Atmos. Chem. Phys. Discuss., 11, C16626–C16628, 2012
www.atmos-chem-phys-discuss.net/11/C16626/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of cloud processes on aerosol particle properties: results from two ATR-42 flights in an extended stratocumulus cloud layer during the EUCAARI campaign (2008)" *by* S. Crumeyrolle et al.

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Received and published: 24 May 2012

3) An improved discussion of the processes and impacts is needed. I assume that there were measurements of cloud microphysics made, in which case these need to be included. How do the below-cloud measurements in a particular location compare with the in-cloud measurements? Vertical profiles from below-cloud to above cloud are fundamental to understanding clouds. Cloud microphysical measurements are important if you are to properly discuss the cloud processes and relate them to the measurements downstream of the CVI. Other questions: where is the input aerosol to the cloud;

what is the activation point; what is the cycling time of the aerosol through the cloud; how does number change in addition to volume; what are the chemical precursors that may contribute to changes in the size distribution; is collision-coalescence important to the change in the distribution? Cloud-top entrainment is thrown out to explain reductions in aerosol above cloud, but none of the observations address this issue and the attributions that I gather seem extreme.

As described using Figure 1, the comparison of below cloud measurements and in cloud measurements give information on two combined processes: activation and drizzle evaporation. And, the input aerosol to the cloud is the BL aerosol in the vicinity of the cloud. The number change in addition to volume is difficult to evaluate in the cloud as we did not have any size distribution available behind the CVI. FSSP measurements are available but we suspect that large droplets are spit to small droplets upon sampling and decided not to use the data.

Unfortunately, measurements could only be performed along the aircraft trajectory. In addition, aerosol properties have not been measured simultaneously in cloud and non cloud phase. These measurements have been performed subsequently (alternation), thus, relating below and in cloud features that have been measured at considerable distances, horizontally. Furthermore, thermodynamics and dynamics may more or less differ along the horizontal extension of the cloud layer. We agree with the reviewer that open questions remain regarding activation processes and cloud-drop closure. Unfortunately, supersaturation measurements for activation calculations have not been performed on the ATR. Nevertheless the gerber probe was measuring the liquid water concentration simultaneously with the CVI (Figure 2). The LWC measured with the CVI and with the Gerber probe are similar. The CVI measurements are overestimating the LWC by a factor of 0.1 which is in the range of the uncertainty in both measurements. According to this results, the authors believe that the mass concentration measured downstream the CVI are representative to the cloud residuals.

Moreover, the authors agree that the assumption of cloud top entrainment reducing

the aerosol loadings above the cloud has not been proved. Indeed we assume that cloud top entrainment is occurring during these flights (assumed from the important variability of thermodynamical parameters as shown in figures below) in a 200m layer where the aerosol concentration has been found minimum. As we didn't prove that the entrainment is responsible for that loading decrease but we suspect it, we nuanced then this position in the manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 33229, 2011.