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Hydrology and Earth System Sciences Discussions

Interactive comment on "Hydrological real-time modeling using remote sensing data" *by* P. Meier et al.

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We would like to thank the anonymous referee for the time spent in revising the manuscript very carefully. The detailed comments are welcome and make a significant contribution to the improvement of this article.

Reply to the general comments:

The use of soil moisture information derived from the C-band ERS scatterometer to drive a simple hydrological model is investigated in a number of river basins in Africa. This is an interesting approach, at least for climatologic applications, and rather convincing results are presented.

Given that ASCAT C-band scatterometer soil moisture products are now disseminated in near real time by EUMETSAT, the methods proposed by the authors may have operational implications, especially in regions where rainfall is poorly measured. However, this paper cannot be published in HESS in the present form. A number of methods are used and it is very difficult to understand where and why they are used. The naming of the methods fluctuates and this is detrimental to the clarity of the paper. Significant editorial work is needed before this paper can be published.

- We certainly agree to the reviewers comment on the usefulness of the method presented, especially when targeting at near real-time applications using more recent datasets. We also agree that some significant changes have to be made in order to improve the clarity of the article.

Reply to particular comments:

- Title: should be more specific.

- We agree that the title is too general. We propose to change it to "Hydrological real-time modeling in the Zambezi river basin using satellite-based soil moisture and rainfall data"

*- P. 8811, L. 25: The first *satellite-derived* global data set.*

- P. 8812, L. 3: Please replace "radar" by "microwave frequencies", as SMOS is a radiometer, not a radar.

- To be changed in the revised manuscript.

- P. 8814, L. 27: This sentence is rather unclear. Is 10 days the value of the T parameter, or are the SWI values produced every 10 days, only ?

- The SWI data is produced every 10 days. This part of the article needs some editing to better explain the applied filter.

- P. 8815, L. 4: Taken place, during which period of time?

- It was assessed how high the probability for the occurrence of rainfall is, given a certain soil moisture value. Therefore the rainfall event takes place in the 10 days the soil moisture value (SWI) is representative for.

- P. 8815, L. 25-26: "The soil moisture product used is not very sensitive to the presence of wetlands". Why?

- This part has to be changed slightly. The wetlands in the Zambezi River Basin are strongly seasonal. They are mainly fed by rivers which flood the wetlands shortly after the rainy season. Flooded areas however, cause the back-scattered microwave signal to be very weak, which normally corresponds to a low soil moisture. This means that the water storage in wetlands is not correctly tracked by radar scatterometer products. Since the area of the wetlands is small compared to the area of the watershed this does not influence the conceptual model significantly. Only the time lags are strongly influenced by the presence of wetlands.

- P. 8816-8817 Sect. 3.2: It is not clear whether the Eqs. (1)-(3) model is proposed by the authors, for the first time, or whether it is derived from previous studies.

- The equations (1) to (3) are proposed by us for the first time. This will be outlined more clearly in the revised version.

- P. 8818, L. 1: The physical interpretation of the k1 parameter should be more detailed. Do the lowest k1 values correspond to higher vegetation densities, related to more rainfall interception and more transpiration? The discussion on P. 8820 seems to suggest that k1 reflects soil properties, instead.

- We agree that the complete physical interpretation of the parameter k_1 should be given in the first place of its appearance. The statement about the parameter k_1 is more complete on page 8820, L. 16. k_1 indeed is influenced by soil properties, but also by interception and storage in small ponds on the soil surface.

- P. 8818, L. 14: It is mentioned that delta-t is set to 10 days while in Table 2, various values of delta-t are given,. This is confusing.

- The notation of the time lags might be somehow misleading in tables 2 and 3. While Δt is the time step of the model the time lags are named $\Delta\tau$. We did not introduce a new parameter for the forecast lead time and just named it Δt. To avoid any misunderstandings we will use a new variable for the forecast time.

- P. 8820, L. 1, L. 6: What does "off-line" mean in the context of this study?

- The proper definitions of the modeling modes applied need further attention in this manuscript. We propose a consistent wording where (1) "hindcast" is defined as the application of the forecast model including the updating by the Ensemble Kalman Filter (EnKF) and (2) "deterministic mode" is defined as running the conceptual model itself without updating using EnKF.

- P. 8821, L. 4: Does "reference method" refer to the "reference model Eq.(5)" defined in P. 8818? This term appears in this page for the first time. How are the 3 parameters of Eq. (5) determined ? Values ?

- Yes, the reference method refers to the reference model as described in Eq. (5). The parameters were obtained by linear least squares fitting. We propose to add the parameters in a new table or to the caption of Fig. 3.

- Table 1: What is the units of the ki parameters ? Delta-t: do you mean delta-tau ? - Tables 2-3: Why are columns 3 and 4 incomplete? The caption of these tables should include a short definition of the used models.

- The units of the k_i are very important and will be added to the table.
- In the tables 1 - 3 the Δt will be replaced by a new variable name defined as the lead time of the forecast and the captions will be extended with some information on how the values are obtained. For the Kafue and the Luangwa river basins only a forecast for 20 days and 10 days is possible. The RMSE and the Nash-Sutcliffe efficiency can be calculated only for a forecast up to the maximum forecast period.

- Caption of Fig. 3: Please define BWI.

- Will be changed

- Fig. 5: Modeled and measured discharges cannot be distinguished. The authors may use different color lines.

- We agree with this statement and produced a new figure (see below).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 8809, 2010.

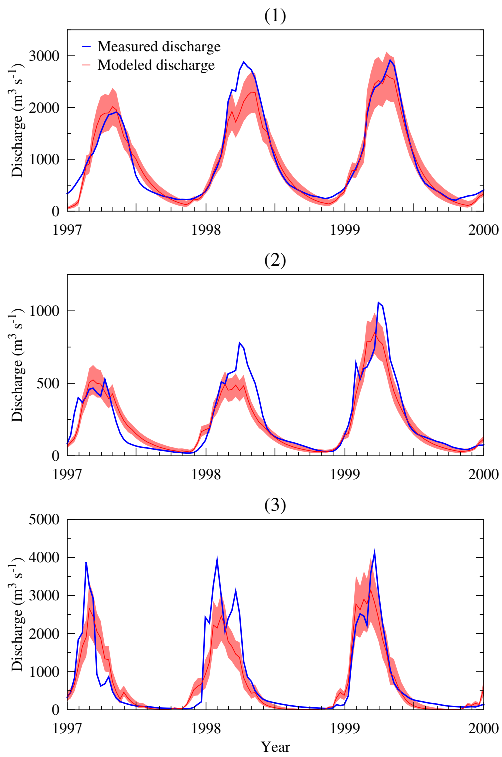

Fig. 1. The modeled discharge (red) including the 95% confidence inteerval compared to the measured discharge (blue line) for the three watersheds Upper Zambezi (1), Kafue River (2) and Luangwa River (3)