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Multidimensional EEMD filter bank for geophysical data processing

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The ensemble empirical mode decomposition (EEMD) algorithm is a noise-assisted data-driven nonlinear analysis method evolved from its original version, the empirical mode decomposition (EMD) method. The advantage of using EEMD is mainly to alleviate mode mixing problem of the EMD filter bank. The EMD and EEMD techniques have been widely applied to many fields of scientific and engineering studies in the last decade but just a few to the geophysical exploration data analysis probably due to the multidimensional feature of exploration data. Several 2D EMD based data analysis algorithms have been developed lately; however, the difficulty of sifting 2D data and the mode mixing problem inherited from EMD algorithm hindered their further developments. To deal with the stated issues, we modify a newer technique, the multidimensional ensemble empirical mode decomposition (MDEEMD) algorithm, to achieve a 2D EEMD filter bank for exploration data signal enhancement. With the data reconstructed by using significant components of the filter bank, the signal embedded in the original data can be retrieved successfully. Furthermore, we compare the performance of MDEEMD with that of logarithmic transformed multidimensional empirical mode decomposition (NLT MDEMD) to find a solution for compromising computation cost. A controlled model study along with a set of real exploration data example are provided to demonstrate the robustness of the proposed method.