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Integration of 3D photogrammetric outcrop models in the reservoir modelling workflow

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3D technologies are now widely used in geosciences to reconstruct outcrops in 3D. The technology used for the 3D reconstruction is usually based on Lidar, which provides very precise models. Such datasets offer the possibility to build well-constrained outcrop analogue models for reservoir study purposes.

The photogrammetry is an alternate methodology which principles are based in determining the geometric properties of an object from photographic pictures taken from different angles. Outcrop data acquisition is easy, and this methodology allows constructing 3D outcrop models with many advantages such as: - light and fast acquisition,
- moderate processing time (depending on the size of the area of interest),
- integration of field data and 3D outcrops into the reservoir modelling tools.

Whatever the method, the advantages of digital outcrop model are numerous as already highlighted by Hodgetts (2013), McCaffrey et al. (2005) and Pringle et al. (2006): collection of data from otherwise inaccessible areas, access to different angles of view, increase of the possible measurements, attributes analysis, fast rate of data collection, and of course training and communication.

This paper proposes a workflow where 3D geocellular models are built by integrating all sources of information from outcrops (surface picking, sedimentological sections, structural and sedimentary dips...).

The 3D geomodels that are reconstructed can be used at the reservoir scale, in order to compare the outcrop information with subsurface models: the detailed facies models of the outcrops are transferred into petrophysical and acoustic models, which are used to test different scenarios of seismic and fluid flow modelling. The detailed 3D models are also used to test new techniques of static reservoir modelling, based either on geostatistical approaches or on deterministic (process-based) simulation techniques.

A modelling workflow has been designed to model reservoir geometries and properties from 3D outcrop data, including geostatistical modelling and fluid flow simulations The case study is a turbidite reservoir analog in Northern Spain (Ainsa). In this case study, we can compare reservoir models that have been built with conventional data set (1D pseudowells), and reservoir model built from 3D outcrop data directly used to constrain the reservoir architecture. This approach allows us to assess the benefits of integrating geotagged 3D outcrop data into reservoir models.

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