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Biogeosciences Discussions

Interactive comment on "Reflectance properties of selected arctic-boreal land cover types: fieldmeasurements and their application in remote sensing" *by* J. I. Peltoniemi et al.

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This is a nice piece of work. The paper is well written and well structured. Remote sensing community certainly needs reliable BRF and spectral databases of various land cover types. BRF measurement results over a wide selection of different land cover types are presented together with a good philosophical analysis of the state-of-the-art of the problem. I am quite confident that the instrument set designed by the FGI team and used in the measurements as well as the metrological/methodological quality of the data are of the highest level and thus the BRF database is reliable. It seems that now at last we will have a systematically compiled BRF database which will surpass

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Discussion Paper

the very old Kriebel's data. It could well be that a real breakthrough in remote sensing application will take place when high-quality spectral, BRF and temporal databases and respective models are available.

The following comments are mostly meant to refer to existing problems rather than clear recommendations to make changes in the paper.

In this paper the authors have not gone deep in analyzing their BRF data. So, the data and figures presented have much an illustrative role demonstrating the BRF differences among various land cover types. The authors point out that new BRF models are urgently needed to promote the understanding how the reflected signal is formed and which are the key (measurable) characteristics of various land cover types that are needed as inputs for these models. Although the present theoretical understanding in radiative transfer problems allows us to qualitatively analyze the effect of many structural and chemical variables on the BRF behavior, there are still serious problems with the predictive power and quantitative agreement between model calculations and measured multispectral BRF data. My opinion is that just now it is the high time to create new BRF models, since it could well happen that some of the key parameters of these targets have not been measured during the present field campaigns. As a consequence, the present and currently measured BRF databases would lack the necessary flexibility to be used in testing the forthcoming reflectance models. To my mind, one of the most problematic issues related to the BRF databases is just how to quantitatively describe the target to meet the requirements set by the needs of modeling. For instance, it is evident that the traditional botanical descriptions of plant communities are clearly not sufficient to characterize the BRF of vegetation.

An important point discussed in the paper is the spatial/temporal inhomogeneity of the majority of land cover types. It is evident that to further promote the predictive power of the forthcoming reflectance models they have to include a quantitative description of the structural and (bio)chemical variability of the targets. It will inevitably lead to a need to have 3D descriptions of the targets and rather complex structural models,

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respectively.

Another important point suggested by the authors is that the new models should be of hierarchical type starting from the smallest structural units. Here, I am a bit pessimistic about a practical outcome of this kind of models. Such models will hopefully provide a means to adequately simulate the reflectance behavior of all land cover types. However, the resulting models will be quite impractical mainly because of the vast amount of input parameters needed to measure and of the large cumulated uncertainty caused by the errors in the measured input parameter values. In other words, these models can give us a confidence that the basic physical theories like the radiative transfer theory, Maxwell equations etc. can correctly describe the BRF behavior of any land cover types. However, will we be able to measure all the set of complex input for a hierarchical model? It is not clear will there be a way to create simple, but yet enough physically based models. I like the authors' optimism that the accuracy of remote sensing could be increased by an order of magnitude, however, it seems to be a rather difficult task in practice.

An important point that has not been treated clearly enough in the discussion paper is when and how the authors plan to make their BRF databases publicly accessible to the scientific community. This is always a delicate issue, since a clear privilege of authors is to use their data first.

A problem existing in the majority of scientific manuscripts are the references. In the paper a rather good overall balance between the local (Finnish) authors and international papers is achieved. However, as an example I would recommend to cite some more international papers is on p.1071-1072 concerning the BRF modeling in forests (e.g., papers by the Canadian, Boston and Tartu teams).

Some minor typos and technical problems with the manuscript: p. 1070 r11 visible instead of visual p. 1074, explain the quantity R in Eq. 1, too; R_STD should perhaps be reflectance, not refractivity; the subscript STD for standard is not a good choice,

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since it could easily be mixed with standard deviation p. 1075, polynomial instead of polynominal p. 1075, I think the mathematics in Eq. 1 and 2 need some more comments to be fully understood, e.g. concerning the polynomial P_i and S_i p.1079, leaf instead of leave p. 1076 and 1079, a problem with the numbering of Figures

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Interactive comment on Biogeosciences Discuss., 5, 1069, 2008.