Baldassare (Unesco-IHE, The Netherlands - Leader), Yan Huang (Changjiang Water Resources Commission, China - Co-Leader)

PANTA RHEI – ACTIVITIES DURING THE FIRST BIENNIUM

Research Themes and Working Groups

In November 2013 the Panta Rhei governance issued a call for Research Themes (RT) and Working Groups (WG). IAHS decided to adopt a bottom-up philosophy to shape the structure of Panta Rhei and therefore the community was involved in the identification of the key research issues thus stimulating the active participation of scientists from all over the world. The call for RTs and WGs was permanently open during the first biennium of Panta Rhei. To date, 11 RTs (see Table 1) and 22 WGs (see Table 2) proposals have been received.

Table 1. Research Themes proposed by the community for Panta Rhei (up to May 25, 2015).

Research Theme	Proposer
Transdisciplinarity	Tobias Krueger
Mountain hydrology	Shreedhar Maskey
Large scale water projects and society	Bellie Sivakumar
Physics of changes	Alexander Gelfan
Water footprint assessment	Saket Pande
Water and energy fluxes in a changing environment	Maria J. Polo
Epistemic uncertainties	Paul Smith
Hydro-meteorological extremes: Decision making in an uncertain environment	Adrián Pedrozo Acuña
Global Change in Hydrology and Society	Jos Timmermans
Reservoirs impact	Aleksandr Tskhai

Table 2. Working Groups proposed by the community for Panta Rhei (up to March 10, 2014).

Working Group	Chair
Hydro-meteorological extremes: Decision making in an uncertain environment	Adrián Pedrozo Acuña
Large dams, society, and environment	Bellie Sivakumar
Thirsty future: energy and food impacts on water	Ana Mijic
Changing biogeochemistry of aquatic systems in the Anthropocene	Hong
Transdisciplinarity	Tobias Krueger
Natural and man-made control systems in water resources	Ronald van Nooijen
Water and energy fluxes in a changing environment	Maria J. Polo
Epistemic uncertainties	Paul Smith
Comparative water footprint studies	Arjen Y. Hoekstra
Hydrologic services and hazards in multiple ungauged basins	Hilary McMillan
Understanding flood changes	Alberto Viglione
Physics of hydrological predictability	Alexander Gelfan
Mountain hydrology	Shreedhar Maskey
Large sample hydrology	Vazkén Andreassian
Socio-hydrologic modeling and synthesis	Veena Srinivasan
Sustainable water supply in a urban change	Tatiana Bibikova
Water footprint of cities	Alfonso Mejia
Evolving urban water systems	Alfonso Mejia
Changes in flood risk	Heidi Kreibich
Anthropogenic and climatic controls on water availability (ACCuRAcY)	Attilio Castellarin
Floods in historical cities	Alberto Montanari
Prediction under Change (PUC)	Hafzullah Aksoy
Data-driven Hydrology	Elena Toth
Modeling Hydrological Processes and Changes	Yangbo Chen
Resilience-based management of natural resources: the fundamental role of water and soil in functional ecosystems	David Finger
Integrating history, social conflicts and hydrology: From semi pristine to highly modified hydrological systems	Victor Rosales Sierra
Drought in the Anthropocene	Anne Van Loon
Water scarcity assessment: methodology and application	Junguo Liu
Improving Hydrological Systems Knowledge	Jun Xia
Process-based hydrologic modeling for decision making	Chaopeng Shen

The reports of the activity carried out by the Panta Rhei Working Groups in 2014 is available for download at <http://www.iahs.info/pantarhei/?q=node/25>. The WGs have carried out an excellent activity during the first year, therefore proving the enthusiasm of the Panta Rhei researchers and the popularity and significance of the Panta Rhei themes.

Scientific symposia

A scientific session entitled "Hydrological Change and Water Systems: Feedbacks, Prediction, and Experimental Management" was proposed under the auspices of Panta Rhei and finally convened at the 2013 Fall Meeting of the American Geophysical Union (AGU). The session was convened

by N. Basu (University of Waterloo, Canada), A. Montanari (University of Bologna, Italy), M.C. Bruno (Mach Foundation, Italy) and T. Melis (USGS, USA). Fifty-four oral and poster contributions were presented, therefore witnessing a relevant success. Six invited presentations were delivered by N. van de Giesen (Technical University Delft, Netherlands), C.T. Robinson (EAWAG, Switzerland), C.P. Konrad (USGS, USA), I. Creed (Western University, Canada), C. Lane (US EPA Office of Research and Development, Cincinnati, Ohio, USA), A. Viglione (Technical University Wien, Austria) and U. Lall (Columbia University, USA) on the three main themes of "Reservoir operation and control", "Peatland and Wetlands" and "Sociohydrology and change".

Three symposia dedicated to *Panta Rhei* have been convened at the 2014 General Assembly of the European Geosciences Union (EGU). The first one was a visionary session titled "*Panta Rhei*: a vision and an agenda for the next 10 years of hydrological research in support of society", convened by G.H. de Rooij (Helmholtz Centre for Environmental Research - UFZ, Germany) and A. Montanari (University of Bologna, Italy). This session hosted the talks of 6 invited speakers: H. Savenjie (Technical University Delft, Netherlands), D. Koutsoyiannis (National Technical University of Athens, Greece), U. Lall (Columbia University, USA), B. Arheimer (SMHI, Sweden), E. Foufoula-Georgiou (Indiana University, USA) and S. Tamea (Politecnico di Torino, Italy). EGU 2014 also hosted the sessions "Stakeholders, public involvement and collaborative processes in hydrology research and water management", convened by T. Krueger (University of East Anglia, UK) and G. Carr (Technical University Wien, Austria), and "Change in climate, hydrology and society", convened by D. Koutsoyiannis (National Technical University of Athens, Greece), J. de Lima (University of Coimbra, Portugal), H. Lins (USGS, USA), X.L. Wang (Environment Canada, Canada), M. Mudelsee (Climate Risk Analysis, Germany), C. Cudennec (INRA, France) and C. Maftai (Ovidius University, Romania).

The conference "*Evolving Water Resources Systems - Understanding, Predicting and Managing Water - Society Interactions*", held in Bologna (Italy) during June 4-6, 2014, was organized within the framework of *Panta Rhei*. A community paper is being produced after the conference to provide a vision for the future of water resources systems. Proceedings of the conference were published in the Proceedings of the International Association of Hydrological Sciences (PIAHS), and are available through open access at <http://www.proc-iahs.net/364/index.html>. The proceedings collect 89 articles presented by research groups active in 31 different countries from 5 continents (see Figure 1).

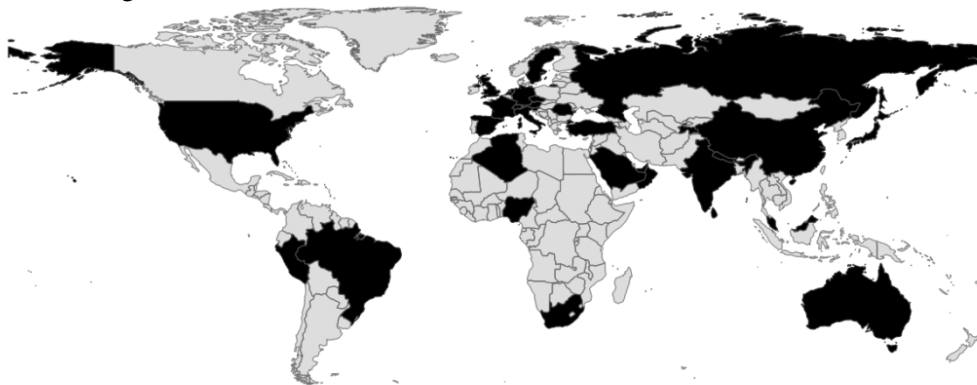


Figure 1. Countries of origin of the international research groups that contributed to the PIAHS volume "*Evolving Water Resources Systems: Understanding, Predicting and Managing Water-Society Interactions*".

The Fall Meeting of the American Geophysical Union (<http://fallmeeting.agu.org/2014/>) proposed several events that are relevant to *Panta Rhei*. First of all, session H34E was explicitly dedicated to *Panta Rhei*, which was titled "*Sociohydrology: Modeling Feedbacks in Complex Coupled Natural Human Water Systems (Panta Rhei - Everything Flows)*". Oral talks were delivered by Alberto Montanari (Chair of *Panta Rhei*), Richard Vogel, Charles J Vorosmarty, Christopher A Scott,

Veena Srinivasan, Juan Carlos Castilla Rho, and Rachata Muneeppeerakul. Furthermore, Hubert Savenije, President of IAHS, delivered an oral talk in session H41L, titled "Water Footprint Assessment and the Panta Rhei research initiative of the International Association of Hydrological Sciences (IAHS)".

Panta Rhei was represented by several sessions at EGU2015, thanks to the activity of the WGs. The list of the EGU2015 session organized by the WGs is reported here below.

- HS5.9 - Irrigation, water and society
Convener: Jimmy O'Keeffe
Co-Conveners: Simon Moulds, Ana Mijic, Wouter Buytaert, Pradeep Mujumdar, Nicholas Brozovic
- HS5.7: Hydrology & Society: Transdisciplinary approaches to hydrology and water resources management
Conveners: Tobias Krueger, Gemma Carr, Antje Bruns, Stuart Lane, Christopher (Kit) Macleod, Eva Nora Mueller, Carly Maynard, Leon Hermans
- HS2.3.8 - Hydrological Consistency: A Stronger Basis for Testing Hypothesis using Large Datasets
Convener: Thibault Mathevet
Co-Conveners: Rohini Kumar, Hoshin Gupta, Jai Vaze, Vazken Andréassian
- BG5.1: Environmental, Socio-economic and Climatic Changes in Northern Eurasia and their Feedbacks to the Global Earth System
Convener: Pavel Groisman
Co-Conveners: Shamil Maksyutov, Evgeny Gordov, Qihong Tang, Elena Kukavskaya
- HS5.12: Water Footprint Assessment
Convener: Saket Pande | Co-Conveners: Arjen Y. Hoekstra, Bridget Scanlon, Megan Konar, Sonia Yeh, Heather Youngs
- HS5.7: Hydrology & Society: Transdisciplinary approaches to hydrology and water resources management
Convener: Tobias Krueger
Co-Conveners: Gemma Carr, Antje Bruns, Stuart Lane, Christopher (Kit) Macleod, Eva Nora Mueller, Carly Maynard, Leon Hermans
- HS3.1: HydroInformatics: computational intelligence, systems analysis, optimisation
Convener: Elena Toth
Co-Conveners: Dimitri Solomatine, Robert J. Abraham
- HS1.5: Droughts in the Anthropocene
Convener: Anne Van Loon
Co-Conveners: Giuliano Di Baldassarre, Henny A.J. van Lanen
- HS5.6: Design and Operation of Water Resource Systems: Computer Based Control and Optimization
Conveners: Ronald van Nooijen, Niels Schuetze
Co-Conveners: Alla Kolechkina, Francesca Pianosi, Renata Romanowicz, Dirk Schwanenberg, Matteo Giuliani
HS7.4/AS4.23/CL2.8: Change in climate, hydrology and society (co-organized)
Convener: Demetris Koutsoyiannis
Co-Conveners: João de Lima , Xiaolan L. Wang , C. Cudennec , Manfred Mudelsee , Harry Lins
- ERE3.8: Design and operation of combined hydro/wind/solar power generation systems: Computer Based Control and Optimization.
Convener: Alla Kolechkina
Co-Conveners: Andreas Efstratiadis, Andrea Castelletti, Paolo Burlando, Patrick Reed
- ERE3.8: Design and operation of combined hydro/wind/solar power generation systems: Computer Based Control and Optimization.
Convener: Alla Kolechkina

- Co-Conveners: Andreas Efstratiadis, Andrea Castelletti, Paolo Burlando, Patrick Reed
- HS2.4.1: Hydrological extremes: from droughts to floods
Convener: Alberto Viglione | Co-Conveners: Attilio Castellarin , Jan Szolgay , Lena M. Tallaksen, Gregor Laaha
- HS2.4.4: Flood changes: understanding the drivers of hazard and risk
Convener: Luis Mediero | Co-Conveners: Alberto Viglione , Sergiy Vorogushyn , Heidi Kreibich
- HS7.7/NP3.8: Extremes in hydrometeorology: Scales, intensities, probabilities (co-organized)
Convener: Alin Andrei Carsteanu | Co-Conveners: Alberto Viglione , Ladislav Gaál , Sabine Lennartz-Sassinek , Marco Borga , Auguste Gires , Andreas Langousis

A Pantarhei Session "4.II - Adaptation to changing flood risk" has been held at the European Climate Change Adaptation conference, 12th to 14th of May, 2015, in Copenhagen.

Pantarhei Sessions "Extreme hydrological events: deciphering changes in hazard and risk at different time-scales", and "Climate change and freshwater" will be held at the Science Conference "Our Common Future Under Climate Change" in Paris, 7-10 JULY 2015.

Finally, several sessions are organized under the umbrella of Pantarhei at the 26th General Assembly of the International Union of Geodesy and Geophysics (IUGG), which will be held in Prague, Czech Republic, from the 22nd of June to the 2nd of July 2015.

Summer and Winter Schools

A Spring School on Global Climate Change Impacts Assessment and Water Resources has been organized during May 15-22 in Beijing. It was funded by my university (Beijing Forestry University) and the National Natural Science Foundation of China, as one key events of the Pantarhei working group "Water Scarcity Assessment". The School was organized by prof. Junguo Liu, Beijing Forestry University, Beijing, China and Director-general of the Society for Ecological Restoration in Beijing, China.

A 7 day Field Course in Hydrology & Geology in Iceland, focusing on "The Principals of Resilience Based Management of Natural Resources", will be held from 17th -22nd August, 2015. The course will include daily field trips, field measurement, modeling aspects and management strategies. The programme is a joint collaboration with the Soil Conservation Service of Iceland.

Outreach activities

Pantarhei was highlighted and extensively promoted during the following events:

- EGU Meeting, Vienna, April 2013
- IAHS-UNESCO Kovacs Colloquium, Paris, July 2014
- AGU Fall Meeting, San Francisco, December 2013
- Russian congress of hydrology, Saint Petersburg, November 2013
- EGU Meeting, Vienna, April 2014
- ICRS conference in Guangzhou, August 2014
- Meeting of the advisory working group of the Commission of Hydrology of WMO, Prague, September 2014
- FRIEND world conference, Montpellier, October 2014
- AGU Fall Meeting, San Francisco, December 2014
- Meeting of the steering committee of GRDC - Global Runoff Data Center under the auspices of WMO, Koblenz, June 2015

Promoting cooperation and visibility of scientific initiatives and publishing

One of the main missions of Pantarhei is to promote the visibility of hydrological research and publishing. To this end, the Pantarhei web site (www.iahs.info/pantarhei) reports in the main page any Pantarhei initiative. Researchers are invited to use the contact page of the web site if

they wish to communicate any related news.

Visibility to scientific publishing will be achieved by hosting on the Panta Rhei web site two lists of papers that are relevant to the subject of change in hydrology and society. An highlighted list will include papers that explicitly acknowledge Panta Rhei (the web site provides instructions to this end) while a second list will include papers that are relevant to the Panta Rhei activity. Papers are included in the above lists on request of the authors, who are invited to use the contact page of the web site to highlight their contributions. The community is invited to refer to the above lists of papers when working at Panta Rhei, as they are meant to provide a coherent information and support the development of future research activities.

Currently, the list of the highlighted papers, explicitly acknowledging Panta Rhei, includes 17 contributions (<http://www.iahs.info/pantarhei/?q=node/27>).

More detailed and updated information is available at www.iahs.info/pantarhei.

Alberto Montanari
Chair of Panta Rhei 2013-2015