



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 Research Theme (RT)

Physics of Changes

Abstract of the research theme

The proposed RT “Physics of Changes” focuses on nature (“physis” in Greek) of changes in hydrological systems in their interconnection with natural and human systems.

Research activities include:

- Advancing approaches for analysing potential predictability of the water cycle processes, quantifying predictability, separating predictable/unpredictable patterns, dividing inherent and model-derived limits to predictability.
- Setting up strategy for analyzing interconnection of predictability aspects of hydrological systems with respective aspects of the connecting systems.
- Exploring the dynamical behaviour of hydrological systems in their feedbacks with connected systems, developing concept of dynamical stability of hydrological systems, analysis of changes in patterns of stable/instable system states, contribution of these changes to self-organization, understanding nature of adaptation to changes.
- Developing new concept and measuring techniques for characterization of memories of the surface-subsurface hydrological systems, identification of the memory factors, improving predictions based on dampening of signals in various-memory components of the water cycle.

Panta Rhei research Targets and Science Questions addressed by the Research Theme

The proposed RT attempts to balance between developing new and advancing existing approaches, i.e. between developing novel theories and process understanding (as in Target 1) on the one hand, and putting science into practice (as in Target 3), particularly, through improving existing methods of hydrological prediction for water resources management and risk mitigation (as in Target 2) on the other hand.

First of all, the RT is closely related to Science Question (SQ) 1 and SQ2. However potentially, results of the research activity are expected to be demanded in addressing (fully or partly) all SQs

Societal impact of the Research Theme

The listed above research activities are framed within the overall context of water management issues. The RT aims to create a basis for a deeper knowledge of hydrological change aspects, which are necessary in order to design efficient measures for solution of the problems of water scarcity, water protection, prevention and mitigation of floods and droughts without compromising the sustainability of ecosystems. These aspects connect, first of all, with the understanding nature the stability of hydrological systems, defining conditions, which can lead to the system instability and, probably, to necessity of revision of the current stationarity-based design. Other aspect is identifying of predictable patterns of all relevant spatial and temporal scales in the water cycle. Better understanding nature of predictability creates opportunity for extending the lead time and accuracy of hydrologic predictions based on predictable weather and climate patterns so that the predictions meet the requirements of water resource management.

Panta Rhei Working Groups referring to the Research Theme

Working Group “Physics of Hydrological Predictability” has been proposed to address the Research Theme “Physics of Changes”.