Answer Reviewer 1

We decided to withdraw the current manuscript in order to refocus the results of the airborne campaign towards the analysis of the Siberian aerosol sources and to drop the discussion on the lidar ratio characterization and comparison with CALIOP. Satellite data will be only provided as a mean to document the regional context of the airborne observations.

Some quick answers to the reviewer comments are nevertheless provided :

Line 57: A comment on the main lidar monitoring networks (EARLINET, MPLNET, LALINET, Cislinet, ADnet, NDACC) should be included.
Yes we agree that the contribution of the ground based lidar networks is not sufficiently recognised. The unfortunate remark referred mainly to the limited amount of measurements available in Russia. This point will be corrected in the new manuscript.

Lines 99-100: Which method was used to perform the polarization calibration? Polarization calibration seems to be not enough for aerosol typing. Can you explain in more detail this?
As mentioned in the first version of the paper, the airborne lidar does not have a reliable measurement of the depolarization channel and only a rough estimate of the presence of depolarization can be used. It is used as an additionnal information in the analysis of the intensity of the attenuated backscatter coefficient to filter out the data within cloud layers.

Lines 115-116: The correction factor applied for deriving the black carbon mass concentration hugely ranges from 0.5 to 1, depending on the blackening. Because of the impact that this correction (up to 100%) has on the final product, this issue should be explain more in detail.
This issue will be addressed in the new version. Absolute calibration of the aethalometer was performed in the laboratory conditions by means of a pyrolysis generator of soot particles and comparison of the data of simultaneous optical and gravimetric measurements.

Line 134-135: For overlap characterization, a method based on the ratio between PR2 and molecular backscatter profile is employed. The latter is computed from the ERA Interim ECWF meteorological analysis, which can differ slightly from the actual atmospheric temperature and pressure values. Is this uncertainty account for the calculations? Which is the impact of using ERA Interim in the overlap derivation? How much does the overlap change from flight to flight?
The error related to the use of the ECMWF analysis for the retrieval of the molecular density vertical profile is quite small (< 1-2%) compared to the assumption of clear sky conditions (5 % error). The shape of the overlap function correction does not change significantly from flight to flight, but the absolute lidar calibration is certainly different from flight to flight.

Line 139-142: The constraining of lidar ratio must be carefully performed. One limitation is the spatial distribution because of the highly aerosol variability.
Yes we agree it is a difficult task to address this question without a direct measurement of the extinction profile. We have estimated the uncertainty in the retrieval when using a constraint with MODIS AOD by using the distribution of several MODIS AOD in the air masses sampled by the aircraft. However it is true that the spatio-temporal differences between the satellite observations and the aircraft observations is always a critical question, especially when the aerosol optical properties rapidly change with mixing or relative humidity evolution. The time difference between the MODIS observations and the aircraft observations are less than 1 hour for three cases (dusty mix, fresh fire and Siberian city emissions), while it is indeed between 4-5 h for the other three cases (aged fire, gas flaring, aged urban emissions from China). In the new version of the paper the retrieval of an aircraft extinction profile based on a constraint by MODIS will be left out. The retrieval of an AOD below the aircraft will be made using our analysis of the type of aerosol based

on the FLEXPART analysis coupled with the in-situ measurements, while the lidar ratio for the corresponding aerosol type will be taken according to the existing values of the scientific literature. The MODIS AOD from Aqua and Terra will be only an additionnal information in the analysis of the airborne lidar data to provide the regional context of the aerosol distribution.

Line 186: In the different subsections of section 4, I miss a more complete comparison/discussion of the lidar ratio values obtained here respect to those in the previous literature.

It is done in section 4.7 line 323-352 when discussing the airborne lidar AOD dat. With the new approach chosen above, an analysis of the lidar ratios used in the litterature will be carried out prior to the analysis of the airborne lidar measurements.

Line 355 (section 5): Here is my main concern. I do not agree with the scope of this section. Taking into account the datasets you are comparing, this does not make sense at all (huge distance/time for comparison). What might be interesting is the use of CALIOP for complementing the profiling done by the flights and check coherence among datasets, but not comparison. Therefore, please reorganize section 5 in this sense.

We understand the reviewer's concern. First of all, we should recall that the CALIOP overpasses were chosen based on the analysis of the transport of the air masses. We therefore believe that the same type of aerosol is considered for the CALIOP overpass analysis and the analysis of airborne lidar data. Nevertheless, changes in aerosol properties are always possible during transport and we agree that the validation of CALIOP data is still questionable, whereas several validation campaigns using direct measurement of extinction have been published, altough not in Siberia. In the newly prepared version, the discussion of CALIOP overpasses will be used only to obtain additional information on aerosol distribution and optical properties at the regional scale during the aircraft campaigns.