Effects of trigger delay on the lidar depolarization products

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The study will present the effects of trigger delay correction in the near range of the lidar particle depolarization profiles.

It is known that uncorrected trigger delay between the laser emission and data recording can drastically influence the range corrected signals and optical products in the near range of the profiles (first 2-3 km) [1]. This effect is caused by higher raw signal values usually found in these regions. When higher raw signals are range corrected using wrong altitude values, a negative or positive bias can be seen especially in the near range of the profile (this is the range where the effects are more visible). We can conclude that the wrong range correction of the lidar signal adds a synthetic offset in near regions of the profile and in altitudes where the aerosol load is significant.

In the case of different trigger delays between the two components collected by depolarization lidar instruments (parallel and cross / parallel and total / cross and total), the derived volume depolarization values are also affected by an offset in the lower regions of the profile. This is caused by different effects of the trigger delay in the two near range signals used to retrieve the volume depolarization ratio. The derived backscatter profiles will also have a significant offset in the near regions of the profile in case of uncorrected trigger delay effects [1]. This will lead to an additional error in the derived particle depolarization ratio since this product is derived from both the volume depolarization ratio and backscatter profiles.

The study shows how depolarization products are affected by even a small offset in the trigger delay correction value and will discuss how the typical lidar range resolution of several meters can cause a systematic error in the particle depolarization ratio profile. To bypass this limitation, the study describes an optimized procedure on how to assess the trigger delay value with an accuracy better than the range resolution of the lidar instrument.

1. Freudenthaler, V., Linné, H., Chaikovski, A., Rabus, D., and Groß, S.: EARLINET lidar quality assurance tools, Atmos. Meas. Tech. Discuss. [preprint], https://doi.org/10.5194/amt-2017-395, in review, 2018.