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Hydrology and Earth System Sciences Discussions

Interactive comment on "Exploratory data analysis and clustering of multivariate spatial hydrogeological data by means of GEO3DSOM, a variant of Kohonen's Self-Organizing Map" *by* L. Peeters et al.

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Author Comment on Interactive comment on 'Exploratory data analysis and clustering of multivariate spatial hydrogeological data by means of GEO3DSOM, a variant of Kohonen's Self-Organizing Map' by Anonymous Referee 1

The authors would like to express their gratitude towards the anonymous referee for providing valuable feedback to the submitted manuscript. In the following paragraphs, effort is made to address each of the remarks made by the referee.

2) The modifications made to the GEOSOM-algorithm may indeed be minor, but the authors feel that the presented algorithm provides a valuable tool in the exploratory data analysis of multivariate, three-dimensional data sets, especially since most of the geosciences related data are three-dimensional rather than two-dimensional. The GEOSOM-algorithm presents a fundamental change to the original SOM-algorithm since the BMU-selection is carried out in a two-step procedure, firstly based on geographic coordinates followed by a (local) selection based on the remaining variables, making the algorithm more appropriate for geospatial data analysis.

3) As the artificial data set was designed to test the GEO3DSOM-algorithm, the conclusions of better performance of the algorithm compared to the original SOM algorithm is indeed not surprising. The application of GEO3DSOM to the hydrochemical dataset however yielded extra information about the data which was not uncovered by the SOM-analysis. This is exemplified by the clear separation of the Brussels sands samples and St. Huijbrechts Hern samples on the one hand and the separation of Quaternary sands samples and Diest sands samples on the other hand by the GEO3DSOM. Additionally the presence of an outlier in the Brussels sands aquifer is more apparent in the GEO3DSOM-analysis, compared to the SOM-analysis. The geographically coherent grouping produced by the GEO3DSOM allows easier hydrochemical zonation of the aquifers under study and facilitates further geochemical interpretation of flow paths and geochemical evolution in the aquifers. The use of quantitative measures to evaluate the performance of both algorithms seems justified to the authors in order to provide an objective basis for comparison of the techniques.

4) The algorithms are implemented in Matlab(r), using modified m-files from the SOM-toolbox (Vesanto, 1999). The m-files and data used can be obtained by email from the corresponding author. The methodology and parameters used in each analysis are respectively described in and section 3 and tables 2 and 4 of the manuscript.

7) & 14) The literature cited in the introduction section will be extended to include earlier work with SOMs in geosciences, like for instance remote sensing (Richardson et

HESSD

3, S1117–S1120, 2006

al., 2003 & Mercier et al., 2005), geophysics (Poulton et al., 1992 & Ozerdem et al., 2006), geochemistry (Lacassie et al., 2004 & Penn, 2005) and reservoir characterization (Chang et al., 2002). Openshaw (1995) was among the first to apply the SOM-algorithm to geospatial data. Other examples of the application of SOM to geospatial data analysis can be found in Takatsuka (2001), Skupin & Hagelman (2003) and Koua et al. (2006)

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HESSD

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