We thank the Editor and Reviewer for their feedback to further improve the paper. The paper was modified taking the comments into account as shown in the marked-up version of the modified paper.

**Responses to the Editor**

*Comment:*

*Dear authors,*
*as mentioned by the reviewer and also having a look myself, I think you did a good job in addressing most of the points the reviewers mentioned in the first round of the reviews. I can also see your point, that some of the suggested changes are not possible without redoing most of the analysis. Hence, I think the paper could be accepted if - as request from the reviewer and supported by myself, the conclusion will be adapted. As mentioned my the reviewer, it would be appropriate to highlight, that due to the limitations of the selected study area, model type and data available, the study will mainly be a novel exemplification of a framework for exploiting satellite data for improved process representation - but certainly cannot be generalized. Meaning that the main interest of this paper is on the idea and framework, and less on the actual improved process understanding. The model, data and approach cannot claim to have increased the process understanding significantly. However, you have exemplified a very interesting approach to potentially use satellite information for increased process understanding. Please make the requested changes and highlight the changes you made in the paper.*

Response:

Thank you for this positive assessment. We agree, as a result of the limited model hypotheses tested in this study, Model F performed best among the hypotheses tested here but in future studies an alternative hypothesis may perform even better. However, this study showed the added value of satellite observations for stepwise model development which contributes to improved process understanding. We have modified the conclusion in the revised version of the paper to address this.

**Responses to Anonymous Reviewer #1**

*Comment:*

*The authors have responded in detail to the questions raised and fundamentally maintained the structure of the paper and argued that some of the suggestions for major revisions are outside the scope of the paper.*
*I appreciate the added discussion on limitations of the study and in particular the data scarce and uncertain study area. I especially appreciate the added analysis of alternative precipitation data (figure S15) and an attempt to address parameter distribution (Model G, Figure S14). I would still argue that the paper would have contributed more towards actually learning from satellite data, if the parametrization had been addressed, both through sensitivity analysis towards different performance metrics and different parametrisation schemes. This would, as argued by the authors require an undesired expansion of the manuscript, and would consequently require a restructuring of the entire study and reduction of the already presented analysis.*
*I find the manuscript ready for publication, but I do have one request, which I find reasonable. That is to address the limitations of the study in the conclusions. It would be appropriate to highlight, that due to the limitations of the selected study area, model type and data available, the study will mainly be a novel exemplification of a framework for exploiting satellite data for improved process representation. Meaning that the main interest of this paper is on the idea and framework, and much less on the actual*

*improved process understanding. I simply do not believe the model, data and approach can clearly claim to have increased the process understanding significantly. However, you have exemplified a very interesting approach to potentially use satellite information for increased process understanding. E.g.Your Model F performs best, but weather groundwater upwelling is the correct process, is not exhaustively examined, especially when considering all the uncertainties.*

Response:

Thank you for this positive assessment. In this paper we tested a limited number of model hypotheses to keep the paper as concise as possible. Based on our results, Model F is the best performing model among the hypotheses tested in this study. However, when considering alternative hypotheses in future studies, this model may be rejected in favour of a new model hypothesis. Therefore, we agree a more comprehensive analysis is needed to further improve the representation of groundwater upwelling and hence our understanding of the hydrological process. Nevertheless, this study showed that satellite observations provide valuable information not only for model calibration, but also stepwise model development which contributes to improved process understanding. We have modified the conclusion in the revised version of the paper to address this.