

Interactive comment on “Hillslope experiment demonstrates role of convergence during two-step saturation” by A. I. Gevaert et al.

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We thank Anonymous Referee #3 for the constructive comments, which we address below.

1. The reviewer states that the results of the study support, rather than challenge, existing hydrological theory.

We agree that the results support existing theory in which vertically infiltrating water reaches an impermeable boundary, forms a groundwater table and subsequently moves downslope. However, there are also observations that are not easily explained. For example, the decreasing water content with depth in the second phase.

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2. The reviewer recommends to define the groundwater ridge more clearly and to make it clear that the topographic effect is due to the bedrock topography rather than the soil surface topography. Also, the reviewer suggests that the groundwater in the trough is divergent rather than convergent in the lateral direction, contradicting the authors analysis that the side slopes contribute to the ridge.

The groundwater ridge is present in the lateral cross-section rather than the longitudinal direction, as suggested by the reviewer. We also agree that the topography of the impermeable ‘bedrock’ rather than the shape of the soil surface causes convergence. These points will be made clearer and added to the discussion. However, we still argue that lateral flow from the side slopes contributes to the ridge formation. Simple column storage calculations show that the convergent area saturates sooner than would be expected due to rainfall alone, and vice versa for the upslope areas. This will also be added to the revised version of the manuscript.

3. The reviewer suggests we test the volumetric water content sensors in controlled cases to learn more about the overshoot sensors show under saturated conditions.

Controlled testing of the volumetric water content sensors showed that the measured water content exceeds the porosity when under influence of a water table. However, the measured values under saturated conditions were not compared to pressure head. At present, the sensors are being recalibrated to prevent these issues from happening in future experiments.

4. The reviewer indicates it would be helpful to discuss the relevance of the experimental rainfall to natural conditions.

The initial intention of the rainfall-runoff experiment was to bring the hillslope response to a hydrologic steady state; it was not foreseen that the applied rainfall intensity would trigger surface runoff and erosion. The rainfall rate was chosen due to its relatively even distribution over the hillslope and the irrigation was stopped when the (unplanned) overland flow was observed. The 24h precipitation sum of the resulting event is com-

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parable to events that trigger floods and/or landslides around the world. However, the main focus of the research is not to mimic natural conditions, but to observe underlying hillslope hydrological processes in great detail and under the simplified (but controlled) conditions of the artificial hillslope, compared to natural hillslopes. This will be made clearer when we describe the LEO project in the revised Introduction section.

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