Multi-level storylines for participatory sociohydrological modelling – involving marginalized communities in Tz'olöj Ya', Mayan Guatemala

Jessica A. Bou Nassar et al.

Scientific significance

The manuscript represents a contribution regarding the implementation of participatory modelling in vulnerable and disadvantaged communities to address eutrophication problems. Understanding and applying tools such as participatory system dynamics in different contexts is illuminating for research and practice and therefore, the manuscript offers a valuable work to be published in this special issue of the journal.

The authors present the integration of multi-level storylines in participatory modelling as the main contribution and as novel feature that departs from traditional participatory modelling approaches. However, the methodology and results associated to the multilevel storylines is really similar compared to the initial phases of conducting traditional participatory modelling processes to elicit causal loop diagrams. In this regard, it is required to strength the comparison of traditional approaches to elicit causal loop diagrams in participatory process and the storylines approach, or otherwise, presenting the storylines in their fair dimensions as an alternative to elicit causal loop diagrams in participatory process.

Scientific quality

The authors reviewed relevant literature regarding the building blocks of the approach adopted. Nonetheless, participatory modelling has been used in water resources management almost from its beginning and some relevant authors regarding the integration of these concepts were overlooked what perhaps lead the authors to not sufficiently acknowledge that practices quite similar to those developed in their research have been employed to: i) construct causal diagrams eliciting the stakeholders´ perspectives; and ii) take part in the whole cycle of system dynamic modeling.

Presentation quality

The manuscript structure could be substantially improved. There are different ways the manuscript could be better structured. One could be to show a conceptual framework with the original building blocks, followed by a proposal of the integrated approach. Then, the methodology where this integrated approach is materialized could be described. After this, the results could be presented. The current way in which the document is developed, with parts of the original approaches and the integrated approach appear in the introduction, the background and then the methodology, is not clear. Another path could be to develop the three proposed objectives in the results section that currently only addresses the implementation of integrated approach. In any case, sections 4.1 and 4.2 should not be part of the methodology since those are

general descriptions of the approaches and not an account of the activities carried out to undertake the research process.

In addition, more insight should be provided regarding the case selection, and how the research idea and problem emerged from the interaction between researchers and stakeholders.

Language

I cannot comment on the language as English is not my mother tongue.

Specific comments

Lines 145 -150

Another approach, stakeholder created causal loop diagrams (CLDs), contain variables connected by links indicating causal relationships. Although CLDs have been previously applied in participatory research (Inam et al., 2015, 2017b), their construction requires reading and writing skills. Hence, they are ill-suited for involving less-literate participants in participatory model-building activities.

This statement is not necessarily true. It is not necessarily the stakeholders those who formulate the CLDs. This approach of a facilitator building CLDs from interviews or focus groups and "translating" the information provided into the System Dynamics language is widely used in SD in WRM.

Line 269

Figure 1 Location of the study area in Guatemala. Created in QGIS (https://qgis.org/) using Esri (2009).

The map in Figure 1 needs to be substantially improved. The location of the study area in Guatemala and of Guatemala in America must be shown. Labels relevant only to the study area with Font of an appropriate size together with a grid of coordinates should be included.

Lines 401 - 403

The sign corresponding to each link indicates the type of relationship between the two variables: (+) indicates a direct relationship, while (-) implies an indirect one.

This statement must be reworded. That is not the correct explanation of polarities for the causal relations in System Dynamics.

Lines 452 - 455

These policies and BMPs are then simulated in a quantitative version of the model. The results are subsequently presented to stakeholders by members of the guidance team and discussed until an agreement on suitable solutions is reached. This paper does not cover the implementation of this step.

Since a relevant feature of this work is the context of their application, involving marginalized and indigenous communities, it would be an important contribution to explain how model results were discussed and communicated to these stakeholders, which is relevant since the authors expressed that most of them cannot read or write.

Line 474

Table 1: Demographics of project participants

It would be convenient to expand the information on the number of participating indigenous communities and their different languages

Lines 511 – 512

From the Macro-level storylines elicited from primary researcher participants, the authors concluded that the model should address the eutrophication problem of Lake Atitlán.

According to that statement ¿how this research fits within a real participatory approach in which external agents (researchers) should have a facilitating role in a process through which the relevant stakeholders reflect, deliberate and are empowered to make decisions, rather than a role of extracting information from stakeholders and make decisions for them?

Figure 7

Assess whether there is a feedback loop between “crop productivity” and “use of inorganic fertilizers and pesticides”

Improve the figure so that the polarity between “irrigation efficiency” and “untreated wastewater can be observed”.

Figure 8

Improve the figure so that the polarity between “WWTP” and “untreated wastewater” can be observed.

Use the term in full for WWTP

Improve the figure so that the polarity between “available land” and “septic tanks” can be observed.

correct typo in septic tanks

Correct the polarity between Jobs and Poverty. This polarity should be negative, not positive

Figure 11

Is confusing that a relation can be reinforcing and balancing at the same time. Please clarify.