Atmos. Meas. Tech. Discuss., 5, C1665–C1669, 2012
www.atmos-meas-tech-discuss.net/5/C1665/2012/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Evaluating the capabilities and uncertainties of droplet measurements for the fog droplet spectrometer (FM-100)" *by* J. K. Spiegel et al.

Anonymous Referee #2

Received and published: 25 July 2012

General comments:

In the paper a very thorough analysis of the capabilities and uncertainties of the DMT fog monitor FM-100 is presented. Both the errors in droplet size that can arise due to the ambiguities in the Mie scattering and those in drop concentration originating from sampling biases (aspiration/transpiration/transport) are extensively studied. The way the results are resumed and represented is clear and concise. The paper is fluently to read but need some restructuring (see 'Specific comments'). Altogether, I recommend the paper to be published after minor-major revisions (in the end I choose 'major

revisions' since I like to see the paper again before publishing).

Here, I'd like to give some suggestions that I think can help to further improve the paper (other comments are listed in the 'Specific comments' below).

(A) My first impression was that the paper does not present something new, since the misinterpretation of drop size distributions measured by light scattering are well known and widely discussed in the literature (see for example Jaenicke and Hanusch, 1993) and resorting the instruments particle size bins to avoid that is a common procedure for the respective instruments.

Also sampling biases and their handling is well known and described, as is referenced in the paper.

I think this should be mentioned in the paper and it should become clear that the focus of the paper is to do an the error analysis for a commercially available instrument that is deployed often without taking care of these problems!

(B) Following the previous point, I like to highly encourage the authors to emphazise more the new stochastic method they have developed to retrieve the drop size distribution from the original particle bins (Section 3.1.2 and Figs. 4 and 6). This is a very useful contribution that might be applied by other groups (maybe you could provide the code in supplementary material?) and thus I think it should be mentioned in the abstract and conclusions of the paper.

(C) I think though it is useful to show all the equations for particle losses they are not new and can be found in the literature. Thus, I suggest to summarize them in an appendix. This would make the paper more compact.

Specific comments:

1. I suggest some restructuring of the paper:

   (i) Insert directly at the beginning of **2 Instrumentation and site** the first paragraph from page 3340, start with:
   The study to validate and compare the FM-100 with other instruments was performed in the frame of ...
   and continue with the text from page 3340:
   .... CLACE 2010 which took place at the Jungfraujoch (JFJ, 46 32 N, 7 59 E) situated in the Bernese Alps at 3580 m a.s.l., Switzerland (Fig. 2). Several intensive cloud characterization experiments have been conducted there for many years at different times of the year (e.g. Mertes et al., 2007; Verheggen et al., 2007; Cozic et al., 2008; Targino et al., 2009; Kamphus et al., 2010; Zieger et al., 2012). The aerosol measurements performed at the JFJ are part of the Global Atmosphere Watch (GAW) program of the World Meteorological Organization since 1995 (Collaud Coen et al., 2007). Long term studies have been conducted at the site, which indicated that the station is in clouds approximately 40% of the time throughout the year (Baltensperger et al., 1998). CLACE 2010 took place in JuneÂ■August 2010 (temperature range: -11 to 11 C) and its main aims were to obtain an in-depth chemical, optical and physical characterization of the aerosols at the JFJ as well as to investigate the interaction of aerosol particles with cloud droplets for improving the understanding of the aerosol direct and indirect effects.
   ...

   (ii) Rename **2.2 CLACE 2010 field experiment** to
   2.2 Instrumentation used for validation of FM-100 and insert directly after

   that
   2.2.1 Particle inlets

   (iii) Remove the title **2.3 Instrumentation used for validation**
   and rename 2.3.1 to 2.2.2, 2.3.2 to 2.2.3, 2.3.3 to 2.2.4, 2.3.4 to 2.2.5

   (iv) Remove the title **2.4 Determination of the cloud periods** and move the paragraph to directly at the beginning of
   4.3 Implementation of the Mie corrections and the particle losses for the CLACE 2010 campaign

   (v) Rename **3 Methods: corrections for the FM-100** to
   3 Methods: Sizing and counting corrections for the FM-100

   (vi) Rename **3.2.3 Implementation of the corrections for particle losses for the CLACE 2010 campaign** to
   3.2.3 Application of the corrections for particle losses to the FM-100

   (vii) Rename **4.1 The effect of the presented Mie correction to the channel widths of the FM-100** to
   4.1 The effect of the Mie correction to the channel widths of the FM-100

2. Page 3358, lines 14-15: *'The droplet size distribution for the default channels (ndft) was shifted towards larger droplets for the continental size distribution (Fig. 6a) ...'*.

   Can you please explain why?

3. Page 3358, lines 20-21: *'The distribution based on the Mie channels (ngeo) is plotted with horizontal error bars indicating the width of the new channels (Fig. 6a and c).'*

   How would the size distribution looks like with the 'classical approach' to account for Mie-uncertainties? It wouldbe good to see a comparison to the new approach!

4. Tables and Figures:

   (i) In addition to Fiure 3, please add a Table listing the default and the Mie left, middle, right channel sizes.

   (ii) Would be convenient for the reader if you explain again R_v in the caption of Figure 7.

   (iii) Figure 12: shouldn't the cloud residuals N_{cr} also be corrected for particle losses before they are compared to N_{FM}^{eff}?

References:

- Jaenicke and Hanusch (1993): Simulation of the optical-particle counter forward scattering spectrometer probe-100 (fssp-100) - consequences for size distribution measurements. Aerosol Science and Technology Volume: 18 Issue: 4 Pages: 309-322 DOI: 10.1080/02786829308959607

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 3333, 2012.