

## ***Interactive comment on “Comparing model performance of two rainfall-runoff models in the Rhine basin using different atmospheric forcing data sets” by A. H. te Linde et al.***

### **Anonymous Referee #1**

Received and published: 12 February 2008

#### General comment

The paper is a detailed comparison of two hydrologic models with different structures and assumptions in terms of their results on the Rhine catchment. The analysis is well documented and discussed. However some concerns can arise on the coherence of the analysis with the aims of the paper. As a matter of fact the declaimed aim is to verify whether or not physically based distributed models better represent observed discharges than conceptual lumped model approaches do. In order to answer to this general question it would be necessary to: (1) use more than one model or the most

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representative one for each category, (2) apply the models in a catchment where, for all the input data required, ground observations are available in order to disregard problems related with external approaches for reconstructing or estimating the input, (3) use exactly the same dataset to calibrate and (4) assess the skills of the models. The paper does not respect these conditions, as it is explained below: (1) HBV can be considered a right representative of conceptual lumped model, but VIC is not a proper representative of a physically based distributed model; (2) Even if the Rhine is a well documented catchment, the forcing data used (ERA15) are not directly observed but obtained by another model (REMO) for downscaling the original data; (3) HBV has been calibrated using ground data, by means of longer timeseries in another application (Eberle 2005) and only two parameters have been adjusted in the present work, while VIC has been calibrated with shorter timeseries and following an automated technique using seven parameters (which is a contradiction if it is considered a physically based model p. 4334, lines 24-25); (4) Even though both models have been compared using the same dataset, HBV performs better using other datasets. For these reasons I think that although interesting and clear, the paper should be revised both in the aims and in the methods.

## Specific comments

1. The VIC is a soil-vegetation atmosphere transfer scheme (SVATS) with a focus on runoff processes (p. 4336, lines 4-6) more than a hydrologic physically based model. Other models (such as SHE, FLOWSIM, WASIM-ETH, REW, tRIBs, TOPKAPI) are maybe more representative of the distributed physically based model category.
2. The observed discharge is an integrated measure and, although fundamental to assess the model performance, it is not sufficient to evaluate the model skill at correctly reproducing the phenomena and processes going on within the catchment. Other quantities such as the soil moisture or the water table could be useful to this scope.
3. (p 4333, line 24-25) The VIC model has been forced only with the re-analysis data

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(ERA15) which are not direct measures but model estimation. It would be better either use other source of data or use a physically based model which can be applied with the available observed data.

4. (p. 4334, lines 24-25) The VIC model, if considered a physically based model, should not be calibrated following an automated approach but the parameters used should referred to measures or at least to reasonable estimation. Otherwise it is not exploited the main skill of a physically based model which is to have physical meaning full parameters, but instead it is used as a conceptual model.

5. (p. 4335, lines 4-9) HBV is more extensively calibrated than the VIC

6. (p. 4336, lines 20-25). How it was conducted the comparison between the different precipitation dataset? It is shown that ERA15 and CHR present many differences at daily scale, could be this the main reason of the poor performance of VIC?

7. Fig.3. It would be important to show also the recession limb of the event, since this features of the hydrograph is representative of the dynamic and many processes of the system.

8. (p. 4337, lines 20-25) Besides the E, R2 and VE coefficients, it could be interesting to critically comment on how the main features of the hydrographs are simulated by the models. Can you discuss more extensively

9. How have been computed the monthly discharge? Running the model at monthly basis or just averaging the daily results?

10. The conclusions should be re-written in order to respect the above suggestions.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 4, 4325, 2007.

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