

Comments to S. Bucci et al. "Aerosol variability and atmospheric transport in the Himalayan region from CALIOP 2007-2010 observations" (MS No.: acp-2013-278)

### **General comments:**

This study reports a seasonal variability of aerosol types using recent CALIOP observation data set. Parts of the manuscript are confusing (see comments below) and there are doubtless ways in which the identified aerosol types could be refined in future (evaluation using in-situ measurements). Nevertheless, I think the paper is interesting. The characterization of seasonal and spatial variability of aerosol types using CALIPSO make the manuscript potentially suitable for publication. However, the assessment of sources of aerosols during pre-monsoon season is confusing. I have outlined some specific comments below which I feel should be addressed prior to publication.

### **Specific comments:**

1. Page 15272, line 14: Quantify the dust amount.
2. Page 15274, line 26: What is CNES?
3. Page 15275, lines 27-29: Sentence is not clear. Rewrite the sentence.
4. Uncertainties in trajectory increase with trajectory length. Provide justification for using 10 day trajectories to resolve transport patterns. In general, kinematic trajectories undergo considerably greater vertical displacements. How much uncertain is the estimated transport patterns?
5. In this study, the analysis is limited to the transport above the Planetary Boundary Layer (Page 15276). How this will influence the BC local emission transport?
6. Back trajectories analysis is confusing. The starting point area is indicated by a blue shaded region. Clarify the starting point area in the manuscript. Why this starting point area is different in Figure 7?.
7. Smoke aerosol types influence is limited to summer and fall seasons (Page 15279). What is the reason for this? It is reported that carbonaceous aerosols are mainly produced from crop-residue, forest and

bio-fuel burning sectors during winter and fall seasons over the south Asian regions. Why smoke influence is less during winter season? Whether the polluted dust type is misrepresenting the smoke influence (Fig 1)?

8. Page 15282, line 21: Add reference.
9. Page 15284, line 19: Quantify the small amount?
10. Page 15285, lines 14-16: Sentence is not clear. Rewrite the sentence.
11. It would be useful if the authors can provide the comparison of total aerosol extinction/ optical depth with the AERONET observed aerosol extinction during 2007-2010. This will also address the issue of general accuracy of CALIOP aerosol extinction data (Koffi et al., 2012).
12. Several limitations in the CALIOP aerosol data were reported in recent literature's, including uncertainties due to finite detection sensitivity of the CALIOP instrument, uncertainties associated with selection of lidar ratios, and misclassifications of features (Koffi et al., 2012; Winker et al., 2013). This discussion should be included in the manuscript.
13. The following papers should be cited in the manuscript:  
Omar, A. H., D. M. Winker, J. L. Tackett, D. M. Giles, J. Kar, Z. Liu, M. A. Vaughan, K. A. Powell, and C. R. Trepte (2013), CALIOP and AERONET aerosol optical depth comparisons: One size fits none, *J. Geophys. Res. Atmos.*, 118, 4748–4766, doi:10.1002/jgrd.50330.  
Koffi, B. et al. (2012), Application of the CALIOP layer product to evaluate the vertical distribution of aerosols estimated by global models: AeroCom phase I results, *J. Geophys. Res.*, 117, doi:10.1029/2011JD016858, 2012.  
Winker, D. M. et al. (2013), The global 3-D distribution of tropospheric aerosols, *ACP*, doi:10.5194/acp-13-3345-2013.

### **Technical errors:**

1. Check the spelling of anthropogenic throughout the manuscript. (See Page 15273, line 2 ; Page 15276, line 17 & 23).
2. In Fig. 1, What is white shade indicate?

3. In Figure 6, grey shades (BC emissions are uniformly distributed) are confusing.

**References:**

Koffi, B. et al. (2012), Application of the CALIOP layer product to evaluate the vertical distribution of aerosols estimated by global models: AeroCom phase I results, *J. Geophys. Res.*, 117, doi:10.1029/2011JD016858, 2012.

Winker, D. M. et al. (2013), The global 3-D distribution of tropospheric aerosols, *ACP*, doi:10.5194/acp-13-3345-2013.