



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

Water&Energy Fluxes in a Changing Environment

Abstract of the proposed research activity

This WG will focus on quantifying and coupling water and energy fluxes at different scales for studying water, sediment and nutrient/pollutant cycles under current and future scenarios. For this, coupling of ground and remote sources of data within hydrological models are the basis for deriving further variables of interests for many applications, especially under changing conditions. Some relevant applications addressed by the WG research activity are:

- Forecasting of extreme rainfall-flood/drought-scarcity conditions
- Modelling water use by vegetation for both crop and natural systems
- Modelling impact on morphological processes in riverine and coastal environments
- Forecasting/Tracing changing in the change drivers of coupled energy&water fluxes
- Forecasting/Tracing impacts on snow-dominated regions
- Forecasting/Tracing successional processes in transitional waters
- Assessing adaptive actions to face impacts of changing conditions on watershed and coastal systems
- Assessing Integrated River Basin&Coastal Zone Management IRB&ZCM
- Assessing economic and legal regulations to face society interactions and needs related to IRB&ZCM

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

This WG is linked to a Research Theme also proposed in this call, RT Water&Energy Fluxes in a Changing Environment. As expressed in the proposal, this RT addresses the three targets of Panta Rhei, since the WG focuses on **understanding** how water and energy fluxes are driven by hydrological processes in a changing environment, for designing and monitoring their

forcing agents, state variables, and/or fluxes themselves from both remote and ground sources, in order to **estimate and predict** their current and future regimes, with the ultimate goal of providing society with **science in practice** : information, knowledge, and tools for the assessment of adaptive actions related to integrated river basin and coastal zone management (IRBM&ICZM).

The Science Questions in Panta Rhei can be addressed by the WG-RT as the following specific aspects:

1. What are the key gaps in our understanding of the energy&water fluxes shifts and interactions associated to changing conditions?
2. How do such changes interact with and feedback agricultural systems, natural systems, and the social systems built on their distribution and use?
3. What are the boundaries of coupled social, environmental and economic development based on or related to agricultural and natural areas in a changing world?
4. How can we include the “human factor” to improve water&energy fluxes modelling at different time and spatial scales in order to assess uncertainty and risk in IRBM&ICZM?
5. How can we improve our prediction capabilities from coupling remote and ground monitoring systems within river basin and coastal zone modelling?
6. How can we provide society with clear but sound knowledge and tools to face the likely shifts of agricultural and environmental resource based systems under this changing environment? How can we put this science in practice through adaptive actions?

Societal impact of the Working Group activity

Water and energy fluxes regimes condition the availability of water at different scales throughout the world. Quantifying them requires an efficient and sound monitoring of the state variables driving their evolution, the external conditions influencing them, and even measuring the fluxes themselves. Ground or remote monitoring systems are not individually capable of generating all the information needed for the assessment and forecasting of current and future excess/deficit situations. Moreover, their integration within hydrological, hydraulic, ecological... models can produce further information than the data themselves. This WG activity has impact on a wide variety of applications: drought/flood risk assessment, crop production, environmental sustainability, water resource management infrastructures, adaptive actions assessment. Citizens, technicians, managers, politicians, and researchers will benefit from this interdisciplinary approach.

List of Participants

This is a preliminary list of confirmed participants in this WG. Some other researchers have expressed their potential interest to join this group, and they may join this initial team. The WG is made up of a core of hydrology researchers with different specializations within the RT but close areas, together with additional researchers with complementary profiles, such as ecology, coastal areas or economy.

Name of Participant	Affiliation (full address and email)	Role in Working Group (Chair or Member)	Main expertise
1 María J. Polo	Andalusian Institute for Earth System Research (Director) University of Cordoba, Spain mjpolo@uco.es	Chair/member	Hydrology; watershed modelling; surface water quality; uncertainty and risk analysis. Mediterranean watershed processes.
2 María Pat González-Dugo	Andalusian Institute for Agricultural and Fisheries Research and Training Andalusian Government, Spain mariap.gonzalez.d@juntadeandalucia.es	Member	Evapotranspiration; energy balance; remote sensing. Natural and crop vegetation water use monitoring.
3 Z. (Bob) Su	ITC, University of Twente, The Netherlands z.su@utwente.nl	Member	Hydrology and global circulation; energy balance; remote sensing. Earth and atmosphere interactions.
4 Rafael Muñoz-Carpena	University of Florida, USA carpena@ufl.edu	Member	Hydrology; water quality; uncertainty. Ecological systems analysis and environmental models.
5 Christopher Neale	Daugherty Water for Food Institute (Director of Research) University of Nebraska, USA cneale@nebraska.edu	Member	Energy balance; evapotranspiration; remote sensing. Agricultural water resource management.
6 Dawei Han	University of Bristol, UK D.Han@bristol.ac.uk	Member	Weather radar rainfall; numerical weather modeling; real time flood forecasting. Flood/drought risk assessment.
7 Miguel A. Losada	Andalusian Institute for Earth System Research (Director) University of Granada, Spain mlosada@ugr.es	Member	Coastal morphodynamics; estuaries; statistics of geophysical variables; uncertainty and risk analysis. Coastal environments.
8 Donald Young	Virginia Commonwealth University, USA dyoung@vcu.edu	Member	Coastal plant ecology; vegetation distribution and successional processes; invasive species. Coastal and transitional environments.
9 Julio Berbel	University of Cordoba, Spain berbel@uco.es	Member	Water resources economy; water costs and prices; environmental and water legislation. Agriculture and rural systems.