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Hydrology and Earth System Sciences Discussions

Interactive comment on "Soil buffer limits flash flood response to extraordinary rainfall in a Dutch lowland catchment" *by* C. C. Brauer et al.

Anonymous Referee #2

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This paper presents an interesting summary of an extreme hydrological and meteorological event. Extreme flood events and flash flood events present a challenge in hydrological research due to limitations in existing monitoring systems and the rareness of such events. Hence, studies like this one provide a valuable dataset of hydrological and meteorological observations that give the potential for improved understanding of flooding processes and mechanisms.

The process understanding developed within this study could, however, be presented in a more streamlined or consistent manner. The extensive data descriptions need to be better connected with the conclusions reached in Sections 5 and 6. As it is currently presented, things are a bit unbalanced and the conclusions come a bit fast and unconnected to the great dataset. In addition, there needs to be a more clearly

stated objective of the study. This would help demonstrate how the data is used to test any proposed interaction between catchment runoff, groundwater, and soil storage. With that, this paper has some good potential to improve understanding of extreme event processes and dynamics in lowland areas.

Please find general and specific comments following below. When appropriate, page and line numbers are indicated.

Title

The title and the term "soil buffer" are misleading and perhaps not appropriate. There are many factors that appear to be buffering this extreme event. These include the culverts, the surface water pond connectivity, and submerged flume effect. I really miss a clear connection between soil storage and its ability to limit the flash flood in this system. The paper either needs re-scoped or re-titled. To me, the culvert seems to be the largest buffer to limit flash flooding.

Introduction

Since flash floods represent very localized extreme events they provide rare but useful insights into runoff generation mechanisms and hydrological process interactions of catchments under extreme rainfall inputs. During the last decade several events like the 26 August 2010 event described in this study have occurred in Europe and were subject to several studies as published by:

Gaume et al. 2004: Hydrological analysis of the river Aude, France, flash flood on 12 and 13 November 1999, J. of Hydrol.

Marchi et al. 2004: Characterisation of selected extreme flash floods in Europe and implications for flood risk management. J. of Hydrol.

Perhaps, the authors could add a discussion on process understanding gained from flash flood studies and how the submitted research study is aiming to add to the existing body of findings?

Objective of paper

The objective of this paper needs clarification. The current objective of the paper provides a rather descriptive study. As such, the process understanding that was gained from this dataset is not presented in a straightforward way. Section "2.2 Data" could be streamlined/shortened and section "4 Hydrologic Response" could be expanded by a discussion of the spatial dynamics of the flood and how they relate to the observed runoff amounts. Further, the discussion of the relation between the spatiotemporal dynamics of the catchment storage and the observed runoff response could be discussed in more detail.

Why were so few of the piezometer data presented? There appear to be 14 active sampling locations. Were those presented representative? This should give insights to the spatiotemporal variability in response and any potential threshold effects.

Data

(p. 116, lines 26-30): The authors mention that the automatic rain gauge at the meteorological station in Hupsel failed to record during the event. It is not clear whether this rain gage is part of the network of 32 automated meteorological stations or part of the manual rain gage network? If so, for the purpose of clarification, the authors should move the paragraph of the failing rain gage subsequent to the respective station description.

Hydrologic response

The hydrologic response section contains a description and discussion of soil moisture and groundwater dynamics over time. However, to accurately forecast flooded areas and the economic damage in areas affected by flash floods the spatial dynamics and recession behavior of catchments are of special concern. Perhaps the authors could expand the discussion on the hydrologic response. For example, how did the flash flood expand in space during the event? What was the ponded catchment area (

Synthesis of the hydrologic response

The four storage types stated are the essential control mechanisms on runoff generation in Hupsel Brook catchment. Could the authors expand a bit on how these storage types develop and spatially distribute in the catchment prior to the storm, at the peak flow and during the storm recession? Can the piezometer and capacitance probe data be used to spatially identify the different storage types at different time steps during the flash flood event to derive a spatio-temporal distribution in the catchment? The spatiotemporal dynamics are quite interesting especially a lowland and flat system where one could expect a uniform response. Clearly that was not the case here as ponds still needed to connect before big flooding could occur.

The authors mentioned in the study site description that soil depths were highly variable in the catchment (p. 115, lines 3-5). How does this variability in soil depth affect the hydrograph recession and soil storage recession in Hupsel Brook catchment?

Soil moisture response

(p. 123, line 7): Suggest to add "26 August," before "07:00 UTC for clarification of the date of the event.

(p. 123, lines 24-26): Suggest to replace "It took until 11:30 UTC before groundwater levels slowly started to rise, more than 4.5 h after the initial increase in soil moisture content was observed." with "Groundwater levels started slowly to rise at 11:30 UTC, 4.5 h after the initial increase in soil moisture content was observed."

Abstract

(p 112, line 17), (p 125, line 5), (p. 130, line 27): Suggest using the same units (either l s^{-1} or m^3 s^{-1}) for consistency and easier comparison of low and high flows.

Figures and Tables

(p. 138): Suggest indicate the location of the study site in Figure 1 more clearly with a

box or symbol in the overview map.

(p. 139): Suggest increase the symbol size in the overview maps that indicate the locations of the weather radar (stars) and the gauge.

(p. 140): Move the graph annotation "4.4 l s^{-1}" to the appropriate location on the x-axis.

Minor, grammatical, and spelling errors

(p. 112, line 15): replace "was" with "were".

(p. 113, line 11): replace "times" with "time".

(p. 115, line 5): replace "thick" with "thickness".

(p. 116, line 13): replace "with" with "to".

(p. 116, line 13): replace "being" with "is".

(p. 125, line 14): replace "was" with "were".

(p. 125, line 16): replace "was" with "were".

(p. 128, line 14): replace "stores" with "storages".

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 111, 2011.