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Flux variability measurements during heavy rainfall: rapid phreatic response to cm-scale spatial flux variation.

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Sandy soils with shallow phreatic levels frequently show a response to high intensity rainfall before a homogeneous infiltration front can reach the capillary fringe. One-dimensional Richards' equation based models need unrealistic soil physical parameters or mobile-immobile flow to simulate these flow conditions. In order to identify the processes involved in this peculiar behaviour we measured the spatial distribution of the downward flux density over a horizontal 960 cm^2 surface halfway between the surface and the phreatic level. We used a newly developed controlled suction lysimeter with a porous ceramic surface that consists of 100 individual cells that count the number of individual water drops and store them at 5 minute intervals. At the same time, soil moisture potential, soil moisture content, soil temperature, and phreatic level were recorded, all at 10- minute intervals. For an individual 24 mm rainstorm the total volume collected at 50 cm depth was 7.9 mm, intercepted by 30% of the porous surface, starting 5 hours after the start of the rain and continuing for 30 hours. The cumulative amount of water in all cells was collected and matched the counted drops. The flux density increased to a maximum of 0.5mm.h^{-1} over a single tile of 9.6 cm^2. The pressure head-front was 10cmh^{-1}. The moisture front followed soon after, but at a velocity of 14cmh^{-1}. The soil water potential measured by tensiometers close to the groundwater and a phreatic level gauge indicated that the pressure front velocity remained unchanged below the sampling depth, and produced a phreatic rise of 16 cm. The presentation will focus on the dynamics of the flux event and conclusions will be drawn on the processes involved in this fast phreatic response. Also the flux variability meter itself will be addressed as well as some applications outside the scope of this

research.