Geophysical Research Abstracts
Vol. 18, EGU2016-17709, 2016
EGU General Assembly 2016

The precipitationshed as a tool for tracing hydrological tele-connections among social-ecological systems

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In hydrology, there are many spatial units of analysis that allow for the quantification of relevant processes, including the river basin (surface water) and the capture zone (groundwater). Our research provides a new unit that can be applied to atmospheric water, called the precipitationshed. We define the precipitationshed as the upwind land and ocean area that contributes evaporation to a given location's precipitation. Building off of much existing scholarly work, we have advanced the field of moisture recycling by defining the method for calculating precipitationshed boundaries, and through our analysis have found that there are persistent inter-annual sources of moisture for many places on the planet. The precipitationshed represents a new way of thinking about hydrological tele-connections across a landscape, region, or continent. We describe three ways in which the precipitationshed has been applied to important societal issues: the vulnerability of rainfall dependent societies, the analysis of moisture recycling as an ecosystem service, and the relationship between dry and wet year rainfall in megacity precipitationsheds. Our analysis reveals some important insights. First, the pressures of demographic and land-use change within the precipitationsheds of many agricultural regions globally potentially increases their vulnerability to future reductions in rainfall. Second, by classifying moisture recycling as an ecosystem service, we are able to better understand how hitherto unconnected places in a region are in fact geophysically connected. Third, we find that many megacities receive more dry season rainfall from land than in wet years, suggesting that these urban areas are particularly reliant, and exposed, to the land-use decisions that take place in their precipitationsheds. In this presentation, we aim to discuss the strengths and weaknesses of the precipitationshed concept, the challenges ahead for understanding how society can use the concept, and what important scientific questions remain to be understood.