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A Correlation Index on the Link between Surface Parameters obtained from Field Measurements and Satellite Data

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Ideal exhaustive covering validation method of remote sensing products is too expensive to be realized. Therefore spatial sampling strategies are always adopted for up-scaling the local field measurements to satellite remote sensing products in large scale. The problem of scaling between the field experiments and the ground parameters obtained from satellite observation is still one of the most difficult problems in the validation of satellite remote sensing data. The difficulty is twofold: First, the field measurements are impossible to be exhaustive; Secondly, the model used to retrieve surface parameters is not linear and medium on satellite pixels is impossible to be entirely homogenous.

Here we define a correlation index which links the measurements and the parameters obtained from satellite, which is realized through the field measurements explanation and the error due to the heterogeneity of medium and nonlinearity of retrieved model.

We separate the correlation index into two parts. The first part means scaling error deduced by limited field measurements, which can be obtained by the simulation procedure for the whole value from field measurements with the method of variogram. The other part of the correlation index means scaling error deduced by the nonlinear model used on heterogeneous surface, which is obtained here by geometrical approach where uncertainty is deduced by the lower and upper boundary of the convex hull of the model. Every field measurement on local scale has a particular value, which is between 0 and 1, describing the contribution to the aggregation precision of this point if current measurement is taken.

Moreover, we present two examples of leaf area index (LAI) and surface temperature with the correlation index, the retrieving model of which are both nonlinear. Based on heterogeneous ground, the maps of correlation index of LAI and surface temperature are given respectively. We find different characteristics are shown on the LAI and surface temperature maps, moreover, larger amount of measurements should be taken when LAI is considered. Certain pixels of the maps will reveal the degree of correlation between field measurements and satellite remote sensing data. Field measurements with larger correlation index values can be selected to do the up-scaling, then to validate remote sensing products. Therefore, field measurements are different to various surface parameters retrieved from satellite data, even validation are carried out on a same area.

The results have shown that correlation index defined here will lead to a promise way to decide the sampling strategy, including how many field measurements should be taken and which representative pixels should be selected to do the field measurements. Based on up-scaling of the field measurements determined by the correlation index, and then validation on retrieved particular surface parameters can be carried out.

Keywords: Scaling; field measurements; satellite data; variogram; convex hull