Approaching "Reality" with Stratigraphic Simulations: Comparing model results with observations

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Stratigraphic simulation is an important tool for understanding the complexities of the stratigraphic record. By tuning the subsidence, water level, and sediment supply history to find a best fit with observations, an interpreter can not only document the history of a region, but predict features that were not originally recognized.

We measure the difference between digital records of horizons depths and their ages produced from seismic, outcrop, and well-log cross-sections and model results. An initial estimate of the paleo-water-depth profile is provided for each horizon. The subsidence rates are tuned to match the depths of the horizons and paleo-water-depth-profile. The sediment supply is tuned to match the sediment volume between each horizon.

After a reasonable match is obtained, we refine our paleo-water-depth model to split the difference between the "observed" and model paleo-water-depth record. Within our inversion algorithm, deviations between the observed and modeled paleo-water-depth force the subsidence rates in the opposite direction to the differences between observed and modeled horizon depths.

After a reasonable match in depth and paleo-water-depth has been obtained, a comparison is made of lithology, grainsize, and coarsening trends for sections in equivalent positions to wells. At this stage it is not uncommon to find improvements in "reality" that lead to discoveries of missing sequences, errors in age designation, etc.

In the final results, the average difference between the observed and modeled depths can get as low as 10 meters in a typical seismic section. This variation is less than the errors generated during time-depth conversion of seismic horizons, and errors in interpretation.