Response to Reviewer's Comments : Anonymous Referee #3

(Referee Comment, RC) The study attempts to examine the possibility of reducing parameter uncertainty by separately calibrating the model for wet and dry periods. Then calibrated parameters were used in regionalization together with selected catchment characteristics. The study concludes that dry season predictions are much better with the used methodology. As such this is a useful research reflecting on an important issue of regionalization in hydrology. However, as noted by the first reviewer, there are significant overlaps between this paper and the previously published work by the author. This raises serious questions about the significant contribution and novelty of this work. For instance, in one of the paper (Kim and Lee, 2014 published in HP), the seasonal calibration for wet and dry periods is already presented in detail concluding that a multi-objective calibration approach is better compared to single objective function. In this paper, the issue of dry and wet season calibration is presented in good detail. In the second paper, Kim and Lee (2014) again published in hydrological processes; the regionalization is presented in detail. The author has noted the references of these papers in this paper submitted to publication for HESS and indicated that this paper builds on the previous work. However, considering the significant overlaps, especially major methodological works already published, I do not see significant originality and novelty in this research. Therefore, I do not recommend publication in HESS journal.

(Author Comment, AC)

This study investigates the possibility to improve the hydrological model parameter regionalization approach through rainfall-runoff model calibration for the different parts of flow regime (i.e., a seasonal calibration), particularly focusing on model behavior during dry periods.

The current paper is part of the same line of works by Kim and Lee (2014a, b); such as rainfall-runoff model, study sites and multi-objective optimization algorithm, but it has sufficient difference from such works in terms of research objectives. The work presented by Kim and Lee (2014b) addresses the use of regional regression of model parameters (through multi-objective calibration), but the seasonal calibration is not adopted; whereas Kim and Lee (2014a) proposes the use of a seasonal calibration (similar to the focus on the dry season applied to the present study), but does not carry out a regional regression of the model parameters (but only applies calibration of single catchments).

Kim and Lee (2014b) assessed the efficiency of the regionalisation approach based on a multiple objective calibration technique to rainfall–runoff modelling under the catchment conditions of the Republic of Korea. They concluded that the regional model with the multiple objective approach led to improved hydrological simulations in ungauged catchments over a single-objective approach, but there

was still a flow-dependent bias (i.e. a tendency towards the behaviour of underestimating and overestimating high and low flows for the wet and dry periods, respectively) in the runoff simulations. The present paper builds on their analysis and examines the relative performance of regionalisation methods. The work presented in this paper is a methodological advancement of the work by Kim and Lee (2014b) in regionalisation studies. The present paper also goes beyond Kim and Lee (2014b) in three important aspects.

First, the variability (or consistency) of hydrologic response in model performance and parameter values and the NIREs (non-parametric impulse response estimates) have been implemented to investigate problems associated with the model accuracy under the different flow regime, which might be accumulated through regionalisation processes (i.e., leading to influences on the identification of relationships between the calibrated parameter values and the catchment characteristics as well as runoff predictions in ungauged catchments). Second, the calibration strategy (splitting the historical time series into wet and dry periods and calibrating data segments only for the dry period separately on the LRM (linear routing module) parameters because of a sufficiently high degree of similarity between the LRM parameter values for the wet period and those for the whole period) was established to improve the identification of relationships, according to an identification of deficiencies on model structure suitability for the different flow regime. The idea on seasonal calibration (Kim and Lee, 2014a) was accepted here. Third, Kim and Lee (2014b) concluded that a flow-dependent bias (i.e. underestimation and overestimation for the wet and dry periods, respectively) in the regional model might be reduced through modifying the model structure. However, the present study demonstrated the flow-dependent bias for the dry period in the regional model can be improved with an advanced calibration approach through improving the identification of the relationships between the catchment characteristics and the calibrated model parameters ‘without modification of the model structure’.

Such issues were already discussed with the editors (handling editor: Dr. Elena Toth; handling executive editor: Prof. Dr. Erwin Zehe) through the editor decision (26 May 2015). The editors concluded that the present manuscript has sufficient difference from the previous works to allow being considered for publication and required to add an addition explanation on that in the manuscript. There was a minor revision on the introduction to make explicit what is in common with the two previous studies and what is novel in the submission after the discussion with the handling editors. Furthermore, more details on these issues (discussed above) will be added in the introduction and the conclusion sections in a next draft in order to clarify the advancements from the previous works.

References

Kim, H. S., and Lee, S.: Assessment of a seasonal calibration technique using multiple objectives in rainfall–runoff analysis, Hydrological Processes, 28, 2159-2173, 10.1002/hyp.9785, 2014a.

Kim, H. S., and Lee, S.: Assessment of the adequacy of the regional relationships between catchment attributes and catchment response dynamics, calibrated by a multi-objective approach, Hydrological Processes, 28, 4023-4041, 10.1002/hyp.9942, 2014b.