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Geometry of Z3 carbonate-anhydrite stringer and kinematic restoration, onshore northern Netherlands using 3D seismic data

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The aim of this study is a better understanding of the internal structure of the Zechstein salt section and the deformation history of the salt section in the northern Netherlands. Interpretation and analyses of 3D reflection seismic data covering key geological structures like the Groningen High, the Friesland Platform, and parts of the Lauwerszee Trough are used. The focus of the study lays on (1) interpretation and structural analyses of the Z3 carbonate-anhydrite intra-salt stringer, and (2) a 2D, sequential, kinematic restoration of selected profiles to reconstruct the impact of tectonic events and sedimentary system on halokinesis phases.
The geometry and structure of the brittle Z3 intra-salt stringer, which is embedded in between the viscous Z2 and Z3 halites and seismically decoupled from the sub- and supra-salt, is highly variable. Complex and superimposed folding and breaking of the stringer imply strong changes in salt deformation through time and space. Different fold generations are classified and divided by their amplitude and wavelength and different types of gaps by their width and length. Fold generations are associated with first salt deformation (e.g. Friesland Platform) and further salt structure rising and sediment down-building. Stringer parts of increased thickness (thicker zones) are observed in networks and as single structures. They are classified by their deformation structure into five different types of seismic geometry. All types originate from undeformed thicker zones, which are barely observed in the study area. The structural interpretation of stringer geometries emphasizes that the Z3 stringer is a well-suited proxy to study intra-salt deformation in much greater detail than implied by the shape of Top Zechstein. In addition, a sequential kinematic restoration along two selected profiles, incorporating sedimentation, decompaction, fault movement, subsidence, and salt movement, revealed that first events of halokinesis took place during the Triassic, starting earlier in the Groningen High than in the Northern Coastal Area (NCA), and last phases ceased in the Neogene (NCA).