



Panta Rhei – Everything Flows  
Change in Hydrology and Society  
IAHS Scientific Decade 2013-2022  
[www.iahs.info/pantarhei](http://www.iahs.info/pantarhei)

## Details of the Proposal

### Title of the Research Theme

Water&Energy Fluxes in a Changing Environment

### Abstract of the research theme

Quantifying and coupling water and energy fluxes at different scales is a key need 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 Targets and Science Questions addressed by the Research Theme

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 Research Theme**

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.

### **Panta Rhei Working Groups referring to the Research Theme**

A Working Group named after this RT has also been proposed in this call. Different divisions of this WG or more specific additional WG (following subtopics and specific scientific questions) can be included following the acceptance-decision of this RT.