We would like to acknowledge the work done by the handling editor and the four anonymous referees. We have followed the referees' recommendations, making the necessary changes in the manuscript. Answers to the referees' comments are given below, where the original reviewer's comments are highlighted in quotation marks in order to proceed with a point-by-point response of how we have addressed each concern as requested by the editor. Please also find attached the revised version.

Referee #3

"The goal of this study is to redistribute observed solar radiation to complex terrain by considering topographic effects. The method presented in the paper can be applied to other complex terrain. However, a major drawback of this method is presented in Figures 5-7, in which significant negative biases are observed at station 802 when solar radiation is high. In Table 1, we see this station has a much higher elevation (2500 m) than other stations that were used as the basis of radiation interpolation. The physics behind the biases is that the surface solar radiation is highly sensitive to elevation, while this is not taken into account, although the authors had tried to consider the slope angle, orientation and shadowing. A high elevation means low air mass, and thus low Rayleigh scattering, water vapor absorption and aerosol scattering, resulting in high solar radiation (see examples in Yang et al., 2010). Due to this sensitivity, the solar radiation cannot be directly extrapolated to elevations beyond the elevation range of stations. A possible way to solve this issue is to interpolate a normalized radiation, for instance, Rg/Rg,clr (Rg,clr is the clear-sky radiation). Actually, the prediction of this normalized radiation was originally presented by Angstrom (1924). Rg,clr at each cell can be easily calculated, and then Rg can be obtained from the interpolated Rg/Rg,clr and cell-based Rg,clr. In the literature, you may find a number of models for clear-sky radiation calculation (e.g. Annear and Wells, 2007; Tham et al., 2009). These systematic errors should be corrected before considering the acceptance of this paper."

We fully agree with the referee and acknowledge the suggestion and methodology proposed for the consideration of altitude in the interpolation process. In fact, once the manuscript was submitted to HESSD, we realized that we should have included the elevation as a factor in the spatial distribution of the clearness index and started to do some trials concerning different methodologies. Finally, we decided to apply the methodology proposed by Ineichen and Perez (2002) as a first approximation and to include more meteorological data available for station 802 (2 July 2010). As stated by the referee, the systematic errors in station 802 have disappeared, and, therefore, the results have improved. However, in the future, we would like to look more deeply into the deviations of the results of the methodology here proposed. For this, the different references given by the referee constitute an interesting source of information and some of them have already been included in the revised manuscript.

Thus, there have been changes in all the sections of the manuscript: introduction, material and methods, results, conclusions and references. However, the major changes take place in section 2.2.1. "Beam and diffuse component estimation on horizontal surfaces", and in section 3.2. "Validation of topographic corrections".

The changes in the manuscript point-by-point are the following:

Page 2, line 19: Reference to Annear and Wells, 2007 has been included.

Page 3, line 4: References to Batllés et al., 2007 and Yang et al. 2010 have been included.

Page 5, line 26: Ineichen and Perez (2002) has been included when explaining the basis of the algorithm: “Thus, an algorithm was derived from Dozier (1980), Jacovides et al. (1996) and Ineichen and Pérez (2002) to take into account the lack of weather stations at high altitudes.”

Page 8: Section 2.2.1. has practically been rewritten. Please see the revised version.

Page 16, line 11: As more available datasets have been included in the analysis, the sentence changes, as follows: “for the period comprised between 4 November 2004 and 2 July 2010.”

Page 19: Section 3.2. has practically been rewritten. See the revised version.

General changes:

As some new equations appear in section 2.2.1., the following equations had to be renumbered.

After the change in the methodology all the figures from the results section were redone.

The following references were added:

Annear, R. L. and Wells, S.A.: A comparison of five models for estimating clear-sky solar radiation, Wat. Resour. Res., 43, W10415, 2007.

Ineichen, P.: Comparison of eight clear sky broadband models against 16 independent data banks, Sol. Energy, 80, 468-478, 2006.

Kasten, F. and Young, A.T.: Revised optical air mass tables and approximation formula, App. Optics., 28(22), 4735-4738, 1989.

Li, X., Koike, T., and Cheng, G.D.: Retrieval of snow reflectance from Landsat data in rugged terrain. Annals of Glaciology, 34, 31-37, 2002.

Mavromatakis, F. and Franghiadakis, Y.: Direct and indirect determination of the Linke turbidity coefficient, Sol. Energy, 81, 896-903, 2007.

Tham, Y., Muneer, T., and Davison, B.: A generalized procedure to generate clear-sky radiation data for any location, Int. J. Low-Carbon Tech., 4, 205-212, 2009.

Yang, K., He, J., Tang, W.J., Qin, J., and Cheng, C.C.K.: On downward shortwave and longwave radiations over high altitude regions: Observation and modeling in the Tibetan Plateau, Agric. Forest. Meteorol., 150, 38-46, 2010.

Minor comment:

“Abstract: “Among them, solar radiation plays an important role, especially in arid environments, as it is a key variable to the circulation of water in the atmosphere.” In arid environment, evaporation is water limited rather than energy-limited. It is not necessary to address “especially in arid environments” here.”

We acknowledge this suggestion and therefore “especially in arid environments” has been deleted.

Referee #4

I fully agree with the former two reviewers that the topic of the paper should be interesting to the readers of HESS and it meets basic scientific quality to be published on HESS. However, there are still some drawbacks that prevent the paper to be *published in its current form. Some parts of the paper, especially the methodology section need to be revised for the sake of more clarity. My suggestion in general would be that the paper needs a medium revision before acceptance for publication.*

Major comments:

"1. It is very straightforward that the topographically corrected and IDW interpolated radiations will be different. So I am wondering if it is meaningful to compare them just using Figure 4. More quantitative comparisons are expected!"

We appreciate this suggestion as the inclusion of more numerical results has helped to contrast the arguments previously stated.

More quantitative comparisons at different time scales have been incorporated in terms of basic statistics of the distributed estimates through both methodologies: the absolute minimum and maximum values in the watershed, as well as the mean and standard deviation of the estimates. Thus, differences between both methods at an hourly, daily and annual scale can be quantified. Also, the calculation was applied for several days and hydrological years in order to assess a general trend.

Thus, some paragraphs have been added (Page 17, lines 14-19, 22-23, 27-30; Page 18, lines 13-19, 23-30) as well as 3 new tables (Tables 2,3 and 4). Please see complete section 3.1. in the revised version (Page 16).

Table 2. Maximum, minimum, mean and standard deviation (MJ/m^2/h) of hourly solar radiation estimates in the watershed on the 20/11/2004 obtained by the topographic approximation and IDW to the values measured at stations with hourly available datasets (601, 602, 603 and 802)

	Topographic (MJ/m^2/h)				IDW (MJ/m^2/h)			
Hour	Min	Max	Mean	σ	Min	Max	Mean	σ
08:00	0.03	0.83	0.18	0.09	0.14	0.29	0.19	0.04
09:00	0.06	2.81	0.85	0.54	0.39	1.21	0.92	0.18
10:00	0.06	3.51	1.43	0.72	0.92	1.91	1.56	0.20
11:00	0.06	3.78	1.84	0.72	1.26	2.38	2.00	0.24
12:00	0.07	3.88	2.05	0.71	1.48	2.61	2.23	0.26
13:00	0.07	3.86	2.05	0.70	1.55	2.64	2.23	0.27
14:00	0.06	3.74	1.83	0.70	1.37	2.43	2	0.26
15:00	0.06	3.46	1.40	0.68	0.92	1.95	1.55	0.23
16:00	0.06	2.69	0.81	0.50	0.43	1.20	0.92	0.16
17:00	0.03	0.61	0.15	0.07	0.12	0.21	0.18	0.02

Table 3. Maximum, minimum, mean and standard deviation (MJ/m^2/day) of daily solar radiation estimates in the watershed on selected days obtained by the topographic approximation and IDW to the values measured at stations with daily available datasets (601, 602, 603, 702 and 802)

	Topographic (MJ/m^2/day)				IDW (MJ/m^2/day)			
Day	Min	Max	Mean	σ	Min	Max	Mean	σ
20/11/2004	0.56	24.77	12.59	4.31	10.67	14.40	13.08	0.66
01/01/2005	0.50	23.26	11.03	4.23	7.72	14.55	11.23	1.45
30/03/2005	0.93	29.81	23.27	3.52	20.98	26.97	24.26	1.30
02/06/2005	3.77	31.94	27.94	2.09	27.30	30.93	29.55	0.77
20/07/2005	2.86	29.41	24.53	2.39	20.18	28.78	26.22	1.36

Table 4. Maximum, minimum, mean and standard deviation ($MJ/m^2/year$) of annual solar radiation estimates in the watershed obtained by the topographic approximation and IDW to the annual accumulated values measured at stations with daily available datasets (601, 602, 603, 702 and 802)

	Topographic $MJ/m^2/year$				IDW $MJ/m^2/year$			
Year	Min	Max	Mean	σ	Min	Max	Mean	σ
2004-2005	773.4	8594.8	6701.8	910.8	6127.8	7794.2	7019.0	370.0
2005-2006	799.3	8362.5	6464.6	861.9	6009.3	7586.7	6750.2	353.4
2006-2007	803.6	8144.3	6372.9	809.7	6020.1	7429.5	6558.3	326.6
2007-2008	779.1	8337.9	6548.4	858.5	6280.0	7562.1	6782.6	286.5
2008-2009	784.9	8210.5	6395.9	813.2	6032.1	7467.2	6633.6	312.1
2009-2010	650.6	6242.9	4233.8	660.1	4478.0	6416.6	5436.1	391.6

"2. How the radiation observation obtained at a horizontal surface and without any obstruction (station 702 and 802) can be used to evaluate the terrain effect?"

In this study, a DEM with a horizontal resolution of 30 x 30 m is the basis for the distributed computation. By applying the topographic approximation, we can compute the estimated values of solar radiation in the cells that contain the stations. Such cells are affected by the surrounding terrain, in terms of high hills that block direct radiation, the sky view factor visible to such cells, etc.

On the other hand, the measurements taken at both stations constitute a point source of information, but at the same time for the purposes of these studies we can assume that such registers constitute representative mean values for the cell on which they are located. Therefore, even though the sensors of pyranometers at the stations are placed horizontally and without immediate obstruction, their registers are still affected by the topography in neighbour cells (e.g. shading cast by the nearby terrain). So, by comparing the solar radiation values predicted by the topographic approximation disregarding both stations' data in the cells where they are located with the measurements registered at both stations, the effect of the terrain can be evaluated. Similar evaluations can be found in the literature where the influence of the cell size in these comparisons is also assessed (e.g. Tovar-Pescador et al., 2006; Batllés et al., 2008; Martínez-Durbán et al., 2009).

In the future, we are planning to consider spatially continuous radiation values derived directly through remote sensing techniques for the spatial evaluation of the role of topographic effects. But up to now, the evaluation is carried out with ground measurements which are assumed to represent the average value of the cell on which they are located. Therefore, for the sake of more clarity, the following paragraph was added (Page 7, line 11 in the revised manuscript): "Even though the measurements at meteorological stations constitute a point source of information, for the purposes of these studies, those registers can be assumed to constitute representative average values for the cell on which they are located (Batllés et al., 2008; Martínez-Durbán et al., 2009)."

"3. Is there any quantitative link between ET estimation and Rn? Evaluate the impact using Figure 5 is not enough. More quantitative evaluation is needed."

Once again, we appreciate this suggestion as the inclusion of more data has helped to contrast the results previously obtained. We assume that the referee meant previous Figure 10 instead of Figure 5.

Statistics of daily and annual ET_0 maps produced by both methods have been included (Tables 6 and 7), together with the difference between the corresponding averaged daily ET_0 values at watershed scale and the annual accumulated difference between both methods (figure 9 in the revised text). Thus, some paragraphs have been added (Page 21, lines 14-23 and second paragraph) as well as 2 new tables (Tables 6 and 7) and a new figure (figure 9). Please see complete section 3.3. in the revised version (Page 21).

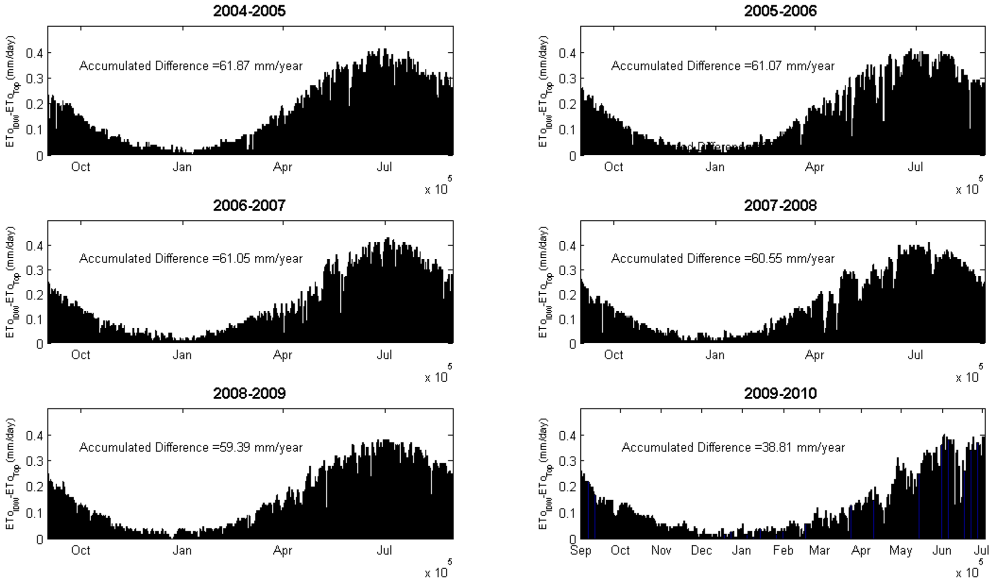
Table 6. Maximum, minimum, mean and standard deviation (mm/day) of daily evapotranspiration estimates in the watershed on selected days with global radiation topographically corrected and IDW interpolated

	Topographic (mm/day)				IDW (mm/day)			
Day	Min	Max	Mean	σ	Min	Max	Mean	σ
20/11/2004	0.15	3.60	1.68	0.74	0.9	2.20	1.71	0.26
01/01/2005	0.1	3.30	1.35	0.70	0.6	1.90	1.36	0.24
30/03/2005	0.2	5.42	3.89	0.61	3.3	4.8	4.07	0.22
02/06/2005	0.2	5.64	4.42	0.43	4.2	5.6	4.77	0.25
20/07/2005	0.9	7.12	5.46	0.74	3.3	7.1	5.78	0.64

Table 7. Maximum, minimum, mean and standard deviation (mm/year) of annual evapotranspiration estimates in the watershed on selected days with global radiation topographically corrected and IDW interpolated

	Topographic mm/year				IDW mm/year			
Year	Min	Max	Mean	σ	Min	Max	Mean	σ
2004-2005	83.24	1472.6	1117.9	159.6	898.8	1358.4	1179.9	66.5
2005-2006	75.7	1386.9	1020.7	145.2	862.2	1286.1	1081.8	57.4
2006-2007	17.85	1317.6	992.7	137.1	917.3	1221.8	1053.6	49.9
2007-2008	51.42	1360.1	1036.2	143.2	981.1	1245.6	1096.8	46.8
2008-2009	78.8	1325.7	1032.3	131.5	939.4	1236.2	1091.6	44.2
2009-2010	42.77	943.6	702.1	103.4	632.1	864.3	747.6	32.9

Figure 9. Daily differences between mean ET_0 estimates at watershed scale with global radiation IDW interpolated and topographically corrected ($ET_{0\ IDW}$- $ET_{0\ Top}$)



"4. How the Rg is calculated is never introduced."

Following next comment 6 and with the modification in the methodology according to referee 3, the whole material and methods section has been re-ordered and changed. In this way, we have tried to better explain the calculation of R_g at each step of the calculation process: 1) distributed R_g values on horizontal surfaces ($MJ/m^2/day$) once fCI_{cl} and CI_{cs} are available at the cell scale for the derivation of daily beam and diffuse solar radiation fields on horizontal surfaces (Page 10, line 24). 2) by aggregation of the hourly global radiation estimates at the cell scale on tilted surfaces once topographic corrections have been carried out (Page 14, line 7).

"5. How the CI is defined needs to be introduced. CI or transmissivity may vary significantly in space in mountainous areas. Suppose that the CI in 4000m can equal to that in 1000 m. Obviously, the spatial heterogeneity of CI, which depends on elevation, needs to be considered. Using IDW to interpolate CI is too straightforward but not reasonable. Additionally, CI (in table 1) should also have a time variation. How it is considered (or not) should be clarified."

We completely agree with this comment. The explanation can be justified with the response to referee 3 after a modification of the methodology in order to include an atmospheric correction with altitude pixel by pixel. Please, see section 2.2.1. of the revised version. As for the time variation, the assumptions taken in this first approximation are justified from line 15 in Page 10 till line 11 in Page 11. And, even though the assumptions at hourly scale may appear to be rather simplistic, the results obtained in the validation of topographic corrections (section 3.2) confirm the validity of the assumptions made in the algorithm, as discussed in section 3.2. (from line 22 in Page 19 till line 31 in Page 20). Nevertheless, the installation of a denser monitoring network would provide the spatial scheme required for the spatial interpolation of hourly values. Thus, as stated in the conclusions of the paper, on-going work is trying to develop a further approach through the establishment of two additional weather stations (from line 25 in Page 22 till line 3 in Page 23).

6. The organization is bad, especially the Methodology Section. For this section, I would suggest to put the first two paragraphs in Section 2.3 at first, followed by "beam and diffuse component estimations on the horizontal surfaces" (section 2.2.1), and then "conversion from estimates on horizontal surfaces to titled surfaces" (section 2.2.2). Section 2.3.1 and 2.3.2 should be subsections under "conversion from estimates on horizontal surfaces to titled surfaces". Additionally, the whole section should be simplified for more clarification. There are also many redundant descriptions this section as well as other places. After the re-organization, some redundant descriptions should be omitted.

We have re-organised the section as proposed by the referee, simplified certain descriptions and omitted some well-known statements. In addition, the modification of the methodology as suggested by referee 3 has been included in section 2.2.1. In this way, we hope to have gained clarification with these changes. However, as with this new organization there would be more than three levels of sectioning, bullet points instead of numbering are applied under section 2.2.2. in order to meet HESS manuscript preparation's rules. Please, see section 2.2. of the revised version (Page 7).

Another example:
In page 15, the following sentences "the clearness index was obtained for each station and spatially interpolated following the inverse distance weighed (IDW) method, in order to distribute it throughout the watershed." should be moved to the Section of Method.
The following sentences "Therefore future research is proposed into the spatial distribution of this index while a simple spatial interpolation technique is applied as a first approximation in the present study" should be moved to the Section of Conclusion.

We agree with the referee and those sentences have been moved or deleted according to the change in the methodology.

After the re-organization of the manuscript the following references were deleted:

González, J.A. and Calbó, J.: Influence of the global radiation variability on the hourly diffuse fraction correlations, Sol. Energy, 65, 119-131, 1999.

Stefano, C.D. and Ferro, V.: Estimation of evapotranspiration by Hargreaves formula and remotely sensed data in semi-arid mediterranean areas, J. Agric. Engin. Res., 68, 189-199, 1997.

Zaksek, K., Podobnikar, T., and Ostia, K.: Solar radiation modelling, Comp. Geosci., 31, 233-240, 2005.

7. There are many confused definitions of solar radiation. Clarification of solar radiation and radiation flux (irradiance) is needed.

We have unified the terminology in terms of solar radiation for a certain time step (e.g. hourly, daily, annually) and so the terms irradiance and flux have been replaced throughout the text (Page 3, lines 18 and 19; Page 12, lines 22 and 23; Page 13, lines 9 and 10; Page 14, lines 3, 4 and 6).

8. I am arguing if Eq. 11 is correct. For more details, see Li et al., 2002. Li X, Koike T, Cheng GD. Retrieval of snow reflectance from Landsat data in rugged terrain. Annals of Glaciology, 2002, 34: 31-37.

Reflected solar radiation towards the surface is calculated as an average radiation reflected from neighbor surfaces corrected by a terrain configuration factor similar to the shape factor (F_{ij}) in Li et al. (2002). Rigorous calculation of the configuration factor is difficult and may not be worth the extra computation (Dubayah et al., 1990) as it would be necessary to consider every terrain facet visible from a pixel. This could be solved through the approximation in Li et al. (2002) when pixel resolution is very high or under the assumption of an infinitely long slope as applied in this study (Dozier and Frew, 1990; Dubayah et al., 1990). Therefore, we estimated reflected solar radiation by assuming that both, beam and diffuse radiation reflect isotropically from a horizontal surface located at the foot of the inclined slope as numerous authors have already proposed (Liu and Jordan, 1963; Dozier and Frew, 1990; Dubayah et al., 1990; Tian et al., 2001; Allen et al., 2006; Tasumi et al., 2006). According to Allen et al. (2006), this is a reasonable and common assumption for unknown specific surface conditions at a point and at surrounding points. In this way, the terrain configuration factor for an infinitely long slope is the term in brackets in Eq. 12 in the revised version. And finally the product of the albedo and the sum of direct and diffuse hourly radiation on the horizontal surrounding pixels would represent the amount of radiation leaving the pixels in the neighborhood of the one considered. Anyway, we appreciate the suggestion of the referee as there was a mistake in the subscripts and therefore, Eq. 12 has been corrected as:

$$r_{r,\beta\gamma} = \rho \cdot \left[\left((1+\cos\beta)/2 \right) - SVF \right] \cdot \left(r_d + r_b \right) \qquad (12)$$

9. How the daily radiation is integrated from sunrise to sunset is not clear.

In order to clarify its calculation, the following paragraph has been added (Page 8, line 21): "In order to obtain the total amount of global radiation during one day ($MJ/m^2/day$), extraterrestrial radiation (Eq. (1)) must be integrated from sunrise to sunset. Thus, by assuming that the solar beam angle originates from the center of the solar disk, Eq. 1. was integrated following the expressions in Iqbal (1983) between the beginning and ending sun-hour angles when the sun's beam first and last strikes the surface (Allen et al. 2006)."

10. Cited references are a bit out of date. Related literatures published in recent years should be cited.

With the modification of the methodology and in order to complete the comments of the referees we have incorporated the following references:

Annear, R. L. and Wells, S.A.: A comparison of five models for estimating clear-sky solar radiation, Wat. Resour. Res., 43, W10415, 2007.

Batlles, J., Bosch, J. L., Tovar-Pescador, J., Martínez-Durbán, M., Ortega, R., and Miralles, I.: 2008. Determination of atmospheric parameters to estimate global radiation in areas of complex topography: Generation of global irradiation map, Energy Conv. and Manag., 49, 336–345, 2008.

Gavilan, P., Estévez, J., and Berengena, J.: Comparison of standardized reference evapotranspiration equations in southern Spain, J. Irrig. Drain. Eng., 134, 1-12, 2008.

Ineichen, P.: Comparison of eight clear sky broadband models against 16 independent data banks, Sol. Energy, 80, 468-478, 2006.
Kasten, F. and Young, A.T.: Revised optical air mass tables and approximation formula, App. Optics., 28(22), 4735-4738, 1989.
Li, X., Koike, T., and Cheng, G.D.: Retrieval of snow reflectance from Landsat data in rugged terrain. Annals of Glaciology, 34, 31-37, 2002.
Mavromatakis, F. and Franghiadakis, Y.: Direct and indirect determination of the Linke turbidity coefficient, Sol. Energy, 81, 896-903, 2007.
Martínez-Durbán, M., Zarzalejo, L.F., Bosch, J. L., Rosiek, S., Polo, J., and Batlles, F. J.: Estimation of global daily irradiation in complex topography zones using digital elevation models and meteosat images: Comparison of the results, Energy Conv. and Manag., 50, 2233-2238, 2009.
Suehrcke, H.: On the relationship between duration of sunshine and solar radiation on the earth's surface: Ångström's equation revisited., Sol. Energy, 68, 417-425, 2000.
Tham, Y., Muneer, T., and Davison, B.: A generalized procedure to generate clear-sky radiation data for any location, Int. J. Low-Carbon Tech., 4, 205-212, 2009.
Yang, K., He, J., Tang, W.J., Qin, J., and Cheng, C.C.K.: On downward shortwave and longwave radiations over high altitude regions: Observation and modeling in the Tibetan Plateau, Agric. Forest. Meteorol., 150, 38-46, 2010.

11. It is suggested to have someone who has a good knowledge of technical English writing read the paper and revise the grammar

A second professional revision has been made all through paper.

There are also some minor comments as listed below.
1. Abstract is too long and needs to be simplified.

Abstract has been simplified. Please, see the revised version.

2. The second to forth paragraphs of Section 2.2 is well known and can be shortened.

Paragraphs have been substantially shortened and re-allocated after the reorganization of section 2.2. (Page 7 in the revised version).

3. Eq 5 and 6 can be omitted because the transmissivity is not used in the paper. Keeping the two equations may cause some confusions.

Both equations have been deleted.

4. Units of solar radiation need to be specified all through the paper.

Units have been specified in the material and method's section every time we name a variable for the first time.

(Page 8, line 21; Page 9, line 8 and 9; Page 10, line 25; Page 11, line 2, 12 and 22; Page 13, line 5 and 19; Page 14, line 2 and 8).

5. In Section 2.4, how the values of Cd and Cn are estimated?

Those coefficients are fixed values by the FAO (Allen et al., 1998).

By defining the reference crop as a hypothetical crop with an assumed height of 0.12 m having a surface resistance of 70 s m^{-1} and an albedo of 0.23, closely resembling the evaporation of an extension surface of green grass of uniform height, actively growing and adequately watered, the FAO Penman-Monteith method was developed for the calculation of the daily reference evapotranspiration (Allen et al., 1998). For such reference conditions *Cd* and *Cn* are fixed values: 900 and 0.34 respectively. Then, the parameterization for hourly time-steps calculations led to the equation known as FAO56-PM (Allen et al., 1998). Finally, in order to unify criteria concerning the reference surface and to simplify and clarify the application of the FAO56-PM equation, the ASCE derived the ASCE-PM equation (Eq. 13) including the variation of the resistance coefficients depending on the reference crop, the temporal time-step and, for hourly time-steps, different values for daytime and night time.

In this study, the same reference crop as the one in the FAO Penman-Monteith method is considered and for the daily time step the values of the coefficients are the same as the ones fixed in the FAO Penman-Monteith method (*Cd* = 900 and *Cn* = 0.34) (Itenfisu et al., 2003; Gavilán et al., 2007, 2008). Thus, the following sentence has been added for a better understanding in Page 15, line 9: "Here, the reference surface defined in the FAO PM equation was considered so that for daily time steps the values of Cd and Cn were 900 and 0.34 respectively (Allen et al., 1998; Gavilán et al., 2008)."

7. Description of longwave radiation should be moved to the section of method.

Description of longwave radiation is in section 2.3. (second paragraph in Page 15)

6. Why the emissivity can be assumed as 1?
8. Eq 14 is absolutely incorrect. Can Ts=Ta?!

The main drawback in the application of the ASCE-PM equation at watershed scale is the common lack of measurements not only in terms of density of meteorological stations but also in terms of the registered variables (e.g. net radiation, air vapor pressure). This is the reason why, for the application of reference evapotranspiration equations, numerous authors show alternatives for certain meteorological variables when no measured data are available (e.g. Doorenbos and Pruitt, 1977; Allen, 1986, Wang and Georgakakos, 2007; Blonquist et al., 2010; etc.). Among them, net radiation is expensive and difficult to measure accurately, especially at broad scales. That is why net radiation is often predicted with models based on measurements of incoming shortwave radiation, air temperature, and humidity (Blonquist et al., 2010).

Net radiation is the sum of net shortwave radiation and net longwave radiation. According to the ASCE-EWRI (2005), the incoming shortwave radiation is the only measured term in the computation of net radiation for reference ET computations, and all other terms are calculated. For net shortwave radiation (Eq. 14), the albedo of the surface is required. A constant value of 0.23 is recommended to represent the standardize reference surface (ASCE-EWRI, 2005) even though, in reality, albedo varies with the zenith angle and the properties of the underlying surface (crop, growing season, etc.) (Blonquist et al., 2010). For the net longwave radiation most of the available models simply apply a modification to Stefan-Boltzmann's law due to the absorption and downward radiation from the sky by predicting a net surface emissivity due to the lack of available records of the surface temperature. Thus, the product of the Stefan-Boltzmann's constant and the mean air temperature to the fourth power is multiplied by a cloudiness factor and an air humidity factor (Allen et al., 1998; Donatelli et al., 2006; Blonquist et al., 2010).

In our study we tried to arrive to a similar expression from the consideration of net longwave radiation as the difference between incident longwave radiation from the atmosphere and the longwave radiation emitted from the reference surface. For this, we had to assume that the emissivity of the reference crop could be approximated to 1 according to Stefano and Ferro (1997) and Taylor (1979) who obtained values of 0.97-0.98 in vegetated areas. Besides, surface temperature is the variable most difficult to obtain in a systematic daily and distributed way, given the general absence of surface sensors. As the simplest solution according to Llasat and Snyder (1998) is to assume that the surface temperature is equal to the temperature measured in a standard shelter, we concluded that both the air temperature and the temperature of the reference surface could be expressed just as the mean air temperature. Thus, the expression for net longwave radiation would remain as previously done by other authors (Allen et al., 1998; Donatelli et al., 2006) as a modification to Stefan-Boltzmann's law. That is, the product of the Stefan-Boltzmann's constant and the mean air temperature to the fourth power is multiplied by the emissivity of the atmosphere as indicator of both, cloudiness and air humidity. However, as these assumptions are only applicable within the scope of the calculation of ET over the reference surface, references to the emissivity and temperature of the surface have been deleted in order to avoid misunderstandings (second paragraph in Page 15) and Eq. 15 rewritten as:

$$R_{nl} \approx (\varepsilon_{atm} - 1) \cdot \sigma \cdot T^4 \qquad (15)$$

9. In Figure 1. Labels such as place names should be added.

Figure 1 has been redone:

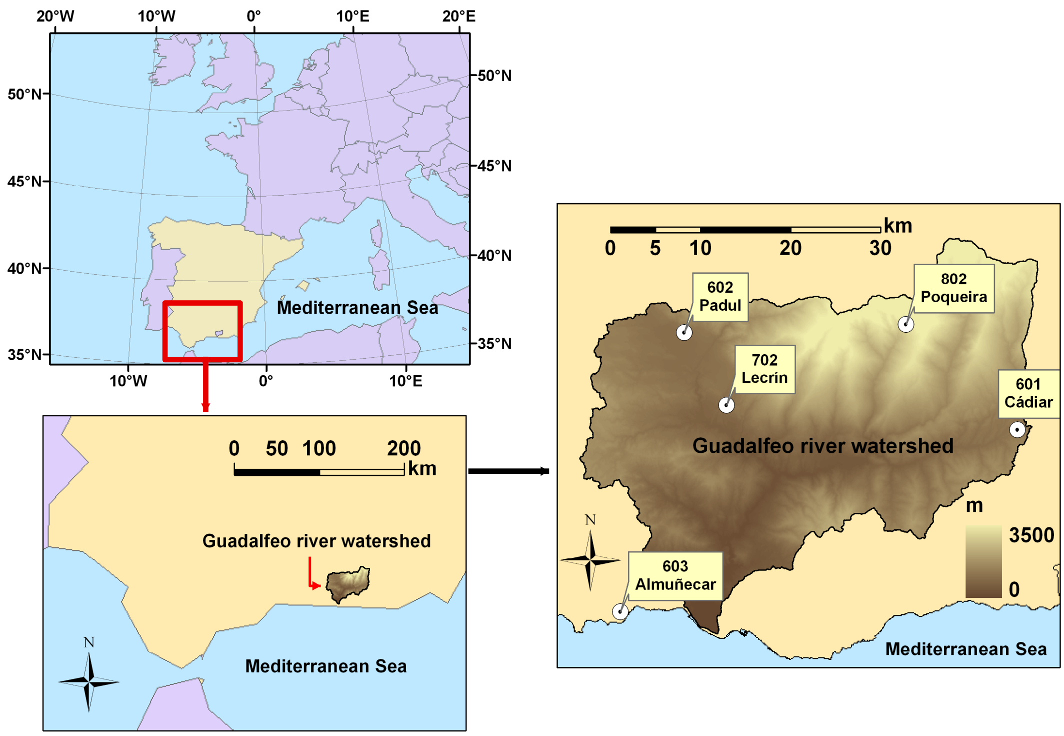


Figure 1. Guadalfeo River Watershed, weather stations and DEM

10. Figure 2 and 3 can be omitted.

Both figures have been deleted, and so the rest of the figures had to be renumbered.

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