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 observed by the aircraft 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 :

1. The extinction-to-backscatter ratio (lidar ratio) of different aerosol types is one of the main products of this study. However, it is not measured directly, but retrieved using the backscatter coefficient from the airborne lidar and the aerosol optical depth (AOD) from the satellite (MODIS). The scientific advance by this indirect retrieval of the lidar ratio is little. And as the lidar ratio is not just a side product but the main product of the aerosol characterization in this study, it is not sufficiently well constrained.

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.

2. The comparison of the airborne observations with the spaceborne CALIOP measurements is highly uncertain. The temporal and spatial distance is too large to draw valid conclusions. The conclusions drawn with respect to CALIOP might be correct but are not based on a convincing comparison.

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.

3. The depolarization ratio conveys important information about the particle shape and is therefore a key parameter in the aerosol classification presented in Burton et al., 2013, to which the authors refer in the manuscript. I wonder how the authors assign one of Burton's aerosol types in Tab. 1.

We agree that the depolarization conveys important information. In this campaign it is not available. I think the reviewer misunderstood that the aerosol type classification proposed in this work is only based on the joint analysis of the FLEXPART simulations, satellite data and in-situ aircraft measurement. The airborne lidar is not used to derive the aerosol type.

4. Two out of the six cases presented have significant ambiguities in the current version of the manuscript. Case 2 (Ob Valley gas flaring emissions) is a multilayer scenario. Case 6 (Long-range transport of Northern China emissions) the source appointment is not very convincing. The FLEXPART backward simulation (Fig. 18a) shows a large residence time in the area south of Yakutsk.

For case two yes the satellite data and FLEXPART analysis suggests that dust aerosol layer might be encountered just above the aircraft. Although it is well separated from the gas flaring signature it is

true that a small additionnal contribution of this layer will be included in the MODIS AOD and not in the airborne lidar AOD. According to the CALIOP data analysis it will not be larger than 0.05. For case six, we agree the figure 18 is misleading. It is the average of the FLEXPART backward simulation between 0 and 5 km and the contribution of the Harbin region is smoothed out. If the FLEXPART simulation is limited to the aerosol layer detected between 2.5-4 km, the contribution of Harbin becomes quite obvious (see FLEXPART Potential Emission Sensitivity plot when splitting the release area for the 1km-2.5 km and 2.5km-4km altitude ranges). This will be discussed in the corrected version.

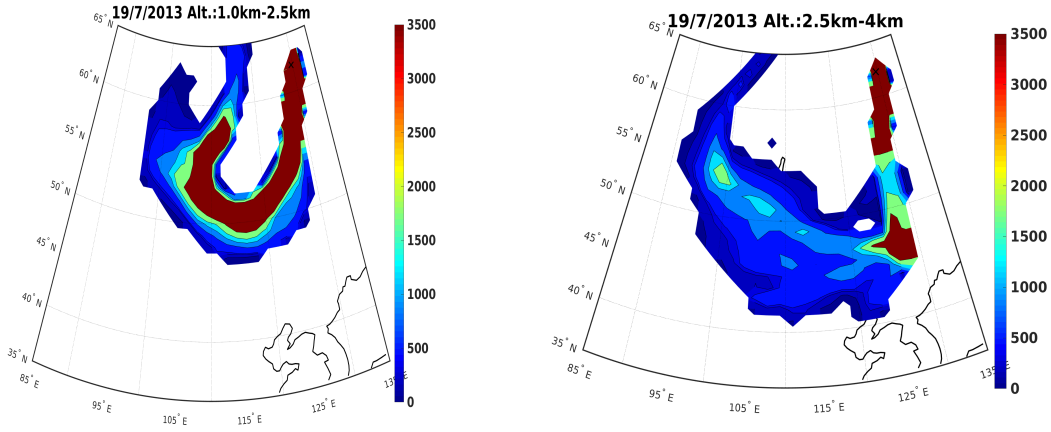

Fig. : FLEXPART potential emission sentivity map in second using 4 days backward simulations between July 16th 2013 and July 19th 2013. The black cross is the aerosol layer position observed by the airborne lidar in the 1-2 km (left) and 2.5-4km (right) altitude range. The Harbin location is at 45°N, 126°E.

I would encourage the authors to focus on different aspects of their campaign: The differences between fresh and aged forest fire smoke or between gas flaring emissions and urban pollution. Also, a stronger focus could be put on the comparison between the lidar and the in situ measurements.

We thank the reviewer for this constructive comment. We decided to refocus the paper along these lines.