Reviewer 1

I reviewed the first version of this manuscript. The authors adequately responded to most of my comments, except for two. I provide follow-up comments related to those two issues below.

Our responses to your comments are in green below.

1) In response to my comment (Ln 848-861 – How were the study-reach lengths chosen? What were the range of reach lengths? Were there any groundwater inputs or lateral flows along the study reaches? If so, were dilution corrections applied?), the authors provided the requested info (For the 144 sites where we measured either velocity or gas transfer velocity (k), study-reach lengths ranged from 6 to 84 m, with a mean of 21 m. Reach lengths were selected to capture the main hydraulic features (i.e., pools and riffles) and to ensure reliable salt dilution gauging, i.e. sufficient upstream mixing and a single, non-braided channel. For the twelve sites where we used propane tracer gas to estimate k, reach lengths ranged from 11 to 40 m (median = 18 m). No groundwater or surface inflows were observed along these reaches. Because sites with any visible inflows were avoided; we did not apply any dilution corrections for tracer gas or salt dilution measurements.) However, this info didn't make into the manuscript. Please add the information from the response to Appendix A.

Thank you for raising this point. We have now added two additional sentences in the subsection A.1:

L858–861: Reaches were selected within a single, non-braided channel to avoid visible lateral inflows and ensure complete mixing between the salt injection and the specific conductivity measurement locations. No groundwater or surface inflows were observed along reaches, so no dilution corrections were applied. Overall, reach lengths ranged from 6 to 84 m, with a mean of 21 m (n=144).

L874–876: Here the reaches were chosen to include the main hydraulic features (pools and riffles), avoid visible lateral inflows, and ensure complete mixing (reach lengths from 11 to 40 m).

We have also modified earlier sentences that partially mentioned study-reach lengths to avoid redundancy.

2) Both Reviewer 2 and I suggested calculating catchment characteristics for the literature sites. The authors responded that this would be potentially unreliable and would require QA/QC (e.g., "From our own experience delineating all sites we sampled directly, this process involves much more than simply overlaying a DEM, it requires multiple QA/QC steps to ensure the correct catchment outlet and boundary, particularly for small or low-relief streams. To maintain data integrity, we chose not to include catchment information unless it could be verified with high confidence as we did with the sites from our sampling"). I would reiterate that catchment info is very important to this type of analysis and dataset and it may be worth the extra steps to include it.

We do see the value of adding catchment areas for all sites in the database. In agreement with this comment, we have now extracted catchment areas for the literature sites from the National Environmental Stream Attributes (NESA) database. This Australian database was selected because of its higher spatial resolution (9 arc-sec) compared to global datasets such as HydroSHEDS (15 arc-sec).

To evaluate the reliability of this approach, we compared NESA-derived catchment areas with those obtained from our QA/QC GIS delineation of the 167 sites sampled in this study (Figure C4). This comparison showed good agreement between both methods ($R^2 = 0.77$, $p < 0.01$), with discrepancies occurring only for very small catchments. The NESA database covers the vast majority of the sites, with only 96 sites out of 2879 sites in total lacking catchment area data.

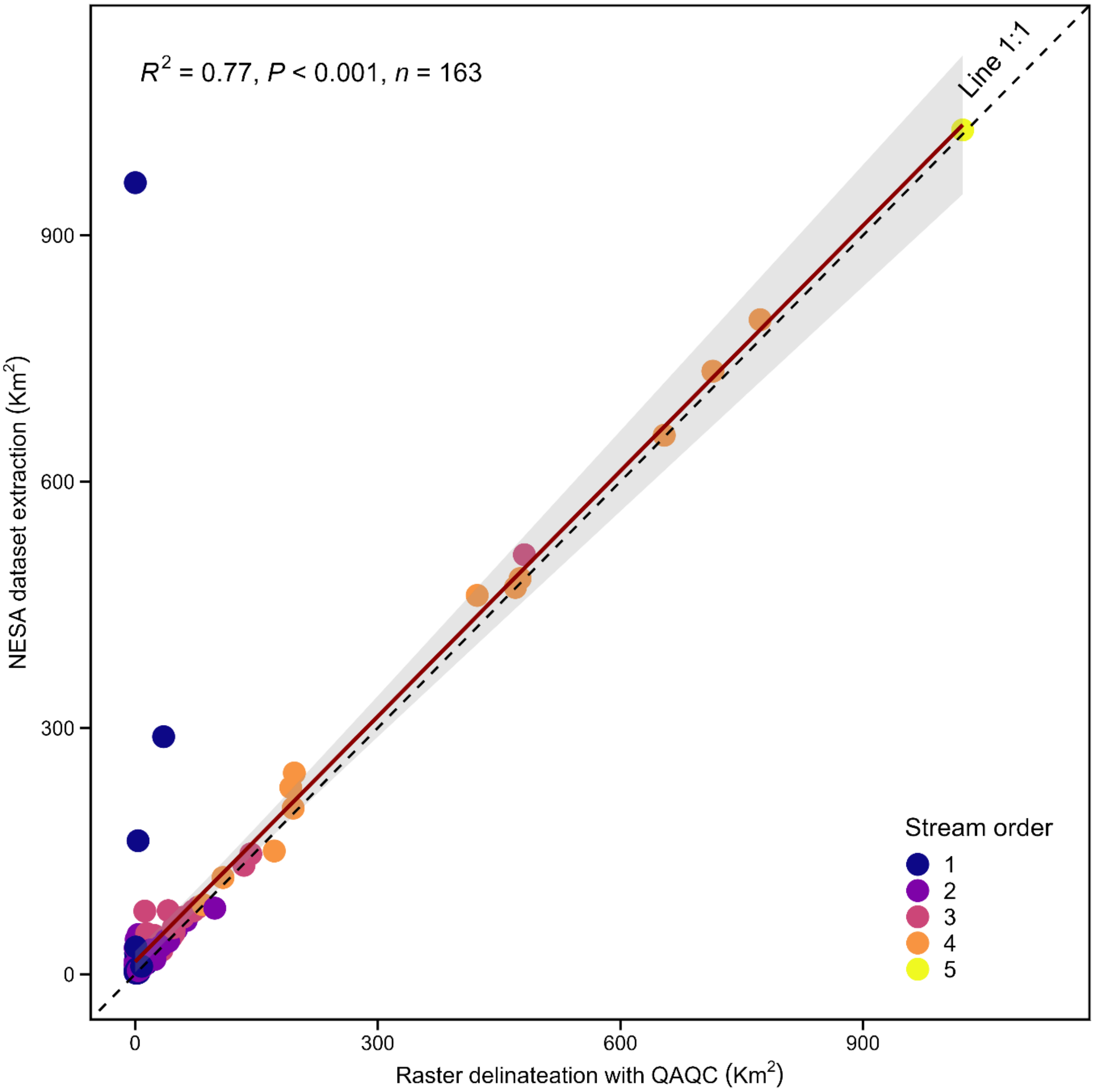

Figure C4. Comparison between catchment areas derived from the NESA database and those obtained from QA/QC catchment delineation for the 167 sites sampled in this study (ref=0, Table C). The dashed line represents the 1:1 relationship. Points are coloured by stream order. The red line shows the linear regression fit (with 95% confidence interval). The discrepancies are due to NESA not detecting very small catchments and instead clipping them to a larger stream or river.

We have updated the main manuscript accordingly:

L212–215: Table B contains a range of catchment characteristics, including the climatic region, stream order and catchment area of sampled sites, which were obtained using the Köppen-Geiger classification (Figure C1, Beck et al., 2018) and the National Environmental Stream Attributes database (Stein et al., 2012) on ArcGIS software (ESRI, 2024).”

We have also added two paragraphs in the Appendix describing the methodology used to estimate catchment area:

L914–918: Catchment area was estimated using different approaches for the 167 sampled sites and for the remaining sites in OzRiCa. For the 167 sampled sites (ref=0 in Table C), catchment area was calculated using a 1-second DEM (Gallant et al., 2011), with each site individually QA/QC-checked to ensure the correct outlet location and accurate catchment delineation. When necessary, manual delineation using topographic isolines was performed for very small catchments where the DEM resolution was insufficient.

L919–926: For the remaining OzRiCa sites, catchment areas were obtained from the literature when available. If no published values were found, we used the NESA database (Stein et al., 2012) rather than a global river network product, because NESA offers higher spatial resolution (9 arc-sec versus 15 arc-sec for HydroSHEDS). To evaluate the performance of this approach, we compared NESA-derived catchment areas with those obtained from the QA/QC GIS delineation of the 167 sites (Figure C4), showing good agreement ($R^2 = 0.77$, $p < 0.01$) and a few discrepancies due to NESA not detecting very small catchments and instead clipping them to a larger stream or river. Overall, the NESA database covered most sites, with only 96 sites (1% of all sites in OzRiCa) lacking catchment area data.