Atmos. Meas. Tech. Discuss., 7, C445–C448, 2014
www.atmos-meas-tech-discuss.net/7/C445/2014/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Estimation of atmospheric mixing layer height from radiosonde data" *by* X. Y. Wang and K. C. Wang

X. Y. Wang and K. C. Wang

kcwang@bnu.edu.cn

Received and published: 8 April 2014

Response to Reviewer #1

General comments The paper is motivated by the requirement to know mixing layer height (MLH) for air quality studies and climate change discussions. The measurement data, which are used for the task to estimate MLH, are from radiosondes launched from 79 stations over North America during the period from 1998 to 2008. Such data are available from the Stratospheric Processes and their Role in Climate Data Center (SPARC). The different methods to solve this task and the different analyses results are discussed in detail. A new method is proposed and demonstrated to determine MLH by integrating different methods. The new method handles cloud also. The prob-

lems during high humidity and cloudiness are discussed. Finally, the spatial variation of MLH over North America is shown. The paper addresses relevant scientific questions within the scope of AMT. It completes the knowledge about layering of the lower atmosphere. The paper presents novel concepts, ideas and tools. The scientific methods and assumptions are valid and clearly outlined so that substantial conclusions are reached. The description of experiments and calculations are sufficiently complete and precise to allow their reproduction by fellow scientists. The quality and information of the figures must be improved (see below). The related work is well cited as well as the number and quality of references appropriate i.e. the authors give proper credit to related work and clearly indicate their own new/original contribution. The title clearly reflects the contents of the paper. The abstract must be improved (see below). The overall presentation is well structured and clear. The language is fluent and precise but should be improved in the figure captions (see below). The mathematical formulae, symbols, abbreviations, and units are generally correctly defined and used but should be improved in some details (see below).

Response:Thank you very much indeed for the through and positive comments. Below please find my point to point response to your comments.

SpeciïňĄc Comments (1) Comment: Why space-borne and not ground-based lidar measurements were used? Lidar measurements detect particles i.e. an atmospheric compound and not a meteorological parameter as from radiosonde measurements is used to detect MLH. This is not discussed. There is no comparison performed but a link to a reference is given only so that this statement cannot be part of the abstract and the conclusions.

Response: We agree with the reviewer that ground-based Lidar measurements are good data to do such measurements. However, these measurements are not routinely made and are unavailable to us. The atmospheric compounds become completely mixed in the mixing layer due to the turbulence. The significant decreased of aerosol concentration at the top of the mixing layer is usually used as a sign of MLH. Water

vapour also acts as a tracer of the atmospheric dispersion state which may have a dramatical decrease at the top of the mixing layer. The temperature profile indicates atmospheric stability and significantly impacts pollutant diffusion. Hence, it has reasons to believe that the MLH derived from atmospheric compound and some temperature and humidity parameters are comparable. The MLH has an obvious diurnal cycle because of the land surface absorbed solar radiation in the daytime and the emitted longwave radiation during the night. The radiosonde data used in this study is observed at 00:00 Universal Time Coordinated which corresponds to 12:00-20:00 local solar time for North America stations. The equator crossing time of the space-borne lidar is about 13:30 local solar time. It is difficult for us to make a quantitative comparison between our result and the MLH derived from the space-borne lidar. A pattern of the climatological MLH was compared rather than the MLH absolute value. We deleted the comparison result in the abstract and just discussed it in the discussion part.

(2) Comment: Page 1251, lines 3-5: This sentence is not understandable.

Response: We will change the sentence "We eliminated the records with surface-based temperature inversions which that indicated possible stable boundary layers" to "Because we focused on the mixing layer height which is the convective boundary layer height in the daytime, we eliminated the radiosonde record with surface based temperature inversion indicating the stable boundary layer".

(3) Comment: Page 1252, equation (1): The units of the factors are not defined.

Response: The units of all the factors in the equation (1) were defined as: where N is refractivity, n is the refractive index, P is atmospheric pressure in hPa, T is atmospheric temperature in Kelvin, and e is water vapour pressure in hPa.

(4) Comment: Page 1258, lines 18, 19; page 1273: over North America instead of over the North America.

Response: Will correct as suggested.

(5) Comment: Fig. 2: It is confusing what black dotted and black solid line mean.

Response: We will replace the "black dotted line" in caption of Fig. 2 with "magenta dotted line". Furthermore, we will revise the Fig.2.

(6) Comment: Fig. 4: existing instead of existed.

Response: Will correct as suggested.

(7) Comment: All figure captions are too long. Some of the details should be described in the main manuscript. The language should be improved in all figure captions.

Response: We will shorten the captions of Fig.3, Fig.5 and Fig. 6. as follows.

(8) Comment: The quality of all figures should be improved by increasing the number of pixels.

Response: We will upload all the figures with resolution no less than 600 dpi separately.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 1247, 2014.