

Gal – Modeling the paradoxical evolution of runoff in pastoral Sahel. The case of the Agoufou watershed, Mali

General observations

This paper deals with the Sahelian paradox: despite the decline of the annual precipitation, the Sahelian region is paradoxically subject to an increase in runoff associated with an increase of the runoff coefficient. The causes of this phenomenon, commonly known as the "Sahelian paradox", are not yet clear. Based on an event-based and physical-based hydrological model, Kineros2, the authors model the runoff on a small basin located in the Gourma under the Niger River loop. The model allows them to prioritize the different factors that lead to this paradox. The title of their article is moreover incomplete since this last part of prioritization does not appear in the title.

This question of the Sahelian paradox questioned some researchers but many hypotheses have not been validated.

My first observation concerns the approach: a model is not the reality, a model is only an impoverished image of the reality, even a physical-based model: there is always a process of calibration of parameters to be launched; a model parameter have never a physical meaning. Therefore, we can not rely exclusively on a model, however excellent it may be, to determine all processes involved in rainfall-runoff transformation, and even to prioritize them. Now, this paper gives the impression that the authors seek to validate their knowledge they have of the problematic by means of a model. I preach for my part for incessant back and forth between observation and simulation ... I'm therefore a bit dissatisfied ...

My second observation concerns the very numerous approximations made by the authors: we do not know what are their simulation impacts, because the authors did not discuss the subject. They present mean or median results that ultimately smooth the response of the basin.

However, I congratulate the authors for all the data that they were able to collect and process (it is not simple in these environments) and which was the basis of this work.

Specific observations

The study material is very simple: a single watershed, which does not make it possible to give a universal character to the results obtained.

I would appreciate that the authors use at least one other model and compare the results of these different models and compare them to their observations and their knowledge of the terrain.

Pleas, give ranges of uncertainties of your treatments/process

I'm not native-english, so I can not evaluate the quality of the English.

Technical observations

Page 3, lines 30 and after : It also means that as a result of important rainfall events, these ponds may be temporarily interconnected for a more or less long period. Is this type of interconnections possible at Agoufou pond?

Page 4, lines 18 and after : the problem of such a model (event-based model) is to fix the initial conditions for each simulation : how do you proceed?

Page 5, "Precipitation and meteorological data..." : you need to more detailed your data. Some analyses are needed

Page 6, "landscape..." : did you discuss of your results with the local population? Did they validate your maps of landscape/.drainage network evolution?

Page 6, "Rainfall..." : astute approach but you have to validate it. That's why I asked before to more analyse your climatic data.

Page 6, lines 35 and after : can we have an idea of how many times you have to widen your intervals?

Page 7, line 4 and after : can't you validate this assumption with the synop station and the stations network of Amma-Catch program?

Page 8, "model calibration..." : why don't use an automatic calibration? Why these intervals : you tell later that some values found in the literature are higher? Can we have the dispersion of your ten simulation for an event?

Page 9, "reference ..." : it is a too simplistic assumption which have an impact on your results... Isn't it possible to use "interpolated situations"?

Page 9, "soil land..." : give ranges of the uncertainties of your process. How can you say that in 2011, the western area of the basin contribute to the Agoufou pond? In the Inner Delta of Niger, there is the same phenomenon of interconnected lakes during some strong events; these interconnections are not necessarily permanent and can disappear for a while; It's certainly the same here. How can you be sure that it does not happen before, between 1960 and 1975?

Page 13, line 37 : Pierre et al., 2016 is not referenced

Page 14, line 32 : "erreur..." ????

Page 15, line 34 : what are the "stocking rates"?