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Comparisons from multiple realizations of a geological model. Implication for uncertainty factors identification

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This paper aims at analyzing data and models acquired from different 3D cartography training sessions performed on the same geological objects in carboniferous basins from Alès (France).

The objective of the training is to reconcile traditional practice of cartography with 3D Geological modelling technics. Students are faced to the exercise of “classical” geology: quality of observations, lithological facies recognition, structures and microstructures analysis,field data acquisition; as well to the integration of these field data in a 3D Geomodelling system.

The geological model and subsequent maps are built in an iterative way by incorporating new data every day. The collective objective is to combine all models from different local areas, in order to obtain a consistent regional model.

Through this work students are sensitized to critical analysis of data, their relevance with respect to a modelling objective, up-scaling issues, estimation of uncertainties and model validation.

Statistical analysis of data covering the different sessions allow to infer different causes of uncertainty (spatial variability) and to estimate the acquisition data errors (human factors).

Each model is considered as one possible realization of a random process. The analysis of differences and resemblances between models is illustrated trough the 3D distribution of statistical parameters as standard-deviations, probabilities, entropy. This allows deciphering the impact of different factors on uncertainty. These include data variability, various field interpretations, faults system interpretation, a-priori conceptual models and necessity to have simplification hypothesis. This contributes to identify and classify the uncertainty factors. The most striking feature is the major influence of fault system variability on horizons geometry.