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Hydrology and Earth System Sciences
Discussions

# *Interactive comment on* "Redressing the balance: quantifying net intercatchment groundwater flows" *by* Laurène Bouaziz et al.

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Dear referee,

Thank you for your positive synthesis and detailed comments. We will take them into account to improve the manuscript and would like to shortly respond to them below.

*Synthesis*

*1. This is a very interesting paper on the difficult question of an unobservable element of catchment water balance, Intercatchment Groundwater Flows (IGF). Because they are unobservable, they must be deduced from water balance anomalies, and their estimates are for this reason extremely uncertain. I recommend the publication of this manuscript after minor corrections.*



*Comments*

*2. Concerning the Introduction : You should perhaps mention that a difficulty inherent in the study of the IGF lies in the fact that conceptual models have several options to adjust the water balance, and that unfortunately they cannot afford to calibrate at the same time a parameter for 1) IGF, 2) Precip correction, 3) PE correction. . . thus they have to make an assumption on the main source of error and historically modellers have had a tendency to favour precipitation correction.*

We agree that conceptual models have several options to adjust the water balance and even though historically modellers have had the tendency to favour precipitation corrections, this may indeed not lead to more realistic representations of the underlying processes. We will make sure to discuss this in greater detail in the introduction.

*3. You use both "watershed" and "catchment". Is it on purpose? If not, I would recommend simplifying the vocabulary, choosing e.g. "catchment".*

We indeed did not imply a distinction between "watershed" and "catchment" and we will make sure to consistently use "catchment" in the revised version of the manuscript.

*4. P. 3 L.3-14 : your discussion reminds me of our own discussion of the same topic, in a paper that you may not be aware of (Mouelhi et al., 2006). There was a section poetically entitled "Is the underground water exchange parameter a fudge factor?". We showed through a proof by contradiction that IGFs "cannot be ignored on the grounds that [they are] difficult to model. The hypothesis that [IGFs] are negligible must be demonstrated by the fact that the models where it is not included are more efficient than the others since they are not overburdened by a useless additional component." We concluded that IGFs, "far from being a negligible flux of water, are an important feature of water balance modelling."*

Thank you for referring us to the interesting paper by Mouelhi et al. (2006), which we will discuss in the revised version of the manuscript. We agree with the drawn

conclusions that IGF should be explicitly considered as they can represent an important feature of water balance modelling.

*5. P6 Eq 1 and 2 : I would find it easier to follow if you used a different notation for the instantaneous flux and the integrated value (may be p and P).*

Thank you for this suggestion, we agree that making a distinction in the symbols used for the instantaneous and integrated fluxes would make it easier for the reader and we will therefore adapt this in the revised version.

*6. P6 L24 : about the "Turc-Pike" formula : even if the literature sometimes use this name for the formula presented in Eq. 3, this is not fair, because the formula has been proposed almost simultaneously in France and in the Soviet Union respectively by Turc (1954) and Mezentsev (1955) : there is a detailed hydro-historical account in Lebecherel et al. (2013). I really think it should be named after both Turc Mezentsev (and not after Turc and Pike). In our 2007 paper, we used this denomination because we had not yet rediscovered the work of Mezentsev at that time. Also, the use of the second parameter (alpha) in Eq. 3 is not standard (it's Le Moine's own modification of the formula), and since you use alpha = 1, I suggest that you stick with the classical Turc-Mezentsev formula (with only one free parameter). Last, to help your readers, you could perhaps replace gamma with n, it is more common in the literature.*

Thank you for this interesting point concerning the historical origin of the water balance formula. We agree that it would be unfair not to acknowledge Mezentsev (1955) and we will adapt this in the revised version of the manuscript by referring to the formula as the Turc-Mezentsev formula. We also value your suggestion to adapt the formula presented in Eq. 3 to its classical form with one free parameter n, as also used in Lebecherel et al. (2013).

*References*

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