25th International Congress on Modelling and Simulation, Darwin, NT, Australia, 9 to 14 July 2023
mssanz.org.au/modsim2023

Estimates of recharge for current and future climate scenarios in Victoria using SoilFlux

P. Jordan [a], R. Pinto [a], A. Tyson [b] and J. Fawcett [b]

[a] *Hydrology and Risk Consulting, Melbourne, Australia*
[b] *CDM Smith, Melbourne, Australia*
Email: rocianne.pinto@harc.com.au

Abstract: This study comprised the development of a methodology to assess the spatial variation in recharge across groundwater management units (GMUs) in Victoria and the potential impact on recharge under projected climate change. SoilFlux was the model adopted for this study. SoilFlux is a one-dimensional model which uses the Richards Equation (Richardson, 1922; Richards, 1931) to estimate water movement through the soil profile. State-wide estimates of water use for key land use types were developed by applying SoilFlux independently at 1km² grid cells over all of Victoria by SKM (2008) and HARC (2016, 2017).

In this study we were interested in mean annual recharge values corresponding to the depth to water table values from the DEWLP (2013) updated water table information and the Victorian Land Use Information System data from 2014/2015 for each 1km² grid cell. The approach involved extracting recharge data from SoilFlux outputs from model runs undertaken by HARC (2016, 2017) for the baseline period from 1975 to 2016, and estimating the anticipated change in recharge using projected changes in mean annual rainfall for six future climate projections. The six future climate rainfall projections were derived for the low, medium, and high projected changes for 2040 and 2065, from the *Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria* (DELWP, 2020).

Scatter plots of the mean annual recharge and runoff estimated by SoilFlux against the Victorian SDL project's mean annual flow estimates for each SDL catchment, revealed significant similarity between the two, although SoilFlux was generally larger. A raster layer of the estimated standard error in the recharge estimates indicated larger uncertainty in recharge in areas with larger rainfall, runoff, and recharge estimates. A standard deviation of the recharge values was calculated for each grid cell and each climate change scenario output. The recharge standard deviation maps showed higher variation in recharge in the east of the state where higher runoff values are found.

It is noted that SoilFlux has several limitations, including uncalibrated outputs and hard-coded assumptions that cannot be adapted easily. SoilFlux also assumes that the water table level is constant for the entire model run period, and while it allows for water to move between the unsaturated and saturated zones, its previous runs made relatively generic assumptions regarding the management of plantations. More effort could be placed on the calibration of SoilFlux against observed data, such as runoff from gauged catchments and satellite estimates of evapotranspiration and soil moisture, to improve its accuracy.

Additionally, all SoilFlux runs were undertaken assuming that the only water input is from natural rainfall. SoilFlux does not provide accurate estimates of runoff or recharge for irrigation areas, as it ignores the additional water input from irrigation. Additional SoilFlux runs could be undertaken for irrigated land use types, to provide estimates of recharge in irrigation areas. For the purposes of this study, the uncertainty estimates in mean annual recharge in and near irrigation districts were set to an arbitrarily large value, to represent the lack of confidence in the SoilFlux estimates for these parts of the state.

REFERENCES

Department of Environment Land Water and Planning. 2020. Guidelines for assessing the impact of climate change on water availability in Victoria. Melbourne.
HARC. 2016. Update of SoilFlux Tools for Victoria, Report
HARC. 2017. Update of SoilFlux Modelling for the SoilFlux Tools ArcGIS Application
Sinclair Knight Merz. 2008. Statewide Estimates of Water Use for Key Land Use Types

Keywords: *Recharge, climate change, SoilFlux, depth to water table, land use*