Visit report 14/10/16: Tulane University (afternoon)

By: Thom Brand

Department of Earth and Environmental Sciences.

In the afternoon of Friday October 15th we returned to the Tulane university campus to attend a presentation and demonstration regarding coastal sustainability in Louisiana. In the Stanley Thomas Hall we were greeted by Tjorbjorn Tornqvist, and Jaap Nienhuis, both faculty members of the Department of Earth and Environmental Sciences. Tjobjorn has a Ph.D. Utrecht University and specializes in, among other things, fluvial and deltaic sedimentology and sea level change. Jaap is an alumnus of the UT, has a Ph.D. from the Massachusetts Institute of Technology, and specializes in Coastal geomorphology and modelling of waves and sediment transport. Both are Dutch expats and have extensive knowledge of coastal sustainability, a topic very relevant within the Netherlands. Tjorborn started out with a presentation regarding this topic. Afterwards Jaap gave us a quick tour of one of the sediment transport experiments currently conducted at Tulane.

The state of Lousiana and The Netherlands face very similar problems regarding subsidence, sea level change and coastal restoration. The presentation gave us a quick insight into each of these three topics, though it started out with the elephant in the room: climate change. A paper by Rahmstorf was presented, which compared climate change models of the 1990's with actual observations made over the past several years. This comparison showed that observed patterns followed the worst case scenario's predicted by early models. This gives rise to the presumption that early predictions were too conservative, a problematic situation for both The Netherlands and Louisiana.

Actual observations show for instance that sea level change in Louisiana is happening at a much higher rate compared to, for instance Florida (2.07mm/year for Pensecola Florida and 9.39mm/year for Grand Isle Louisiana). Faulting, compacting, fluid withdrawal, sediment loading, glacial isostatic adjustment and eustatic sea level change are the main reasons for the rapid change in sea level in Louisiana. The main conclusion drawn here was: there is no number 1 reason for the change rate, it is a combination of factors and moreover a 4-dimensional problem.

Subsidence in Louisiana is the result of post glacial rebound and depression. The high loads of glaciers created a bulge on which Louisiana is situated. With the disappearance of the glaciers the ground is slowly returning to its original position, thus reducing this bulge (at a rate of approximately 0.5mm/year). An interesting problem as The Netherlands faces quite similar rates of glacial depression.

Yet this movement alone does not explain the rapid change. Faulting adds to low rates of change over the short term, though has a significant impact on larger geographical time scales. There is also significant movement in the muddy top layers, mainly caused by compaction. This shallow subsidence attributes to 60% of total relative sea level change in the Mississippi delta, and 85% in the Chenier plain. This subsidence is almost completely the result of manmade actions, such as the construction of canals. These rates will continue of no changes are made to the way the Delta is managed. The present day relative sea level change at land level is 12±8mm/year. Measures can be taken to retain what we have, though regaining what we had will proof to be next to impossible.

It was explained that most of this data regarding subsidence was obtained by rod surface elevation table marker horizon method (RSET-MH) performed by members of the faculty themselves. This is but one

example of the practical element of earth and environmental research conducted at Tulane. After the presentation by Tjorjorn, Jaap took us on a quick tour of an experiment simulating sediment transport in a delta. This experiment consists of 2 basins. It uses camera observations, has a runtime of 2 months and is a small scale delta in which multiple parameters can be adjusted. These experiments have as goal to determine the boundary conditions, and to understand what constitutes the internal and external in delta sedimentation transport, and the deep sea transport system. Based on these topography / morphology analyses of seabed movement Tulane strives to create a forward model, which can be used for instance to predict the behavior of the Mississippi delta.

In conclusion, this afternoon's excursion was quite different from what we're used to in this study tour. No large concrete structures, just a good old lecture with some modelling and experiments (and pizza) to boot. But that comes with the territory, a good civil engineer has after all both strong practical and theoretical knowledge!

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