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Interactive comment on "Transpacific transport of Benzo[a]pyrene emitted from Asia: importance of warm conveyor belt and interannual variations" *by* Y. Zhang et al.

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We thank Dr. Pöschl for the valuable comments.

We admit that we should add some discussion on the neglecting of degradation of BaP associated with atmospheric particle. Based on the literatures listed by Dr. Pöschl, the BaP adsorbed onto aerosol surface is subject to fast degradation by O3, OH and NO3 etc. with a lifetime on the order of minutes (e.g. Shiraiwa et al., 2011; Kaiser et al., 2011). However, large fraction of BaP residences inside of bulk aerosols where the degradation rate is much slower because of the surface/bulk shielding effect (Lohmann and Lammel, 2004; Pöschl et al., 2001). The aging of aerosol can further slowdown

the reaction rate (Perraudin et al., 2001). Schauer et al. (2003) actually find that the BaP concentration can decreases to up to 50% of the original level when exposure to 80 ppbv O3 in a time scale of 1-4 days. The latter study gives us a reasonable estimation of the residence time of particulate BaP reaction with O3 and other oxidants in the environmental conditions, on the order of several days.

Meantime, the BaP associated with particles suffers from dry/wet deposition, which is also important sink of BaP in the atmosphere. Based on our model result, the residence time of BaP loss via dry/wet deposition is $\sim$48 hours. Another important sink of BaP is via reaction with oxidants in the gaseous phase, the residence time is comparable with that from depositions. Therefore, the neglecting of BaP degradation in particulate phase actually overestimates the residence time of BaP in the atmosphere by a factor of $\sim$30%. This really is a significant source of uncertainty for our model result, so the following statements are added to the end of line 11, page 8 of the manuscript, and corresponding reference is also added:

"Based on the reaction estimation by Schauer et al. (2003), the residence time of particulate phase reduction of BaP is on the order of a couple of days due to heterogeneous reaction with O3 and other photo-oxidants in the atmosphere. The neglecting of this effect could cause an overestimation of the residence time of BaP in the atmosphere for $\sim$30% in this study."

References:

Lohmann, R., Lammel, G., 2004. Adsorptive and absorptive contributions to the gas-particle partitioning of polycyclic aromatic hydrocarbons: state of knowledge and recommended parameterization for modeling. Environmental Science & Technology 38 (14), 3793-3803.

Perraudin, E., Budzinski, H., Villenave, E., 2007. Identification and quantification of zonation products of anthracene and phenanthrene adsorbed on silica particles. Atmospheric Environment 41(28), 6005-6017.

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