Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2016-321-AC1, 2017

Atmospheric Measurement Techniques Discussions

Interactive comment on "Assessing the accuracy of microwave radiometers and radio acoustic sounding systems for wind energy applications" *by* Laura Bianco et al.

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Received and published: 9 February 2017

Anonymous Referee #1

1) The manuscript AMT-2016-321 by Bianco et al. evaluates the accuracies of two MWRs and two RASSs with radiosonde soundings and 300-m meteorological tower observations based on the XPIA campaign data set. The authors show us the accuracy differences of temperature profiles of two identical MWRs and two different RASSs, which can benefit our better understanding on the measurement abilities of these instruments, especially on the random error between two identical MWRs. Another interesting point is the manuscript also evaluates the abilities of MWR and RASS for measuring temperature lapse rate, and the results may do good for wind energy

applications. Overall, the manuscript is within the scope of the journal and it meets the scientific quality for AMT. Minor revisions should be considered by the authors before the manuscript gets accepted for publication on AMT.

2) Answer: We thank the Reviewer for these encouraging comments, as well as for the constructive suggestions. We have modified the manuscript according to the Reviewer's suggestions and hope to have addressed his/her concerns in the revised version of the manuscript.

Minor comments:

1) p13, line261, the "that" in ". . . with a slightly lower MAE that the CU MWR" should be "than".

2) Answer: We thank the Referee for catching the typo.

3) Changes: The text was modified in the revised version of the manuscript as suggested.

1) p13, line264-266, as shown in Fig. 3d, the temperature bias near the surface shows a negative value for NOAA MWR but a positive value for CU MWR, what's the explanation?

2) Answer: We thank the Referee for suggesting us to investigate into this. The neural net retrieval algorithm uses ground-based observations of temperature and pressure to derive the vertical temperature profile. The bias close to the surface is most likely related to the differences in temperature and pressure from the surface observations. We observed small variations in temperature throughout the day, which might be related to boundary layer heating. We also observed that differences in pressure had a great impact on the accuracy of the temperature. We did look into the accuracy of the surface sensors comparing to the 2m measurements collected at the base of the 300-m tower. For the pressure we found that:

- For the period of analysis between Mar 9 and Apr 4 the NOAA MWR surface sensor

had a bias in pressure (p_NOAA_MWR -p_TOWER) equal to -6 mb, while the CU MWR had a bias in pressure (p_CU_MWR -p_TOWER) equal to 0 mb.

- For the period of analysis between Apr 29 and May 7 the NOAA MWR surface sensor had a bias in pressure (p_NOAA_MWR -p_TOWER) equal to -1 mb, while the CU MWR had a bias in pressure (p_CU_MWR -p_TOWER) equal to 0 mb.

We note that the failure of the surface pressure sensor between 5-27 April produced large differences in the retrieved profiles, so large that we had to avoid including that period of NOAA MWR data into the analysis. For this reason, we can expect that the differences of 6 mb between the NOAA and CU MWRs surface sensors might be the cause of the opposite biases found at the lowest levels of Fig. 3d, while those of Fig. 5d (after the surface sensor was replaces) are of the same sign.

3) Changes: Some text was added to the revised version of the manuscript about this on page 14: "For the March comparison, we note that biases are opposite for the NOAA MWR and CU MWR (Fig. 3d). Since surface observations of temperature and pressure are important for the retrieval algorithm, we analyzed surface observations of the two MWRs. Differences in surface pressures between the two MWRs and a surface met station on the order of $\sim$6 mb were observed for the March period and only $\sim$1 mb for the May period. Note that the NOAA MWR surface sensor was not functioning between 5 – 27 April. We believe that the differences of $\sim$6 mb between the NOAA and CU MWRs surface sensors are the likely the cause of the opposite biases found at the lowest levels of Fig. 3d, while those of Fig 5d, after the surface sensor was replaced and the differences were only $\sim$1 mb, are of the same sign."

1) p13, line267, the "if" in "... (an example if" should be "of".

2) Answer: We thank the Referee for catching the typo.

3) Changes: The text was modified in the revised version of the manuscript as suggested.

1) p13, line271, the "if" in "... an example if which is shown..." should be "of".

2) Answer: We thank the Referee for catching the typo.

2) Changes: The text was modified in the revised version of the manuscript as suggested.

1) p19, line397-404, the temperature MAE shows a smaller value in unstable conditions compared to stable conditions, could the authors give an explanation or discussion on it?

2) Answer: This is an interesting question. Most of the cases captured in Fig. 14b (stable) are cases with a surface inversion in the morning. When we analyzed individual cases, we can see that the MWR's sometimes have difficulties correctly representing the depth and the slope of the temperature inversion which is probably due to the coarser resolution (compared to soundings or tower observations). The unstable cases are usually profiles with a straight temperature line taken throughout the day. Even though the temperature decreases with height, most of the cases are just slightly unstable. As a result, we would expect the "stable" profiles to have a higher MAE due to the uncertainties in depth and slope of the surface inversion.

3) Changes: Included explanation in the text: "Note that stable conditions might generate profiles with an inversion at the surface. Smaller MAE's occurred in unstable conditions (MAE = 0.8 K; Fig. 14a) compared to stable conditions (MAE = 1.2 K; Fig. 14b). Larger MAE values in stable conditions might indicate that the MWR has difficulties accurately capturing the depth and the slope of the surface inversion."

1) The authors should check typing errors carefully.

2) Answer: We thank the Referee for the suggestion.

3) Changes: The manuscript was checked for typos and we hope we found them all.

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