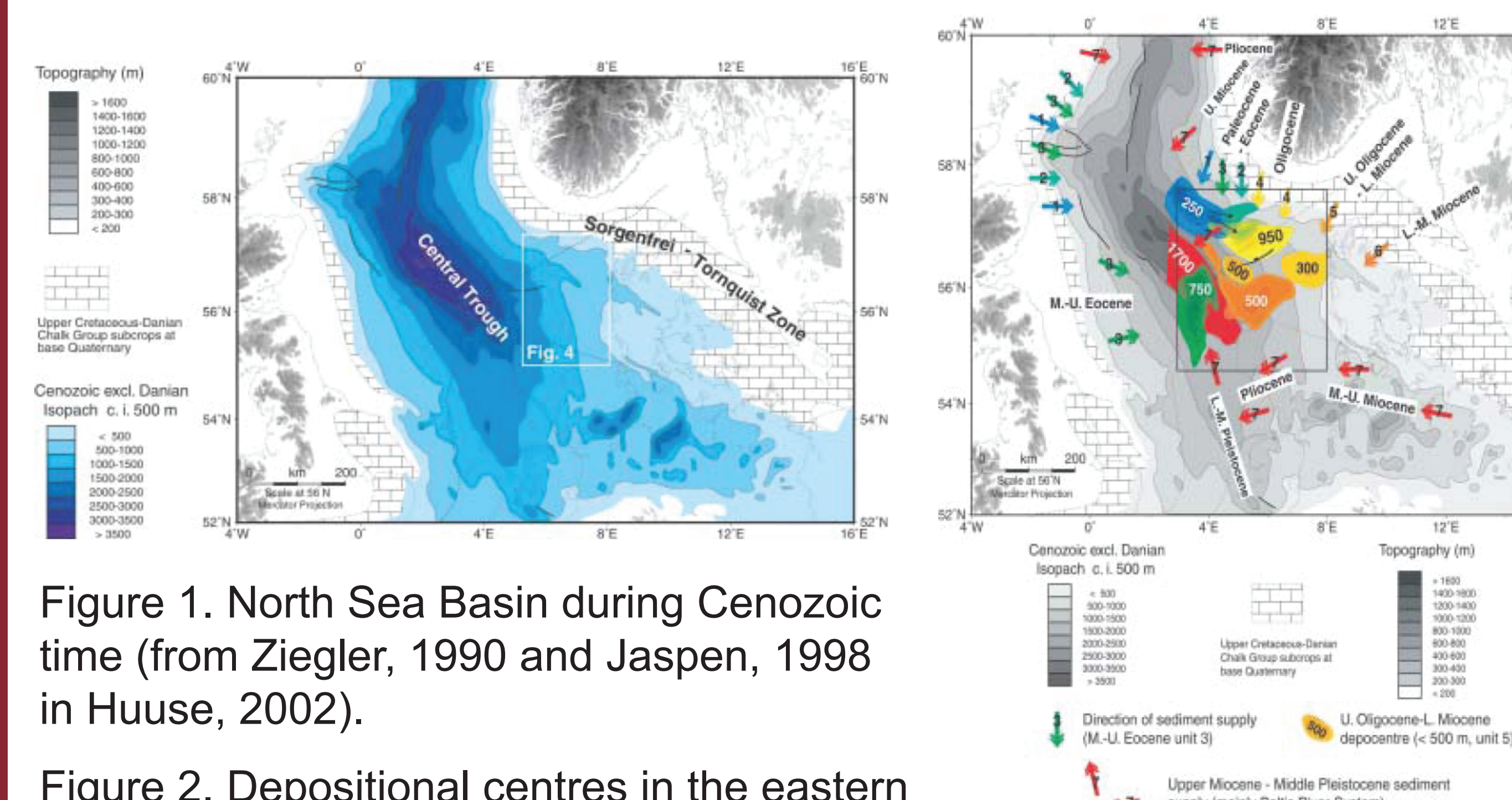


## 1. Abstract

The present work is based on a 3D seismic survey from the North Sea Basin, with emphasis on the shallow section, corresponding to Cenozoic rocks. Attribute analysis was applied to the cropped seismic volume in order to characterize the different features associated with possible sediment gravity flows and channel systems. Spectral decomposition analysis and geobodies extraction were carried out in order to identify a series of events taking place in the study area.

## 2. Geological Setting

During the Cenozoic, the North Sea Basin developed as an epeiric sea, which was filled by large deltas, built from the eastern basin margin. These deltaic systems were fed by ancient rivers from southern Norway, Sweden, and the Baltic region, from Late Paleocene to Pleistocene.



## 3. Data Quality

Seismic data showed a high amount of noise and footprint; therefore, several filters needed to be applied in order to improve data quality and ease interpretation and attribute analysis. First, a structural oriented filter was applied. This method is a pre-stack data conditioning which follows dip, preserves edges, and averages over a window using robust mean techniques. For this data, the filter window used was of 9x9 traces. After this, a principal components filter was applied. Finally, a footprint suppression filter was run on aaspi, in order to reduce the evident footprint from the data. The result was a smoother, better-defined seismic data set that allowed to make a more reliable geophysical and geological interpretation.

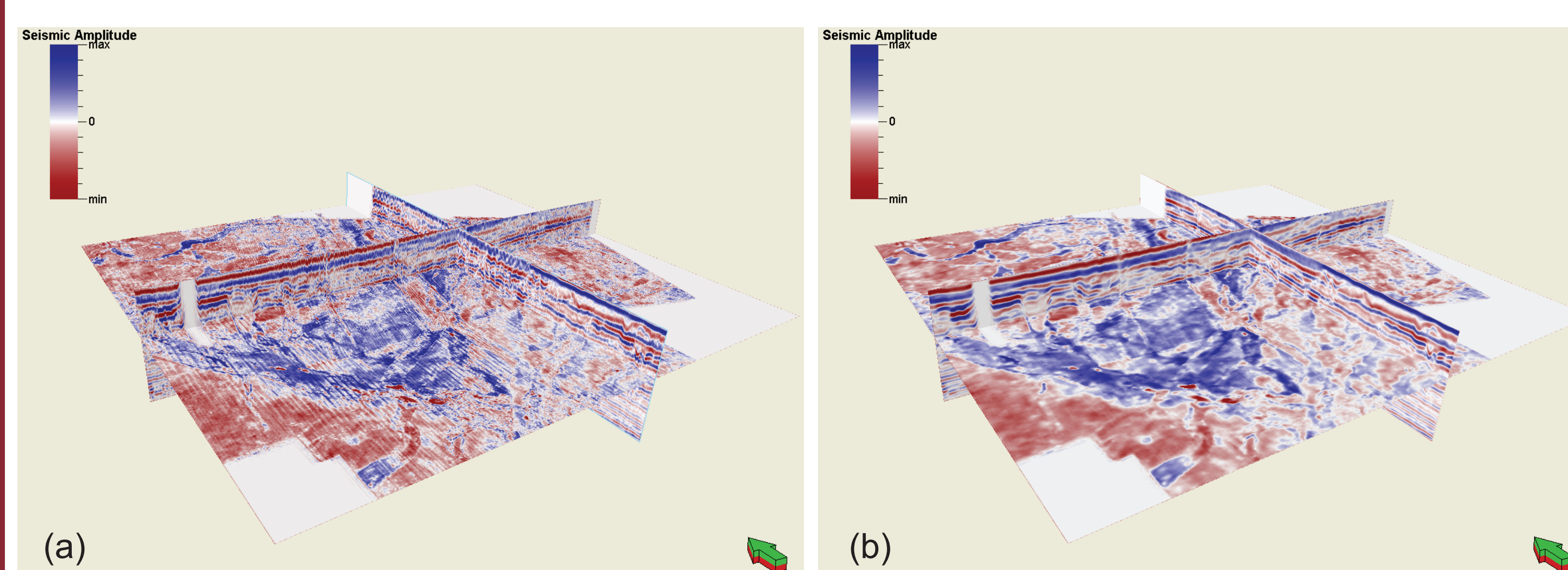


Figure 3: 3D Seismic volume used for this study. (a) Before filtering; (b) After filtering.

## Acknowledgements

We would like to thank Dr. Tim Kwiatowski, TameCAT, and Seis-9 for their help with the data filtering, and their prompt and valuable suggestions on this project.

## 4. Attribute Analysis

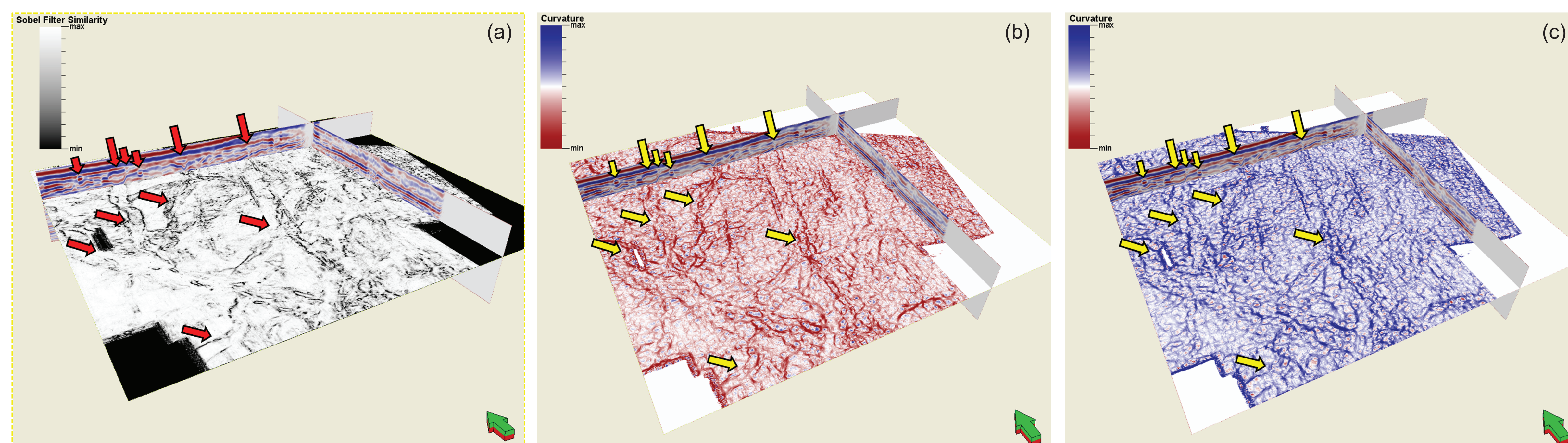
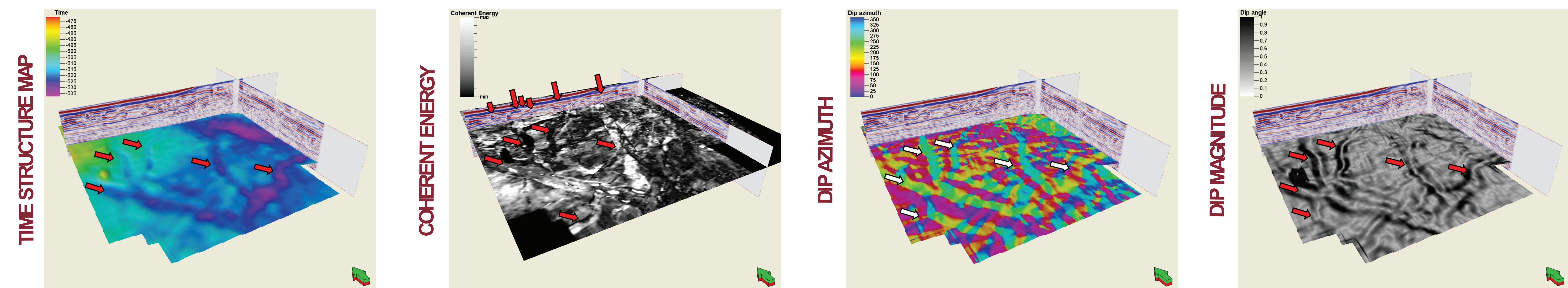


Figure 4: Time slices at 320 ms showing (a) Sobel filter; (b) most positive curvature, and (c) most negative curvature. Arrows show channel-like features on the time slices and vertical sections.

A time-structure map was generated from a continuous horizon picked at the bottom of the section. From this horizon, coherent energy, dip azimuth, and dip magnitude were calculated. The footprint associated with this seismic volume notably affected the attributes calculated, particularly curvature. Therefore, spectral decomposition was chosen to carry on the analyses, since is less affected by this type of noise.

Sobel filter applied to the seismic volume shows good edge delineation, particularly for channels. The most positive and most negative curvature attributes are affected by the remaining footprint and coincide with the channel-like feature edges from the Sobel filter, indicating there is no differential compaction within the channels in the section analyzed.

## 5. Spectral Decomposition

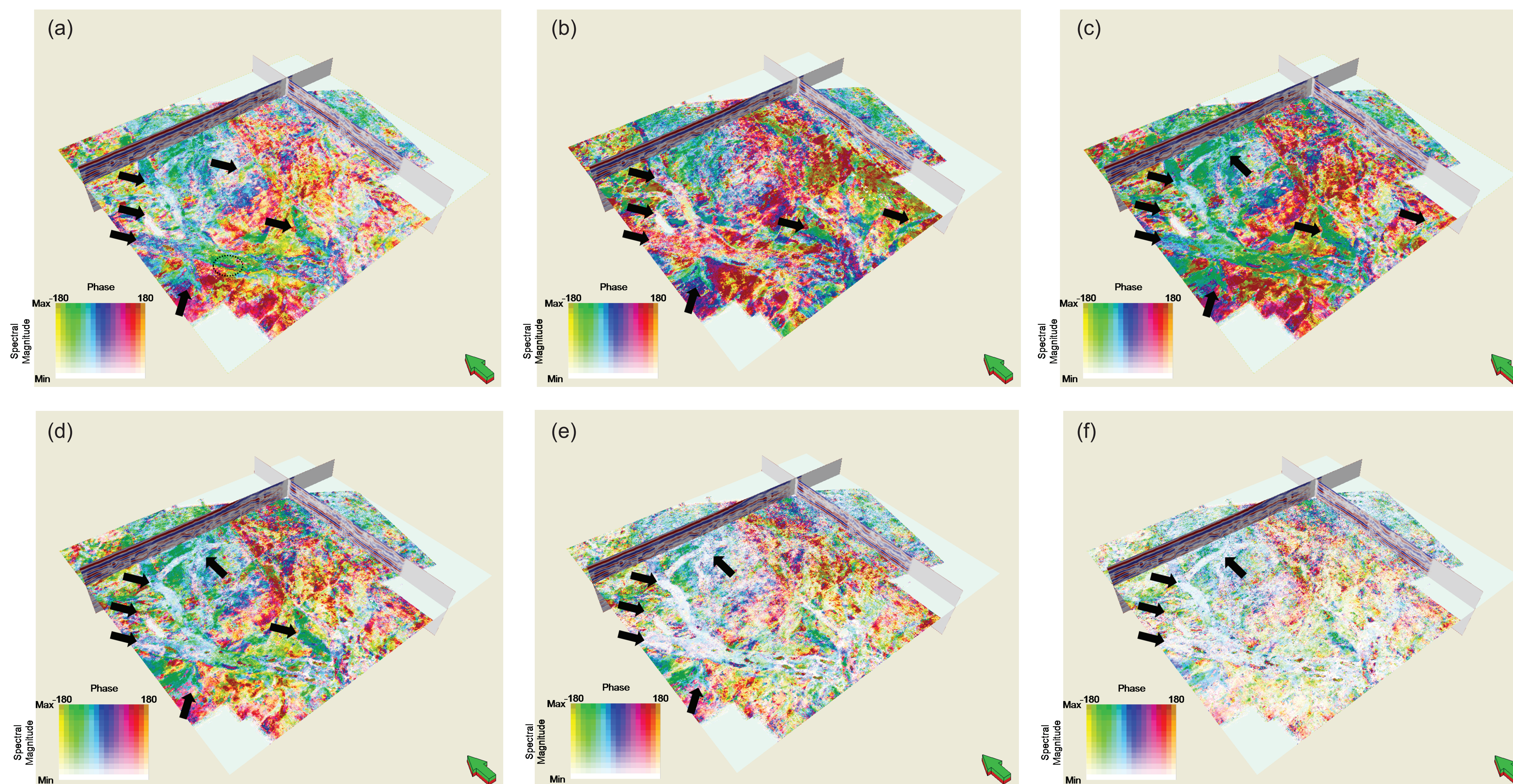
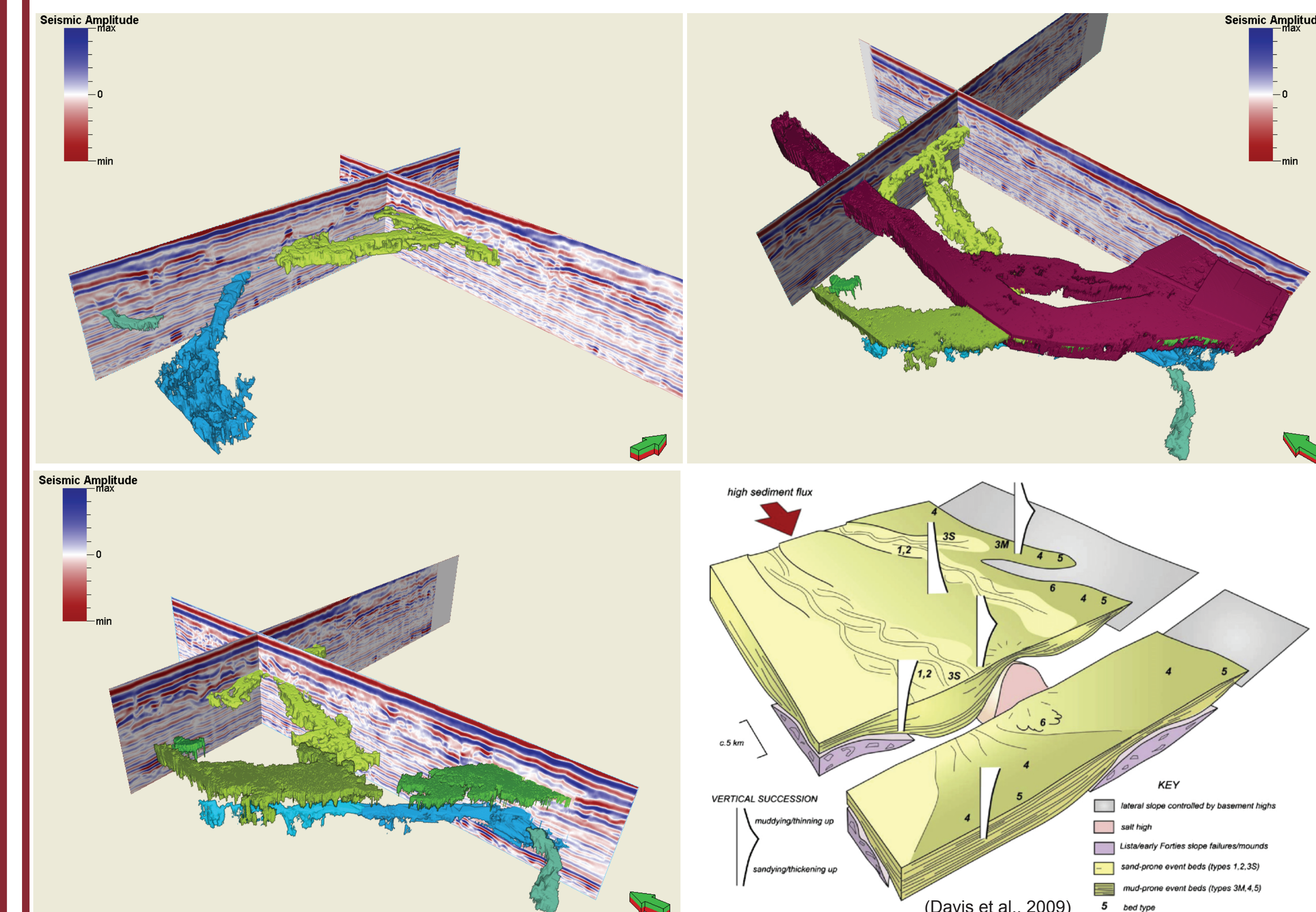


Figure 5: Time slices at 320 ms showing spectral magnitude versus phase attributes at (a) 10 Hz; (b) 20 Hz; (c) 30 Hz; (d) 50 Hz; (e) 60 Hz; (f) 70 Hz. Black arrows indicate channel features. At different frequencies, different channels are highlighted by these attributes, especially at lower frequencies. At higher frequencies, other type of sand bodies, possibly sand bars (black dotted circle) are easier to identify.

## 6. Geobodies Extraction



Sobel filter and spectral components were used to extract several geobodies associated with channels and debris flows. On these figures, it can be observed the complex geometry and sequence of events that had taken place in the shallow section of an area in the North Sea Basin.

## Conclusions

Volumetric attributes represent a good tool for delineating geometry of geological bodies, such as channels and debris flows (this case). Footprint and noise can greatly affect the signature and quality of seismic data. Spectral decomposition takes advantage of tuning effects in the presence of channels.

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