Panta Rhei – Everything Flows
Change in Hydrology and Society
IAHS Scientific Decade 2013-2022
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Details of the Proposal

Title of the Working Group

Hydrologic services and hazards in multiple ungauged basins

Abstract of the proposed research activity

Societal needs for water are not limited to locations with flow gauges, but occur in all sizes and types of rivers. As demands for water increase, more consistent, reliable and accessible information on flow volumes and dynamics is required to balance competing water uses, including ecological, agricultural, fisheries, recreational and cultural values.

Our central research question is how to estimate hydrological behavior in ungauged locations, by bringing together and advancing best practices on robust large-scale modelling approaches. We will integrate statistical and physical modelling approaches to combine hydrological knowledge and information content to predict river flows. We will use signatures relevant to societal needs to assess model performance, and to investigate regional patterns of hydrological services and hazards.

Example activities are (1) A USGS-led science goal to provide daily streamflow estimates at 160,000 ungauged river reaches across the US (2) Participation in the EU project SWITCH-ON which uses open data to provide water information valuable to society across Europe.

Panta Rhei Research Themes, Targets and Science Questions addressed by the Working Group

Target 2: Estimation and prediction

Science Question 4: How can we use improved knowledge of coupled hydrological-social systems to improve model predictions, including estimation of predictive uncertainty and assessment of predictability?

Science Question 5: How can we advance our monitoring and data analysis capabilities to predict and manage hydrologic change?

Societal impact of the Working Group activities

We expect the societal impact of our working group to be high. We will place a strong emphasis on translation of our model results into indicators (e.g. ecological, economical, and recreational) which describe the values that society places on water. In addition, the results will be used in operational products and services for societal needs on efficient water management and policy decisions. A key output of our working group will be a 30-year 'Hydrological Reanalysis' which describes how flows and their associated values have changed throughout the US and Europe, respectively. We also plan an overview analysis of the magnitude of societal impacts on river flows away from their natural state. For Europe, the activity aim at sharing research infrastructure based on open data and will result in a virtual water-science laboratory for collaborative experiments and analysis.

Our model analysis results will be freely available to the public; 1) for our US study we will use existing USGS infrastructure, and 2) for our European study we will use the infrastructure of the EU project Switch-on, to make model predictions available via the Internet. We see our stakeholders as all members of the public, authorities, water managers and appointed enterprises with interests in making business on water information products.

List of Participants

Name of Participant	Affiliation (full address and email)	Role in Working Group (Chair or Member)	Main expertise
Hilary McMillan	National Institute of Water and Atmospheric Research, *New Zealand* h.mcmillan@niwa.co.nz	Chair	Research hydrologist with expertise in hydrological model design and evaluation. Leader of research programmes for flood prediction and water resource assessment.
Stacey Archfield	U.S. Geological Survey, Northborough, Massachusetts, *USA* sarch@usgs.gov	Task Leader	Research Hydrologist with expertise in statistical methods to predict streamflow in ungauged basins. (Leader for Activity 1) .
Julie Kiang	U.S. Geological Survey, Reston, Virginia, *USA* jkiang@usgs.gov	Task Leader	Leader of the USGS National Water Census Program research group tasked with providing daily streamflow estimates at ungauged rivers in the United States. (Leader for Activity 1)
Berit Arheimer	Swedish Meteorological and Hydrological Institute, *Sweden* Berit.Arheimer@smhi.se	Task Leader	Associate Professor and Head of the Hydrologic Research Group with expertise in large scale and multi-basin modeling, comparative hydrology, and predictions in ungauged basins. (Leader for Activity 2)
Lauren Hay	U.S. Geological Survey, Lakewood, Colorado, *USA* lhay@usgs.gov	Member	Research Hydrologist and leader of the USGS Modeling of Watershed Systems (MoWs) project: http://wwwbrr.cr.usgs.gov/projects/SW_MoWS/index.html
Rodney Knight,	U.S. Geological Survey, Nashville, Tennessee, *USA* rrknight@usgs.gov	Member	Research Hydrologist with expertise combining statistical and rainfall-runoff models to address ecohydrology questions.
Andrew Bock	U.S. Geological Survey, Lakewood, Colorado, *USA* abock@usgs.gov	Member	Hydrologist and Geospatial Analyst with rainfall-runoff modeling experience, including PRMS.

Vazken Andreassian	National Research Institute of Science and Technology for Environment and Agriculture (IRSTEA), *France* vazken.andreassian@irstea.fr	Member	Research Hydrologist and Deputy Scientific Director of IRSTEA with expertise in hydrologic modeling and prediction in ungauged basins.
Thorsten Wagener	University of Bristol, *United Kingdom* thorsten.wagener@bristol.ac.uk	Member	Professor of Water and Environmental Engineering and leader of a multidepartmental research group that focuses on hydrologic modeling and calibration. One of the editors of the book "Runoff Prediction in Ungauged Basins – Synthesis across Processes, Places and Scales".
Alberto Viglione	Vienna University of Technology, *Austria* viglione@hydro.tuwien.ac.at	Member	Postdoctoral Fellow with international appointments at universities in the US, Ethiopia and France and hydrologic modeling projects in Italy, Austria and at the European level. One of the editors of the book "Runoff Prediction in Ungauged Basins - Synthesis across Processes Places and Scales".
Jan Seibert	University of Zurich, *Switzerland* jan.seibert@geo.uzh.ch	Member	Associate Professor of Hydrology and Climate in the Department of Geography with expertise in hydrological modelling for climate-change impact assessment
Martyn Clark	National Center for Atmospheric Research, Boulder, Colorado, *USA* mclark@ucar.edu	Member	Expertise in large-scale climate dynamics, land-atmosphere interactions, and applied hydro-climatology.
Sabine Attinger	Helmholtz Centre for Environmental Research -UFZ, *Germany* sabine.attinger@ufz.de	Member	Hydrologist with expertise in multiscale parametrization methods to predict streamflow in ungauged basins; Head of the Division of Environmental System Computation and Monitoring