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Interactive Comment

Interactive comment on "A pan-African Flood Forecasting System" *by* V. Thiemig et al.

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Dear Prof. G. Pegram,

we thank you very much for dedicating your valuable time to review our manuscript, your positive attitude towards AFFS and your suggestions how to improve the manuscript. In the following we addressed each of the issues raised:

Author response to Referee #1

-(RC on p5562) All acronyms are now defined at first mentioning. We also included a glossary as the reviewer suggested.

-(RC on p5563) The name of the Basin we referred to as Save was changed to Sabi as it was indicated by the reviewer as the more common name. Additionally, the location was added in Figure 1 (a), and in the text (abstract and main body) it was added that its location is in Zimbabwe.

-(PC on p5564) Our reference database of reported flood events excludes flash floods (page 5564, l. 18). The exclusion was mainly based on the explicit statement given by the disaster databases (Dartmouth Flood Observatory; Emergency Event Database EM-DAT). In a couple of cases, where the flood was not reported by Dartmouth Flood Observatory or Emergency Event Database EM-DAT, but by the NASA Earth Observatory or Reliefweb (which usually don't specify the specific type of riverine flooding), either the duration of flooding and the indicated inundated extend were used to filter flash floods out. Hence, if the flood duration was only one or two days, or the extend local it was presumed to be a flash flood and the event was excluded. The resulting flood events are medium- to large scale events (p. 5564, l19) by their extent and duration.

-(RC on p5566) The whole section explains the four main processes upon which AFFS relies on to calculate flood forecasts (see 1. To 4. On page 5566; and also Figure 3). The referee noted in step 1 (p5566), that he is missing the mentioning of observed flow records as they were used in Section 5. However, the paragraph of concern, explains how the critical hydrological thresholds, with which a hydrological prediction is discriminated into no-flooding and flooding (including severity of the flooding), are derived based on a long-term simulation. In order to calculate this long-term simulation LISFLOOD is forced with historical meteorological data; in our case we used 21 years of ERA-Interim data. Thresholds were derived based on calculating the 2-, 5-, 10, and 30-year return period (for each pixel) of the simulated discharge, which represent low, medium, high and severe level of flooding. Section 5, though, evaluates the model and flood forecast performance, hence, the result of AFFS after all four main processes were executed as described on page 5566. For this verification ground observations are needed.

-(RC on p5568) The reservoir module in LISFLOOD is developed within the JRC. Water reservoirs are simulated as points, with a given water storage potential in Mm3, and

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outflow operation rules. The outflow behaviour of a reservoir is described by a number of parameters. First, each reservoir has a total storage capacity S [m3]. The relative filling of a reservoir, F, is a fraction between 0 and 1. There are three 'special' filling levels. First, each reservoir has a 'dead storage' fraction, since reservoirs never empty completely. The corresponding filling fraction is the 'conservative storage limit', Lc. For safety reasons a reservoir is never filled to the full storage capacity. The 'flood storage limit' (Lf) represents this maximum allowed storage fraction. The buffering capacity of a reservoir is the storage available between the 'flood storage limit' and the 'normal storage limit' (Ln). Three additional parameters define the way the outflow of a reservoir is regulated. For e.g. ecological reasons each reservoir has a 'minimum outflow' (Omin, [m3/s]). For high discharge situations, the 'non-damaging outflow' (Ond, [m3/s]) is the maximum possible outflow that will not cause problems downstream. The 'normal outflow' (Onorm, [m3/s]) is valid once the reservoir reaches its 'normal storage' filling level. Depending on the relative filling of the reservoir, outflow (Ores, [m3/s]) is calculated as: O_(res)=minâĄą(O_min,1/∆t F·S) F ≤ 2Lc O_res=O_min+(O_norm-O_(minâĄą))((F-2L_c))/((L_n-2L_c)) Ln ≥ F ËČ 2Lc O_res=O_norm+((F-L_n))/((L_f-L_n))·max{(I_res-O_norm),(O_nd-O_norm)} Lf ≥ F ËČ Ln O_res=max(((F-L_f))/∆t S,O_nd) F ËČ Lf

with: S: Reservoir storage capacity [m3] F: Reservoir fill (fraction, 1 at total storage capacity) [-] Lc: Conservative storage limit [-] Ln: Normal storage limit [-] Lf: Flood storage limit [-] Omin: Minimum outflow [m3/s] Onorm: Normal outflow [m3/s] Ond: Non-damaging outflow [m3/s] Ires: Reservoir inflow [m3/s]

Defining these parameters peak flows can be levelled off and distributed on a longer timescale for a certain extent. As we don't have information on the reservoir management operation rules the normal storage volume, the flood storage volume, the normal outflow and the non-damaging outflow parameters are calibrated to match the discharge in the nearest downstream gauge station. Of course, in reality humans are in control, who may take different decisions for reservoir outflow. Results from a sensitivity study over Southern Africa showed that the calibration parameters related to infiltration and groundwater processes are much more important compared to the reservoir parameters. Therefore, simulations with or without the reservoir routine should not affect our results. Because the reservoir routine is not important for the results we only limit the manuscript by adding two references who describes the method: 1) The revised LISFLOOD manual: Burek, P., Van Der Knijff, J., and De Roo, A.: LISFLOOD, distributed water balance and flood 30 simulation model – Revised user manual 2013 (Ispra: Institute for Environment and Sustainability), 2013. 2) And a reference which described the method (although very brief) and is public available: De Roo, A., Odijk, M., Schmuck, G., Koster, E., Lucieer, A. (2001), Assessing The Effects Of Land Use Changes On Floods In The Meuse And Oder Catchment . Physics and Chemistry of the Earth, Part B, Vol. 26, No. 7/8, 593-599. In the manuscript we added on page 5567 line18 the reference where the reservoir module is described: "The model structure was extended to also account for large reservoirs (Burek et al., 2013; De Roo et al., 2001) as well as . . .

-(RC on p5576) The figure was updated and includes now the Sabi Basin

-(RC on p5578) The acronym SRFE was written out as "Satellite-based Rainfall Estimates" and also added in the glossary

-(RC on p5589) The figure was updated and includes now the Sabi Basin. All the units are listed in the figure caption

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/11/C3602/2014/hessd-11-C3602-2014-supplement.pdf

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 5559, 2014.