Interactive comment on *"tran*-SAS v1.0: a numerical model to compute catchment-scale hydrologic *tran*sport using StorAge Selection functions", by Paolo Benettin and Enrico Bertuzzo

This study introduces a numerical transport modeling package, *tran*-SAS, which is aimed to simulate solute transport and water residence time at a catchment scale. In particular, the authors explore the computational stability as well as the numerical accuracy of the proposed model. The manuscript is well written, easy to follow, and quite interesting to the hydrologic transport community. A few minor and relatively major points are listed below.

1) Section 1, Line 21: Please revise the first sentence. The new transport model has improved the capabilities in terms of what? I understand your point, but it worth it to make it clear for a general audience. A suggestion is to add two or three sentences on, e.g., how the new transport model can be expressed in different ways depending on the ease of its application in a desired study (Botter et al., GRL2011 vs. van der Velde et al., WRR2012 vs. Harman, WRR2015 vs. Benettin et al., WRR2017). Or, for instance, how this new transport model is much less biased to spatial aggregation as opposed to the traditional approaches assigning the TTD a priori (Danesh-Yazdi et al., GRL2017).

2) Section 2, Line 7: Characterization of the SAS function is also part of the requirements (as emphasized in section 2, line 21) for solving the age distribution of the water storage. Please revise this sentence, accordingly.

3) Equation 3: Isn't this conditional on no precipitation takes place at time *t*? What about those conditions when part of the input precipitation falls directly into the river, contributing to the streamflow? Or what about those conditions when a major portion of the input precipitation contributes rapidly to the streamflow?

4) Section 2, Lines 20-24: S_0 and k have been written in different formats in the manuscript (i.e., at one place as bold and italic, and at another place as normal). Please make them consistent throughout the manuscript.

5) Section 2.4, title: I know in their former papers, the authors have already emphasized on the distinction between the random sampling and the well-mixed conditions. As such, I am not sure why they equivalently put them together in this title.

6) Section 3, Line 18: You already called $S_T(0, t_0) = 0$ a "boundary" condition in Eq. (3).

7) Section 3, Line 22: I am not following this last sentence.

8) Page 7, Line 12: Not sure what does 1 in $\Omega_Q[1, j-1]$ imply? It is essentially $S_T(i, j-1)$, so you meant *i* instead of 1?

9) Page 10, Line 12; Page 11, Lines 1-2: This is an important conclusion, but with a relatively weak reasoning. The difference between the curves in Figure 3b after year 2 is not really

significant. Author might want to provide another example that clearly demonstrates this conclusion.

10) Does the *tran*-SAS package also include the Markov Chain Monte Carlo calibration scheme (with reference to Page 15, Line 8)? If yes, please add a few lines on how such a scheme is embedded within the package. If no, why not to include?

11) The examples include two different ways of parameterizing the SAS functions, that is, using the power-law and the gamma functions. However, there is no discussion about which model provides a better solution to TTD and C_Q. This is a missing, but quite important information for the users of this model and should be well addressed in the manuscript.

12) Section 1, Line 22: "such as" instead of "like"? Also, at Page 14, Line 13.

13) Section 2, Line 24: "expressed in terms of" instead of "expressed as"?

14) Section 2: You might want to define $C_Q(t)$ as well to complete your definitions here.

15) Page 11, Line 11: Define the acronym for the random sampling, i.e., RS, earlier in the manuscript where it was first mentioned.