

***Interactive comment on* “Temporal variations of evapotranspiration: reconstruction using instantaneous satellite measurements in the thermal infra red domain” by E. Delogu et al.**

Anonymous Referee #1

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The authors touch up on an important aspect for estimating daily, and seasonal evapotranspiration from the remote sensing methods, which only provide an instantaneous calculation of surface energy fluxes (and ET), and usually suffer from data gaps between the days due to cloud cover or satellite revisit frequency. The authors use an extensive in-situ dataset to compare the performance of two commonly used methods, constant evaporative fraction (EF) and Stress Factor (SF) namely, for upscaling the instantaneous to daily ET, and filling the data gaps in the seasonal time-series. Additionally, the study suggests and tests a new function to describe the diurnal variation of EF to improve the daily ET estimation. Although the manuscript suffers a lot from not having a clear and organized structure, I suggest the paper for publication after

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addressing the below mentioned comments.

Specific comments: 1) Organization of the paper is not good and clear: - Introduction is generally too long, and can be made more concise. For example, some results already provided in Introduction section, (e.g. pp 1704, lines 3-5: “This work also . . .”. The results of the paper should be presented only under Results section, not in the introduction.

- Methods are not presented in an organized way. Section 2.1 is called “Method”, but in sub-sections 2.1.1 and 2.1.2, some background theory is presented related with the two methods. The real methodology description (of the paper) starts with section 2.3. Therefore, section 2.1 could be named as “Background theory” and all the sections starting with 2.3 could be grouped under a “method description” section as sub-sections.

- Additionally, providing a flowchart for the two alternative ways (tested in the paper) would improve the readability of the paper.

2) Terminology used in the paper (especially some equations and variable names) is confusing: - In Method 2.1.1 (EF method) and 2.1.2 (SF method), there is confusion between Eq. 1 (pp 1707) and Eq. 3 (pp 1708). In Eq. 1, ETd denotes daily evapotranspiration. But in Eq. 3, what does LETd denote is not mentioned? Is it daily evapotranspiration, or daily total latent heat flux? Since the aim of the paper is to assess the performance of two methods (EF and SF), what they calculate should be consistent and comparable (either both daily evapotranspiration, or both latent heat).

- Besides Eq. 1 and Eq.3, especially some abbreviations (such as LET) are misleading/confusing sometimes. LE generally denotes “Latent heat – the energy consumed for evapotranspiration in $W\ m^{-2}$ ” and ET denotes evapotranspiration (in $mm\ d^{-1}$, $mm\ h^{-1}$, etc.). I suggest to stick to this generally accepted terminology instead of introducing variable names like LETd, LETp, LETpd. Instead of LETp, ETp could be used to represent potential ET (instantaneous) and ETp-d for daily potential ET.

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- In most of the equations, the units of the variables are not explained. The units should be clearly provided under each equation.

3) About Results: - In section 3.1.1, 10% overestimation is mentioned for estimated AEd (compared to measured), which is corrected using 0.9 factor (Eq. 6). However the result of this comparison is not shown. Considering its huge effect on the ET results (in pp 1717 lines 3-7, it is mentioned that all the error statistics related with ET estimations were improved when Eq. 6 was used instead of Eq. 4), it can be good to provide a graph of AEd comparison (estimated vs. observed) because applying a constant factor means there is a systematic bias between estimated and observed AEd.

- There is a wrong calculation of the average % error related with the Table 5. In pp 1722 line 18, the average error for improved EF (Eq.7) is given as 1.9%. However, this average calculation didn't pay attention to the cancelling-out effect of error signs (for example, average of 3.6% and -2.1% is not 0.8%, but it is 2.9%). Based on the errors given in Table 5, the real average error for variable EF is found as 6.5%, not 1.9%.

- In section 3.3. (pp1722, lines 17-19), the authors indicate the average errors of 15.8% for constant EF and 1.9% (in reality 6.5%) for variable EF. As understood from section 2.2., measurements from eddy covariance systems were used as the reference for these comparisons. Kalma et al. (2008 and references therein) provides an extensive review of land surface evaporation estimation, and state that even the ground-based ET flux measurements derived from Bowen ratio and eddy covariance systems have an uncertainty of around 20-30% generally. However, the authors don't mention about these in-situ measurement uncertainties in the results section. With the current in-situ measurement uncertainty levels, is it really realistic to achieve EF estimation accuracies as low as 1.9%? Additionally, it is understood that the proposed variable EF (Eq.7) provides improvement only for little or no water stress days, while constant EF gives better result for water stress days. If not generally applicable, can the proposed Eq.7 be really an "efficient operational" alternative? A better discussion of the results is needed in section 3.3.

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Technical corrections: - Do not use (...) when providing a list of things in parenthesis (E.g. pp1702 line 11; pp1705 line 19; pp1706 line 19). If the list is not complete, you can end the list like (Landsat, Aster, among others).

- pp1702, line 14, What is CNES? Always provide the full name when you use first time an abbreviation.

- pp1704, line 8: Replace “For theses..” with “For these..”.

- pp1706, lines 5-9: Divide the long sentence into two as following: “.. during the day. The self preservation of EF is, ...”

- Be consistent with using the subscripts. For example, in Eq. 1 (pp. 1707) it is used as AEd, but in pp.1711 line 15 it is used as AEd. Same as in pp 1716 lines 6-7, LETP or LETp?

- pp 1712, line 12: use “.. cloudy days,..” instead of “..cloudy sky days, ..”

- Some of the section titles are unnecessarily too long. For example, the title of section 2.5.3 (pp. 1713) can be shortened as “Testing the methods with in-situ data”.

- pp1714, line 5: Title of section 2.6 is again too long. “Estimating the seasonal ET” is sufficient since you can provide the details under the section.

- pp1713, line 26: What IRT stands for? When an abbreviation introduced first time, provide the full name in parenthesis.

- pp1730: In Table 2, does “Rs” stand for Remote Sensing? If so, better to use “RS” instead of “Rs”.

- pp1718, line 14: change “In the previous paragraphs, ..” with the specific section name like “In section 3.1.3, ..”.

- In pp1721, line 8 it is mentioned “..,results do not vary significantly..”, then further in line 8 change it as “..performances of the interpolation algorithm do not drop signifi-

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cantly”.

- “Time of day representativeness” is already covered in section 3.1.4 and section 3.2.2 (About the time of overpass) does not provide any new information. Then, it’s better to remove the redundant section 3.2.4.

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