Review: Discharge and sediment fluxes along the Amazon river: RDSM model concepts and validation

The authors are using RDSM to simulate annual and monthly discharge and sediment load for the Amazon River. The model is validated using observed data from 7 gaging stations for 1989-2009. The study includes detailed consideration of land use and specifically highlights sedimentation in lakes and reservoirs. Overall, the manuscript is well written with clear description of the study and its results, including relevant literature.

The model validation for sediment suffers from lack of sediment data. A more thorough evaluation of could help to interpret the modeling results further. For example, analyzing a range of flows sampled for sediment could help to see whether the assumption that average load derived from sampled concentrations is equal to average load per day for a given month or a year (eq. 18-19). Perhaps another estimation method that considers flow changes during the month could have been applied.

The abstract highlights that the method accounts for land use changes and entrapment of sediments in lakes and reservoirs. However, there is very little description of the land use or how the land use changes were included in the model development and how they affected the results. How often did the land use change at the cell level? Can it be used to explain some of the sediment behavior? Did it help to improve the model performance? It seems counterintuitive to talk about land use changes and then only analyze average behavior.

Similarly, it would have been interesting to include more of the results from reservoir sedimentation. In my opinion, it is not necessary to provide these analyses for the publishing of the manuscript, it is sufficient to change the existing language to state that these analyses can be potentially done in the future and move them to a relevant section.

An editorial review is recommended; there are missing spaces, minor grammatical errors, and incomplete sentences in several places.

Specific comments:

Authors use “water bodies” to mean lakes and reservoirs. Often this term includes also rivers. It would be good to define the term at the first use.

l. 27-30: it is not clear how “the hydrological response as a result of climate change” links to the rest of the sentence. I would recommend breaking it down and rephrasing

l. 80-81: please verify units for the discharge

Section 3.1. Methods are missing to specify how the hydrological processes were calculated (i.e., infiltration, evapotranspiration, percolation, …)

l.93-94,138: one states that forcing data is taken from global datasets, another says Hybam

eq.1 last term should be P, not Y

Section 3.3. I would recommend reordering some of the formula descriptions (especially from l.214) so it follows a more logical order. It works better for the reader to start from the higher level equations and work step by step into details. E.g., start with Suptake (eq.9-10), then TC (eq 8).

Similarly l.235-240. Overall, I'd recommend a thorough review of formulas and symbols. I found several mistakes but might have missed some also.

Figure 4: it may help to show y-axis on a log-10 basis. Also, the caption states that "the curve rises steeply at first … and it levels off (later)". I see it as opposite: the curve rises slowly at first with a sharp rise at the end with only a few large reservoirs. It may be interesting to add another line for lakes.

Eq.6: please check the units considering the inclusion of the time step. Stot is in kg, but so is Sload while Suptake is in kg/s

Eq. 9, l. 223, 227: why include SUF if it's assumed 1? I would also question this assumption in a basing with significant land use changes where flow and sediment regime may also be changing

Eq.11: should V be Vs? V is previously used as water volume in eq.7.

Eq15: RA not defined, instead Awb is listed on l.242

l.245: how was the model parameterized?

l.273: abRMSE not listed here but shown later.

Eq.22: this is shown without context or introductory text.

Eq.23: I'm not sure I understand the intent here. Sediment production is a sum of erosion and sediment delivered to the river in the catchment (Sdel). What exactly is meant by Sdel? Is this not a portion of A?

l.310 – should this be Figure 5?

Figure 5: please add catchment boundaries and a legend explaining the lines

l. 325 "Because …" – incomplete sentence

figure 9: It appears that for Manacapuru and Tabatinga there are some differences in seasonality for discharges and sediment transport. Observed discharge peaks in May – June while sediment transport behaves very differently. I assume this is directly related to estimating monthly sediment transport from one or two observed data points and does not represent reality.

Figure 10 caption: the inflow is on the left side, not on the right, and vice versa for outflow.

l. 386: it should be KGE <= -0.41 implies no skill / baseline, although optimal KGE would be of course higher

l.393: I would argue that figure 11 does not show impacts of climate and land cover variations, at least not specifically. Generally it shows changes in time that can be due to these and other changes. I recommend rephrasing the statement. Impact of reservoirs can potentially be implied from the slope depending on what is shown in the figure (see below).

Figure 11. The figure labels say sediment delivery while the caption says sediment production. It is unclear if all points are for the same location (and which one, total transport from Amazon?) or for selected stations. Sediment transport is 3-9x10^{11} t/yr while sediment transport in Table 3-5 is in the order of 10^8 t/yr. What is marked as "sediment delivery" is in the order of 10^9 t/yr.

Conclusions: For increased readability I would recommend to move paragraph 4 ("RDSM computes…") to paragraph 2 before the existing single sentence ("The analyses…").

l.426: Perhaps modify to say “bank and channel erosion”.