Lee et al. present an interest study of the impacts of aviation emissions on air quality in the PBL. In particular, they address the influence of aviation emissions at various altitudes and explain that vertical mixing of directly emitted species is not the main mechanism under which aloft emissions affect air quality in the PBL. I find this paper is within the scope of ACP and recommend its final publication after the authors address several issues listed below.

1. Aviation emissions will likely increase in the future (particularly in developing countries) if control measures are not enhanced. While it is critical to assess the influence of aviation emissions in current years, it is also important to discuss the potential changes in future emissions and implications for air quality. Also, I suspect that emissions in Asian countries are underestimated given the fast growth in the past decade. For example, total non-aviation anthropogenic emissions of NOx in China increase by about 30% from 2005 to 2008 (Lin and McElroy, 2011). Please comment on the recent trend of aviation emissions.
2. The global model has a relatively low resolution and thus cannot simulate the non-linear chemistry in the PBL very well. I suggest the authors to discuss the potential uncertainties due to model resolution, both horizontal (Lin et al., 2008) and vertical (Menut et al., 2013). Also, the impacts of LTO emissions should be significant near the airport. Therefore the paper should be clearer on the horizontal scale of the air quality being addressed, particularly when it concludes that aviation emissions only have insignificant impacts on air quality.
3. The paper shows an interesting result that aviation emissions of NOx during cruise reduce, rather than enhance, NOy in the PBL in January. The authors also explain the seasonality of the magnitude of NOy perturbation by analyzing the heterogeneous reactions. It is unclear, however, why increased NOx emissions aloft would reduce NOy in the PBL.
4. As the impact of air pollution on health is continuous (i.e., there is no ‘threshold’ below which amount pollutants do not affect health, as pointed out by the other reviewer), it appears inappropriate to completely disregard the impacts of aviation emissions on air quality just because the impacts are small.

Specific comments:

P690, L9: better to specify the height.

Abstract: please emphasize the spatial scale of the findings. i.e., small-scale influence near the airports is not simulated here.

P691, L15: please define the height of non-LTO.

P692, L22: what is ‘N’?

P693, L9: Emissions of NH3 from soil and waste are affected by temperature and other met conditions.

P693, L14: ‘his’ should be ‘this’

P693, L20: emission dataset here and even the FAA dataset later do not account for the recent rapid growth in developing countries (like China). Please comment.

P693, last paragraph: please discuss the diurnal cycle of emissions. Aircrafts fly mostly during the daytime. In the later paragraph the authors suggest uncertainties are not important for the ‘hydrophilic’ assumption for BC and for emission indices. It will be helpful to indicate the point here.

P695, L26: how about the thickness of the three layers?

P696, L9: ‘surface’ or ‘PBL’? Also, the sentence is difficult to understand. It is better to briefly mention here the cause of reduced NOy in the PBL.

P698, L3: which case is the result for?

P698, L26: the sentence is unclear.

P700, L9: do you mean PM in the PBL?

P700, L10: HNO3 has a longer lifetime than NOx?

P702 formulae: what is x?

P703, L11: how about p-value of 0.87 in Dec?

P703, L23: how about E. Asia for the >50 ppbm case? The number of gridpoint-day increases from 39 to 43, an increase by 10%. Also, aviation emissions here are probably underestimated over Asia by not accounting for the recent rapid growth.

P704, L29: As NOy are decreased in the PBL in January, it suggests that the increased formation of NH4NO3 is the cause of reduction in NOy.

Ref:

Lin and McElroy: Detection from space of a reduction in anthropogenic emissions of nitrogen oxides during the Chinese economic downturn, Atmos. Chem. Phys., 11, 8171-8188, doi:10.5194/acp-11-8171-2011, 2011

Lin et al.: Global model simulation of summertime U.S. ozone diurnal cycle and its sensitivity to PBL mixing, spatial resolution, and emissions, Atmos. Environ., doi:10.1016/j.atmosenv.2008.08.012, 2008

Menut et al.: On the impact of the vertical resolution on chemistry-transport modeling, Atmos. Environ., 10.1016/j.atmosenv.2012.11.026, 2013