Interactive comment on "Optimal Site Selection for Sittinga Solar Park using Multi-Criteria Decision Analysis and Geographical Information Systems (GIS)" *by* Andreas Georgiou and Dimitrios Skarlatos

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We would like to extend our sincerest gratitude to the reviewer for the very useful comments and suggestions. The review was very motivating and inspiring. We will respond to the comments and questions below in the order that they were presented.

[COMMENT #1]: First think I would, therefore, suggest to the authors is to explicitly state where their work differs from the other similar works in the field that they cite. By those means the reader would easily identify the added value of this work.

[RESPONSE]: In order to address this comment, a paragraph in "Introduction" section

has been added where explains the difference of our work with other similar works: "Innovative aspects comprise of straightforward integration and modeling of available tools, the integrated evaluation of potential sites taking into consideration a variety of constrains and criteria and the overall development of a consistent methodology which is flexible enough for applying "what if" scenarios".

[COMMENT #2]: The list of references is adequate. The English, though, should be checked again throughout the whole text.

[RESPONSE]: We read carefully the whole text and we enriched it with proper use of English through out of it.

[COMMENT #3]: The Introduction presents some rather trivial issues like the plus and minus of solar and PV power, etc. I would suggest that the authors provide for a shorter introduction to their paper that will focus mainly on what they have done.

[RESPONSE]: The introduction has been extended following the comments of reviewers on the RSCY 2013 conference, where an initial approach has been announced.

[COMMENT #4]: I would suggest that Chapter 2 'Materials and methods' would start with Figure 3 that presents the methodological framework developed.

[RESPONSE]: We accepted this useful suggestion. In addition, in order to improve the paper's clearness the structure of the paper rearranged like: 1 Introduction; 2 Material and Methods; 2.1 The AHP Method; 2.2 Simple Additive Weighting (SAW) method; 3 Case Study; 3.1 Study Site; 3.2 Preparation of the geo-database; 3.3 Landsat-8 OLI/TIRS data pre-processing; 3.4 Classification of main area categories; 3.5 Establishment of Constraints factors; 3.6 Establishment of Evaluation criteria and normalization; 3.7 Rationale for weights in AHP; 4 Results; 4.1 Suitable areas suggestions 4.2 Sensitivity Analysis; 5 Discussion; 6 Conclusions.

[COMMENT #5]: Then, an explanation of the several steps adopted should be realized.

[RESPONSE]: The several steps of the current methodological framework are briefly

described in section 2 named "Material and Methods": "The presented methodological framework involves several stages as presented in Fig.1 and were grouped as: (i) Collection of data; (ii) Set up of the GIS model; (iii) Sensitivity analysis; and (iv) Extraction of the suitability maps. More specific, the first step is to define and gather all appropriate data layers that needed for the analysis in order to set up the digital geo-database. The next step is to establish the constraint factors that will determine unsuitable areas and will be in form of a binary map; where "0" refers to unsuitable areas and "1" to areas suitable for further examination of solar exploitation. At the exclusion areas, local and EU legislations where used to define criteria in addition with GIS and Remote Sensing techniques for the production of them. The next step is to establish the cost functions for all available criteria and estimation of weights of the evaluation criteria according the AHP algorithm. These weights based on subjective criteria that can be changed accordingly the needs of researchers. The final step consists of the formulation and calculation of the final suitability index map using the SAW method and the presentation of the results in thematic maps".

[COMMENT #6]: Subsequently in Chapter 3 'Case-study' the application of the framework should unfold.

[RESPONSE]: Due to the new structure of the paper as described earlier in Comment #4, the "Case – Study" Chapter extended in a way to explain to the reader the several steps we have made in more comprehensive descriptive and analytical way. The structure of Chapter 3 it is as follows: 3 Case Study; 3.1 Study Site; 3.2 Preparation of the geo-database; 3.3 Landsat-8 OLI/TIRS data pre-processing; 3.4 Classification of main area categories; 3.5 Establishment of Constraints factors; 3.6 Establishment of Evaluation criteria and normalization; 3.7 Rationale for weights in AHP.

[COMMENT #7]: Figure 4 is not very instructive; it cannot be read. The authors may want to replace it or delete it.

[RESPONSE]: We totally removed Figure 4.

[COMMENT #8]: In Table 2 there is no point in having a column Normalization if this is the same for all criteria.

[RESPONSE]: We removed the column "Normalization".

[COMMENT #9]: In section 3.3 the term 'cost function' should be explained.

[RESPONSE]: In order to be more understanding, we rephrase the whole paragraph as follows: "The evaluation criteria that score the potential sites are based mainly on financial parameters as presented in Table 2. After the evaluation criteria were determined and assessed, they were normalized through cost functions in a scale from 0 to 100 in order to allow direct comparability, with 100 representing the most desired value (low cost) and 0 representing the most undesired value (high cost). Some standardize evaluation layers were calculated using and inverse distance cost function, i.e. main roads and distance from them".

[COMMENT #10]: A number of 'cases' are explained and properly introduced in section 4.1 sensitivity analysis, even though the authors refer to these cases earlier in text for example line 262. The authors may want to correct this inconsistency.

[RESPONSE]: We corrected this inconsistency through the paper by explaining briefly these cases only in section 4.2 named "Sensitivity Analysis".

[COMMENT #11]: Chapter 4 starts with text that it is not numbered. I suggest that all sections are numbered.

[RESPONSE]: We add a sub-chapter 4.1 named "Suitable areas suggestions"

[COMMENT #12]: In Figure 6 the right down part presents some type of distribution that is not explained nor can be read.

[RESPONSE]: We explained this graph through the text and in the caption of the Figure as well. The number of Fig. changed to 5 as we did some rearrangements.

[COMMENT #13]: Line 9: Please replace dependable with reliable [COMMENT #14]:

Line 25: Please replace summation rule with weighted summation rule

[RESPONSE]: We accepted these recommendations.

[COMMENT #15]: Line 30: Please explain what is GUI?

[RESPONSE]: We explained it as follows: "The suggested methodological framework applied can be easily utilized by potential investors and renewable energy developers, through a front end web based application with proper Graphic User Interface (GUI) for personalized weighting schemes".

[COMMENT #16]: Line 36: Please put security of supply

[RESPONSE]: We accepted this recommendation.

[COMMENT #17]: Lines 43-46: Please rewrite sentence with better English

[RESPONSE]: We rewrite it as follows: "However, currently, it only covers a minor portion of global energy demands (0.05% of the total primary energy supply) as photovoltaic (PV) power generates less than 1% of total electricity supply (Solangi et al., 2011), solar energy has great future potential".

[COMMENT #18]: Line 67: Expression like sustainable development used here are too general postulations and add limited value to the paper

[RESPONSE]: We rephrased it as follows: "The sitting of photovoltaic power facilities is important in order to maximize the potential of the PV technology implementation in reality".

[COMMENT #19]: Line 238: Please explain what these distance cost functions' are

[RESPONSE]: We answered this comment earlier in Comment #9

[COMMENT #20]: Line 241: Same as previous comment

[RESPONSE]: We answered this comment earlier in Comment #9

[COMMENT #21]: Line 262: Please first introduce the what so called 'cases' and then use them in text

[RESPONSE]: We have made some changes and "cases" are briefly explained in section 4.1 named "Sensitivity Analysis".

[COMMENT #22]: Line 267: The term mild technical criteria may not be appropriate here Line 288: What about the rest of the criteria?

[RESPONSE]: We rephrased the whole paragraph explaining better the criteria as follows: "Case 1: All criteria have the same weights; Case 2: The weight of the criterion "solar energy" has the biggest score and the rest are equally distributed; Case 3: The weight of the criteria "solar energy" and "land value" have the biggest score while the rest distributed equally; Case 4: All economical criteria (road network, electricity grid and land value) have weights equal to zero (0)".

[COMMENT #23]: Line 303: Which are these tools of integrated site evaluation?

[RESPONSE]: The sentence rephrased as: "The framework it is a combination of already existing tools such as multi-criteria analysis, AHP and integrated site evaluation in a straightforward way. It also combines GIS and remote sensing techniques for spatial analysis, modeling and visualization."

[COMMENT #24]: Line 317: The authors may want to revise this statement since there are plenty of earlier works that have utilized this type of modelling and overall methodology for renewable and PV in particular project siting.

[RESPONSE]: The sentence rephrased as: "The innovation of this work is mainly the balanced implementation between theory and practical and legal aspects. Novelty also derives from the proposed modeling of the entire methodology, providing a versatile platform of analysis and semi-automation of the operations, which might also be extended into fully automated web based platform. This work derives a holistic approach from criteria selection and evaluation, data gathering and multicriteria analysis".

Constraint Map

(a)

Constraints
Available

0 2.5 5   10   15   20

Evaluation Map

(b)

100

0

Suitability Map

(c)

TIMES →

90

Suitability Index

MEDITERRANEAN SEA

30

(d)
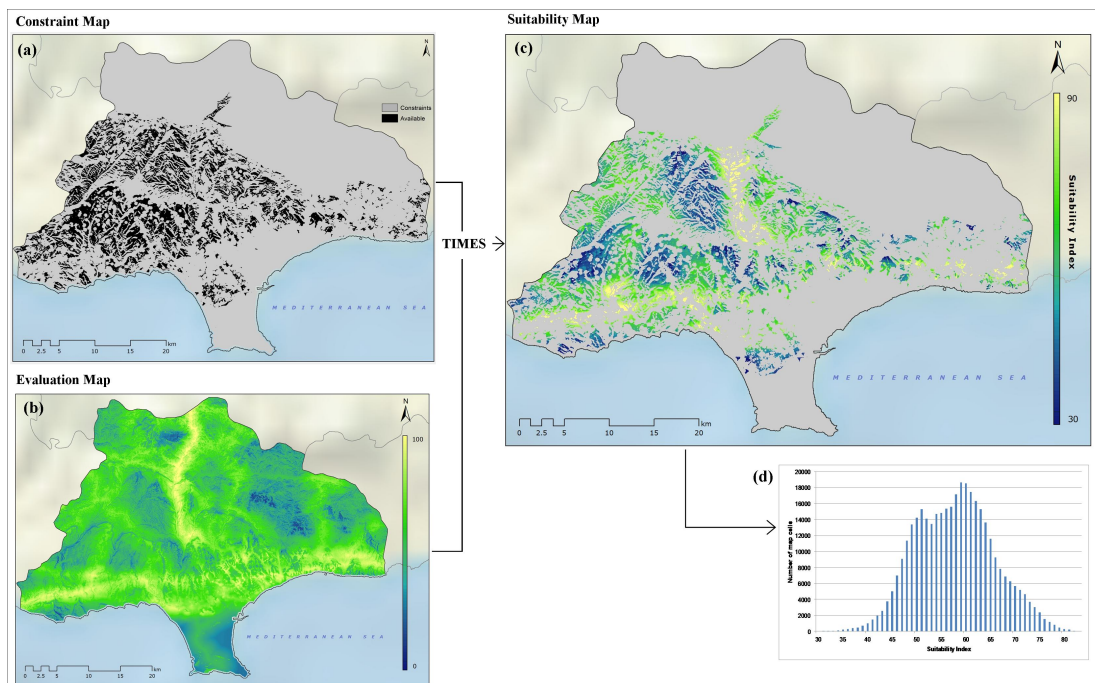
Fig. 1. (a) Constraint map; (b) Evaluation map; (c) Final SI map of study area as extracted from the multiplication of the Constraint map with the Evaluation map; (d) Distribution of SI pixels over final map