**Hydrology and
Earth System
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Discussions**

Interactive
Comment

Interactive comment on "Snow glacier melt estimation in tropical Andean glaciers using Artificial Neural Networks" *by* V. Moya Quiroga et al.

Anonymous Referee #2

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In this paper, the authors present an application of ANN to snow and glacier melt in the tropical Andes (Bolivia). The main contribution of this study is to estimate glacier melt rate while reducing the number of input data, consequently allowing modelling in data scarce regions. The ANN model is based on the energy balance model and several model structures are trained using shortwave radiation, temperature, relative humidity and antecedent melt rate. Model structure including relative humidity and antecedent melt rate are found to perform better than other structures. Although this paper is to me an novel and noteworthy contribution to hydrology I think the authors are to address the following issues:

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Discussion Paper

Major comments

1) the ANN methodology has been applied to hydrology in numerous studies and a more critical approach to the challenges linked with this method in the Zongo Basin in particular is missing. To my opinion, this paper as it is and in the light of the answers provided by the authors still lack criticism about the ANN methodology and fails to explain its limits to applications in tropical glaciers. More specifically, addressing the following issues is of paramount interest to the readers:

a)how long should be the learning period and how does this affect the model performance?

b)How do ANN perform when confronted with a change of scale (if the glacier area change over the Andes), the spatial resolution of available data does not.

c)How do uncertainties linked with input data are treated by the ANN model (are they treated?). In this particular case, another dataset could be used to illustrate it.

2)I agree with the first reviewer that there is a demand for a "validation" of the presented models. In addition to a proper validation, I would argue that testing a new methodology should include a comparison with other existing methods and highlight how this particular methods performs better and in which cases. With regards to this paper, I would suggest for instance a multiple regression (see Riad et al 2004). The discussion that will follow this comparison appears to me a key to support the advantages of the methods presented here.

Minor comments

1)If the paper of Perroy et al (2007) is not available online or to HESS readers, it should removed from this manuscript

2)P9460 l. 19: "undeveloped country" should be replace by "developing country" which is the term used by the United Nations and most international organisation.

3)P9473 l.22 "further research will focus on uncertainty". It is not clear to me to what uncertainty you are referring to: uncertainty in input data, cascading uncertainty (i.e. passing it through the model) or model uncertainty (linked with the structure of ANN).

Literature

Riad S, Mania J, Bouchaou L, Najjar Y. Rainfall-runoff model using an artificial neural network approach. Math Comput Modell 2004; 40: 839-46.

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