

## ***Interactive comment on “Simulating hydrology with an isotopic land surface model in western Siberia: what do we learn from water isotopes?” by F. Guglielmo et al.***

**Anonymous Referee #2**

Received and published: 10 October 2015

This paper extends the land surface model Orchidee to include water isotopes, and applies it pointwise to 4 locations in Labytnangi, Russia. These accomplishments may represent important steps in the development process of Orchidee and in the understanding of its behaviour.

The paper, however, is inconclusive about the main question raised in the title, namely, what can we learn from water isotopes. The reasons, in my opinion, have to do with 2 aspects: 1. The large uncertainty in the data and boundary conditions. 2. The absence of comparisons with alternative isotope models.

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With respect to the data, the vertical soil profiles at the 4 stations were measured in August. They therefore represent one point in time, and they do not provide indications about the existence of seasonal dynamics.

The isotope input data are available at monthly time scales, with contrasts with the model time step of 6 hours. This makes wonder whether, given such coarse input data, the 6 hours simulations may be considered representative of isotope dynamics at fine time resolution.

Moreover, the input data are available at stations far apart the experiment 360, 970 and 980 km respectively. The Authors say that they interpolated between these values. But this does not save them from a potentially exceedingly large input uncertainty.

The model is applied point wise. As far as I understood, the exchange is assumed to occur only with the atmosphere. What about groundwater flow, lateral flow, and all other potential impact about other inputs? These are not mentioned and discussed.

With respect to the second point, the Authors provide a certain process description, which is basically assumed. In order to convince the readers that such description is appropriate, the Authors should have at least compared it with some alternative descriptions.

A more conclusive study requires changing the location to a place where more data are available and more extensive analysis can be carried out. Moreover, it would be necessary to do some “hypothesis testing” with the proposed model developments.

This analysis would help to support statements such as “The model performed relatively well in simulating some features of the  $^{18}\text{O}$  soil profiles”. Relative to what?

Other points:

The paper is not clearly written. For example, in the abstract: “In this paper, we investigate the usefulness of water stable isotopes in land surface models studying land surface processes. To achieve this, we implemented...”. What does “this” refer to?

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There are many examples like this in the paper, such as the following one in the introduction.

“The fact that the isotopic composition of water is affected by phase changes makes it a reliable tracer”. What does “it” refer to?

Equation 3 is wrong, or at least it does not follow from Equation 2.

Page 9397: “Moreover, at least two hydrological regimes (swamp, alluvial plain) are identifiable”. Is alluvial plain an hydrological regime?

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 9393, 2015.