

Interactive comment on “Impacts of climate change on groundwater flooding and ecohydrology in lowland karst” by Patrick Morrissey et al.

Anonymous Referee #1

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In the submitted manuscript, Morrissey et al use a semi-distributed karst model to estimate the possible impacts of climate change on a lowland karst system in Ireland both in terms of groundwater flooding and ecohydrology. Their model predicts that groundwater events that are currently considered extreme will increase in the future. In addition, a future shift of flood seasonality is simulated by the model, which the authors suggest will likely affect ecological systems.

Generally, the study is well-written and concise. Using a well-established karst model to estimate future groundwater flood frequency and ecohydrological implications is novel and of high interest for the readers of Hydrology and Earth System Sciences. As

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elaborated in the technical/specific remarks below,

(1) comparing the RCMs' control periods simulations with meteorological observations may help to assess their trustworthiness.

(2) estimating the uncertainty of the hydrological predictions may help avoiding wrong conclusions about moderate changes that are smaller than the prediction uncertainty

(3) A comparison with projected changes of karst processes of other karst model applications to assess future changes may permit some evaluation of the predicted changes of this study.

Overall, I am confident that the authors will be able addressing these point within the frame of minor revisions.

Abstract:

Some more information about the methods (model setup, climate scenarios) is necessary.

Introduction:

Line 51: Typo “changeon”

There is some work on groundwater level frequencies and climate change by Bloomfield & colleagues and some semi-distributed modeling of GW levels and climate change by Brenner et al (2018, NHESS), which may be useful for the state-of-the-art

Regional Climate Modelling

This section is a short of a general review. Please either add study site specific information (which RCMs are available? how have they been established?) or move to Introduction

Methodology

Is it possible to compare the model ensembles of the historic/control time period with

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observed climate data?

Lines 192-193: "GCM to 18 km to 4 km" Please rephrase into full sentence.

Table 1: Not all RCPs are available for all of the models. How was this handled when working with the model ensembles?

Figure 2: numbers in grey circles within figures not elaborated in caption

Karst Groundwater Model:

Since the model parameters are estimated via calibration, it would make sense providing some estimate about their uncertainty especially since the model is used for prediction far in the future. Moderate predicted changes in flood frequency might be still within the envelop of the simulation uncertainty.

Results & Discussion:

A general assessment on how much you trust the model projections is necessary. A comparison of the karst hydrological projections of this model with the hydrological projections of other karst models might be useful for that. Which processes are prediction to become more pronounced by this model and is this in agreement to the projected changes in hydrological behavior of other karst simulation models that were run with climate projections? Do the projected karst hydrological changes agree with the conceptual understanding of the lowland karst?

The discussion about ecohydrology could be a bit more specific. Which negative specific consequences may occur? Which plants/animals are affected most? Maybe one or two specific examples would help.

Figure 4: please enlarge x-/y-axis label font sizes

Line 325: Typo "Figure 5illuminates"

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203, 2020.