Hydrology and
Earth System
Sciences
Discussions

Interactive comment on "Surface water monitoring in small water bodies: potential and limits of multi-sensor Landsat time series" *by* Andrew Ogilvie et al.

Anonymous Referee #1

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General comments

This paper presents an evaluation of the LANDSAT capability to monitor small water bodies in a Central Tunisia. An extensive and accurate evaluation is carried based on a precious dataset extending over fifteen years which makes this work valuable. However, more work should be done for this study to bring an original contribution over previous published literature, since no new methodological developments are implemented neither novel findings form a hydrological point of view are reported.

Several issues should be addressed before publication in HESS. The main points are highlighted below:

1- The last few years have seen new developments and products release in optical remote sensing that are not addressed by the current study, although they could be quite relevant to the final objective of monitoring small water bodies with a rapid temporal dynamic in time.

First, Sentinel 2 data are available since the end of 2015 with a revisit time of 10 days and 5 days since the launch of Sentinel 2B last year. Recent works have shown the capability of Sentinel 2 (alone or in combination to Landsat) to monitor small water bodies using spectral indexes over different regions (i.e. Kaplan et al. 2017, Du et al. 2016 and Zohu et al. 2017). Addressing the potential of Landsat alone, as done in the current study, does not allow to take into account the potential of the multi-sensor combination available with the actual generation of optical satellite sensors.

Second, land surface reflectances and cloud mask for the Landsat sensors are available since few years now (Landsat level-2 data). It would be quite interesting to take into account this widely used product in the current study and analyse its impact on the water bodies classification employed in this work.

2- It is important to discuss the value of this work for hydrological applications: beyond the assessment of the capability of monitoring water areas in the study region (that could be further investigated, see point 2 about it) is the analysis of water areas derived by Landsat over 15 years leading to any new finding on the hydrology of this region (in addition to those reported by Olgivie et al 2016b)?

3- The comparison to the JRC product is a bit misleading since the Peckel database concern "open water" only, while the classification carried out for this paper also includes flooded vegetated area. For the comparison to be meaningful, open water pixels only should be considered. It is however quite interesting to evaluate the proportion of vegetated/flooded area, not taken into account by the JRC database, over open water areas for these small water bodies. To do this, the authors could attempt at classifying separately open water and water with vegetation: would this be possible? (I

guess calibration/validation could be more difficult if this information is not reported in the in-situ data base)

4- Finally, several points need to better explained or clarified concerning both the methodology and the in-situ measurements (see specific comments below). In particular, a point that needs clarification is the methodology used to derive water areas in-situ: for what I understand for calibration and validation water contours were derived by GPS, but for the long term analysis water levels coupled to bathymetry data were used. If this the case, more details on the hypsometric relationships applied should be given and an accuracy assessment of water areas derived in this way should be carried out. When the bottom is quite flat (which can happen for flooded areas during the rainy season), small changes in water level can result in significant changes in water area.

Specific comments:

Abstract: line 6: better small instead of smallest

Pg 2 line 31: 16 days since the 1970s? Prior to Landsat7/8 data are generally much less frequent

Pg 3 lines 8-12: this is not very clear given that several studies (including the cited Peckel et al. 2016, Olgivie et al 2016b and Jones et al 2017) analysed the long term dynamics of water bodies including small water bodies

Pg 3 line 20: the term "low resolution" is a bit confusing. Does it refer to Landsat 30m resolution? Or to medium resolution sensors like the cited MODIS?

Pg 3 last par: temporality issues can be now better addressed by combining to Sentinel2 (i.e. Kaplan et al. 2017, Du et al. 2016 and Zohu et al. 2017), see general comment above

Pg 5 section 2.2. this section should be more clearly written (see point 4 above): how many GPS contours were available? And more important: how in situ areas for the long term analysis were derived? (line 13 refers to water volumes derived from stage

values, what about areas?)? An accuracy assessment on the in-situ measurements would be more than welcomed!

Section 2.5: employing different metrics allows a complete evaluation of Landsat performances. However the manuscript is a bit confusing about it (minimum RMSE is used to define the thresholds, PDAI for validation purposes, RMSE and NSE for the long term analysis). A table summarising all the metrics employed would help the reader. For completeness, RMSE could be also reported in Table 2 and mean PDAI in table 3.

Fig 3: this example shows one of the biggest lake analysed. Given the paper focus on small water bodies, it would be interesting to add some examples of MNDWI performances for smaller lakes, and discuss this in term of the amount of vegetated and/or mixed pixels.

Fig. 12 This figure would be more informative if the authors could add the information on the MNDWI points directly derived from Landsat data and those interpolated

Section 3.3.3 lines 21-24: As already pointed out this should be better clarified in the methodology section. An error analysis seems necessary.

Section 3.5 see point 3 in general comments. Fig. 15 Given that the JRC dataset only concern "open water" a 1:1 line should not be expected

Conclusion pg 23, line 32 reference to SWOT is not appropriate given the focus on small water bodies. SWOT mission spec are indeed given for water bodies with area above 1 km2 Line 33: Low cloud: not if radar is used (i.e. Sentinel1)

Appendix A: see point 2 in the general comments concerning the Landsat land surface products

Technical comments:

Fig 7: white dots are difficult to see, please change the color table

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