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Hydrology and Earth System Sciences Discussions

Interactive comment on "A general real-time formulation for multi-rate mass transfer problems" *by* O. Silva et al.

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Major concern

The reviewer thinks that the main contribution of the manuscript is presentation of the mathematical framework and Fortran 90 module that enable easy integration of MRMT into existing codes. For that reason, the reviewer thinks the manuscript is more in the spirit of a Computers in Geosciences paper. Although he recommend that the manuscript is suitable for publication, he suggests the article may have a more significant impact if it were to appear in a journal like Computers in Geosciences instead of HESS.

Reply

The reviewer suggest that the paper may be better suited for "Computers and Geosciences" than for HESS. We assume that this reflects the fact that we are presenting a code and making it available to the scientific community. Indeed, this is much in the style of "Computers and Geosciences". However we feel that the main contribution is not the code itself, but rather:

1) The unified formulation of all non-local in time approaches. These formulations are used by many authors, but it appears that each of us has got his/her own way to represent them. This is confusing and hinders scientific developments in this field because it is not easy to compare parameters obtained by different authors. We contend that this is well within the spirit of HESS (although it is true that, as stated by referee 1, many papers in HESS are more applied).

2) A subsidiary contribution is to present an algorithm that is very efficient and accurate. By using the MRMT formulation, the algorithm becomes localized, which facilitates (a) physical interpretation of parameters and (b) incorporation of other phenomena, such as chemical reactions, that require local variables. As an algorithmic contribution, this could go in many journals.

In re-reading the paper, under the light of the comments by the referees, we realize that these contributions may not be sufficiently clear. In view of this, we suggest:

(1) Expand the introduction to better motivate the above contributions.

(2) Provide a table, as suggested by Albert Valocchi, with an explicit comparison of methods.

(3) Drop Section 5 (although still directing readers to a web page for free downloading of the code.

(4) Expand Section 6 with a few examples comparing the parameters obtained with different formulations (we are hesitant about this).

Specific Comments

Comment 1: Two additional references The reviewer suggests to include a couple of additional references. He thinks that the Tsang and Tsang paper in Geophysical Research Letters, and the paper by Sudicky in the March 1990 issue of Geoderma are relevant.

Response: We appreciate the reviewer recommendation and accordingly we will add the references he suggests.

Comment 2: p. 2417, l. 17. The reviewer did not think that Barker or Acuna & Yortos used fractional calculus, but perhaps their flow dimension framework can be cast as fractional derivatives.

Response: We appreciate the reviewer comment. We can change the sentence on line 18, page 2417, to "Fractional derivatives and/or fractal mobile/immobile transport. . ."

Comment 3: Section 4 The reviewer suggests to improve the organization of Section 4 by using sub-sections and including a table showing the equivalence between MRMT and other methods.

Response: We appreciate the reviewer recommendation. As stated above, we agree on a table with an explicit comparison of methods can help to clarify the equivalence between them. We also agree that using subsections for the equivalences between different approaches could improve the organization of Section 4.

Comment 4: Figure 3 The reviewer says that it is not clear what the numbers signify on the flowchart of Figure 5.

Response: We appreciate the reviewer comment and agree with him. Actually, the numbers on the flowchart of Figure 3 only try to give an idea about the order of the different steps involved in a typical numerical code for flow and transport. Because these numbers are not referenced in the text, they may be dropped from the figure without causing any damage. Therefore, we will change Figure 3 eliminating these numbers.

Comment 5: XML format The reviewer suggests that the authors should explain a little about the advantages of using XML for the input files. These are not very many parameters needed in the input file, and I would like to understand the advantage of using XML.

Response: The XML format for input files was chosen because it is increasingly being used in current object-oriented programming applications. Using XML to exchange information offers many benefits, including: XML is easily readable; completely compatible with Java and portable, i.e., any application that can process XML can use your information. XML is also extendable, which allows to create your own tags (or use tags created by others) that use your language, have the attributes you need, and make sense to you and your users. However, we could add a sentence explaining that, if other formats of input files are preferred, the user should modify mod_process_MRMT.f90 replacing reading subroutines contained in flib_sax.f90 and flib_xpath.f90 by their own subroutines. In such a case, it would not be necessary to include folders xmlreader and xpath, and the two use statements located on top of mod_process_MRMT.f90 have to be removed. Note however, the input file structure should be the same, as well as the name of input attributes.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 2415, 2009.