

Interactive comment on “How can aerosols affect the Asian summer monsoon? Assessment during three consecutive pre-monsoon seasons from CALIPSO satellite data” by J. Kuhlmann and J. Quaas

Anonymous Referee #2

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Review of paper titled "How can aerosols affect the Asian summer monsoon? Assessment during three consecutive pre-monsoon seasons from CALIPSO satellite data?"

General Comments: Authors use the spaceborne profiling capability of the CALIPSO lidar to study the aerosol vertical distribution and the associated heating rates in the troposphere in the Asian Monsoon region centered around Tibetan Plateau (TP). The paper addresses the Elevated Heat Pump (EHP) hypothesis for the aerosol-monsoon linkage by analyzing in detail the aerosol-induced heating rates over the TP and other surrounding major aerosol source regions. Major finding is that the aerosol radiative

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heating over the elevated Tibetan Plateau is not substantial enough to influence monsoon circulation patterns as suggested by the EHP mechanism.

Although the paper is interesting by itself and reports new data from CALIPSO observations of aerosol vertical distribution and heating rates modeled by radiative transfer calculations over the key regions in and around the TP, the paper lacks in the treatment of the aerosol-monsoon linkage via the EHP mechanism. Authors are recommended to consider the following suggestions/clarifications before the manuscript can be accepted for publication.

Firstly, The EHP hypothesis focuses mainly on the heavy pre-monsoon aerosol loading (dust mixed with soot) over the Indo-Gangetic Plains (IGP) that pushes against the southern slopes of the Himalayas. The radiative heating along the southern (aerosols from IGP) and northern slopes (due to dust from Taklamakan) of the TP triggers convective feedback processes resulting in tropospheric temperature anomalies over the TP. Therefore, conceptually, the aerosol-induced heating would occur largely over the southern slopes (I am not too sure about the northern slopes) and not necessarily over the TP. Heating (or warming) over the TP may be a consequence of other atmospheric feedback processes triggered by aerosol-induced heating over the slopes.

Authors should clarify this key aspect in the manuscript and then decide whether the aerosol-induced heating over the TP (or over the slopes) is critical to monsoon via the EHP mechanism. Additionally, Liu et al., 2008 (ACP) show from CALIPSO the presence of dust mixed with soot along the southern slopes and therefore the possibility of enhanced heating over the slopes is a more likely response due to aerosols.

Specific comments: Section 2.1 CALIPSO Satellite Data Authors should let readers be aware of the various uncertainties associated with the CALIPSO data. Additionally, the data they use are Level-2 products and many of these products are in beta stage and not validated.

I don't think the Arabian Sea should be considered part of their analysis as it is not in

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close proximity to the TP. Moreover, the dust blowing over the Arabian Sea is eventually transported to the Indo-Gangetic Plains (these regions are already part of the analysis).

Section 3: How do the authors explain polluted dust over the Arabian Sea? Are there any references to this observation?

When authors show the frequency occurrences of dust (and other aerosol types) and their altitudes, the issue of number of samples is not discussed or clearly explained. Therefore, the analysis carried out over different regions may be biased by the sampling issue especially when CALIPSO transects are sparse and often attenuated by clouds. This is a major issue the authors should address to make the results appear more coherent.

Section 4: This is where authors describe the methodology of the combined analysis of wind and aerosol data. It needs to be explained in more detail. The first paragraph needs to be more clear.

Minor Comments: Line 20: Page 4888: "Aerosol concentrations..." This is a very vague statement. Authors should be more focused and should provide some key references to aerosol studies in the Asian/Indian monsoon region.

Line 22, Page 4888: change "modeling" to "radiative transfer modeling"

Line 19, Page 4889: "lifeline of many"; sentence should be more focused.

Line 29, Page 4889: change "supposing" to "suggesting"

Line 22, Page 4891: "Since the CALIPSO is available....." this entire sentence is not clear.

Line 20, Page 4892: remove "the" from "consists of the"

Lines 1-4, Page 4895: entire sentence is not clear, it should be explained clearly.

Line 13, Page: 4895: explain the "ROI". The sub-regions should be mentioned here.

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Line 11, Page 4896: "stemming" is not appropriate here.

Lines 15-17, Page 4896: "Meanwhile..." this sentence is not clear.

Line 6, Page 4897: change "we carry out a..." to "we carry out an analysis of..." or something similar.

Line 9, Page 4897: change "aerosol layers above" to "aerosol layers exist above" and remove "exist" from the end of the sentence.

Line 8, 4899: change "Every one" to "Each one"

Line 20, Page 4900: change "unchanged" to "not changed" and "lower aerosols" to "lower aerosol loadings".

Line 1, 4901: change "they are situated at" to "they are advected to".

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 4887, 2010.

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