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Interactive comment on "Naturally driven variability in the global secondary organic aerosol over a decade" *by* K. Tsigaridis et al.

K. Tsigaridis et al.

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We thank Dr. Boris Bonn for his thorough comments and for communicating us his manuscript in press. We have appropriately modified the revised manuscript as follows:

Detailed model description: Addressing also the comment of anonymous referee #1, the description of the model is summarized in a paragraph that has been added to mention briefly the points noted by the referee, in section 2.1 (see reply to the first comment of referee #1).

What is the effect of the limitation of the dynamic vegetation model ORCHIDEE to 13 different plant type functional groups? The following text has been added at the end of the first paragraph of section 2.2: "However, there is insufficient information

on emission rates to consider significantly more plant types. Additionally, there are too few emission factors for different monoterpene compounds from different plant species, and even less for a global study. This certainly leads to a non-negligible error in the distribution of detailed terpenes but we are far from knowing enough about biogenic emissions to be able to calculate emissions in such details."

The parameterization for dry and wet deposition has been described in detail in Tsigaridis and Kanakidou (2003). A short comment has been added to Section 2.1: "All aerosols in the model have a rural continental size distribution, i.e. mostly accumulation range aerosol."

There is an open question on the importance of the contribution of the oceanic emissions (O'Dowd et al., 2004; Nature, 431, 676-680) to the OA budget and fate in the atmosphere that definitely deserves dedicated studies. However, this is not the topic of the present paper. In section 6 we have added the following sentence in the last paragraph when discussing the future improvements: "These particles could affect the chemical composition of the atmosphere by acting as surfaces for heterogeneous reactions that modify both the gas and aerosol phases."

SOA and rainfall: The relation between SOA and rainfall in our model is only due to the impact of the water cycle on SOA, since TM3 has no interactive water calculations. The water cycle is input to the model and affects the removal processes of aerosols and gas-phase species, together with the gas-phase chemistry. For clarity, the corresponding sentence at the end of Section 4 has been modified as follows (page 1265, lines 1-3): "The observed reduced rainfall over most of precursor VOC source regions as recorded by the ECMWF meteorological data, result in the presence of more pre-existing particulate matter available for condensation of semi-volatile compounds and thus in higher SOA mass production."

To mention the effect of temperature on saturation vapor pressures as an additional explanation of the changes in SOA burden we added the following in section 3 (page

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1263, line 24): “Additionally, since 1990 is warmer than 1986, enhanced evaporation could result from higher saturation vapor pressure of SOA precursor species, thus reducing the condensation rate of semi-volatile compounds. However this effect is expected to be of minor importance, as it will be discussed later.”

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 1255, 2005.