

A new software tool for statistical error quantification of subsidence calculations

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Subsidence analysis based on decompaction of the sediment record is one standard method to reconstruct the development of sedimentary basins. The restored sediment thickness allows a plot of sediment accumulation rate versus time to be constructed. Commonly, following parameters are incorporated: thickness of stratigraphic layers, stratigraphic age, lithology, palaeowater depth, decompaction parameters and physical properties. The variety of input parameters, each containing uncertainties have a major effect on the shape of the curves, and therefore errors at successive points on a subsidence curve are not independent. Potential error ranges of single parameters are well-known, but quantitative approaches of error estimation are rare and normally concentrated on specific related parameters (e.g. stratigraphic age and thickness, porosity and compaction).

Our programme combines 1D-subsidence calculations, including backstripping, with error quantification, based on the principles of a Monte Carlo Simulation. Thereby the full range of 11 possible input values is assigned to each of the parameters used. A random function chooses values within the defined intervals and calculates a curve for every combination. This results in a mean curve with extreme values to quantify the error range.

The number of parameters used influences the number of runs of the Monte Carlo Simulation necessary to get constant results, i.e. from which run on no significant changes occur. Calculations have shown that above 10 000 iterations upward, error variations appear to be negligible.

The programme can be used in basins where exponential decompaction is assumed (e.g. normally pressured basins, rift basins, pull-apart basins), because linear, power law equations or other types of assumptions are not integrated. Therefore for overpressured basins or shallower basins the programme is not applicable.

The change of one single parameter influences the errors not significantly, it is the bulk of parameters, which have great influence. This programme provides the extension of the method to the full backstripping process.