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Biogeosciences Discussions

Interactive comment on "The emission factor of volatile isoprenoids: caveats, model algorithms, response shapes and scaling" *by* Ü. Niinemets et al.

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To understand my argumentation i try to introduce some concepts about inverse problems (or inverse modeling). One can define two manifolds, the so called model and data space. Just in very short, it is possible to define a "coordinate system" on a manifold. A given parameterization of a model is such a coordinate system in the model space and the application of it will yield in a coordinate system on the data space, representing the solution of the model according to that parameter set. That is a so called bijective map, or a one-to-one mapping.

If we now want to find a parameter set to a given "coordinate system" on the data

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space (a series of measurements), we have to solve the inverse problem and map data space coordinates to model space coordinates. This is, unfortunately not bijective. This mapping will have an infinite number of solutions and one needs additional, maybe subjective, informations to constrain the possible solutions.

Now, we should be able to see, that it does not matter if we parameterize the Arrhenius function to temperature, a SVAT model to eddy flux data or a CTM with satellite born data, the procedure is the same. Or more clear expressed, we can not blame the parameterization for uncertain and insufficient input data.

There is also the task of scaling that have to be defined in a proper way. Again using the abstract idea of the data and model spaces, a change in scale in the data space will be a change in it's coordinate system, causing a change in the model space coordinate system if we again apply the inverse problem solution.

So in a way, scaling, up or down, is a "subtle difference in the definition of the parameterized algorithm". That now may lead to the point that the challenge is challenging itself.

It is clearly agreeable that another approach is needed. In what sense it has to be more integrated has yet to be defined. From the short discussion above it may come clear that the definition of the data and model spaces and the set up of coordinate systems on them is a crucial task. As reality does allow data sampling with discrete time steps only, discretization of the data and parameter space coordinates is a task to be performed. This is introducing the problem that it's only possible to find parameters with a certain probability distribution. Such discussions on building new model approaches are yet lacking.

For the interested ones, inverse problem theory is nicely described by Albert Tarantola (2005) Inverse Problem Theory and Methods for Model Parameter Estimation. SIAM, Philadelphia, ISBN 0-89871-572-5.

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Introductory information on manifolds is available on Wikipedia as an example.

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