Comments on hess-2010-394: Semi-automatic extraction of lineaments from remote sensing data and the derivation of groundwater flow-paths

General Comments

This article presents a method to extract lineaments (as indicators for possible groundwater flow paths) from a coarse topographic digital elevation data in a semi-automated fashion. This method is applied to a fairly large (4160 km2) catchment of the Dead Sea (Israel), and the results, while not very precise, are at least consistent with existing groundwater flow studies and well data. While the parts of this study pertaining to this catchment are well thought out, in my opinion this article would benefit from significant editing before publication for the following reasons:

1) The methodology is not very advanced, is not very accurate, nor is it very robust. However, due to its simplicity, this method seems useful for areas where only coarse topographic data is available and where groundwater flow paths are largely unknown. In particular it would be beneficial in the context of motivating a field campaign where one could benefit from knowing ahead of time where to investigate. The authors make this exact comment in the very last line of their conclusions, but I feel it should be introduced earlier as a fundamental motivation. The simplifications performed and the use of low resolution data would be then justified. I would not try to justify the use of very coarse topography, as the authors did, simply by the fact that few man-made features can be seen in it, and thus present a less confusing input to their procedure. In the study of other linear features (such as fault systems, e.g. EarthScope Northern California LiDAR Project), the highest resolution data (such as LiDAR) is always sought, and man-made features don't present too much of a problem as they can be removed efficiently by many filtering algorithms. I would motivate the authors' approach by the fact that for large parts of the world these data are not available, and a crude automated analysis would inform field campaigns. In the presence of high-resolution data this approach would not, in my opinion, be justified.

2) I think that this paper would also benefit from being more focused on the task at hand: delineating lineaments of this specific area near the Dead Sea. I think that if the method were the focus of this study, as implied by the title of the article and by the abstract, then not only it would have to be motivated differently (as mentioned above), but many of the choices made would have to be more clearly justified: why not use a Laplacian of Gaussians instead of median filter then a Laplacian filter; why this filter size; why only 4 directions; why 30 training samples; why remove objects less than 20 pixels; why 0.8 threshold in binarization; why and what are the suitable line-link parameters based on our own criteria", just to mention a few examples. I do not dispute these choices for this site, and I applaud the authors for tweaking a vast number of parameters to get good results. However, for this procedure to be transferable to other sites such choices need to be made less arbitrary and some guidance offered to the reader as to how one may come up with a parameterization for a different location. In my view, this does not imply making major changes to the article, but rather some re-branding or re-packaging: a title change, some re-ordering in the abstract, and in the conclusions. I think this was a more than reasonable approach to follow in this specific site, as the lack of LiDAR and other digital data did not permit more sophisticated approaches. With suitable parameterizations, this

approach may be used in other areas were little data is available before going into the field and drilling wells at random.

3) The ordering of the sections is inconsistent regardless of what the authors may feel about my comments in 2). If, in spite of my previous comments, the method were to remain the focus, then it should be presented before a detailed description of the study area. If, on the contrary the focus of the paper is shifted to the extraction of lineaments in this specific site, then the method should be mention after the problem at hand is stated in both the abstract and in the conclusions. The body of the paper does present the study area first and lists the methodology in the methods section, in a fashion that is consistent with being a site-specific study.

4) The English in this draft is at times a little awkward. Editing by a native English speaker for clarity should be completed during this review process. I have taken the liberty of suggesting some such edits in the specific comments below.

Given all the above, my recommendation is that this article undergo significant revisions before its publication.

Specific Comments and Technical Corrections

(Line-by-line comments and edits)

Abstract:

- Combined use of “we” and “the authors”, use one or the other for consistency
- Line 14: change “statistic” to “statistical”

Introduction

- Page 2, line 1: “indicator” to “indicators”
- Page 2, line 12: “approaches are based”
- Page 2, line 13: “filters”

Methodology

- Page 1405, line 8: “with a 30 x 30 matrix”
- Page 1406, line 22: “based on our own”
- Page 1407, line 4: “algorithm is based”
- Page 1407, line 7: “The pixels”
- Page 1407, line 8: “image based on a”
- Page 1407, line 8: “GTHR), and a”
- Page 1407, line 23: “derived from coarse elevation data”
- Page 1409, line 26, page 1410, line 1: “close to wells reflect the probable hydraulic flow conditions, in contrast to lineaments further away, we calculate”
- Page 1410, line 14: “In contrast, lineaments present”

- Page 1410, line 19: “In total, 751 lineaments with … were detected.”
- Page 1411, line 4: “30-40^{o}, while”
- Page 1411, line 8: “Partitioning the total lineaments”
- Page 1411, line26, 27: “Therefore, a clear differentiation of lineament types based on the distance to wells cannot be conducted.”
- Page 1412, line 1: “Morphological lineaments generally exhibit better numbers with respect”
- Page 1412, line 2: “as well as to the standard”
- Page 1412, line 3: “on the results we calculated, the”
- Page 1412, line 4: “revealing that”
- Page 1412, line 5: “from a known well”
- Page 1412, line 6: “In order to create”
- Page 1412, lines 7, 8: “The general distribution reveals”
- Page 1412, line 11: “wells are between 13 m and 6767 m.”
- Page 1413, line 16: “having strike directions related to the Syrian Arc stress field”
- Page 1412, line 19: “well-matching”
- Page 1412, lines 20-22: not clear
- Page 1412, line 24: “to the nearest well”
- Page 1412, lines 27-29: not clear
- Page 1412, line 3: “on the results”
- Page 1413, line 6: delete repetition before “from the northern”
- Page 1413, line 16: “feeds the Ein Gedi”
- Page 1415, lines 10, 11: “pointed out that in carbonate rocks”

Conclusions

- Page 1717, line 3: “These results also show the”

Figures

- Figures 5 and 8 have a much smaller font in their captions