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Multiscale analysis of noisy 3D GPR data using the Directional Continuous Wavelet transform (DCWT)

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Here we present a new technique of noise effect attenuation in the 3D GPR data analysis using the 2D directional continuous wavelet transform. Ouadfeul and Aliouane (2010), have presented a technique of multiscale analysis of the 3D GPR data suing the continuous wavelet transform, it has been applied on land topographical GPR data analysis, this last play a high important role in the seismic design (See Ouadfeul and Aliouane, 2010). The proposed technique is very sensitive to noise, to demonstrate this; we have added a 05% as a white noise in the 3D GPR data analyzed in the cited paper. After that the modulus of the DCWT is calculated and the maxima of this modulus are mapped. Obtained Results show that we are not able to identify topographic orientations; this is due to the noise effect on the DCWT analysis. For this reason we propose an algorithm to reduce this phenomenon, this last is based on the application of an exponential low pass filter, at the modulus of the 2D DCWT for the low range of scales. After application of the low pass filter, maxima of the CWT are mapped for all range of scales. Comparison of maxima of the initial model (without noise) and the filtered model shows that the filtred model is not very far from the original one, and we are now able to identify the dominant topographic orientation.
Keyworsd : GPR data, DCWT, noise, filter.

References:
Ouadfeul , S., Aliouane, L., 2010; Multiscale analysis of GPR data using the continuous wavelet transform, presented in GPR 2010, IEEE Xplore Compiliance, doi. 10.1109/ICGPR.2010.5550177.