



## Supplement of

## The outflow of Asian biomass burning carbonaceous aerosol into the upper troposphere and lower stratosphere in spring: radiative effects seen in a global model

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Figure S1: Distribution of dust AOD from the BMaeroon simulation and averaged for spring 2013. White lines show the orography (km) of the Tibetan Plateau.



Figure S2: Distribution of anomalies of dust aerosol ( $\mu$ g.m-3) (BMaeroon-BMaerooff) averaged for spring 2013 for (a) the lower troposphere (1000 to 700 hPa) and (b) the mid-upper troposphere (600 hPa - tropopause). Gray shading in Fig (a) indicates the Tibetan Plateau.



Figure S3: Distribution of anomalies (BMaeroon - BMaerooff) averaged for spring 2013 (a) atmospheric column concentration of BC and OC together (%), (b) ratio of BC-AOD to the total AOD (%), (c) ratio of OC-AOD to the total AOD (%).



Figure S4: Horizontal distribution of anomalies of (a) BC (ng  $m^{-3}$ ) and (b) OC (ng  $m^{-3}$ ) at 100 hPa from the ECHAM6-HAMMOZ simulations (BMaeroon - BMaerooff).



Figure S5: Vertical section of anomalies of BC (ng m<sup>-3</sup>) for spring 2013 from ECHAM6-HAMMOZ simulations (BMaeroon – Bmaerooff) (a) latitude-pressure section over South Asia (averaged for 70°E-95°E); (b) same as (a) but for OC. The black vertical bars show the topography and the black line indicates the tropopause.



Figure S6. Vertical section of anomalies of vertical velocity (m.s<sup>-1</sup>) for spring 2013 from ECHAM6-HAMMOZ simulations (BMaeroon – Bmaerooff) (a) latitude-pressure section averaged for 91°E-107°E, (b) same as (a) averaged for 108°E-123°E, (c) distribution of anomalies in OLR (Wm<sup>-2</sup>) from the ECHAM6-HAMMOZ simulations (BMaeroon - BMaerooff) averaged for spring 2013. Vectors of the circulation anomalies (BMaeroon-BMaerooff) are shown in (a)-(b) with the vertical velocity field scaled by 300. In Fig (a)-b) the black vertical bars show the topography and the black line indicates the tropopause.