Monday 3/13/2017

2–3:30 p.m.

Advancements in Coastal Geotechnics 2

Chairs: Nina Stark, Virginia Tech; Malay Ghose Hajra, University of New Orleans

Pore Pressure Response to Irregular Waves at a Sandy Beach

Nina Stark, Virginia Tech

Two vertically aligned pressure transducers were embedded at a sandy beach at a sediment depth of 5 cm and 20 cm, respectively. Pore pressure buildup, and the impact of horizontal and vertical pressure gradients were assessed with regard to the ocean wave forcing. The results indicated that all three processes may impact and enhance sediment erosion. Excess pore pressure built up, and exceeded the initial mean effective stress at both measurement sediment depths. However, the pore pressure build-up appeared interrupted by irregular wave forcing. The critical instantaneous Sleath parameter for sediment mobilization by horizontal pressure gradients was exceeded for many wave cycles, suggesting a contribution to sediment erodibility. Upward directed vertical pressure gradients exceeding the buoyant specific weight were measured, being likely associated to the formation of wave groups. The field study represents a proof-of-concept for future field investigations regarding pore pressure response to wave forcing.

Preliminary Simulations of Free-fall Penetrometer Behavior: Toward Validating Against Geotechnical Field and Laboratory Observations and Predicting Sediment Erosion and Deposition in Waterways in Coastal Louisiana

Katerina Ziotopoulou, University of California, Davis; Sean O'Connell, Virginia Tech; Nina Stark, Virginia Tech; Malay Ghose-Hajra, University of New Orleans

Sediment instability and erosion in coastal wetlands has been identified as a major concern, particularly in locations such as coastal Louisiana. In order to model coastal zones, an improved understanding of sediment transport, erodibility, and morphologic evolution is crucial. The geotechnical sediment behavior in areas of active sediment dynamics is still poorly understood, and rarely integrated in predictive models. During field investigations at three locations in coastal Louisiana, loose and likely mobile sediment surface layers were characterized using a free fall penetrometer. The predictive capabilities of numerical tools need to be validated against datasets from such investigations, before numerically investigating the evolution of mobile layers, their geotechnical characteristics and the resulting potential impact on increasing sediment erodibility during extreme events. In this paper, a brief literature review is presented on current methodologies of numerical simulations of field testing processes. Preliminary results from a three-dimensional simulation in finite difference platform of the field-testing method at a generic soil profile are presented in order to evaluate current capabilities and limitations of numerical platforms and protocols. Areas of future research are identified and a discussion is presented on the prioritized fronts.

Earthquake-induced Water Level Rise: Implications for Tsunami-Induced Sediment Instability in Coastal Areas

Abbas Abdollahi, Rachel K. Adams, and H. Benjamin Mason, Oregon State University

Coastal areas are vulnerable to the earthquake-tsunami multi-hazard, which can cause significant sediment instability near the shoreline, leading to potential damage or collapse of critical coastal infrastructure. During the earthquake, sediment instability can occur via residual liquefaction, and the water level can rise following the cessation of strong shaking. The water level rise has significant implications for the ensuing tsunami-induced sediment instability. Herein, a modeling framework for the aforementioned problem is established using two different pore water pressure generation models. The water level rise is estimated for a hypothetical sediment profile and earthquake motion for both fully saturated and partially saturated conditions. The results show that water level rise can be significant just onshore, which is validated with post-earthquake field reconnaissance. The results imply that tsunami-induced sediment instability will be significantly affected by the earthquake-induced sediment instability. Future work will focus on the interaction between earthquake-induced and tsunami-induced sediment instability.