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0.1 Analysis of the performance of parameterisation strategies for modeling hydrological processes: An intercomparison of techniques for upscaling SVAT parameters

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Accounting for subgrid scale effects in climate modeling is crucial for the accurate representation of surface energy fluxes and moisture indicators on the grid scale. Although the effects of spatial variability on estimation of surface energy fluxes are well established, the representation and analysis of subgrid scale variability remains an open research enquiry and has generated a great deal of controversy. This has come about mainly because there is no unified theory from which subgrid scale heterogeneity can be modeled. As a result, several studies based on different approaches have recently focused on how to fully represent and parameterize these land surface heterogeneity so as to enhance model efficiency and accuracy.

To contribute to this debate, a numerical experiment was set up to assess the performance of some well-established parameter aggregation techniques, namely, 1) energy matching, 2) simple averaging and 3) inverse modeling techniques. In this numerical experimentation, subgrid scale land surface parameters were synthetically generated at constant intervals and passed to a nonlinear Parameter Estimation Tool (PEST-PARREP) which was coupled to a 1D SVAT (Soil-Vegetation-Atmosphere-Transfer)

model. PEST-PARREP sequentially runs the SVAT model using the synthetically generated parameter values and generates surface energy fluxes and moisture indicators. The effective subgrid scale surface energy fluxes and moisture indicators were computed as the arithmetic mean of the corresponding surface energy fluxes and moisture indicators generated by the SVAT model for each subgrid scale parameter. PEST-PARREP generates a sequence of output consisting of the objective function for each corresponding parameter. Effective parameters were obtained from each of the methods that yield scale-invariant surface energy fluxes and moisture indicators and their corresponding objective functions inferred form a plot of objective function vrs effective parameter.