

# Supplementary material

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## Modeling the partitioning of organic chemical species in cloud phases with CLEPS (1.1)

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### Methodology regarding the sensitivity test performed with dicarboxylic acid concentrations from Legrand et al. (2007) (Run 3 and 4):

As mentioned in the main text, sensitivity study was performed to further assess the effect of particle-to-cloud transfer on aqueous carboxylic acid concentrations. For that purpose, the particulate concentrations of several dicarboxylic acids (oxalic, succinic, malic, malonic and tartaric) were increased compared to the reference case according to measurements reported by Legrand et al. (2007) at the PUY station. However, Legrand et al. (2007) did not provide the mass distribution of these acids over the particle spectrum, but rather their total mass concentration, as reported in Table S1 b) (first row). Thus, we assumed that for each compound, the relative contribution of each aerosol mode calculated from the mass distribution of the reference case (dicarboxylic acids measured at the puy de Dôme between February 28<sup>th</sup> and March 1<sup>st</sup> 2000 using low pressure cascade impactor, Table S1 a)) also applies to the measurements conducted by Legrand et al. (2007). Resulting concentrations are reported for each compound in the different modes in Table S1 b) (3<sup>rd</sup> to 6<sup>th</sup> rows). In addition, Fig. S2 shows the comparison between the dicarboxylic acid mass distributions used in the reference case (Run 1, as well as Runs 5 and 6) and that derived from Legrand et al. (2007) and used in test Runs 3 and 4.

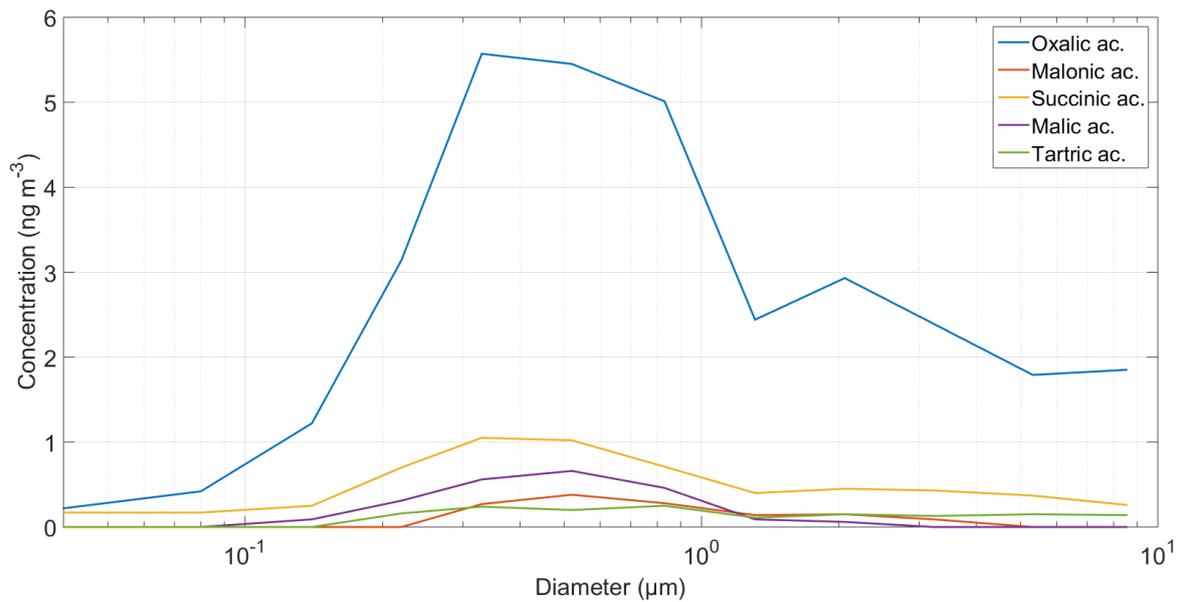
**Table S1: a) Absolute (Abs.) and relative (Rel.) contribution of each aerosol mode to the total particle phase concentration of the dicarboxylic acids measured at the puy de Dôme between February 28<sup>th</sup> and March 1<sup>st</sup> 2000 using low pressure cascade impactor and used in Run 1, 5 and 6. b) Total concentrations measured at the PUY station during winter by Legrand et al., (2007) and used in Runs 3 and 4. Corresponding absolute contribution of each aerosol mode are also reported assuming similar relative contributions as those reported in a).**

a)

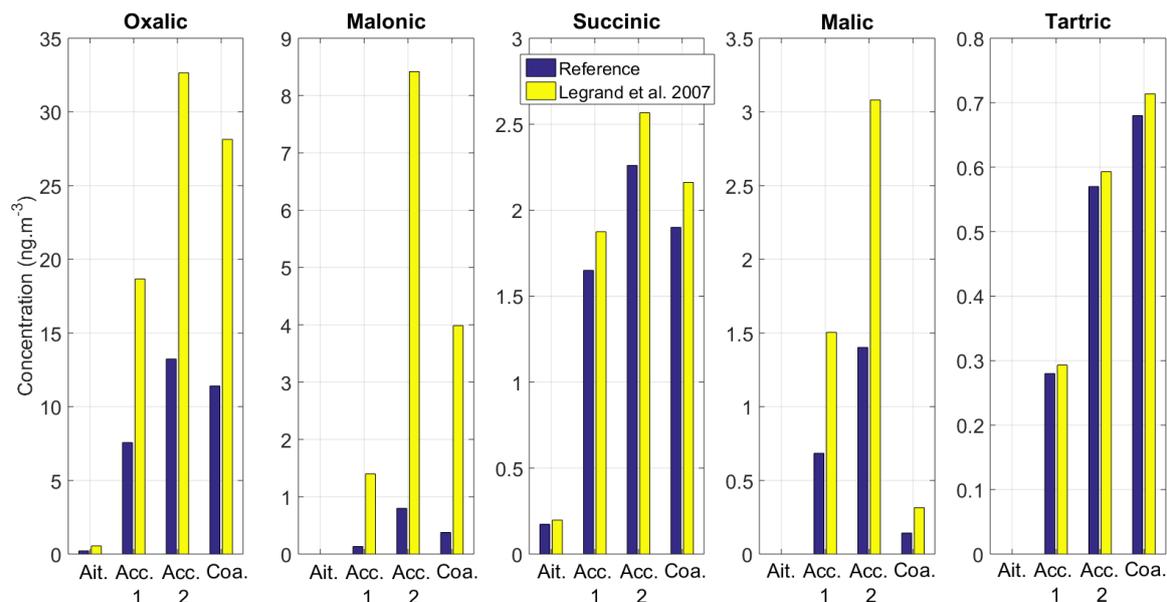
	Succinate		Malate		Malonate		Tartrate		Oxalate	
Total concentration (ng m <sup>-3</sup> )	5.98		2.23		1.31		1.53		3.25×10 <sup>1</sup>	
Contributions of the modes	Abs. (ng m <sup>-3</sup> )	Rel. (%)	Abs. (ng m <sup>-3</sup> )	Rel. (%)	Abs. (ng m <sup>-3</sup> )	Rel. (%)	Abs. (ng m <sup>-3</sup> )	Rel. (%)	Abs. (ng m <sup>-3</sup> )	Rel. (%)
Aitken	1.74 × 10 <sup>-1</sup>	3	0	0	0	0	0	0	2.24 × 10 <sup>-1</sup>	1
Accumulation 1	1.65	27	6.84 × 10 <sup>-1</sup>	31	1.33 × 10 <sup>-1</sup>	10	2.81 × 10 <sup>-1</sup>	18	7.57	23
Accumulation 2	2.26	38	1.40	63	7.99 × 10 <sup>-1</sup>	61	5.69 × 10 <sup>-1</sup>	37	1.32 × 10 <sup>1</sup>	41
Coarse	1.90	32	1.43 × 10 <sup>-1</sup>	6	3.78 × 10 <sup>-1</sup>	29	6.84 × 10 <sup>-1</sup>	45	1.14 × 10 <sup>1</sup>	35

b)

	Succinate		Malate		Malonate		Tartrate		Oxalate	
Total concentration (ng m <sup>-3</sup> )	6.8		4.9		13.8		1.6		80	
Absolute contribution of each aerosol mode derived from relative contributions in a) (ng m <sup>-3</sup> )										
Aitken	2.0 × 10 <sup>-1</sup>		0		0		0		5.5 × 10 <sup>-1</sup>	
Accumulation 1	1.9		1.5		1.4		2.9 × 10 <sup>-1</sup>		1.9 × 10 <sup>1</sup>	
Accumulation 2	2.6		3.1		8.4		5.9 × 10 <sup>-1</sup>		3.3 × 10 <sup>1</sup>	
Coarse	2.2		3.1 × 10 <sup>-1</sup>		4.0		7.1 × 10 <sup>-1</sup>		2.8 × 10 <sup>1</sup>	



**Figure S1: Mass distributions of the main diacids measured at the puy de Dôme between February 28<sup>th</sup> and March 1<sup>st</sup> 2000 using low pressure cascade impactor and used in Run 1, 5 and 6.**



**Figure S2: Comparison of the mass distributions of selected diacids used in the reference simulation (Run 1, as well as runs 5 and 6) with those derived from Legrand et al. (2007) and used in sensitivity test Runs 3 and 4. “Ait.,” “Acc 1.,” “Acc. 2” and “Coa.” respectively refer to Aitken, first accumulation, second accumulation and coarse aerosol mode. Mass distribution used in Runs 3 and 4 was obtained from total concentrations measured by Legrand et al. (2007) and using relative contribution of each mode from the reference case (diacids collected at the PUY station between February 28<sup>th</sup> and March 1<sup>st</sup> 2000 using low pressure cascade impactor) (Table S1).**

## Reference

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Legrand, M., Preunkert, S., Oliveira, T., Pio, C. A., Hammer, S., Gelencsér, A., Kasper-Giebl, A. and Laj, P.: Origin of C2–C5 dicarboxylic acids in the European atmosphere inferred from year-round aerosol study conducted at a west-east transect, *J. Geophys. Res. Atmospheres*, 112(D23), D23S07, doi:10.1029/2006JD008019, 2007.