

Review of the manuscript hess-2013-65
“How to identify groundwater-caused thermal
anomalies in lakes based on multi-temporal
satellite data in semi-arid regions” by U Mallast,
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Geyer & R Merz

13 July 2013

1 General comments

The paper presents a method for the processing of LANDSAT data to assess the influence of groundwater flow on the thermal structure of a surface water body, in order to infer information on subsurface or submarine discharge.

Although the basic idea is not original, the approach is quite interesting and innovative, even if I cannot provide a full judgement, as the basic index used to estimate the impact of subsurface water, the influence factor, is not properly defined in equation (4), which is apparently incomplete. However the results seem to be correct and physically consistent.

On the basis of these remarks, I answer the questions that the referees are asked to take into account.

Does the paper address relevant scientific questions within the scope of HESS? Yes, it does.

Does the paper present novel concepts, ideas, tools, or data? The paper proposes an original method for processing remote sensed data.

Are substantial conclusions reached? The application of the processing procedure gives an interesting example to support the relevance of the method.

Are the scientific methods and assumptions valid and clearly outlined? In general, yes, but for equation (4), as stated above.

Are the results sufficient to support the interpretations and conclusions? A sensitivity analysis of the results with respect to some parameters would permit to put the conclusions on a more firm basis and would strongly improve the paper quality. See the specific comment 4.

Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? No, the definition of IF is not given correctly.

Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes, they do.

Does the title clearly reflect the contents of the paper? Yes, it does.

Does the abstract provide a concise and complete summary? Yes, it does.

Is the overall presentation well structured and clear? The presentation is generally quite clear, some changes in the structure could be useful. See specific comment 3.

Is the language fluent and precise? In general the language is quite clear, but should be improved. The structure of the sentences is more “German” than “English”. I provide some, although non-comprehensive, suggestions in the technical corrections below.

Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? No, mainly for equation (4) and some other aspects listed in the technical corrections below.

Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? See the technical corrections below.

Are the number and quality of references appropriate? Yes, they are.

Is the amount and quality of supplementary material appropriate? Yes, it is.

My opinion is that the paper requires a major revision, before publication.

2 Specific comments

1. The first paragraph of the Introduction introduces the problem of sustainable management of water resources, but the paper does not provide results that are directly or straightforwardly applied to this ultimate goal. In fact the notion of sustainable water management is treated by a large number of papers, which are neglected by the Authors in their introductory section. Therefore, I suggest to start directly from the scientific problem of the determination of groundwater discharge in surface water bodies.
2. Page 4903, lines 17-25. I suggest to substitute “water bodies (lakes, ocean)” with “lakes”, because the statement that “the spatio-temporal SST pattern is similar for the entire water body” should require further discussion when applied to oceans.
3. As mentioned above, the definition of IF, namely equation (4), is wrong or incomplete and involves SRT and CAT, which are defined later, in section 4.2.1. I think that it would be much better to introduce the method and then discuss the details of its application to the Dead Sea. In other words, I would appreciate separating theory from application, so that the distinction among the proposed methodology, the basic assumptions, the approximations introduced for the specific application, etc. should be clear.
4. Several, somehow arbitrary, parameters are introduced in the application, for instance, water emissivity and the lengths to define the SR investigation areas or the central area. It would be nice to provide a discussion of the sensitivity of the results with respect to these parameters. This problem is partly discussed in section 6, but it would deserve further investigation.

5. A very naive groundwater flow model (see section 4.3) is applied to provide estimates of surface-runoff influence time.

3 Technical corrections

1. Page 4902, line 4. Modify “larger”: larger than...?
2. Page 4902, line 5. Substitute “why” with “because”.
3. Page 4902, line 10. The acronym SST is defined later at line 18.
4. Page 4902, lines 10-11. Modify “19... data”, possibly with “19... images”.
5. Page 4902, line 11. Substitute “in the example of” with “to”.
6. Page 4902, line 13. Modify “surface-runoff influenced images”.
7. Page 4902, line 17; page 4906, line 4. Erase “per-”.
8. Page 4902, line 25. Erase “number”.
9. Page 4903, line 10. Move “(IAEA, 2007)” immediately after the quotation marks and before the full stop.
10. page 4903, line 11. Modify “At least for the spatial scale”.
11. Page 4903, line 16. Modify “in an array of patterns varying in space and time”.
12. Page 4903, line 24. Modify “contrastingly”.
13. Page 4905, lines 3-4. Modify “From these applications only two account for”.
14. Page 4905, lines 9-10. Modify “primarily” and “secondarily”. In particular “primarily” is in the wrong position and makes it difficult to follow the sentence.
15. Page 4905, line 10. Modify “it”, because the subject of the last sentence was “these criteria”.
16. Page 4905, line 17. Modify “This expectation uses Tcherepanov et al. (2005)”.
17. Page 4905, line 22. Substitute “there” with “their”. Am I right?
18. Page 4905, line 27. Modify “image statistics based approach”.
19. Page 4905, line 28. Modify “off”.
20. Page 4906, line 14. Modify “limy”.
21. Page 4907, line 10; Table 1. Siebert et al. (2011) is missing in the reference list.
22. Page 4907, line 13. USGS (2011) is missing in the reference list.

23. Page 4908, line 20. Modify “alternate”.
24. Page 4909, line 7. Modify “is ETM+ specifically adapted”.
25. Page 4909, line 13. Modify “ 0.5 ± 0.8 K”.
26. Page 4911, lines 26-27. Rephrase the sentence “Essential...contrasts”.
27. Page 4913, line 2. Modify “this step”.
28. Page 4913, line 5. Please, provide reference for the D8 flow model.
29. Page 4913, line 18. Substitute “maintains” with “remains”.
30. Page 4914, line 2. Modify “not-surface runoff influenced”.
31. Page 4914, line 8. Substitute “ $-0.1 > x \leq 0$ ” with “ $-0.1 < x \leq 0$ ”.
32. Page 4915, line 10. Modify “applied”.
33. Page 4915, line 21. Modify “and – fans”.
34. Page 4915, line 24. Is “trough-flown” correct?
35. page 4916, line 22. Substitute “physical” with “physically”.
36. Page 4918, line 4. Substitute “adaption” with “adaptation”. Am I right?
37. Page 4918, lines 20 & 22-23. Modify “Given is a groundwater velocity...” and “Also given are water densities...”.
38. Page 4919, line 4. Erase “ \leq ”.
39. Page 4920, line 10. Modify “larger”.
40. page 4920, line 29. IHS (2012) is missing in the reference list.
41. Page 4921, line 17. Erase an “r” from “Corriolis”.
42. Page 4922, line 3. Modify “a method independent main advantage”.
43. page 4923, line 2. Modify “constellation”.
44. Page 4923, line 25. Modify “as the often...capable”.
45. Page 4925, line 19. Add “s” to “reason”.
46. Page 4925, line 22-23. Modify “In parallel rises the air-temperature the native groundwater temeprature of...”
47. Page 4925, line 26. I have not found Figure 11, I think this should be Figure 10. Am I right?
48. Page 4926, line 13. Add “n” to “show”.
49. Page 4927, line 27. Modify the sentence “the higher...the slower adapts...”.
50. Page 4928, line 9. Substitute “the current” with “this”.

51. Page 4935, line 14. The reference “Landsat ETM+ (2011)” is misplaced and possibly wrong.
52. Figure 1. Hall (200) is missing in the reference list. Substitute “subset” with “inset”. Substitute “climatological stations” with “meteorological stations”.
53. Figure 2. The colour scale is not very useful to highlight the interesting features. Why are high values differentiated with a fast variation of colours from blue to green, yellow and red? These high values appear in the south-western corner for a couple of images, don't they? Can the Authors comment on this?
54. Figure 3. It is not clear what is the “mean SST range”. May be, “range” could be erased from the figure, the figure caption and the text.
55. Figure 9. Modify the format “ $\geq 0.01 - < 0.1$ ”.