The forward solution of the Klett inversion algorithm is thus adopted here. In particular, to obtain ßa from ALC measurements, we report the equations of the detailed algorithm procedure described in Wiegner and Geiß (2012, equations 1 – 3):

$$\beta_a(z) = \frac{Z(z)}{LR\ N(z)} - \beta_m(z) \qquad (11) \text{ with}$$

$$Z(z) = LR\ z^2 P(z) \exp\left[-2 \int_0^z (LR\ \beta_m - \alpha_m)dz'\right] \qquad (12) \text{ and}$$

$$N(z) = c_L - 2 \int_0^z Z(z')dz'. \qquad (13)$$

Here, β_m and α_m are the molecular backscatter and extinction coefficients calculated from climatological, monthly air density profiles, and $z^2 * P(z)$ is the ALC range(z)-corrected-signal (P) (also referred to as RCS), that is the raw data format of the considered ALCs. Knowledge of the calibration constant c_L is needed to solve eqs. 13 (and thus 11, forward solution). When analyzing ALC daily records, the constant c_L has been obtained by the "backward approach" (Rayleigh calibration) applied to night-time, cloud-free ALC signal averaged over 1 or 2 hours at 75 m height resolution. This allows for using the best c_L retrieval (that is the night-time, lowest noise one), in the forward solution of the lidar equation, which guarantees operating over the best signal to noise range of the ALC signal.