Introducing data and model uncertainty into the new 3D voxel model of the Belgian part of the North Sea

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One of the major challenges in creating geological models is to be able to prove how 'realistic' these models are. Since the 3D voxel model developed within TILES (Belspo project on 'Transnational and Integrated Long-term Marine Exploitation Strategies') will form the basis of a decision support system that will 'guide' the sand extraction in the Belgian part of the North Sea for the coming years, it is crucial to integrate estimates of uncertainties into the model. Two major categories of uncertainties are being quantified: database related uncertainties (e.g., core density) and interpolation-related uncertainties. The latter are quantified by calculating entropy (i.e. entropy of a voxel is a single value ranging from 0 to 1 that can be calculated from each of the probabilities of lithological class. An entropy value of 0 means that there is no uncertainty, whereas a value of 1 indicates that all lithological classes have the same probability thus higher uncertainty.) on the lithoclass data (i.e., fine, medium to coarse sand), as well as on the stratigraphical unit the lithoclass belongs to (i.e., the different Quaternary layers). The uncertainty layers can be queried and visualized independently or in comparison with the actual model. In these visualizations areas that have more certainty can be identified, but also areas that need further investigation. This combined information is essential for the effective use of the voxel model by stakeholders.

Keywords: uncertainty; entropy; 3D voxel model; North Sea; sand extraction