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Determining sedimentation rates by accounting for past compaction in the Mekong Delta as input for 3D delta evolution modelling

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The Vietnamese Mekong River Delta has been formed by the deposition of soft, fine-grained sediments during the last thousands of years. Natural compaction of these unconsolidated deposits over time and with increased overburden load is one of the main drivers of subsidence in this delta. High rates of natural compaction may have a considerable increased flood vulnerability of the lowly elevated delta plain and ultimately result in permanent inundation.

Following the loading history of accumulating sediments during the Holocene delta evolution, it is possible to estimate delta-wide present-day natural compaction rates. The ultimate goal of this study is to provide reliable input data on Holocene sedimentation rate throughout the Mekong Delta for a novel 3D numerical model to simulate delta formation and its dynamic evolution during the late Holocene. In order to achieve this, it is fundamental to first take into account previous compaction that already happened to the sediments in the past to estimate the original sedimentation rate of Holocene sediments.

We employed a 1D decompaction module to compute the original, uncompacted thickness of Holocene delta sequences from lithological borelogs to estimate the amount of virgin sediment that has been deposited in time. The original thickness of Holocene sediments was determined after investigating geomechanical properties of Holocene deposits and decompaction of lithological boreholes spread over the delta. To determine the sedimentation rate for the borelogs with missing dating information, the age was estimated by using a linear distance interpolation of age isochrones starting from a limited number of boreholes, where both stratigraphy and sediment ages are available.

As a final step, the estimated sedimentation rates from each of the borelogs are interpolated to arrive at delta-wide sedimentation rates and lithology during the Late Holocene. This provides the required input data for the 3D model to simulate natural consolidation during the delta evolution and accurately assess present natural compaction rates.