ANALYSIS OF WATER-GAS FLOW PROCESSES IN DIKE SYSTEMS WITH FAULT ZONES

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Dikes play an important role for the protection of human life and goods. As the height and occurrence of floods will increase in the future, the loads on dikes as well as the probability of dike failures will increase, too. The occurrence of fault zones such as macropores, void spaces or inhomogeneities in dikes is unevitable, and such fault zones have a strong influence on the dike stability. There is an urgent need to develop numerical, experimental and monitoring methods to detect fault zone in dikes.

Different model concepts for simulating the interaction of surface waves with the flow and deformation processes in inland and coastal dike systems are briefly discussed. This contribution concentrates on the numerical simulation of water-gas flow processes in dikes assuming a non-deformable porous medium. The corresponding model concept for two-phase flow in porous media is introduced as well as its implementation in the numerical simulator MUFTE-UG. The chosen model concept has a much wider application range compared to a groundwater-flow model concept because it can simulate general water infiltration and spreading processes in a dike (see fig. 3) including effects of capillarity (see fig. 2).

In the following, seepage processes through a homogeneous dike and a dike with a fault zone are analysed (see fig. 1) and partially compared with experimental data. The results show the strong influence of capillarity and fault zones. Capillarity makes the water front wider and slows down the front speed (see fig. 2). The numerical results qualitatively agree with experiments. The fault zone strongly accelerates the speed of the water front within the fault zone (see fig. 3), and consequently in the dike, too.

Further numerical and experimental studies are planned to serve as a basis for comparing the ability of different non-invasive geophysical methods, for example soil soil radar or elctromagnetic conductivity, to detect fault zones. This should be done first under 'controlled conditions' on a larger scale experiment and then in the field.

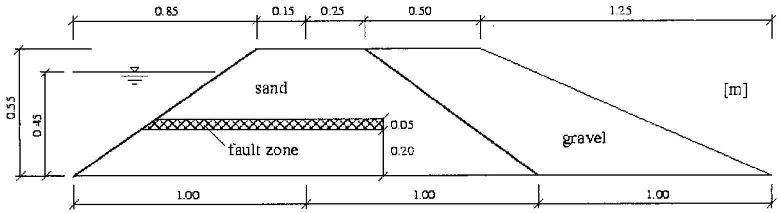

Fig. 1 Geometry of the dike system.

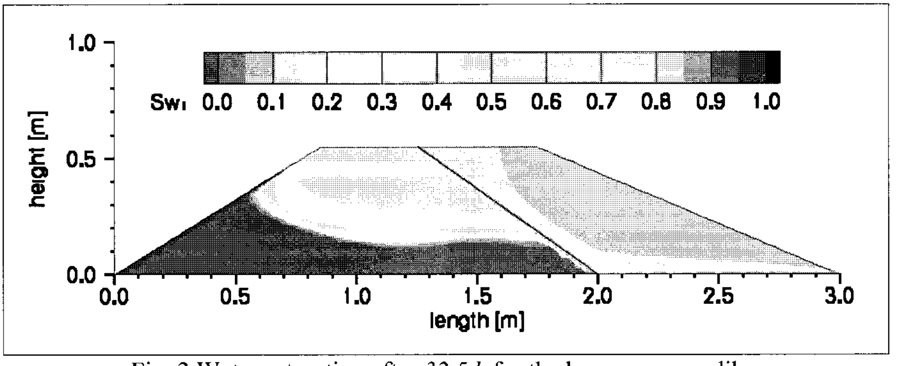

Fig. 2 Water saturation after *32.5 h* for the homogeneous dike.

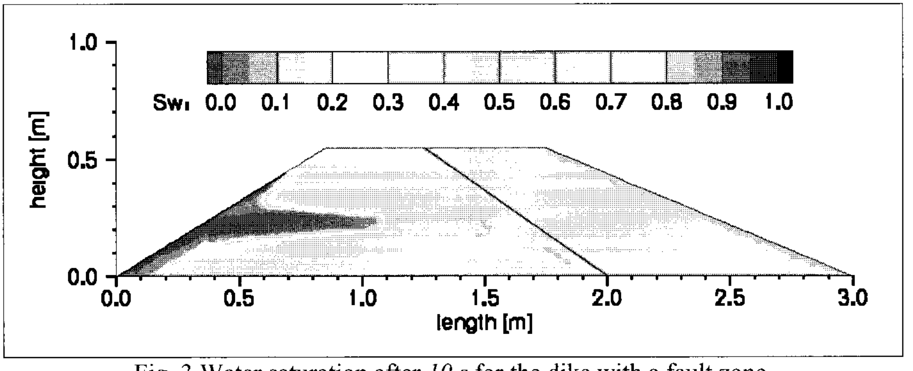

Fig. 3 Water saturation after *10 s* for the dike with a fault zone.