Answer to Referee #1

We thank the referee for the careful reading the manuscript and the kind suggestions to improve it. Please find our answers to the specific comments and technical corrections below. Answers are typed in cursive letters and new text is typed in smaller letters.

Specific comments

P1L12, coarse mode is mentioned here, but only small and medium size are mentioned in P9L16 for same angstrom range 1-1.5. Unify the statements.

- *There was some mismatch, the statement was adapted in the abstract*

The majority of the Angström exponents were observed between 0.5 and 1.5 indicating a mixture of fine- and coarse-mode aerosols.

P3L32, the interval 2-3h was written, but the original time resolution was not indicated.

- *The original time resolution is 30 seconds and the vertical resolution is 7.5 meters. New sentence P3L15*:

The vertical resolution of the raw profiles is 7.5~m and the data were stored with a temporal resolution of 30~seconds.

P6L18, What are 'large, non-spherical particles'? Are they dried sea salt stated in P9L10?

- *Large, non-spherical particles can in principle be dust particles, or sea-salt particles, or even ice particles (the latter is very unlikely here, due to the altitude and corresponding temperature). We just wanted to express, what a higher depolarization ratio implies. However, in this chapter of the manuscript the particle classification is not the subject, so we leave this sentence out here and come back to the particle classification later.*

P6L28 and Fig.4, is there any reason to choose 48 hours for backward trajectories here? Do authors just intend to show the air mass stayed there for long time? If trajectories are introduced to infer the origin of particles, 48 hours are insufficient.

- *Yes, here we wanted to show, that the air masses came from close by during the last 48 hours. The trajectory cluster analysis discussed in chapter 4.3, for which trajectories were calculated for 144 h, showed that only a few percentage of the air masses come from far away sources.*

P7L9 and Fig.5, does the particle extinction mean extinction of aerosol particles? In the figure, we see several peaks around 7- 8km. Are they cirrus or aerosol layers?

- *Particle extinction coefficient at 532 means the extinction of light by the aerosol particles. Figure 5 caption was corrected accordingly:*

Figure 5. All single and seasonal mean particle extinction coefficient profiles measured by the lidar at 532 nm during the entire observation period from November 2011 to June 2012.

- *Yes, the peaks around 7-8 km height are due to cirrus clouds.*

P8L2, How were the top heights of the lofted aerosol layers determined?

- *The top heights of the lofted aerosol layers were identified visually from the backscatter coefficient profiles. The top height was defined were the backscatter coefficients reach the molecular background, the lower boundary of the lofted layer was set to the minimum in the backscatter coefficient profile between the PBL and the lofted layer. We added this point as follows:*

The top heights and the depths of the lofted aerosol layers are shown in Fig.5. Both values were identified visually using the backscatter coefficient profiles. The top height was defined were the backscatter coefficients reach the molecular background and the lower boundary of the lofted layer was set to the minimum in the backscatter coefficient profile between the PBL and the lofted layer.

P9L5, Indicate literature to identify local sources using depolarization ratios and lidar ratios.

- *We did not want to state that the depolarization ratio and lidar ratios identify the source, but the type of the aerosol. Literature that is reporting similar optical properties is used iin the discussion of these results at P9L33-35.*

Modified sentence:

Depolarisation ratios below 5 % and high lidar ratios up to 80 sr are caused by particles of lower reflection and higher absorption capabilities. These are most likely freshly produced smoke and pollution particles arising from local sources.

P9L19, If authors identify lower Angstrom 0.1-0.3 as marine particles, the lower left part in Fig.7b should be marked similarly.

- *The data points of low Angström and low lidar ratio are identified as dust and dust mixtures because the origin of the particles was surveyed by individual trajectories. This is the only dust case of 2-3 December 2011 and is discussed in another paper, see P9L11.13.*
  Since there are no measurement points of pure marine particles, we did not mark this area separately.

P10L14, 1200 m was determined from Fig.5?

- *The altitude of 1200 m was determined as the mean/median value of all identified PBL layer tops. They are not shown in a separate figure. However, you are right; the total of all extinction profiles in Figure 5 gives further evidence that it is reasonable to choose this height for the mean upper boundary of the PBL top.*

<u>Technical corrections:</u>

P9L30, a mean lidar ratio 56+-6 ’sr’ - *done*

P12L7, 1.28+-0’.’42 - *done*