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Ellen Brook catchment nutrient export: sources and pathways

BCS Rivers and Estuaries Science

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Context

Water quality in Ellen Brook and its sub-catchments has been investigated for more than two decades. A bulk estimate of surface water, baseflow and groundwater contributions to the catchment nutrient discharges have been calculated using a watershed approach and conceptual groundwater model in 2009 by CSIRO. There still remain uncertainties of spatiotemporal variability of the contributions in relation to land use type to the overall nutrients export to the Swan River estuary.

To better inform land management policy and support decision making with respect to management interventions to reduce nutrient export from Ellen Brook, a distributed (2D) processed-based hydrological and nutrient model will be developed to quantify nutrient export from specific land use types, to differentiate active and legacy source, and to illustrate how they vary in space and time. Climate change also needs to be factored into the model to proactively define the necessary adaptation in the catchment management.

Aims

- Understand the complexity of Ellen Brook catchment with regards to surface water and groundwater interaction, particularly during low-flow in summer and autumn months when groundwater-derived baseflow acts as predominant nutrient transport to the lower reaches of the catchment.
- Understand the substantial flow contributions from the streams draining Dandaragan Plateau at the northern sub-catchments of Ellen Brook.
- Simulate daily distributed (1km resolution) flow and other surface water fluxes including run-off generated baseflow and soil moisture at soil layers within the catchment for simulation period 2008-2022.

Progress

- Ellen Brook mHM hydrological model structure is developed with 100m resolution morphological raster files (e.g., DEM, slope, aspect, flow direction and accumulation, gauges, soil characteristics, geological types, land use and land cover) and 1km resolution netcdf4 files of daily meteorological forcing (potential evaporation, precipitation and air temperature).
- Simulated distributed flow at 1km resolution is calibrated using recorded daily flow at two gauging stations. Further work is required for parameters calibration.
- Surface water quality (at 34 monitoring stations) and groundwater levels and quality recorded within the catchment have been processed and stored in a matlab structure datafile to ease the application.

Management implications

- Understanding the seasonal variations of nutrient concentration at each monitoring stations and their relationship with flow will give an indication of whether nutrient be active or legacy type, which is critical information to assess how long water quality improvement measures at watershed will come into effect in achieving a water quality target.

Future directions

- In-depth investigation of soils, percolation, interflow, geology parameters utilized in Ellen Brook mHM and application of field data and previous investigation to support the parameters derivation.
- Groundwater levels and quality data interrogation to gain an understanding of any key water quality parameters (such as major ion composition) useful as a tracer to investigate groundwater contribution to stream flow.

- Spatial analysis of monthly soil moisture 1K resolution, derived from TERN's Soil Moisture Integration and Prediction System, for soil moisture calibration to the model.