Geophysical Research Abstracts, Vol. 9, 05046, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05046

A Generalized-Nearest-Neighbor (GNN) technique for the improved classification of remote sensing data

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One fundamental prerequisit for parameterizing spatially distributed hydrological models is the correct characterisation of land surface properties. When using remote sensing techniques, it is often necessary to first classify areas (pixel) into a number of predefined soil or vegetation categories, before any quantitative measure can be derived. Also, uncertainties related to this process are rarely considered especially when appropriate ground information are sparse. Classifications methods commonly used in remote sensing (Nearest Neighbor, Maximum likelihood) apply distance measure that are adopted a priori. In contrast to these standard approches we here propose a general procedure to find an adaptive metric that combines a local variance reducing technique and a linear embedding of the observation space into an appropriate Euclidean space. Besides significant improvements with regard to the overall accuracy of the method and its robustness when the cardinality of the calibration data set is low, the methods also allows to explore the uncertainties of the classification to be explored by a ambiguity measure, allowing to find critical areas/classes or data limitation of the calsiification process. Several land cover classifications using Landsat scenes are presented to illustrate this method. We will also demonstrate how the principal idea of this method can be extended to a variety of other application in spatial hydrology, especially where systems are dominated by non-linear behavior.