

## ***Interactive comment on “Estimating reflectivity values from wind turbines for analyzing the potential impact on weather radar services” by I. Angulo et al.***

**Anonymous Referee #2**

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### General Comments

The content of this manuscript aims at evaluating the impact from windmills on weather radars. More in depth, the work focuses on estimating the wind turbine clutter (WTC) reflectivity by means of a new proposed model, which in turn should allow quantifying this kind of affectation.

The proposed new model consists on a set of simplified reflectivity formulae. This set is valid for a wide frequency range and different wind turbines. The most part of this work focuses on providing an accurate Radar Cross Section (RCS) of wind turbine through

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characterizing numerical results from a Physical Optic (PO) simulation technique.

This work shows an effort into reproducing a real scenario, and hence, the new contribution seems to be useful for Weather Radar Services in the task of quantifying this kind of affectation. However, in an actual scenario, other elements like the terrain or secondary lobes can take an important role in a real WTC reflectivity map. In this regard, a little effort on a final validation to corroborate the WTC reflectivity model (model accuracy) would highly consolidate this work. Somehow, in the manuscript should appear some discussion that includes the disadvantages or limitations of the proposed model regarding the elements that have not been considered in the analysis.

On the other hand, with the aim to corroborate the proposed new work, the following general remarks (A-D) should be considered for the whole manuscript:

A) Consider depicting or representing more clear for the reader the coordinates used into the overall text, specially with the different angular coordinates (e.g. 'alfa' and 'tetha' in expression '(3)', and 'tetha' in figures 1 and 7). B) Consider reorganizing Section 4 and 5, as some contents about results from simulations need to be linked better to Subsection 4.2. When doing this, consider creating a new subsection for the analysis, rewording its conclusions (paragraphs 3 and 4 in page 1486), in order to emphasize that these are the base for characterizing the backscattering in Section 6. C) The expressions which are the base of the proposed formulae should have a better detailed deduction (e.g. expressions '(2)' and '(3)' in Section 6). D) The references should be checked regarding each citation in the overall text. In this regard, peer-reviewed references should take a significant role.

These general remarks would be also included in the specific comments below.

### Specific Comments

#### Abstract

1. Page 1478, Second Paragraph

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Consider mentioning how is the scenario for the developed model just to situate the reader.

#### Section 1

##### 1. Whole section

Review the references citation. Regarding the references section 'Norin, 2012' should be 'Norin and Haase, 2012', 'Gallardo, 2011' does not appear and the same for 'Grande, 2015', 'ITU-R, 2009', etc.

##### 2. Page 1479, Line 2

Add a reference to reinforce the factors proposed as the main factors.

##### 3. Page 1480, Line 1

Avoid the use of the word 'interferences' in this context. Consider 'afectations', 'impacts' or a similar word in this case.

#### Section 2

##### 1. Page 1480

Avoid the use of pharentesis to enclose statements and use commas instead. Reword this paragraph.

##### 2. Page 1480, First Paragraph

'Norin and Haase, 2012' can be included to reinforce the statement about the error classification.

##### 3. Page 1480, Fourth Paragraph

Consider adding some other reference about the impact due to signal blockage. See, for example, a suggested reference below this text. Mention that this non-desired phenomena is not treated in this manuscript.

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#### Section 3

##### 1. Page 1480, Fifth Paragraph

Avoid the use of pharentesis to enclose statements and use commas instead. Consider including some reference to reinforce the statement at the end.

#### Section 4

##### Section 4.1

##### 1. Page 1481

In a real scenario, the backscattering from windmills can contain important differences depending on the terrain surface: In a flat area or over a hill, the reflectivity will be different from irregular surfaces or with important mountains behind. Reword this section to indicate that, in a more realistic calculation, the texture of the terrain should be included.

##### 2. Page 1482

Add some words to justify that both the effect of secondary lobes and the terrain are excluded from the analysis.

##### Section 4.2

##### Section 4.2.1

##### 1. Whole section

Generally, simulation tools take into account some assumptions, as for example standard conditions for modelling the radar beam propagation in the troposphere. In this work, apart from the reference given (Jenn, 2005) about the simulation software used, add some extra information for the reader explaining its principal assumptions.

##### Section 4.2.2

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1. Page 1484, Line 19

Replace 'currently' with 'usually' or give some reference instead.

Section 4.2.3

1. Page 1484

Replace 'accuracy' with 'precision'.

2. Page 1484, Line 22

Replace 'previously' for the corresponded section.

Add more information in this subsection about the requirements of the simulation procedure.

3. Page 1485, Second Paragraph

Add a link at the end to indicate where in this manuscript the reader can find the separated analysis (mast, nacelle and single blades).

Section 5

1. Page 1485

Consider combining this section with the previous one, as it seems that the analysis from simulation outputs is an important part of the methodology to characterise the scattering for the proposed model. Moreover, reword this section with the aim to reinforce all the conclusions of the analysis.

2. Page 1485, Line 10

Replace 'As previously mentioned' with a phrase to clarify in what section is mentioned.

3. Page 1485, Fifth Paragraph

Reword this paragraph to indicate better the coordinate system that is being used.

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4. Page 1486, Line 7

Replace 'Obviously' with a more proper expression, as for example 'As it can be expected'.

Section 6

Section 6.1

1. Whole section

Consider reorganizing this subsection to describe better the angular coordinates, as in figure 7 seems that does not appear the half cone angle, 'alpha'.

Consider describing a little bit more in depth how is deduced the expression (2) from the formulae in Siegel (1995), as it is the base for the proposed model. If you prefer, include an appendix with the procedure.

2. Page 1488, Line 19

Avoid the use of parenthesis.

Section 6.2

1. Page 1489, First Paragraph

Remove 'as demonstrated in the simulations' or replace it with a more concrete reference to the section number where it is demonstrated.

2. Page 1489, Second Paragraph

Reword this paragraph reorganizing the order of the statements.

3. Page 1489, Line 19

Replace 'Obviously' with the section where it is demonstrated the frequency dependence of maximum RCS.

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4. Page 1489, Line 25

Justify a little bit more why they must be proportional to their corresponding dimensions.

5. Page 1490, Line 1

Justify better the reason why to consider only the 50 % of impact regarding the blade design. There would be important differences in results considering other percentages?

6. Page 1490, Fourth Paragraph

Consider including a new table with the values of the differences between results from Table 2 and 3, and the results obtained from expression (9).

Section 6.3

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Section 6.4

1. Page 1492, Line 4

Replace 'This' with 'The proposed'.

2. Page 1492, Final paragraph

Consider rewording the first or the second 'is obtained' so that the text would be more readable.

Section 7

1. Page 1494, Fourth Paragraph

Secondary lobes has not been considered in the analysis of this manuscript. Consider rewording this paragraph in order to be more consistent with the previous analysis.

References

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1. Whole section

Check all references in the manuscript, specially the ones that only appear in the previous text citation.

Technical Corrections -

Suggested references:

Belmonte A., Fàbregas X., 2010: Analysis of Wind Turbines Blockage on Doppler Weather Radar Beams, IEEE Antennas and Wireless Propagation Letters, Vol. 9.

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Interactive comment on Atmos. Meas. Tech. Discuss., 8, 1477, 2015.

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