This study assessed how geographic controls (elevation, temperature, and slope) and % anthropogenic land cover (urban/agriculture) influence DOC export and DOM composition from mountainous rivers. The data presented shows that increased %urban/agriculture cover in lower reaches (and shallower gradients) of these catchments results in higher DOC concentrations, where carbon isotopic signatures (13 and 14C-DOC) of DOC are more deplete, and DOM is less aromatic. I believe these findings are of interest to a broad community. I believe the manuscript would be suitable for publication once the comments below are addressed.

General Comments:
1. The final paragraph of the introduction (aim/objectives) should be revised, as it is a little unclear as it stands. Specifically, I suggest combining the two hypotheses sentences into one to make the hypothesis clearer (i.e., by dealing with DOC concentration and quality at the same time). Lines 93-5 is a list of metrics/relationships examined but the sentence is long and could do with being broken up. I would also mention analysis of 14C-DOC samples in the Yinjiang river as a separate point.
2. Section 3.1 – there is a tendency to only reference 2 out of 3 of the rivers in this section. I understand why this is the case in some places as you are looking at where there are the largest differences, but this could be made clearer.
3. Results section: many of the figures are discussed out of order in text, and there is a lot of jumping between boxplots figures and then linear regressions. I suggest you restructure the results to that there is an initial description of metrics across sites (i.e., geochemical, DOC, isotopes, optical), followed by an additional section on the regressions with slope and land use. I think this will make the results easier to follow. Because of this, it would be good to include a section briefly describing optical parameters before diving into covariance with slope/land use. Consider including Figure S4 as a main text figure to aid initial description of optical metrics. This figure could be combined with Figure 7 and moved earlier in text. I would also suggest you discuss optical indices (e.g., SUVA, FI, HIX) before describing PARAFAC results.
4. $SUVA_{254}$ values have been corrected (i.e., in rebuttal table, and figure 3e), but not consistently (i.e., Figure 6a). Please update the figure and confirm that there is still a correlation with urban/agricultural land use.
5. 434 – 447 seems out of place. I think it would be better to contextualizes values more briefly and earlier in the discussion or within the results section. The importance of table 3 is also unclear to me.

Line Specific:
37: this sentence seems to be missing an 'and' or 'as well as'
53-55: this is a little unclear consider rewording.
58: consider revising to "…, the underlying mechanisms that regulate DOC dynamics in small mountainous rivers remain poorly understood'.
63: SOC has not been defined. Please check that abbreviations are always defined in text (same applies to OC on line 144, and TP)
64: 'effectiveness' seems like the wrong word choice here.
71-70: suggest making the difference in DOM quality between the two stream types clearer in this sentence.
100: consider abbreviating or including abbreviation throughout text.
104: 'greatest' rather than 'great'.

111: revise sentence. Perhaps… "The proportion of urban and agricultural land uses in the Yuqing River catchment is from 17.3% to 23.1% (Figs. 1c and S1c). This catchment has typically higher % urban/ agriculture land use than other studied catchments, and less variability in land use compared to Yinjiang and Shiqian river catchments (4.5% to 46.5% and from 9.6% to 41.3%, respectively)."

113: remove "typically".

117: 'respectively' needs moving earlier in the sentence, just after values.

125: where were springs samples taken?

126-128: consider revising this sentence – it is a little unclear.

133: were bottles acid-washed before use?

135: what filter size was used for DIC? This should be specified.

136: remove 'moreover'.

146: which analysis does the deviation relate to?

155: remove 'same methods as 14C-POC'. The POC data was previously published? This should be made clearer in aims/objectives (i.e., after line 88), and perhaps reference should be made in figure captions.

157: I suggest stating that optical analyses were only conducted on River samples

199: can you contextualize which values represent supersaturation?

199: Q river also had higher water temperature than Y and springs?

224: add 'although not significantly different.'

225: sentence seems incomplete – perhaps add '…besides groundwater to the rivers'

226: remove 'in the supplement.'

285-286: it is unclear how a greater proportion of C3 in S and Q make them 'distinctive' to Y, especially when this is only significant for Y-S.

301: it would be useful to specify the direction of trends here.

298: your data does not support that this OC was 'fresher', as you did not find a significant correlation between freshness index and slope (lines 300)

316: there is more not 'less' aromaticity in steeper catchments.

317: there seems to be words missing from this sentence. Aromatic content tends to decline with what?

325: change to '….in regulating DOM composition.'

331: add '…increase in DOC concentration with microbial degradation in spring water…'

334: I think it would be useful to relate this back to the trends seen in your data.

352: replace 'it is worth noting that' with 'furthermore.'

365: I agree, but I can't see this trend in figure S3. There doesn't seem to be a correlation between elevation and land use or Cl- plotted.

379: I am unclear as to how you concluded that lower del13C-DOC with nitrate indicates greater algae contributions when no isotopic values for algae are presented. Some literature shows that algae has very enriched del13C values. Please expand and use isotopic data from the literature for endmembers to evaluate this discussion point.

399:'we further discussed' is confusing here.

408: it would be useful to include values from your study here for context.

421: consider rephrasing

423: if there are significant damming/reservoirs on these rivers I think it would be useful to reference this in the site description

431: this sentence could be made clearer. I think you are point to the fact that it is difficult to disentangle the two influences and they likely affect DOC concentration and DOM quality in tandem in these rivers.

454: 'deeper' is not needed

463-464: this seems like repetition.

Figure 2: please include Cl- concentrations as a panel.

Figure 2 / 7: 'average' should be replaced with 'mean' in the caption.

Figure 6: if PARAFAC components identified in the 3 rivers then why is there only one rivers data shown in panels b and C and/or why has the coloring changed. why is C3 not plotted in figure 6?

Figure 7: why are axes on EEMS not labelled. Please label axes and remove from caption.

Figures: boxes around legends are not always present – see comment from first review.