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Geoscientific Model Development Discussions

Interactive comment on "Using model reduction to predict the soil-surface $C^{18}OO$ flux: an example of representing complex biogeochemical dynamics in a computationally efficient manner" *by* W. J. Riley

Anonymous Referee #1

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The author applies a high-dimensional model representation (HDMR) approach to a model of the isotopic flux of CO_2 from the terrestrial biosphere (ISOLSM). He demonstrates that the model is well capable to reproduce the full ISOLSM at a C_4 grass land.

The paper is short, concise and sound. I have only the obvious remarks about predictability, etc. Additionally, the paper needs more explanations about quite a few concepts mentioned and or applied, that might or might not be important, but are not elaborated upon.

1. What is steady-state in this context? Steady in what? If I force ISOLSM with random precipitation input, diurnal and seasonal cycles of temperature, etc., when is it steady?

2. What is the predictive power of the HDMR? What happens far away from steady-state (but see 1)? What happens outside the parameter ranges that were used for the sampling points of HDMR.

3. What is the advantage of HDMR over artificial neuronal networks (ANN) or other similar approaches?

4. The model was built for the isotopic flux. If I am interested in other things than the flux, I still have to run the full model, isn't it. I thought that isotopes are a diagnostic tool and, therefore, am I not always interested about other things on top of the isotopic fluxes?

I just have a problem to imagine a scenario where I am interested in only the fluxes. The fluxes are to and from the atmosphere. Atmospheric isotopes are used for double deconvolution, for example. But then I also need the fractionations. Could the author please further explain what the HDMR of ISOLSM is needed for. Would it be possible to build (an) HDMR but with several output variables, e.g. also the fractionation factors?

5. I cannot believe that Table 1 lists all relevant inputs to build the HDMR. Or put it another way, I think that there are more relevant parameters that were not used in HDMR but are important in ISOLSM. One obvious missing parameter is porosity, another one is CO_2 concentration. This might hinder the predictive skills.

Moreover Table 1 is not indicating which soil moisture and temperature were taken: in one depth, the same in all depths, etc.

Consequently I wondered if the remaining parameters in ISOSLM were fixed at the values for the C_4 prairie where the model is validated now.

6. I have not understood the business of D1 and D2. This was not well explained.

7. The author uses cut-HDMR and linearly interpolated between the forcing values. He therefore chose small steps. I wondered why he did not use (random sampling) RS-HDMR using quasi-random numbers and orthogonal interpolation functions. Would that not decrease build-up time of the HDMR enormously? It might even reduce the computation time again.

Interactive comment on Geosci. Model Dev. Discuss., 5, 3469, 2012.