Geophysical Research Abstracts
Vol. 14, EGU2012-2669, 2012
EGU General Assembly 2012

Evolution of boundary layers on beaches

E. K. Lindstrøm, G. Pedersen, A. Jensen, and A. Bertelsen
Univiversity of Oslo, Department of Mathematics, Oslo, Norway (geirkp@math.uio.no)

The understanding of wave runup on beaches is crucial for the prediction of coastal impact of tsunamis, storm surge and swells. There exists a number of theoretical models based on inviscid theory on this subject and the models are usually validated by experiments. Experiments are generally performed in wave tanks with depths ranging from 10 cm to 50 cm. For depths of this order the runup might be scale dependent since the swash tongues are very thin and the flow might be influenced of viscosity and surface tension, and one should be aware of these effects. This presentation addresses discrepancies between experimental and theoretical runup heights on an inclined plane. Recently we have performed experiments in a wave tank with 20 cm water depth and a beach of 10 degrees inclination. Five incident solitary waves of different amplitudes are generated. Detailed observations are made for the shoreline motion and velocity profiles during runup. Both viscous and capillary boundary layers are detected and the flow behavior depends on the amplitude of the incident wave and the location on the beach. Comparison with numerical simulations reveals that the experimental runup heights are markedly smaller than predictions from inviscid theory. Findings suggest that laminar bed friction is important in the runup experiments and may be a main reason for the over-prediction of runup by inviscid models. Moreover, the smaller incident waves yield stable, laminar boundary layers on the beach, while the higher amplitudes give instabilities at some locations. Hence, corresponding experiments with a water depth markedly larger than 20 cm will presumably yield transitional or turbulent boundary layers.