Reply to Comment on essd-2022-446 by Ian Moffat (Referee)

Referee comment on "A strontium isoscape of northern Australia" by Patrice de Caritat et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2022-446-RC1, 2023

General Comments:

Thank you to the authors for this important data set, which addresses an expansive deficiency in strontium isotope mapping in Northern Australia. The methodology of this study is robust, and it will provide an important tool to facilitate future research in this area.

Several aspects of this study are of particular note. The analysis of the relationship between the "top outlet sediment" and "bottom outlet sediment" is novel and expands the interpretability of this data set. The consideration of strontium isotope values compared to mineralisation is also a very interesting inclusion.

Thank you for the comments.

Specific Comments:

I suggest the authors make explicit that food tracing, provenance and archaeological applications of strontium isotope tracing (referred to specifically in lines 64-68) rely on bioavailable rather than "whole rock" values and so don't benefit directly from this data set.

The sentence now clarifies that these studies use bioavailable Sr.

The decision to analyse catchment outlet sediments is understandable given the availability of these samples from the National Geochemical Survey of Australia, however this methodology differs from most other strontium isoscape studies and has important implications for interpretation of these results. I suggest the authors elaborate on these issues, perhaps as a new section in the discussion.

This is an important point and we have strengthened our discussion of it in Subsection “5.1 Comparison with other datasets”, which we find most appropriate location for this. The following sentences have been added:

These issues complicate data compilation and integration across projects/countries, but do not preclude them. Indeed, through contemporaneous data analytics, including artificial intelligence and machine learning, it is likely that the relationships between bioavailable and total Sr isotope values and a host of other environmental variables (including from climatic, topographic, biotic and geoscientific categories) can be teased out and high-spatial resolution models/predictions of bioavailable or total Sr isotope distribution can be derived (e.g. Bataille et al., 2020). This is indeed a future research direction we propose/support for isoscape science in general, and an Australian Sr isoscape in particular.

The data set presented by the authors in this paper is extremely useful and interesting however it could be considerably enhanced by including the bedrock geology, age and stratigraphic unit (as summarised in Figure 6), notwithstanding that these samples have been collected from fluvial systems.

Thank you for the suggestion. We present a new Sr isotopic dataset here, and do not pretend to provide a complete dataset of all possible variables all potential users may need or wish to have. We leave this degree of data manipulation and integration to future users as they are bespoke customisations we cannot start to predict. The important and relevant contribution we make here,

in our view, is to put a significant new dataset on the table, so we deliberately want to remain focussed on this in this paper.

Technical Corrections:

Figure 1 is extremely small in the manuscript and the sample locations use the same colour as the Towns and Places, can I suggest this is revised to make it easier to view?

As this point is also raised by another reviewer, we suggest the **Editor** requests the production team prints this figure in a larger format than currently shown. We have prepared a new Figure 1 with Towns and Places more clearly distinguishable (changed from gray to orange).