This study presents the design and implementation of simple on-off or state sensors for detecting the presence (or absence) of water in ephemeral streams. This presentation of the design is very informative and does a great job telling the story of how these new sensors came into being. In addition, the text is very well written. There are several shortcomings that I think the authors should address, however, before this paper can be accepted to HESS. Since this will take some effort, I would consider these major revisions. I do believe that by addressing these issues the authors will improve the strength of this manuscript. General comments to be considered in revision follow directly here with a list of more Short/Editorial comments to follow.

**General comments**

One section of this work that needs better development is the Results section. Clearly, the authors have opted not to present such a section in this manuscript. I feel that is a weakness that should be overcome. As the current manuscript reads, it is very much a technical note without any more real 'research' aspect. Why have the authors presented things this way? I would expect it could be quite straight forward to provide some analysis of the sampled data shown in Figure 6 for example. Why have the authors not analyzed the directionality or sequencing of the wetness states (i.e., the order in which sites wet up or turn 'on') or the duration of the wetness states? Do these make physical sense relative to the understanding (even conceptual understanding) of how these systems function hydrologically?

Further, why not compare the observed ephemeral streams sequences and durations of wetting to some local stream flow records? There must be some stream gauge near enough to reflect the precipitation record shown in Figure 6. Showing precipitation (even though this is not really presented in the text – that needs to be done better!) is a good start since it indicates some time series of potential initiations of wet states. However, flow durations could help estimate the dynamics of the system and help determine if the sensors turn 'on' for a realistic amount of time. If the sensors are wet much longer than streamflow is above baseflow conditions that would (and should) raise some eyebrows.

Lastly along this same line of thought is the lack of ground truthing presented for the sensor data or time series of observations. It appears (from reading the text) that multiple site visits took place. Were any of these visits during wet conditions or periods when sensors would be 'on'? Looking at November for example, there appear to be several days of wet states in a row. Some field observations must be available from that period from the basic field notes. If not, at least this study could report that there were no false positives of wet states recorded during site visits that were observed dry.

The discussion of the noise in the sensor records is logically put forward, but I wonder if other possible explanations exist. How are we sure this noise is not due to films of water left on the surface of the sensor the trip the open circuit? I imagine the likelihood of this would increase with the duration of deployment of this type of sensor. Longer deployment could allow for the growth of biofilms and algae and sediment could load onto the sensor. Both of these could potentially facilitate film formation or make it take longer for the sensor to dry completely and, thus, lead to noise. Could the authors put forward an analysis to demonstrate that the noise (or the length of noise) per sensor is independent of the length of time it has been deployed in the field? That could further support the original wind-driven explanation of the noise.

Also, would there be any variability in the electrical conductivity of the water flowing in these ephemeral streams? Would the sensors (or the noise signature) be sensitive to this? If these regions are draining agricultural field and there is application of nutrients or pesticides (particularly during planting), that could influence the EC of the water in the ephemeral stream.

Lastly, it seems like a more complete summary or review of other sensor techniques is needed. There is a focus on the work of Goulsbra et al. (2009) and some brief reference to temperature techniques, but these are not further explained/explored. For example from ephemeral streams, why not include the temperature-based work from Constants et al. (2001) or more recently Lyon et al. (2008)? This would help round out the presentation of this type of work.

**Minor/Editorial comments**

P6382L13: For who or what is this the greatest cause for concern?

P6382L15-21: This is true for certain landscapes but not necessarily all. Either be more specific or justify the statements here.

P6382LL25: Should be ‘network’s’

P6382L26: Moisture conditions or water tables? These are not necessarily the same thing thinking of variable source areas and preferential pathways (both vertical and horizontal).

P6383L3: Should be ‘catchment’s’

P6383L4: ‘their basins’ is awkward to me. Consider restructuring this sentence.

P6383L12: This is really starting to blur the lines between ephemeral streams and variable source areas. Perhaps present a clear distinction of the two to help the reader?

P6383L15: Perhaps this reflects a lack of interest in the topic?

P6384L8: Consider renaming section ‘Overall sensor design’

P6384L21: Consider renaming section ‘Sensor head’

P6385L29: These holes and marine glue are not introduced yet.

P6386L2: ‘<0.50’ what? Is this Canadian dollars?

P6386L10: I think ‘were’ should be ‘was’ here.

P6387L13: I disagree that it eliminates the subjectivity. It merely passes it along to a predefined threshold. There was subjectivity (on someone’s part) in defining that threshold (even if it was not the authors!).

P6388L9: Delete comma after channel

P6390L10 Change ‘degrees of slope’ to ‘slopes’

P6391L9: Should be ‘sets’

P6392L2: Why have the authors not included a plot showing the unprocessed data to let the reader judge noise effect? I think that could be quite informative and helpful. Basically, it is the same as Figure 6 without filtering out the noise.

P6392L12: ‘either’? I think I missed the second explanation in the text. Clarify.

P6393L2: The ER abbreviation has not been introduced and is strange here. Just spell it out everywhere.

Figure 1: Why not have a photograph, too? At least that could be uploaded as supplemental material.

Figure 3&4: Put arrows on figures showing the downslope directions.

**References**

Constantz J, Stonestrom D, Stewart AE, Niswonger R, Smith TR. 2001. Analysis of streambed temperature in ephemeral channels to determine streamflow frequency and duration. Water Resources Research 37(2): 317–328.

Lyon SW, Troch PA, Broxton PD, Molotch NP, Brooks PD. 2008. Monitoring the timing of snow melt and the initiation of streamflow using a distributed network of temperature/light sensors. Ecohydrology 1(3): 215-224.