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Time reprocessing and depth imaging of vintage seismic data: the Southern Adriatic Sea case study

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Nowadays depth imaging of seismic data, using different migration schemes (rays tracing or waves equation methods) and different techniques for velocity model building (i.e. grid or layer-based tomography, isotropic or anisotropic velocity field) is a standard approach for the earth's subsurface characterization. When dealing with low fold vintage data, acquired with outdated technologies, modern processing algorithms may fail. On the other hand, the reprocessing of these old data with modern techniques may lead to an improvement of quality and resolution, allowing a more accurate interpretation of the investigated geological features. It is important to note that a lot of vintage data were acquired in areas with no recent surveys or currently subject to exploration restrictions. Therefore, available vintage data could be of great importance for all the stakeholders involved in geophysical exploration. We present a case study about the reprocessing of low fold marine seismic data that were acquired in 1971 in the Otranto Channel (Southern Adriatic Sea, Italy).

The first part of the work consists of a modern broadband sequence processing in the time domain, that allowed us to obtain a pre-stack time migrated seismic section; in the second part, depth imaging has been achieved through a pre-stack depth migration (PSDM). Reliable interval p-waves velocity model has been obtained using two tomographic approaches: grid tomography and layer-based tomography; for both, we carried out several iterations of the refinement loop, consisting of migration, ray tomography, residual velocity analysis, velocity model update.

The results show significant improvements compared to the original vintage section, in terms of resolution and signal to noise ratio. Moreover, depth imaging and velocity modeling added further information (e.g., reliable interval p-waves velocity model, real geometry and thickness of the main geological units). This study confirms that applying the up-to-date processing and imaging techniques to vintage data, their geophysical and geological value is enhanced and renewed at a relatively low cost.