Pulling it together
Integrative approaches to facilitate knowledge discovery in the data deluge

Matthew Hipsey
University of Western Australia, email: matt.hipsey@uwa.edu.au

ABSTRACT

Much of hydrological science is about reducing complexity to elucidate fundamental relationships that describe catchment function. However, many of the science challenges of the next decade are related to understanding how the function of complex catchment sub-systems interact and co-evolve in response to an unprecedented level of environmental change â€“ dealing with complexity, nonstationarity and an uncertain future is essential for sustainable management of our water resources. A potential way forward lies in the community-driven integration of the diversity of models of hydrology, ecohydrology, biogeochemistry and society, with environmental sensing approaches and cyber-infrastructure in a way that balances process-driven and data-driven approaches for exploring catchment function. These approaches must be integrated in a way that accommodates spatial heterogeneity, sub-system connectivity, and the ongoing synthesis of their multi-scale dynamics. The implementation of such a system requires formalization and adoption of flexible (but standardized) approaches and frameworks for model use by the science community, such as the routine use of rich multi-scale diagnostic metrics for assessing model performance including catchment signatures and emergent patterns. The careful adaptation of model function can then be guided by learningâ€™s from data-driven informatics approaches, in a way that hybridizes our process models with observations. Such an iterative refinement in our thinking will improve our models and our understanding of response pathways of catchment systems to change. By embedding our collective efforts in development of such â€˜adaptiveâ€™ observatories within global science networks, we can ultimately support knowledge discovery as a community through facilitating cross-domain synthesis.