

# ***Interactive comment on “Performance of METRIC in estimating hourly and daily evapotranspiration fluxes over an irrigated field in Saudi Arabia” by Rangaswamy Madugundu et al.***

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Author Response to Anonymous Referee #2

Referee comment (RC); Author Response (AR)

General comments:

RC-1: The reliability of results: there are many discrepancies in the provided statistical values between the abstract, text, figures and tables.

AR-1: Agreed, there were discrepancies in provided statistical values among the abstract, figures and tables. Those discrepancies have been rectified and the correspond-

ing section of the manuscript has been revised.

RC-2: The methodology lacks important information.

AR-2: Detailed description of methods used for the study has been incorporated.

RC-3: The results discussion should be considerably strengthened.

AR-3: The results and discussion sections have been modified considerably.

Specific comments:

RC-4: - The introduction is poorly structured:L 15-25:The paragraph is described in vague terms. The conclusion “the ET values measured by the EC systems need to be adjusted through, through an appropriate method, to improve their accuracy” is not clear to me. What the author want to explain? The energy closure of EC system is not always satisfied?, I am not sure that an entire paragraph should be devoted to this point. Twine et al. (2000) should be cited then.

AR-4: Introduction and conclusion sections have been modified. The explanation on Energy closure of EC system modified and the Reviewer suggested references were incorporated in the revised manuscript.

RC-5: - The state of art concerning the RS approaches to monitor spatialized ET is not sufficiently detailed. The FAO-56 approach is an interesting alternative to thermal based approach and thermal based approaches are usually separated into image-basedmethod (named contextual) and pixl to pixel based where the energy balance is solved independently from one pixel to another. The sited article Kalma et al., 2008 together with Courault et al. 2005 could be certinly help to improve the introduction.

AR-5: The image-based method has been followed for the monitoring of spatialized ET. As suggested, reference of Courault et al. (2005) is added along with Kalma et al. (2008).

RC-6: The objectives are not clearly stated.

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AR-6: The goal and objectives of the study have been stated clearly in the revised manuscript.

RC-7: The study area description should be strengthened. Please provide some details on the typical annual cycle of alfalfa crop in the region (in the 2.1 part of instance) and on the soil type.

AR-7: Description of the study area, the typical annual cycle of alfalfa crop in the region and soil type of experimental plot has been added.

RC-8: Landsat8 LST: Please provide some details on the split window algorithm and give the proper references of the software.

AR-8: A detailed explanation on “split window algorithm” has been provided with the proper reference to the software. ENVI (Ver. 5.1) software has been used for the execution of split window model.

RC-9: P7 L1-7: give some detail on the Footprint analysis approach

AR-9: A detailed text on Footprint analysis approach is added to the revised manuscript.

RC-10: P7 L23: what is the “EC flux tower measured temperature (TEC)”? is it derived from upward longwave component measured by the CNR4?

AR-10: Explanation pertaining to TEC and its method of measurement is provided in the revised manuscript. Yes, the TEC is the product of a series of computations from upward longwave component measured by the CNR4.

RC-11: The discussion on the results should be strengthened: - Providing scatter plot only does not help in this objective. A time-series, of at least LE, showing both in situ and satellite estimates should be shown and discussed.

AR-11: Discussion and results sections has been strengthened. A time-series of LE showing both in-situ and satellite (landsat8) estimates has been provided and dis-

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cussed accordingly.

RC-12: Discussing on statistics with such small sample data may be uncertain.

AR-12: Results obtained with the use of correlation procedure will be given less importance. In addition, Mann-Whitney U-test and/or Kruskal-Wallis H test, which are often used in applications involving small size samples will be used as described in Gisondi et al. (2004) and McCune and Grace (2002).

RC-13: Please organize and strengthen your discussion. For instance, the “Sensible heat flux” part (3.2.3) is very difficult to follow after the first sentence where you provide the statistics of the comparison between EC and metrics.

AR-13: Discussion and results sections will be strengthened.

RC-14: The high RMSE value of 72.01 W m<sup>-2</sup> (63.54%) for the HRS might be due to the advection and variability in the canopy density”. Right. Advection may vary strong in hyper arid environment but you could give some references to support your comment.

AR-14: As suggested, appropriate references were provided to support the given statements.

RC-15: Hence, most of the R<sub>n</sub> has been partitioned into LE than into H, as introduced by the near surface air temperature difference ( $\Delta T$ ) and the aerodynamic resistance (r<sub>ah</sub>), i.e. propagation errors”. Not clear to me

AR-15: More explanation is provided and the discrepancies in the statement has been removed.

RC-16: “This was evident in the linear regression analysis (Figure 7), ..... with the RMSE 10 of 63.5%”. I don’t see the link with the preceding sentence.” In contrast, Carrasco-Enavids et al. (2013) ..... error of 10%”. In the previous sentence, you are commenting the correlation and the RMSE, this one refers to bias, Not clear.

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AR-16: As suggested, appropriate references were provided to support the given statements.

RC-17: Energy balance (3.2.6): Please provide a figure of EC EB closure in the section 2.2 (and explain if a correlation for EB closure has been applied). The discussion on the EB closure at the date of the LANDSAT images acquisition should be put earlier in the results section.

AR-17: More explanation is provided on Energy Balance Closure. Discrepancies in the statement has been removed. The EB closure and the date of the Landsat image acquisition will be provided prior to the results section.

RC-18: Please check the consistency of the statistical value in the abstract, table and figures.

AR-18: Agreed, there were discrepancies in provided statistical values among the abstract, figures and tables. Those discrepancies have been rectified and the corresponding section of the manuscript has been revised.

RC-19: Technical corrections.

AR-19: All suggested technical corrections has been incorporated in the revised manuscript.

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