General Comments

As with the earlier paper from Lainer et al. (2021) it was a fun for me to read this manuscript. It is the first time I find my review to be cited in the next publication :-).I strongly recommend to publish its content. Nevertheless, some improvements are necessary and among them are important issues.

We warmly thank the Reviewer for their positive feedback and appreciation of our work. We answer below point-by-point to the concerns and suggestions.

The most important issue is the interpretation of the presented measurements. I do not see anything "peculiar". Let me describe my point of view a bit more detailed; A WT is a scatterer that is neither small compared to the radar wavelength nor is it small compared to the diameter of the main lobe of the radar beam. It is - in general - not of constant shape but changing its properties with (i) nacelle orientation, (ii) rotor angle, and (iii) blade angle. The shape of the rotor blades even changes with (iv) wind speed, as the blades are bended by the wind. The echo "seen" by the radar further depends on the (v) elevation under which the radar "looks" at the WT and the exact (vi) height and (vii) horizontal position and (viii) the diameter of the radar beam at WT position. Furthermore, the (ix) position of the WT within the recent range gate of the radar has to be considered. --- There are more but minor dependencies that impact the echo from a WT, as the distance between radar and WT which is implicitly included in (v) to (ix) but further indicates how well the radar beam can be approximated by a plane wave.

We thanks the Reviewer for this relevant and well-phrased input, which is kindly appreciated. Indeed, we find this clear and exhaustive scheme very helpful for a better understanding not only of the present results; of which we are confident, but also for a future, exhaustive and detailed analysis of longer temporal intervals during which the WT rotor speed was zero (e.g., on March 19).

Regarding March 19, following the input of the Reviewer we conducted a preliminary analysis of 93 minutes (nine 10-min intervals plus one lasting 3 minutes and 5 seconds) characterized by zero rotor speed, which confirms the main results of our short paper. Most of all, it confirms also your interesting above-listed interpretation scheme. The last page of the present document presents a short summary of this preliminary analysis. Because the results agree with our current findings we decided not to include them in the revised version extensively, in order to keep the message of the manuscript as easily conveyable as possible and to keep the paper short.

To give a more intuitive description I cite an engineer who once told me: Imagine the WT was coated with polished chromium and you light the WT with a spotlight. You see the reflections gliding over the surface of the WT, occurring and vanishing with the motion of the WT. At visible wavelengths the surface of a WT is mat but at radar wavelengths it appears to be glossy.

We thank very much the Reviewer for this intuitive and illustrative description. We are glad that Reviews are public in this journal, so that they are available to the readers.

For the antenna we call the dependency on azimuth and elevation its directivity pattern. We know, the larger the antenna the stronger the (possible) gradients of the directivity pattern. For the scatterer the corresponding term is "differential scattering cross section." Which, in the end, is nothing else but the directivity pattern of a scatterer. The differential scattering cross section of a WT is at least(!) dependent on the nine parameters mentioned above (i to ix). As the WT is much larger than the radar antenna, we have to expect very strong gradients of the differential scattering cross section to occur.

The presented study investigates variation due to the first four parameters, keeping all radar related parameters constant. The stability of the echoes during periods where the WT is standing still (condition "a" in the discussion) indicates that WT and radar are very reliable. The variations of the echoes of different "type a" periods simply show the

dependency on rotor angle and blade angle. As these two angles are random but constant the measured values are random but constant.
For a slow rotating rotor the experiment measured the differential scattering cross section at high resolution, mostly regarding rotor angle. We see all the extreme values. With increasing rotational speed (and constant temporal resolution) the angular resolution at which we see the crossection is reduced/coarsened. Thus the extreme values are smoothed out, everything looks smoother. This is immediately seen in the figures.
On the other hand: rotor speed is totally unimportant for an instantaneous (single) radar beam and its echo. The integration over several pulses (here 128) introduces changes in the echoes due to rotational speed.
Again, very kind of you to share with us your explicative interpretations of the figures: we are glad that Reviews are public in this journal, so that they will be available to all the readers.
There is nothing peculiar but the scattering cross section of a WT is complicated. So, please, shorten the title and remove the term "peculiar". (E.g.: "On the polarimetric backscatter of a still or quasi-still wind turbine.")
We entirely agree with this comment (and with Reviewer 2): we have shorten the title following this suggestion.

Dealing with the partially very precise time information is difficult and inconvenient. I propose to add two different indicating schemes:

1. Mark the four 10-min periods for which you have WT properties as I to IV in the figures. (Introducing e.g. black vertical markers at 17:10, 17:20, 17:30 and creating the four different "WT time steps".)
2. Mark those periods with comparable rotational speed and blade angles as indicated as a) through d) in the discussion by e.g. blue vertical markers and indicate the periods as a_1, a_2, a_3, b_1, and so on.

Thank you for the suggestion: indeed, we have “labelled” the “distinctive” periods of interest, also in each Sub-sec title. P1, from 17:08 to 17:10, which corresponds to a still WT; from P2 to P4, the successive three 10-min intervals.

Most of the precise time indicators in the text could be replaced by these indications of time periods. The markers can occur in the figures 2 to 5. Figure 6 and 7 should then be assigned to the corresponding periods.
We thank the Reviewer for the suggestion, that we included in the revised version of the manuscript A thick line in Figure 2 introduces the sub-period P2.a, which is shown in Fig. 7. P2.a is thoroughly described in Sec. 4 “Discussion (despite it lasts only 8.96 s!)
Two “start” and “stop” markers are associated with P2.b, which lasts 80 s, are shown in Fig. 6 and is thoroughly described in the same Sec. 3.2 (rotor partial rotation equal to 72 deg and blade pitch angle changed from 70 deg to 65 deg).

The authors expect the differential reflectivity to be close to 0 dB (line 435: "easier to understand"). If we recall that photographers use a polarizing filter to reduce reflections on (glossy) surfaces we know that reflections at (glossy) surfaces may introduce polarization effects. Especially, multiple reflections (internally, only from the WT) will cause strong polarization of the backscattered signal. (Review also Line 387 f.)
Indeed, we are deeply grateful for this explicative and clarifying comment: we agree that the exclamation mark at line 388 is certainly misleading. Furthermore, this comment helped the authors to shorten al the three “bullet-sentences”.

Minor remarks

The abstract shows already very detailed information which is not necessary. If the authors insist on having these details in the abstract, they should add the distance between radar and WT.
We agree with the suggestion and we have rewritten the abstract following the suggestions of both Reviewers.

Gabella et al. (2008) (line 90), Gabella and Perona (1998) (line 92), and the book by Fabry (line 191) do not show up in the references. I did not check more entries but obviously the references have to be controlled.
We apologize about the omission. We have checked the references in the revised version. We thank the Reviewer for spotting this issue.

In line 108 it needs to be 180 m x 180 m x 75 m. We have added twice the units (m) after 180.

Line 182: remove one "that" Removed, following the suggestion of the Reviewer.

Line 373: red curve in Fig. 2 (not inf) “f” has been deleted.

Line 412: Shouldn't it be "It could have been caused"? Thank you for correcting my mistake.

Line 430: The comma is falsely shifted to line 431.We corrected the typo and thank the Reviewer for spotting it.

Line 452: Remove "have". Deleted

Line 473f: Use Z_v as introduced in 2.3.1 and not ZV. (Same for ZH) The variables appear now as Z_h and Z_v, thank you.

General Comments

The topic of this study is both interesting and timely as the weather radar community seeks to find mitigating actions to cope with the increasing number and size of wind turbines. One of them is to understand how the wind turbines are seen in the observations and can this information be used to identify and remove the wind turbine echoes as simultaneously keeping the precipitation echoes. The polarimetric variables has generally proven to be a useful metric for the classification of clutter and there have not earlier been many studies of the polarimetric signatures, one comes to mind Hall et al. 2017, where the dual-pol variables are used to classify the wind turbine echoes at C-band with a fuzzy logic - based methodology.

I find this study important, and it provides new insights that can be used to develop classification algorithms. However, in my opinion, this manuscript and the presented research are not yet scientifically mature enough to be published, and I would recommend major changes. The authors acknowledge that these are preliminary investigations in the title, and I would encourage them to analyze their dataset more thoroughly to provide more conclusive results, including the second period of still wind turbines (March 19, 2020), which would strengthen their findings.

Thank you for your stimulating and encouraging comments and the helpful information regarding the interesting study of the polarimetric signatures by Hall et al., of which we were not aware. Yes, there is still potential in our dataset, for not only polarimetric measurables, but also regarding Doppler and Spectrum width. Not limited to still conditions (March 19), but also for the other days. We hope we will be able to exploit it thoroughly in future years.

Regarding March 19, following your stimulating input, we have conducted a preliminary analysis of 93 minutes (nine 10-min intervals plus one lasting 3 minutes and 5 seconds) characterized by zero rotor speed, which confirms the main results of our short paper. In particular, from 03:30 UTC to 05:10 UTC, there were ten 10-minute periods characterized by 0 rotor speed. As you will see in the preliminary analysis presented at the end of this document, they confirm the main findings of the present short note:

- ρ_{hv} always equal to 1.000 (to be precise, DN=255, namely rhoHV larger than ~0.996); this means a 2-way biunivocal (rs=0 <--> ρ_{hv}=1) correspondence (so far) during eleven 10-min periods (ten on March 19, one on March 4).
- Very small dispersion and temporal variability of Zh, Zv and Zdr.

Because the results agree with our current findings, we decided not to include them in the revised version extensively, in order to keep the message of the manuscript as easily conveyable as possible and to keep the paper short.

As noted by Anonymous Referee #1, the title is quite complex, and I agree that it could be shortened. Additionally, the use of the word "peculiar" to describe the polarimetric signatures is confusing, and I suggest using another adjective, such as "distinctive." Checking the Merriam-Webster dictionary the word peculiar is defined as characteristic of only one person, group, or thing: DISTINCTIVE or different from the usual or normal: ECCENTRIC, UNUSUAL. I assume the authors have meant the first interpretation, but I and I assume also the other Anonymous Referee #1 interpreted the second option and it was slightly confusing to read the manuscript. The language throughout the manuscript should be checked for any phrases or words that are more appropriate for spoken language than written language. While I am not a native speaker, I can provide some examples in the minor comments section.

Thank you so much. It has been so kind of you and Reviewer 1 to clarify this important aspect and to help us in finding a better title. Indeed, we meant “distinctive” rather than “eccentric”; however, we think that the best way to avoid any confusion is to follow the suggestion of both Reviewers: avoid using the adjective “peculiar”.

Thank you also for the patient help with the English language, as none of us is a native speaker, too. We appreciate very much your help and are grateful for the valuable suggestions in the “Minor comments” section at the end.

In the detailed theoretical explanations or definitions, such as in section 2.3, the authors should pay attention to using precise definitions. For example, the authors should distinguish between radar reflectivity and reflectivity factor, which

have different dimensions. I suggest providing an exact definition of these terms in the manuscript and then stating that the authors will use reflectivity to refer to reflectivity factor throughout the manuscript, as is common practice in the field.
In the manuscript, we have always used the 1-word term “reflectivity” for z instead of the more complete form “radar reflectivity factor”. Yes, as stated in the manuscript [z] = mm^6/m^3, while using a Logarithmic transformation [Z] = dBz (see line 163 of the original submitted manuscript). Similarly, I have seen that in many papers/books the 1-word term “reflectivity” is used for η, which is the total equivalent backscattering cross-sectional area per unit volume. However, in the paper, there is no need to use η. [η] = m^2 / m^3. In Sec. 2.3.1 we have adopted your helpful suggestion above. Up to that point, we have always used the complete form “radar reflectivity factor”. After that, in a few cases, we have used reflectivity, as it is common practice in the field.

Major Comments

As Anonymous Referee #1 noted, the abstract is way more detailed with the specific numbers. I would suggest rewriting the abstract by firstly providing a brief description of the measurement setup and then main conclusions without referring to specific periods.
We have rewritten the abstract following the suggestions of both Reviewers.

The suggestions of Referee #1 were good to clarify the periods of interest, the authors should name them and indicate them in the figures. Referring to the chosen names in the text will make the manuscript easier to read.
Thank you, yes, we have “labelled” the “distinctive” periods of interest following the suggestions of Reviewer 1: P1, from 17:08 to 17:10, which corresponds to a still WT; P2 to P4, for the successive three 10-min intervals, up to 17:40. The four labels “P1” to “P4” appear now also in the titles of the four subsections.

Line 42: The authors state that research on polarimetric signatures of wind turbines is rare, which is true. However, it would be helpful to see a comparison with at least one other study, such as the one by Hall et al. 2017
Yes, it would helpful to link some results of the 2019 campaign (both PPI and RHI, see Lainer et al. 2021) with the interesting results of Hall et al. 2017; while it is not at all straightforward to find such link with the stare mode part of the 2020 campaign, especially for the still and quasi-still conditions, which are investigated in this study and linked with observations of Bright Scatterers.

In lines 80-100, a schematic picture showing how the radar is located in respect to the wind turbine with the distances and stated elevation angles would be beneficial.
Thank you, this is a helpful comment. We forgot to explicitly to mention in the text Fig. 1.c from Lainer et al. (2021), which shows what you are asking. Now it is referenced in the manuscript.

As stated in general comments, especially the section 2.3.1 (lines 156-171) should be rephrased with correct terminology. The authors should be careful when using reflectivity and reflectivity factor, and "Log-transform" should be changed to e.g. "in logarithmic units." The lines 166-171: The authors should clarify the explanation of the range of reflectivity values that can be measured with Meteo Swiss radars, as it is currently unclear and DN is not defined.
We have adopted your helpful suggestion above (“stating that the authors will use reflectivity to refer to the radar reflectivity factor”).

The authors should explain why they performed an extrapolation of 8 minutes in lines 251-253.
Thank you for this sensible and legitimate question. While trying to answer, I have realized it is a proper example of your relevant remark above: “a phrase that is more appropriate for spoken language than written language”.

Consequently, we decided to delete it. Well, we have tried to express something similar at line 135 where we wrote "Unimportant if during 8 minutes no radar data are available …", (see your helpful comment below); also there, we have decided to delete the colloquial and unnecessary sentence.

In lines 296-302, the authors should rephrase the section and add references to the correct figures.
Yes, thank you very much, we apologize for this mistake. Obviously, we meant small dispersion of Ψ_{dp} ; unfortunately, we wrote ρ_{HV}. Now it is corrected.

Minor Comments

Lines 51 – 64: Section about the BS. I do see the need to explain BS in general, but I cannot really see how a wind turbine could be used for monitoring hardware due to its varying signatures, at least operationally, and now the section reads as to justify the campaign set up by using then wind turbines as BS. Maybe considering rephrasing this section.
The former 51-64 paragraph has been shortened. However, please note that the paragraph does not intend at all to justify the campaign in view of a better understanding of BS. It rather intends to show that even the 10-min intervals with 0 rotor speed, which are apparently useless to characterize the typical signatures of an energy production WT (hence, a "rotating and moving" WT), can still be useful to a better understanding of BS.

Line 59: Clarify the meaning of "hit" in the context of the sentence, "However, since it is hit during the operational weather scan program…."
The sentence has been rephrased and the citation has been updated (the new link is now with a peer-reviewed Journal).

Lines 65 – 78: Rephrase this section and provide a brief description of the manuscript structure rather than providing detailed results.
These paragraphs have been rephrased and made shorter following your suggestion.

Line 100: Consider changing the word "peculiar" when referring to the stare-mode strategy.
Yes, and following your helpful comment and interpretation at the previous page, we have used "distinctive". An alternative would be to delete "peculiar" and use no adjective at all.

Line 116: Rephrase the title: "Wind turbine data and metadata collection: a very peculiar 40 min interval under detailed investigation." Rephrased.
Lines 121 – 123: When listing parameters, use "e.g." instead of "…", and write temperature with a lowercase letter. Implemented, thank you.
Line 135: Rephrase "Unimportant if during almost 8 minutes no stare mode radar data are available" as it is unclear. The sentence has been deleted.
Line 139: Use a lowercase letter for "maximum." We now use lowercase letter for "maximum".
Line 145: Rephrase the sentence to make it complete. Rephrased.

Check that equations are styled consistently throughout the manuscript.
Eq. 1 has been changed accordingly.

Line 185: Remove "very" in "A very important…." deleted.

Line 191: Clarify if the numbering "e06.1" is referring to a chapter.
Yes, "e06.1", which is the first part of the electronic supplement number six accompanying the book by Fabry. Clarified in the text, too.

Lines 208 – 211: Rephrase the example of quantization of co-polar correlation coefficient as it seems redundant and not necessary. Remove the extra "use" in line 209.
This is indeed a good suggestion. We have now rephrased it and shortened it.

Line 232: Clarify the meaning of "a standard deviation of $360°/12^{0.5}$ would be expected."
The standard deviation of a uniform distribution varying from 0 to B is by definition $B/\sqrt{12}$.

Lines 235-238: Rephrase and remove the detailed results in this section.
This is shortened, rephrased and the details moved now to a more appropriate section(Sec. 3.2).

Line 242: Suggested to use "radar variables" instead of "backscattering properties."
Great suggestion, thank you. We have used “polarimetric radar measurables”, consistently with the title of subsection 2.3, line 154.

Line 251: Remove "amazing" as it is not typically used in a scientific context. Replaced.
Line 277: Remove "very" in "at the original (very high) temporal resolution." Deleted.
Lines 307 and 336: Replace "remarkable" as it is not typically used in a scientific context. Replaced.
Lines 308: Replace "huge" as it is not typically used in a scientific context. Replaced.
Line 371: Use a lowercase letter for "maximum." We now use lowercase letter for “maximum”.
Paragraph 421 – 433: Remove "very" statements. The two “very” have been deleted.

Line 433 avoid using IF and THEN in capital letters in this section as it is not suitable for a scientific context, in my opinion.
If and then are now lower case.

In the Summary section, rephrase lines 472 – 477 without the exclamation marks and questions such as "How comes?" and "Well, because, to our great surprise."
Another good example of your relevant remark above: “a phrase that is more appropriate for spoken language than written language”. Consequently, we have rephrased line 472-477.

In Figures and their corresponding captions (Figures 2. - 5.), could you clarify why "MAX" is written in capital letters while the other terms such as median, mode, and minimum are written in lowercase letters. I suggest to state somewhere in the text that the mean is not shown in these figures, since the text is often referring to mean.
Following your recommendation above regarding line 371, we have now used lowercase letter for “maximum”.
In the introductory lines 240-244, it is stated that we are using the “central and most probable locations of the original 125 echoes available every 8 s: the median and the mode.” Please note, that now the mode is omitted in the Figures 2. -5, also to make them visually clearer.

REFERENCES

Hall, W. et al. (2017), Offshore wind turbine clutter characteristics and identification in operational C-band weather radar measurements. Q.J.R. Meteorol. Soc., 143: 720-730. https://doi.org/10.1002/qj.2959

ADDENDUM

PRELIMINARY ANALISYS REGARDING 92 MINUTES OF PERFECTLY STILL CONDITIONS ON MARCH 19, 2020.

From 3:30 UTC to 5:10 UTC, none of the 3 most relevant parameters for the backscatter have changed.
Both nacelle orientation and blade pitch angle have remained the same. Most of all, the 10-min average (and even max.) rotor speed was constantly equal to 0. Not surprisingly, all 86250 ρ_{hv} values were equal to 1 (DN=255).

Table 1: Values of ρ_{hv} during 102 minutes on March 19

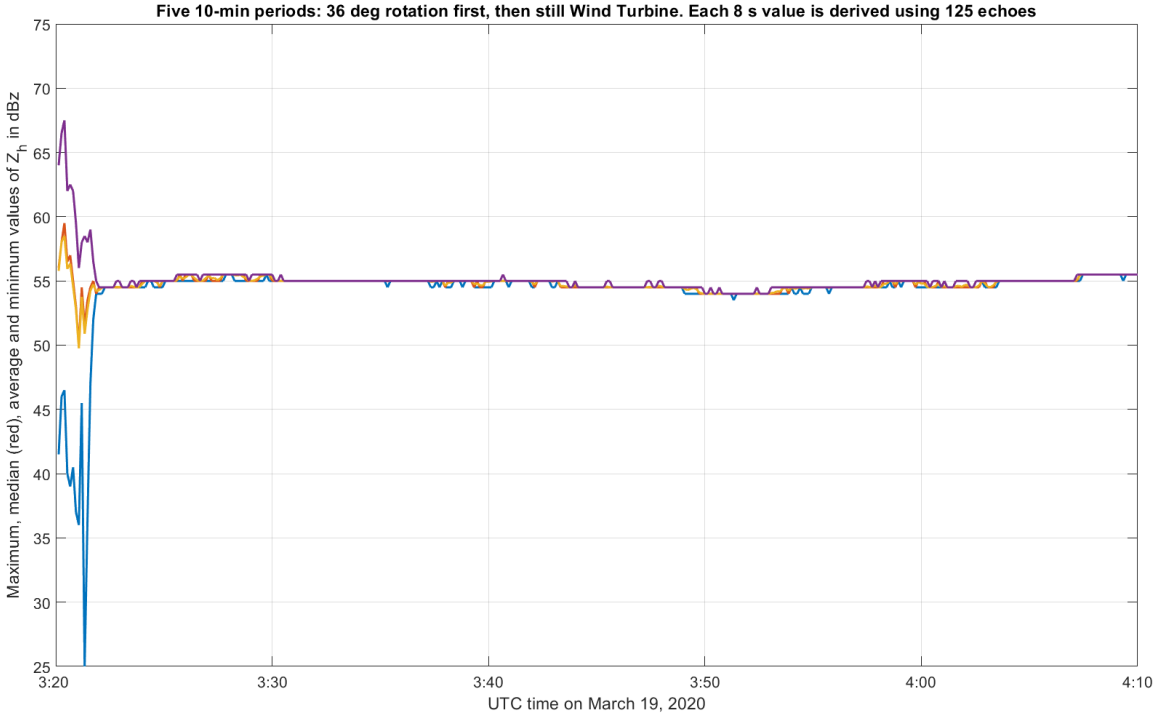
UTC time	10-min average rotor speed in m/s	10-min average	10-min median	10-min MAX.	Sequential # of intervals
03:20-03:30	0.01	0.9854	1.0000	1.0000	1
03:30-03:40	0.00	1.0000	1.0000	1.0000	2
03:40-03:50	0.00	1.0000	1.0000	1.0000	3
03:50-04:00	0.00	1.0000	1.0000	1.0000	4
04:00-04:10	0.00	1.0000	1.0000	1.0000	5
04:10-04:20	0.00	1.0000	1.0000	1.0000	6
04:20-04:30	0.00	1.0000	1.0000	1.0000	7
04:30-04:40	0.00	1.0000	1.0000	1.0000	8
04:40-04:50	0.00	1.0000	1.0000	1.0000	9
04:50-05:00	0.00	1.0000	1.0000	1.0000	10
05:00-05:02	0.00	1.0000	1.0000	1.0000	11

From 3:20 UTC to 3:30 UTC, only a partial rotation of 36 degree has occurred, which has caused several “drops” of ρ_{hv} below 1. During this 10-minute period, the range of Zh (Zv) goes from 25 (35) dBz to (72.5) 67.5 dBz, as it can be seen in Table 2.

Table 2: Minimum and maximum values of the radar reflectivity factors during five 10-min intervals.

UTC time	10-min average rotor speed in m/s	Z_h 10-min minimum	Z_h 10-min Maximum	Z_v 10-min minimum	Z_v 10-min Maximum
03:20-03:30	0.01	25.0 dBz	67.5 dBz	35.0 dBz	72.5 dBz
03:30-03:40	0.00	54.5 dBz	55.5 dBz	50.0 dBz	52.0 dBz
03:40-03:50	0.00	54.0 dBz	55.5 dBz	50.5 dBz	54.0 dBz
03:50-04:00	0.00	53.5 dBz	55.0 dBz	53.0 dBz	55.0 dBz
04:00-04:10	0.00	54.5 dBz	55.5 dBz	53.0 dBz	54.5 dBz

Finally, the figures in the next page show the minimum, median, average and maximum values of the radar reflectivity factor every 8 s during 50 consecutive minutes (see table 2 above) for horizontal (top picture) and vertical polarization (bottom picture). Being the original sampling time 64 ms, 125 “echoes” have been used to derive such four statistical indicators, two for the central location and two for the envelope. In turn, each echo has been derived by the Radar Signal Processor using 128 pulses (128 I and Q values) for each polarization state.


Five 10-min periods: 36 deg rotation first, then still Wind Turbine. Each 8 s value is derived using 125 echoes
Maximum, median (red), average and minimum values of Z_h in dBz
75
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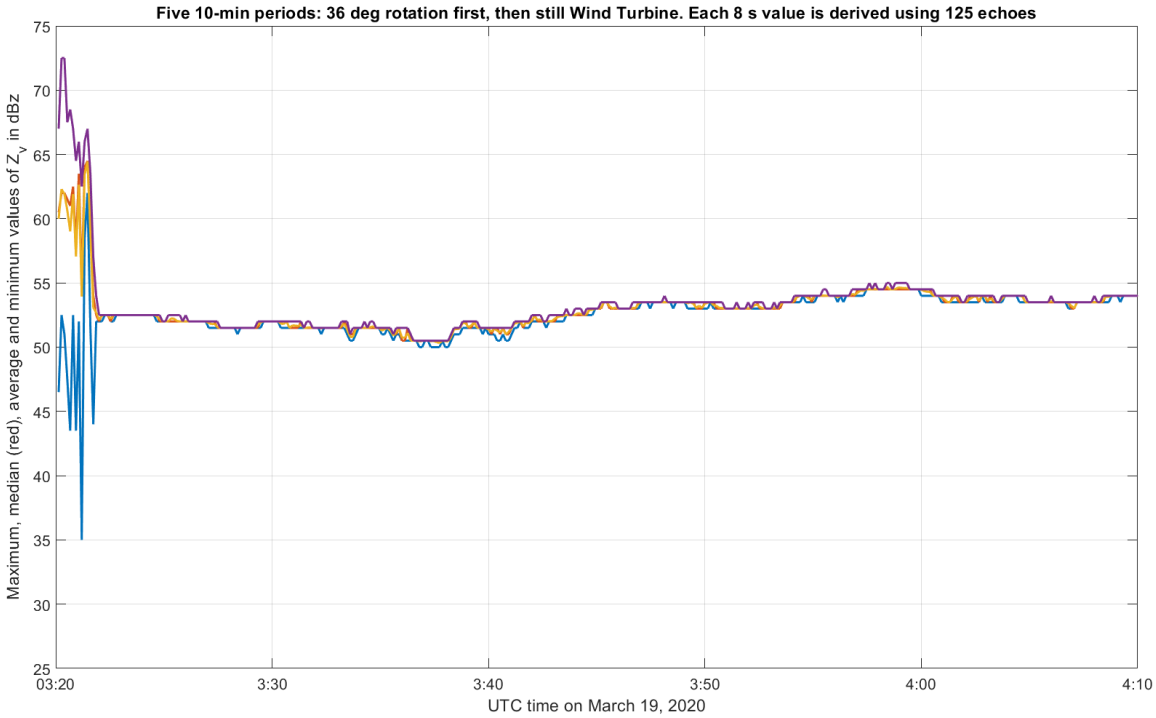
UTC time on March 19, 2020


Five 10-min periods: 36 deg rotation first, then still Wind Turbine. Each 8 s value is derived using 125 echoes
Maximum, median (red), average and minimum values of Z_v in dBz
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UTC time on March 19, 2020