Imaging driven modeling.

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Introduction

The depth image, which fits to the seismic time field and all the additional geological information, is the final result of modern seismic data processing. In order to get such a result, from the very beginning of the processing chart flow we should look at the processing as at the process of the inverse task solving.

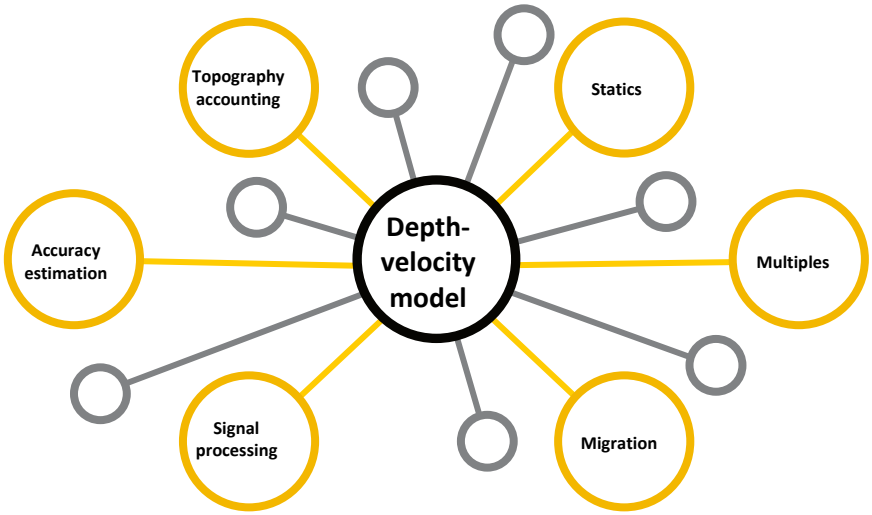


Figure 1: *Velocity-depth model – the central element of the whole seismic processing workflow*

As many processing procedures (static correction multiple removal, migration, etc.) are based on the depth-velocity model, we consider depth-velocity model is a key step of processing. Thus, the accuracy of final migrated images significantly depends on the depth-velocity model that was used for migration. Such approach required a special software solution, such as our development, Prime software system.

The objective of Prime is mostly oriented to the depth processing rather than time processing. It allows using a lot of effective algorithms, which are applicable only to processing in depth domain and depth-velocity model enhancement. For example, approximation of heterogeneous upper part by layer, wave field transformation, etc.

Processing, driven by the depth-velocity model building and migration, has to include multiple and simultaneous direct and inverse tasks solution and interactive subsystems for the results analysis.

The better understanding of the processing precision and accuracy has been achieved by the usage of a special technology of depth-velocity model building. (Figure 2)

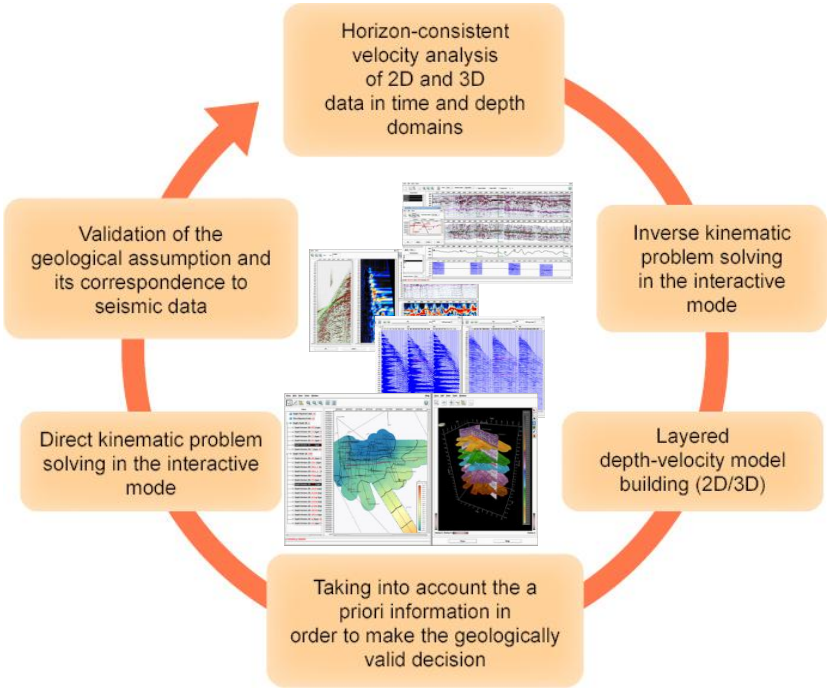
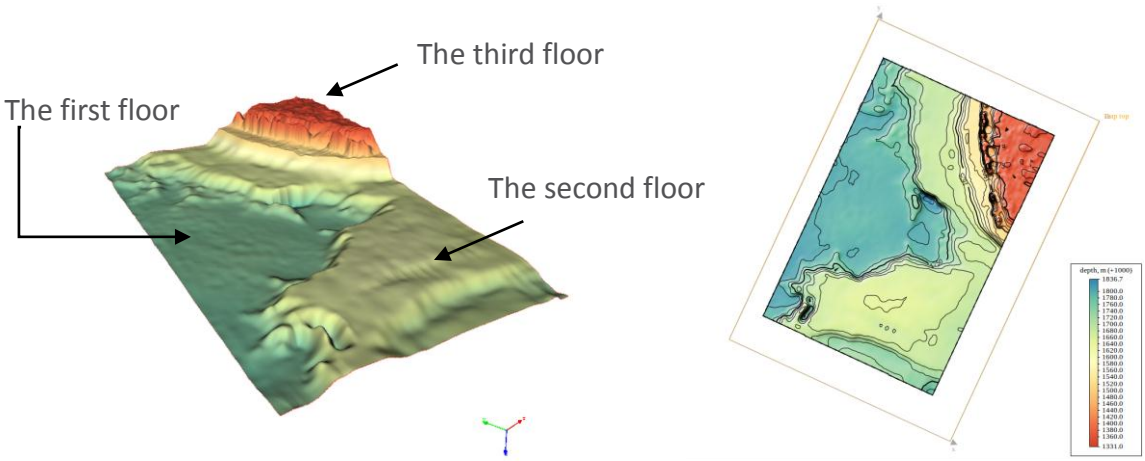


Figure 2: *The scheme of making decisions, meaningful from a geological point of view, at any stage of data processing.*

Examples of processing

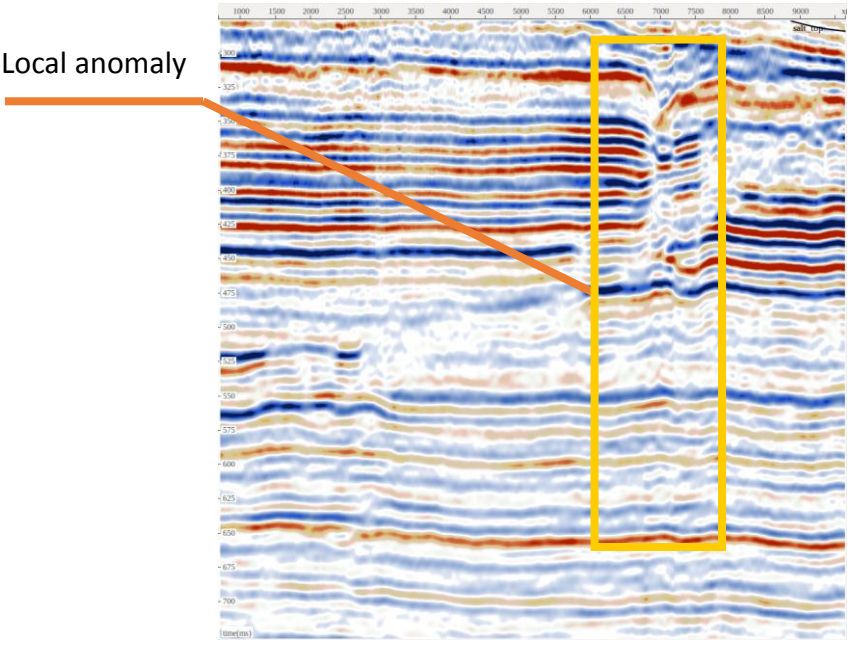
Below we show the example of seismic data processing in complex heterogenous media of Eastern Siberia (trap inclusions)



Surface corresponding to top of intrusion

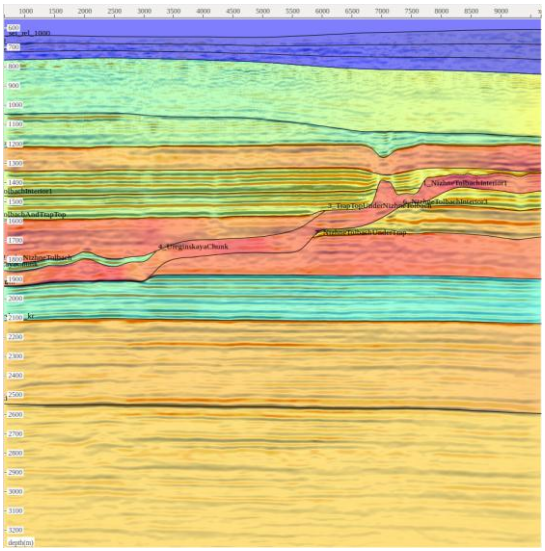
Map of surface corresponding to top of intrusion

Figure 3: *Building top of intrusion by layer inversion.*

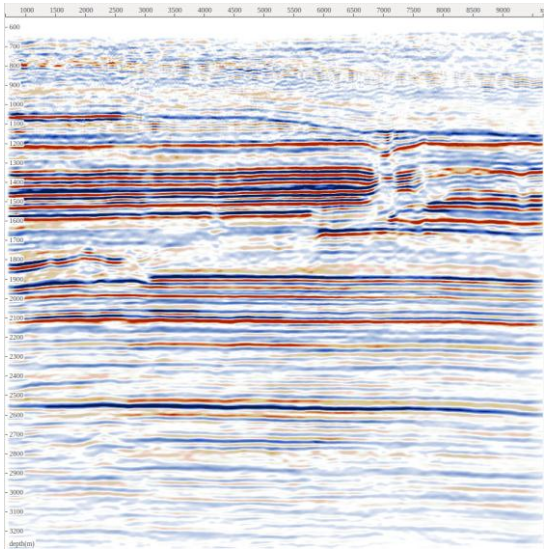


Example of time migration result
(has been received from client)

Figure 4: *Influence of intrusion shape.*



Example of depth migration result
with overlaid model



Example of depth migration result

Figure 5: *Influence of intrusion shape.*

Conclusions

A thick-layered velocity-depth model, built during the seismic data processing, allows you to make geologically meaningful decision and to control the processing at all stages.

A priori information can play an important – even a crucial role - in the velocity-depth model building.

The usage of seismic data processing results only in the time domain leads to significant errors in structural forms and, as a consequence, to an incorrect valuation of deposits.
An opportunity of remote control and geological support of seismic data processing allows to obtain geologically meaningful results, consistent with the available a priori information, in the shortest time.

References

Glogovsky V.M., Gogonenkov G.N. [1998] Study of methods for determining velocity and depth parameters in layered realistic media. Geophysical transactions, Vol. 33, No. 3-4, 157-173.

Bocharova A.A. [2009] Origin of Multiple Bottom Simulating Reflectors in the Black Sea. 71st EAGE Conference & Exhibition, Amsterdam, The Netherlands. (Abstract).

Glagovsky V.M., Landa E., Langman S.L., Moser T.J. [2009] Validating the velocity model: the Hamburg Score. First Break, 27, 3, 77-85.

Silaenkov O.A. [2017] Additional possibilities of parameterization of seismic wave fields in the process of depth-velocity models creation using the example of simulated data. GeoSochi-2017 Conference, Russia, Sochi. (Abstract).

Anisimov R.G. [2017] A layer approach to hybrid parametrization in the framework of a generalized reservoir model. Tomography in conformal-layered model. Geomodel-2017 Conference, Russia, Gelendgik. (Abstract).