

Figure S1: Modelled near surface H_2SO_4 (gas), MV-SOG, SV-SOG and LV-SOG concentrations during June 2010 at Puy-de-Dôme. (a) Model results for the thermodynamic-kinetic approach with 10 % aging, (b) model results for the thermodynamic-kinetic approach with 10 % aging, but considering the first aging step only, (c) model results for the thermodynamic-kinetic approach with 1 % aging and (d) model results for the thermodynamic approach. Note, that the scale of the y-axis is different.

The modelled time series in Figure S1 reveal a pronounced diurnal cycle in H_2SO_4 (gas), MV-SOG, SV-SOG and LV-SOG during June 2010 at Puy-de-Dôme. The highest concentrations are determined for the medium- (MV-SOG) and semi-volatile (SV-SOG) secondary organic gases. The lower volatile gases LV-SOG and H_2SO_4 (gas) show much lower concentrations. Generally, the concentration development can be explained by considering the respective production and loss processes: MV-SOG and SV-SOG are generated from VOC precursor gases via reactions with OH, O_3 and NO_3 (Figure S1). Aging represents another production process for SV-SOG and LV-SOG and simultaneously a loss

process for MV-SOG and SV-SOG. Further loss processes for the secondary organic gases are the formation processes of the different SOA components (Figure S1). The maximum concentrations of all gases occur during daytime, when the production processes dominate. The contribution of the aging processes from MV-SOG to SV-SOG (and further to LV-SOG) is clearly visible in (a) and (b). In the case of 1 % aging (c), MV-SOG concentrations generally dominate over the lower volatile SOG concentration and exceed MV-SOG concentration shown in (a) by a factor of ~ 3 . With the exception of two days, lower concentrations for SV-SOG are determined in (c) compared to (a), in particular after June 24. Therefore, the concentration time series in (a), (b) and (c) clearly illustrate the influence of the aging processes. LV-SOG and H_2SO_4 (gas) concentrations in (a) and (c) are generally of similar magnitude. Note, that LV-SOG concentration in (b) and (d) are 0 because of the underlying model assumptions. With the thermodynamic model assumption (d) SV-SOG concentrations reach only maximum values of about $0.03 \mu\text{g}/\text{m}^3$, whereas MV-SOG concentrations reach $\sim 5 \mu\text{g}/\text{m}^3$.

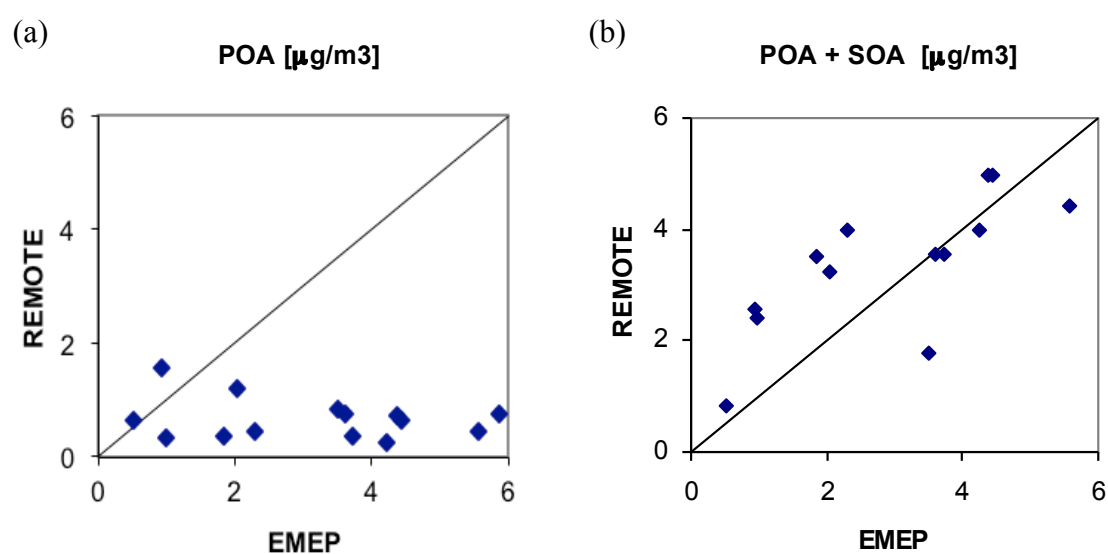


Figure S2: Comparison of OA station measurements from the EMEP network during June 2003 with REMOTE model results for (a) POA according to Langmann et al. (2008) and (b) POA + SOA as determined by the mixed thermodynamic-kinetic approach.