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Hydrology and Earth System Sciences Discussions

Interactive comment on "Hydrogeomorphic controls on runoff in a temperate swamp" *by* S. C. Kaufman et al.

Anonymous Referee #1

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General Comments

This paper discusses some of the possible water sources and sinks of a forested swamp. The aims of this paper were to 1) to investigate the hydrogeomorphic controls on the streamflow of the temperate forested swamp and 2) to investigate changes in water flux, flow paths and groundwater-surface water interactions between a wet and a dry summer. Much of the data presented in this paper are both site and time specific. Rather than conducting a rigorous and thorough investigation of all hydrogeomorphic controls on the streamflow, this paper identifies several processes that may be at play during the times of study. It also illustrates that the flow paths and groundwater-surface water interactions may be related to climate. It is noted that the two climate scenarios shown are not nearly as dramatically different as implied. The interannual variation of these two summers is not evidence for general inter-annual variation. No conclusions

can be made as to how often the wetland functions according to these patterns. No conclusions can be made as to how these processes will change over time.

The paper is significant in so far as indicating that the sources and sinks to this swamp are related to the climate and to the groundwater conditions. However, the investigation presented is not detailed nor thorough enough to indicate exactly how these hydrological processes function over time. The conclusions are not presented in a way that can be applied to other systems.

Specific Comments

1. It is unclear how the two swamps studied in detail are delineated from the Beverley Swamp system as a whole. Clearly there are two distinct inflows to the system but it is not clear how the sub-catchments are separate and not interrelated. In addition, later in the paper, the water table is discussed to be above the surface for the majority of summer 2000. In this case, it is unlikely that the two swamps behaved as separate water bodies. Figure 1 shows the entire area as one swamp. Is there water exchange or interaction between the two sub-basins? The topography is not clear enough for the reader to discern.

2. The experimental design is not clearly described. The terminology is somewhat unclear throughout the paper and sometimes causes confusion. For example, Page 487, Line 8, are the six monitoring sites that include both catchment surface water inflows the same as the stream discharge that is measured at both swamp inflows (Line 11)?

The location of 40 groundwater wells in the swamp are not clearly shown on Figure 1 so that the reader is unable to follow any further discussion of the groundwater wells without knowing which ones are being referred to and their respective locations in the system. Similarly for the five piezometer nests referred to on Page 487, Line 20. There are 7 transects marked on the figure but no description as to how these fit in. Without a clear delineation of the swamp boundaries, indication of where the groundwater is

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being measured and how this corresponds to stream measurements, it is difficult for the reader to conceptualise what is being investigated. A more detailed site map would better describe the experimetnal design.

3. It is doubtful that the studies have actually been conducted in a wet and a dry summer. Both summers are stated to be below the 30 year average. According to this, therefore, both summers must be dry. Further, with a difference of only 40 mm between the two years, it seems they are not significantly different from one another. If this difference is significant for the area, a more detailed presentation of climate data should be presented to validate the position. Given that both years are below the 30 year average for rainfall, the question remains as to whether additional hydrological functions are triggered in a year with rainfall above the average. For this reason, the question of whether all wetland functions are described and investigated here remains unanswered. How would the swamp water budget and outflow change with significantly greater rainfall? Are there other flowpaths that are only triggered in a truly wet year?

4. No evaporation data for the period studied is presented. On Page 489 Line 27, a very large difference in discharge is shown for a relatively small difference in total rainfall. What was the difference in evaporation for these periods? Is it possible that variation in evaporation is also contributing to the change in hydrology observed?

5. The use of dissolved oxygen and electrical conductivity as tracers for groundwater flow, particularly when there seems to be an abundance of groundwater data, is not clearly understood. There are no references, nor background concentrations for the sources, given to support or justify this method. Electrical conductivity is not a conservative tracer and can increase due to evapoconcentration. Without evaporation data, it's difficult to assess the conclusions drawn from the electrical conductivity data.

6. Perhaps the most interesting element of this paper is the fact that so much difference in wetland function was found with such a small difference in rainfall. Is it possible that the two climate conditions (combination of rainfall and evaporation) are on either side

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of a switchpoint, that they represent some sort of critical point between two wetland conditions?

7. The information listed in the tables was difficult to follow. It would be better if some of this information was presented graphically.

Technical Comments

Page 487 Line 9 What is the swamp outflow? Is it Lower Beverley Swamp?

Page 488 Line 15 "a maximum of nine days passed without precipitation" - is this nine days in succession without rain or did it rain for every day of the period except for 9 days? If it's the former, is this really significantly different from 15 days in succession without rain?

Page 488 Line 19 There is confusion over the term "inflow discharge" - "inflow" only is clearer.

Page 491 Lines 5 - 8 DO is used to illustrate groundwater flow after rainfall. Why don't the groundwater bores show this? Why not use this information? What is the timescale of the sampling?? With respect to Water table position - is it possible that the groundwater is draining from Fletcher into Spencer? Where is the water table being measured? The groundwater dynamics are not clearly shown.

Page 491 Line 25 If between the inflow and outflow of Spencer Swamp, the water table stayed near the surface in the disappearance zone, what disappeared? Does the stream become open water? Does the swamp take over and why does it? Is there a topographic reason for the disappearance?

Page 493 Line 16 It is not certain that the conclusion that the tracers show a lack of stream interaction with the surroundings is justified. There may be other functions such as mixing which have not been accounted for in this study. No distinct characteristics of the sources have been presented to adequately make this conclusion and the tracers used are not conservative.

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Page 494 Discussion of the behaviour of flowpaths around the disappearance zone should be mentioned and detailed in the results section.

Page 495 Line 6 Storm events which occurred in succession within 48h substantially increased runoff rates. This can also be due to surface saturation rather than rising water table to the surface.

Page 495 Line 24 The use of the inclusive phrase "throughout much of Beverley Swamp" supports the idea that the subbasins cannot truly be divided into separate subsystems with independent sources.

Page 496 Line 2-5 This sentence seems out of place. Is it here as further justification of hydrological processes? If so, more information is needed to be presented otherwise it should be removed.

Page 497 Line 11 No context is provided for this sulphate and methylmercury flushing. Is it an issue here?

Figure 6 How are the hydraulic gradients calculated - what two water heights are being used?

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 483, 2005.