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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Retrieval of cloud liquid water distributions from a single scanning microwave radiometer aboard a moving platform – Part 1: Field trial results from the Wakasa Bay experiment" *by* D. Huang et al.

Anonymous Referee #2

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Scientific Comments:

1. p. 12027: Author list. Please explain why there are no co-authors from the MIR instrument at NASA/GSFC or the ACR instrument at JPL and CSU. These engineers/scientists had to be just as involved as the co-author from the Univ. of Colorado for the PSR instrument, in terms of calibrating, quality-checking and plotting their instruments' data from the Wakasa Bay experiment.

2. p. 12028, lines 4-6: "A mobile cloud tomography system using only a single scan-

ning microwave radiometer has many advantages over a fixed system using multiple distinctly-located radiometers, e.g. efficient and flexible data collection." These advantages need to be better justified. First, what is meant by "efficient"? This system is certainly not more cost efficient than a set of fixed sensors. Second, the disadvantages of the mobile system need to be listed as well, e.g. limited temporal sampling and duration of observations. Since the most recent data reported were collected in 2003, an obvious limitation is that of available resources required to repeat such an experiment.

3. p. 12028, line 21: "moving speed" needs to be defined in terms of air speed or ground speed.

4. p. 12029, lines 10-11: "requires the atmospheric emission at a frequency of 31.6 GHz be measured..." This specific frequency is not "required". Other measurements have shown that he same cloud retrieval could be accomplished from measurements at any window frequency in the range of at least 30-37 GHz.

5. p. 12030, lines 3-4: "Microwave technologies have also advanced considerably and microwave radiometers have become more portable ..." This is certainly true, but PSR and MIR are not examples of such portability since they are large and bulky instruments that require sizable aircraft or UAVs to deploy.

6. p. 12030, lines 25-26: These lines repeat the exact ideas of p. 12028, lines 4-6 (discussed in #2 above) and do not add any new information.

7. p. 12032, lines 18-20: Most of these lines repeat the exact ideas of p. 12031, lines 8-9 without providing any new information. One of these two instances should be removed.

8. p. 12033, lines 5-7: This is the *third* time that these exact ideas are stated in the paper, repeating those listed in #7 above. The only new concept is "retreiving the spatial distribution of cloud liquid water," but this is the goal of the entire paper. There

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is no need to state this three times.

9. p. 12034, line 1: "precise measurements of the external targets." What are the physical temperatures of the two external targets in PSR? The corresponding temperatures are stated for MIR in the last line of this page and the first line of the next page.

10. p. 12034, lines 9-10: "brightness temperatures at the 37 GHz frequency averaged over horizontal and vertical polarizations" Please explain the justification for averaging horizontally- and vertically-polarized brightness temperatures when they are so different over the ocean. Such averaging would seem to obscure the value of measuring oceanic brightness temperatures.

11. p. 12034, lines 12-13: "view angles range from 200 degrees (70 degrees off nadir in the forward direction) to 340 degrees (70 degrees off nadir in the backward direction)." The reason for this odd definition of angles (as used in Fig. 4(b)) is unclear and hard to interpret.

12. p. 12043, lines 14-15: Since altitudes are referred to in the text in km, one needs a conversion from hPa = mbar to km above sea level (ASL). It could be plotted on the right axis of Fig. 6.

13. p. 12045, line 22: "The maximum LWC in the retrieval ... occurs in the 2.0 to 2.8 km altitude range." What is the large amplitude signal at 75 km distance and about 3.5 km altitude?

14. p. 12047, line 9: "point-by-point comparison between the MIR LWP and the PSR LWP." Since this comparison shows a very large correlation coefficient of 0.96, it needs to be stated whether the PSR and MIR brightness temperatures were used in calibration the other's brightness temperatures (and if so, how), and whether or not their LWP retrieval algorithms use the other's brightness temperature data in any way.

15. p. 12050, lines 3-4: "It is unfortunate that there were no in-situ measurements of cloud water content during the field campaign that can be used to validate the tomo-

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graphic retrievals." This repeats the exact ideas of p. 12044, lines 12-14. Again, there is no need for such redundancy in the paper.

16. p. 12050, lines 29-ff: "The wind speed was about 20 m/s during the cloud tomography test, causing a 2 to 3 K uncertainty in the background (sea surface brightness temperatures" (1) The average wind speed is specific information that was not mentioned, and is only being introduced in the conclusions. Furthermore, a reference height is needed for the wind speeds. Are they at a standard 10 m height?

References:

The authors have omitted a reference to related work in water vapor tomography published before Huang et al. (2008a,b) [p. 12030, line 10] and that is appropriate to add as an application of algebraic reconstruction tomography on p. 12040, line 12. The reference is:

S. Padmanabhan, S. C. Reising, F. Iturbide-Sanchez and J. Vivekanandan, "Retrieval of 3-D Water Vapor Field Using a Network of Scanning Compact Microwave Radiometers," in Proc. IEEE Geosci. Remote Sens. Symp., Barcelona, Spain, 2007, pp. 251-254.

English Grammar and Detailed Comments:

The paper needs to be proofread carefully by a native English speaker. Comments on some of the English errors and on the figures are given below.

1. p. 12027, "Gasiewski" is misspelled.

2. p. 12028, line 12: "respectively" makes no sense here because nothing corrresponds to the three configurations. Instead, change it to "using three configurations: the PSR, MIR, ..."

3. p. 12028, line 21: Change to "the radiometer scan strategy, the aircraft altitude and the aircraft speed."

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4. p. 12028, line 23: Change "a group of sensitivity studies" to "a set of sensitivity studies"

5. p. 12029, lines 10-11: Change "requires the ... be measured" to "requires that the ... be measured"

6. p. 12029, line 14: Change "at Boulder in Colorado" to "in Boulder, Colorado,"

7. p. 12029, lines 20 and 22: Change "similar ... as" and "similarly as" to "similar ... to" and "similarly as"

8. p. 12029, lines 27 and 28: Add "the" before "1980s" and before "high cost"

9. p. 12030, line 7: Change "Now is timely" to "Now is the time"

10. p. 12030, line 11: Delete "the mathematical nature of" and add "mathematically" on line 12 between "tomography" and "and developing"

11. p. 12030, lines 17-18 AND p. 12037, line 20 AND p. 12037, line 22 AND p. 12050, line 20: Change "measurement noises" to "measurement noise". In English, "noise" is a collective noun. Even when there are separate, distinct sources of this noise, the singular form is used.

12. p. 12030, line 22: Change "one order." to "one order of magnitude." This is required.

13. p. 12031, line 4: Change "The PSR was boarded" to "The PSR was deployed"

14. p. 12031, line 7: Change "at Wakasa Bay" to "over Wakasa Bay"

15. p. 12031, line 15: Change "detailed description on" to "detailed description of"

16. p. 12031, line 17: Change "basis of" to "basis for"

17. p. 12031, line 3: Change "working frequencies" to "measurement frequencies"

18. p. 12031, line 25 AND p. 12042, line 22: Change "at the 95 GHz frequency." to "at

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95 GHz."

19. p. 12032, lines 14-15: Change "understanding on winter precipitation over mid-latitude ocean." to "understanding of winter precipitation over the mid-latitude oceans."

20. p. 12033, lines 15-16: Change "sets a serious limit" to "imposes a serious limitation"

21. p. 12033, line 18: Change "Environment" to "Environmental". This is the name.

22. p. 12033, line 19: Change "were" to "was". The subject is "suite".

23. p. 12033, line 21: Change "coordinate" to "coordinates"

24. p. 12034, line 16: Change "proceeding for viewing" to "preparing to view" or similar.

25. p. 12034, line 20: Change "aircrafts" to "aircraft". Just like "noise", "aircraft" is a collective noun. "Aircrafts" is never used.

26. p. 12034, line 21: Change "centered about" to "centered on"

27. p. 12035, line 16: Change "a higher emission" to "the higher emission" and add "the" between "and also" and "higher sea surface"

28. p. 12036, line 2: Change "Atmospheric Science" to "Atmospheric Sciences"

29. p. 12036, line 5: Change "found in clouds" to "in the clouds" and "amount of large particles" to "number of large particles"

30. p. 12036, line 9: Change "at Sect. 2.5" to "are provided in Sect. 2.5"

31. p. 12036, line 18: Use the numbers and symbols instead of words in "zero degree[s] Celsius" and "-25 degrees Celsius"

32. p. 12038, line 6: Change "one of our previous study" to "one of our previous studies"

33. p. 12039, line 10: Change "imposed to" to "imposed on"

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34. p. 12039, line 12: Change "knowledge on" to "knowledge of"

35. p. 12039, line 17: Change "in other worlds" to "in other words"

36. p. 12039, line 24: Change "an estimate about" to "an estimate of"

37. p. 12040, line 3: Change "stands an the error" to "is the error"

38. p. 12040, line 10: Change "problem" to "problems" and add "and" between "very slow" and "sometimes even impossible"

39. p. 12040, line 11: Change "get unmanageable." to "become unmanageable."

40. p. 12040, line 17: A comma is needed to separate the digits, as "10,000"

41. p. 12040, line 25: Change "is within" to "are within" because the subject is "measurements"

42. p. 12041, line 5: "TV" must be defined at its first use.

43. p. 12041, line 6: Change "a way as to" to "a way that" and "should" to "must"

44. p. 12041, line 7 AND line 15: Add "the" before "data constraint."

45. p. 12041, line 10: Change "than unit." to "than unity."

46. p. 12041, line 26 AND p. 12042, line 2: Change "underneath" to "underlying"

47. p. 12042, line 5 AND p. 12043, line 19: Change "is depended" to "depends"

48. p. 12042, line 6: Change "incident angle" to "incidence angle" to conform to the commonly-accepted usage in the literature.

49. p. 12042, line 7: "Foam" is a collective noun, and "foams" is not used in this context.

50. p. 12042, line 11: Define LWC upon its first use.

51. p. 12042, line 18 AND p. 12048, line 12: Change "south-west to" to "southwest of"

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52. p. 12043, line 1: Change "descends." to "descents."

53. p. 12043, line 4: Change "in details" to "in detail"

54. p. 12043, line 7: Delete "being"

55. p. 12043, line 10: Change "has to been" to "have been" since the subject is "terms"

56. p. 12043, line 13: The symbol "m" has not been defined.

57. p. 12043, line 15: "Cloud support" is a specialized term of art that should be avoided.

58. p. 12043, line 23: Change "these needed" to "these necessary"

59. p. 12044, line 20: Delete "to" between "gives" and "a mean".

60. p. 12044, line 25: Delete "made" between "beams" and "at distinct locations"

61. p. 12045, line 3: Change "to" to "and" between each of the three sets of altitudes.

62. p. 12045, line 12: Change "transmission" to "transmitted"

63. p. 12046, line 5: Change "where" to "which"

64. p. 12046, lines 6-7: Change "in ... frequency" to "at ... frequency" [twice in these two lines]

65. p. 12046, line 8: Change "backscattering" to "backscatter" and change "show" to "shows"

66. p. 12046, line 14: Change "though, at the first glance," to "although, at first glance,"

67. p. 12046, line 23: It is not appropriate to use contractions, such as "don't" in scientific or technical writing.

68. p. 12047, lines 2, 3 AND line 23 AND p. 12050, line 26: Change "overlapping" to "overlap" [three cases in three lines]

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69. p. 12047, line 21: Change "platform moving speed" to "aircraft speed"

70. p. 12049, line 11: Change "cross the flight track" to "across the flight track"

71. p. 12049, line 17: Delete parentheses and change "constraints (force" to "constraints, the last forcing"

72. p. 12049, line 26: Change "inactivated" to "not included"

73. p. 12050, line 1: Change "to retrieval" to "to retrieve"

74. p. 12050, line 16: Add "way the" between "with the" and "radiometers"

75. p. 12050, line 20: Change "associate" to "associated"

76. p. 12050, line 21: Change "type" to "types"

77. p. 12051, line 9: Change "observation system observation experiments" to "observing system simulation experiments"

78. p. 12051, line 16: Change "that help" to "that helped"

79. p. 12051, line 17: Change ", to R. Austin" to "and to R. Austin"

80. p. 12051, line 20: Delete "the" between "acknowledge" and "insightful discussions"

81. p. 12056, lines 4-5: Change "succeeding" to "successive" [twice]

82. p. 12057, Fig. 4: The upper panel needs to be labeled "PSR" and the lower panel needs to be labeled "MIR" to clarify, in case the reader does not carefully read the long caption.

83. p. 12057, Fig. 4 AND p. 12059, Fig. 6 AND p. 12061, Fig. 8: The size of the labels must be increased in order to be legible in the PDF version.

84. p. 12058, line 2: Change "around" to "near"

85. p. 12058, line 3: Change "But" to "However,"

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86. p. 12058, line 4: Change "the involved" to "some of the"

87. p. 12059, line 2: "SART" needs to be defined in Fig. 7, not only in the text.

88. p. 12062, line 1: Change "The image" to "Image"

89. p. 12062, line 4: Change "microwave" to "microwave emission."

90. p. 12062, line 5: Change "very week" to "very weak"

91. p. 12064, Fig. 11: In the dependent variable axes on both figures, the two axes need to be labeled for "northeast" and "southwest".

92. p. 12064, line 3: According to the last line of p. 12048 in the text, the designations (a) and (b) are reversed in this caption. Finally, the text after (a) is not a complete sentence.

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