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Quantifying green water flows for improved Integrated Land and Water Resource Management under the National Water Act of South Africa: A review on hydrological research in South Africa.

C. Jarmain (1), C.S. Everson (2), M.B. Gush (2), and A.D. Clulow (2)

(1) CSIR, Natural Resources and the Environment Unit, Stellenbosch, South Africa (cjarmain@csir.co.za, +27 21 888 2684),
(2) CSIR, Natural Resources and the Environment Unit, Pietermaritzburg, South Africa

The contribution of hydrological research in South Africa in quantifying green water flows for improved Integrated Land and Water Resources Management is reviewed. Green water refers to water losses from land surfaces through transpiration (seen as a productive use) and evaporation from bare soil (seen as a non-productive use). In contrast, blue water flows refer to streamflow (surface water) and groundwater / aquifer recharge. Over the past 20 years, a number of methods have been used to quantify the green water and blue water flows. These include micrometeorological techniques (e.g. Bowen ratio energy balance, eddy covariance, surface renewal, scintillometry, lysimetry), field scale models (e.g. SWB, SWAP), catchment scale hydrological models (e.g. ACRU, SWAT) and more recently remote sensing based models (e.g. SEBAL, SEBS). The National Water Act of South Africa of 1998 requires that water resources are managed, protected and used (developed, conserved and controlled) in an equitable way which is beneficial to the public. The quantification of green water flows in catchments under different land uses has been pivotal in (a) regulating streamflow reduction activities (e.g. forestry) and the management of alien invasive plants, (b) protecting riparian and wetland areas through the provision of an ecological reserve, (c) assessing and improving the water use efficiency of irrigated pastures, fruit tree orchards and vineyards, (d) quantifying the potential impact of future land uses like bio-fuels (e.g. Jatropha) on water resources, (e) quantifying water losses from open water bodies, and (f) investigating “biological” mitigation measures to reduce the impact of polluted water resources as a result of various industries (e.g. mining). This paper therefore captures the evolution of measurement techniques applied across South Africa, the impact these results have had on water use and water use efficiency and the extent to which it supported the National Water Act of South Africa.