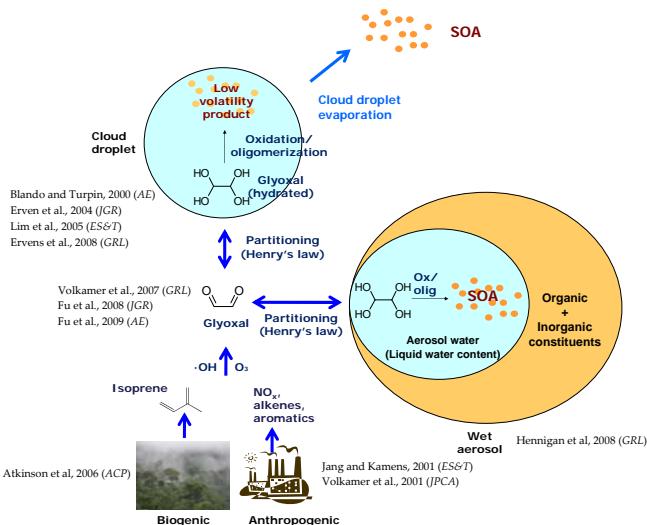


SOA formation from aqueous-phase reactions of glyoxal with OH radicals

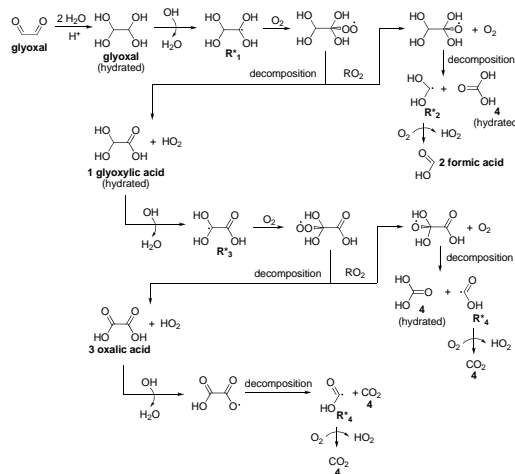
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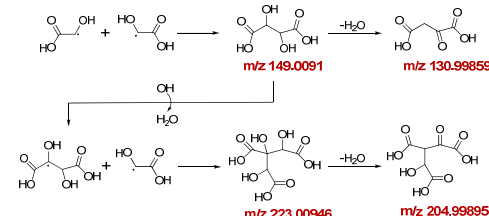
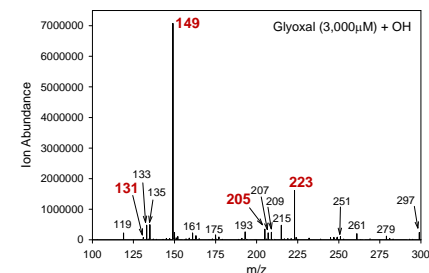
SOA formation through aqueous-phase reactions



Aqueous-phase reaction mechanism

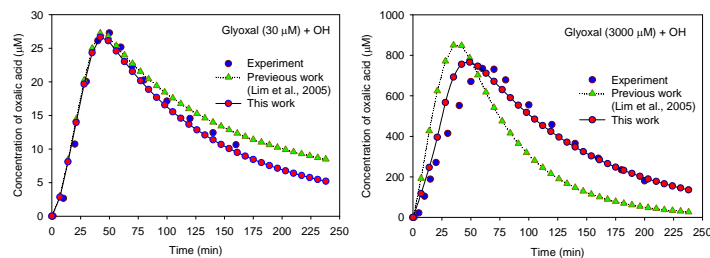


FTICR-MS Interpretation (Formation for high molecular weight compounds)

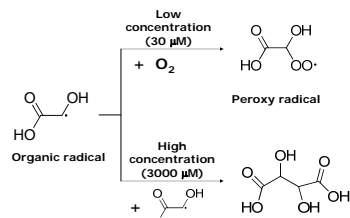
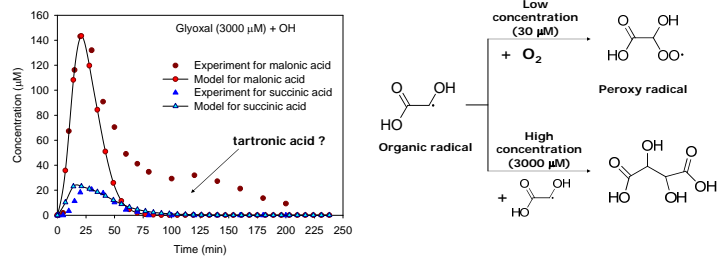


Reaction Vessel Kinetic Modeling

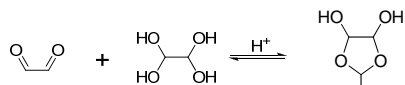
Oxalic acid formation



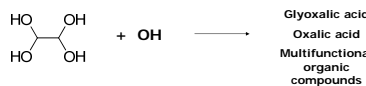
Malonic/succinic acid formation



Non radical versus radical reactions in the aqueous phase



- Glyoxal self-oligomerization: acid catalyzed
 - Liggio et al., 2005 (JGR): aerosol water
 - Loeffler et al., 2006 (ES&T): cloud water



- Aqueous photooxidation
 - Volkamer et al., 2009 (ACP): aerosol water
 - Carlton et al., 2007 (AE): cloud water

Conclusions

- A new kinetic model has been developed based on the explicit reaction mechanism
 - The model includes radical-radical reactions: combination of two organic radicals ($R^*_1-R^*_2$)
 - Peroxy-radical channel: formation of glyoxylic acid and oxalic acid
 - Radical-radical reaction channel: formation of high-molecular-weight organic compounds (carbon number > 2)
- Atmospheric implications
 - Aqueous photooxidation competes with gas-phase photooxidation
 - Aqueous photooxidation is an irreversible process: potentially faster and more SOA formation

References: Atkinson 2006 ACP 6:3624-4055; Blando and Turpin 2000 AE 34:1623; Carlton 2007 AE 41:7588; Ervens 2004 JGR 109:D15205; Ervens 2008 GRL 35; Fu 2008 JGR 113:D15303; Fu 2009 AE 43:1814-1822; Hennigan 2008 GRL 35; Jang 2001 ES&T 35:3626-3639; Lim 2005 ES&T 39:4441; Liggio 2005 JGR 110:D10304; Loeffler 2006 ES&T 40:6318-6323; Volkamer 2001 JPCA 105:7865-7874; Volkamer 2007 GRL 34; Volkamer 2009 ACP 9:1907-1928.

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