EP53B-1721: Modelling Mekong delta evolution and shallow compaction over the past 4000 years

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The Vietnamese Mekong Delta has World's third largest deltaplain, which was formed by rapid transgression during the second half of the Holocene. Its young, shallow deltaic deposits consists mainly of unconsolidated, fine-grained (clayey) material, which in places reach thicknesses over 40 meter. They are prone to high natural compaction rates, which could potentially have significant impact on delta plain elevation, especially as sediment supply to the delta dwindles.

We employed a 2-D groundwater flow model coupled to a 1-D compaction module to simulate the formation of the Mekong delta and its dynamic evolution over the past 4000 years. The resulting soil matrix compaction was computed based on pore water overpressure and delayed pressure dissipation of the system, properly accounting for the large soil grain motion. We compute natural compaction rates of the Holocene sequence of ~30 mm yr⁻¹ at the delta coastline, matching field observations of shallow compaction in the Mekong delta. Further inland, as sediments age, natural compactions rates gradually decrease towards ~5/6 mm yr⁻¹, still exceeding absolute sea level rise.

Our method could provide similar assessments for coastal regions elsewhere in the world, which have experience similar transgression of fine sediments during the Holocene. Our findings reveal the high contribution of natural compaction of the young Holocene deposits to the total subsidence experienced by this mega delta, an important realization as natural subsidence cannot be mitigated.

Plain Language Summary

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