



Panta Rhei – Everything Flows
Change in Hydrology and Society
IAHS Scientific Decade 2013-2022
www.iahs.info/pantarhei

Details of the Proposal

Title of the Working Group

Epistemic Uncertainties

Abstract of the proposed research activity

Considering uncertainties in hydrological experimentation and modelling may be considered state-of-the-art, yet how to account for epistemic (lack-of-knowledge) uncertainties in the prevailing methodologies is far from obvious. When predictions are made of socio-hydrological systems or when decisions are made within them, then there are even more unknowns relating, for example, to human epistemologies, values and behaviour. These are rarely considered at all. The Working Group *Epistemic Uncertainties* will conduct research under these strands. Specific research questions include:

- What should a typology of epistemic uncertainties include?
- What are the added “social” epistemic uncertainties in socio-hydrological systems?
- How far do prevailing uncertainty methodologies stretch in capturing epistemic uncertainties?
- How are epistemic uncertainties processed in decision making?
- Are there modes of knowledge production and governance that may safeguard against epistemic uncertainties?

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

This Working Group addresses all three targets, but predominantly in the context of estimation and prediction (target 2). By analysing the “known unknowns” of epistemic uncertainties, the Working Group will help address science question 1 (“What are the key gaps in our understanding of hydrologic change?”). Key contributions will further be made to 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?") and science question 6 ("How can we support societies to adapt to changing conditions by considering the uncertainties and feedbacks between natural and human-induced hydrologic changes?"), both having an explicit uncertainty angle.

Societal impact of the Working Group activity

Society is faced with urgent decisions of water sharing and adaptation to a changing environment that are linked in complex ways with other resources and human needs. Much about the socio-hydrological system remains unknown, yet decisions have to be made now. Hence, analysing the robustness of those decisions under epistemic uncertainties and finding ways to safeguard against severe surprises will benefit society greatly. It is one aim of the Working Group to create and maintain interfaces for knowledge exchange with wider society, particularly through the applied research of the Working Group members.

List of Participants

Name of Participant	Affiliation (full address and email)	Role in Working Group (Chair or Member)	Main expertise
Paul Smith	Lancaster Environment Centre, Lancaster University, Lancaster, LA1 4YQ, UK, p.j.smith@lancaster.ac.uk	Chair	Epistemic uncertainty; real time forecasting; operational decision making; floods
Tobias Krueger	IRI THESys, Humboldt-Universität zu Berlin, Unter den Linden 6, 10099 Berlin, Germany, tobias.krueger@hu-berlin.de	Member	Model structural uncertainty; social uncertainty; adaptive water resources management; co- production of socio- hydrological knowledge
Hilary McMillan	National Institute for Water and Atmospheric Research, PO Box 8602, Christchurch, New Zealand, h.mcmillan@niwa.co.nz	Member	Uncertainties in data, hydrological signatures and model structure; hydrological model design and evaluation
Ida Westerberg	University of Bristol, Queen's Building, University Walk, Clifton BS8 1TR, UK, Ida.Westerberg@bristol.ac.uk	Member	Observational uncertainties; model evaluation; uncertainty estimation; applied hydrology
Liz Stephens	Department of Geography and Environmental Science, University of Reading, Whiteknights, PO Box	Member	Ensemble flood forecasting; decision- making from

	217, Reading, Berkshire, RG6 6AH, UK, Elisabeth.stephens@reading.ac.uk		probabilistic forecasts; forecast evaluation; user requirements
Grey Nearing	NASA Goddard Space Flight Center, Hydrological Processes Lab, Code 617, Bldg 33, Rm G205, 8800 Greenbelt Rd, Greenbelt, MD, 20770 USA, grey.s.nearing@nasa.gov	Member	Bayesian methods for uncertainty mitigation; system identification; land surface modeling; information theory