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Multi-scale experimental programs for estimating groundwater recharge in hydrologically changing basins

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Groundwater recharge estimates are required to evaluate sustainable groundwater abstractions and to support groundwater impacts assessments associated with minerals and energy extraction. Increasingly, recharge estimates are also needed for regional and global scale water cycle modelling. This is especially the case in the great arid and semi-arid basins of the world due to increased water scarcity and dependence of ecosystems and livelihoods on their water supplies, and the considerable potential influence of groundwater on the hydrological cycle.

Groundwater resources in the semi-arid Surat Basin of south-east Queensland, Australia, support extensive groundwater-dependent ecosystems and have historically been utilised for regional agriculture and urban water-use. Large volumes of water are currently being produced and will continue to do so as a part of coal seam gas extraction. There is considerable uncertainty about the impacts of gas extraction on water resources and the hydrological cycle, and much of this uncertainty stems from our limited knowledge about recharge processes and how to upscale them. Particular questions are about the role of storm events in controlling annual recharge, the relative contributions of local 'recharge zones' versus diffuse recharge and the translation of (relatively easily quantified) shallow drainage estimates to groundwater recharge.

A multi-scale recharge research program is addressing these questions, using multiple approaches in estimating groundwater recharge, including plot and catchment scale monitoring, use of remote sensed data and simulation models. Results during the first year of the program have resulted in development of process hypotheses and experimental designs at three field sites representing key gaps in knowledge. The presentation will overview the process of designing the experimental program; how the results from these sites will be integrated with existing knowledge; and how results will be used to advance our knowledge of the changing hydrological cycle in the Surat Basin.