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Atmospheric Measurement Techniques
Discussions

Interactive comment on “On the estimation of vertical air velocity and detection of atmospheric turbulence from the ascent rate of balloon soundings” *by* Hubert Luce and Hiroyuki Hashiguchi

Anonymous Referee #1

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Precise measurements of vertical winds are an important topic with many meteorological applications. The paper by Luce and Hashiguchi deals with the calculation of vertical winds from radiosonde ascent rate measurements. Recently, different publications described new methods to separate the different parameters influencing the ascent rate, like vertical winds, drag coefficient of the balloon and other effects. Nevertheless, direct comparisons of retrieved vertical winds with independent observations are rare. In the first part of their paper, Luce and Hashiguchi make use of collocated UAV measurements of atmospheric turbulence and vertical wind measurements by

radar. This analysis is limited to altitudes below 7 km because the drift of the balloon and local inhomogeneities make further comparisons arbitrary. In the second part, they make a statistical analysis of a series of 376 radiosondes, confirming their results that the stability of the atmosphere influences the ascent rate of the balloon. In their main conclusion, the authors state that in a turbulent atmosphere the vertical winds can hardly be calculated without detailed knowledge of turbulence parameters. On the other hand, the ascent rate profile can be used to identify turbulence in the atmosphere. The paper is generally well written and concise. The arguments are described comprehensively and clearly. In the following, I describe only some minor comments that should be clarified before publication.

Minor comments:

ll. 82-83: I do not see the results of Gallice et al. (2011) limited to Tu=4%. The main “problem” is that they do not account for inhomogeneities in the turbulence field.

ll. 174-175: The agreement between V_Bc and W is expected from the calculation of V_z from the difference of W and V_B, and the definition of V_Bc. Is the calculation of V_z done in a different altitude than the V_Bc / W comparison?

l. 179: I am sorry, but I cannot identify the oscillations from below 3.8 km in the MCT layer above 3.8 km. Looking at the dashed lines the higher frequencies seem to dominate. Please explain.

l. 235: Please explain in short, why <V_B>_ST is not exactly the ascent rate in still air in the stratosphere.

ll. 267-270: Houchi et al. (2014) state in Section 6 a) that turbulence should broaden the ascent rate profile but not induce a tendency to purely higher ascent rates. Here, mainly the influence of turbulence on the drag coefficient is emphasized, yielding a higher ascent rate but not a broadening of the distribution. This seeming contradiction may be a question of the scales of turbulence cells. I suggest adding a clarifying sentence.

Fig. 8: Please provide a scaling for the ascent rate and the offset.

Technical comments and typos:

l. 22: “makes the estimation of W impossible”

l. 41: “making their models and hypotheses uncertain”

l. 79: Please add a multiplication sign in “4*10ˆ5”

l. 181: “1.8 km” should read “1.8 m/s”

l. 228: “. . . in the troposphere (Fig. 9a). This is an indirect . . .”

Fig. 5-7: I suggest either to turn the figure or the figure caption by 90°.

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