

Spatial Dimension of Socio-hydrology and the Heterogeneity of Human-Water Dynamics

Murugesu Sivapalan, Megan Konar and Veena Srinivasan

Socio-hydrology deals with the dynamics arising from the bi-directional feedbacks between coupled human-water systems. In this presentation we specifically focus on the feedbacks that arise due to complexities in the spatial organization of coupled human-water systems. How the Earth system responds to human alterations or interferences is governed by natural laws and has been well studied through decades of hydrologic research. How the human system responds to natural variability and change involves human choices and/or tradeoffs, which may be governed loosely by societal laws. Tradeoffs can be of many kinds: between humans and the environment, between different sectors using water, or between different groups in society. Within the prevailing environmental and resource milieu, tradeoffs are mediated by human values and preferences, which are in turn shaped by the dynamics of the human-water system and must be treated as endogenous to the system. The values and preferences can vary along upstream-downstream, urban-rural, humid-arid, rich-poor, or technologic-green society gradients. In this way the tradeoffs have a spatial dimension, and over a period of time can manifest in patterns of legacy effects recorded in the land/human-scape. In this way they can add to the complexity of socio-hydrologic system dynamics, exhibiting strong multi-scale heterogeneities. Presence of heterogeneities causes differences in human decision-making behavior, leading to inequities and conflicts, which may be alleviated or even exacerbated through exchanges of real water and trading of both virtual water (embedded in food or commodities) and ecosystem services. For example, Europe values its own environment and has strict laws but imports asparagus grown unsustainably in arid regions where people value the environment less. This is representative of the broad phenomenon of countries moving polluting manufacturing or food production to poorer countries as economic development gives rise to a change in values regarding natural resources and the environment. The resulting complexities have major implications for modeling human decision-making behavior as well as management, governance, and policy at all scales. In this presentation we will present a conceptual framework to characterize the resulting spatial heterogeneity of human-water dynamics and patterns of consequent global teleconnections, illustrating these with case-studies drawn from different parts of the world, regional conflicts and global trading patterns.