Disaggregation of annual water demand in the southern Murray–Darling Basin

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Abstract: Developing water demand forecasts is essential for planning and decision-making, but it can be challenging depending on the factors that affect water demand. For example, crop water demand varies significantly within a year and depends on crop type. However, many monthly models assume that irrigated crop types and areas are known at the beginning of the season and do not consider crop type selection, which is an annual decision. Therefore, for circumstances where annual decisions influence the monthly water demand, it is crucial to incorporate them into monthly demand models. In this study, we aim to address this issue by extending an existing annual model by disaggregating into monthly time scale and applying it to the southern Murray–Darling Basin (sMDB) as a case study.

We disaggregate the allocation water use from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) water trade model. The study focuses on seven regions and nine irrigation activities of the sMDB, using datasets such as reference evapotranspiration (ETo), crop coefficient (K_c) values, and monthly diversion data. In addition, an extensive literature review has been conducted to derive the nominal K_c values for crops under the nine irrigation activities. Finally, we determined the within year proportion of total crop water requirement to disaggregate annual allocation water use into monthly time scale for each region. We evaluated the monthly allocation water use after disaggregation against diversion data.

The results indicate that the disaggregated allocation water use aligns well with the monthly diversion pattern, as shown in Figure 1(a). The correlation coefficient (r) between the allocation water use and diversion data is high in regions where horticulture dominates the regional landscape (Figure 1(b)) and in periods when water demand is high (Figure 1(c)). Discrepancies exist between two variables, possibly due to difference in data sources, variations in crop water requirements, losses during water transportation, the behaviour of river operators, and the interconnected nature of water resource management. Overall, this study demonstrates the practical applicability of the proposed disaggregation method to forecasting monthly water demand.

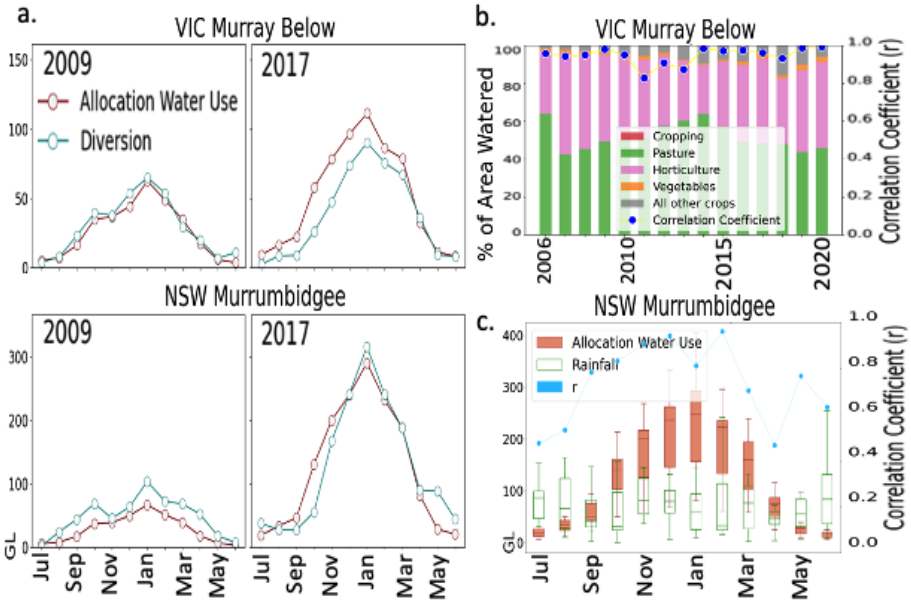

Figure 1. (a) monthly disaggregated allocation water use against diversion data, (b) percentage of area watered for five cropping categories against correlation coefficient (r), (c) monthly r-value against water demand and rainfall for two regions

Keywords: *Water demand models, allocation water use, annual decisions, irrigation activity, disaggregation*