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Cluster analysis of ERS scatterometer soil moisture data

A. Xaver (1), W. Wagner (1), F. Aires (2), and C. Prigent (3)

(1) Institute of Photogrammetry and Remote Sensing, Vienna University of Technology, Vienna, Austria, (2) Laboratoire de Météorologie Dynamique/IPSL/CNRS, Université Pierre et Marie Curie, Jussieu, Paris, France, (3) Laboratoire d'Étude du Rayonnement et de la Matière en Astrophysique/CNRS, Observatoire de Paris, Paris, France

This contribution discusses the results of a cluster analysis of soil moisture data retrieved by satellite measurements. In the first part, different methods for estimating missing values are described. In the second part, the robustness of the result is examined by applying a cluster analysis method. An interpretation of the cluster result is given in the third part.
The study is based on the dataset developed at the Institute of Photogrammetry and Remote Sensing of the Vienna University of Technology where a change detection algorithm is used to retrieve soil moisture from the ERS scatterometer (Wagner et al. 2003). The global dataset covers a period from 1992 to 2000 and consists of time series with relative soil moisture measurements in the first centimetres of the surface. For further analysis the data had to be transformed to a regular grid system and monthly mean values.
Soil moisture is one of the most important variables for the water cycle and climate system. It is already well-known that satellites offer a great potential to detect soil moisture on a global and continuous scale. Hence the knowledge and understanding of the meanwhile soil moisture products are of high importance. In order to gain a better understanding for the complex character of soil moisture on climate and water cycle and the quality of satellite measurements statistical methods are often applied to these datasets. However the existence of missing values related to data gaps, snow, frost, etc. causes difficulties for analysing the data. Although existing multivariate analysis methods have problems and limitations with the treatment of missing values, this problem has received little attention yet. The most common and simplest way to deal with missing values is to ignore them. As this methodology means to dismiss even some valuable data it is not a satisfactory procedure. Conducted by this motivation the current study discusses several methods for estimating missing values of the soil moisture dataset, one example is the k-nearest neighbour technique. Based on these estimations a cluster analysis method is applied and the different outcomes caused by different missing value estimation methods are compared. Finally the resulting clusters are interpreted with respect to the Köppen-Geiger climate classification.