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Determination of Optical Properties of Secondary Organic Aerosols Using UV-VIS Spectroscopy

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DETERMINATION OF OPTICAL PROPERTIES OF SECONDARY ORGANIC AEROSOLS USING UV-VIS SPECTROSCOPY

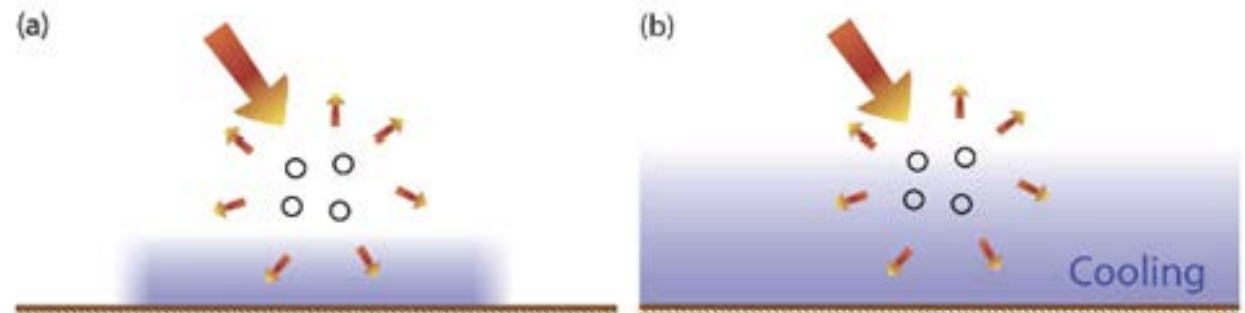
Vanessa Selimovic, Matthew Wise, John Shilling

AEROSOL-ATMOSPHERE INTERACTIONS

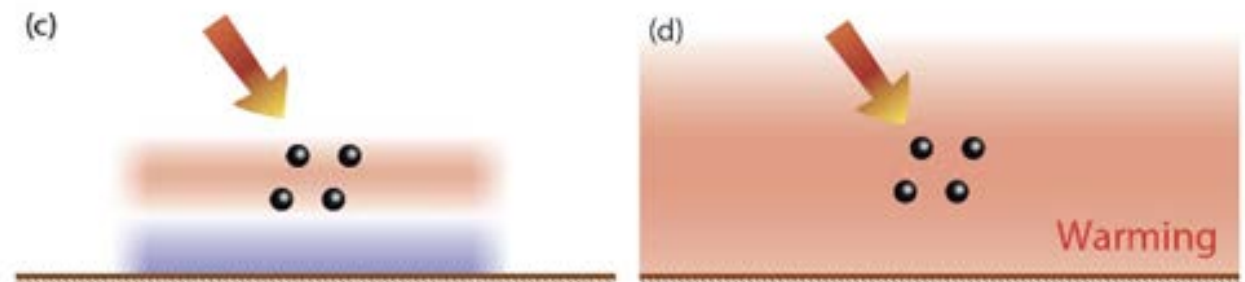
- Aerosols interact differently with the atmosphere depending on:
 - Composition
 - Size
 - Phase
 - Reactivity
 - Optical Properties
- Reactivity with atmosphere determines impact on Earth's radiative budget

Aerosol-radiation interactions

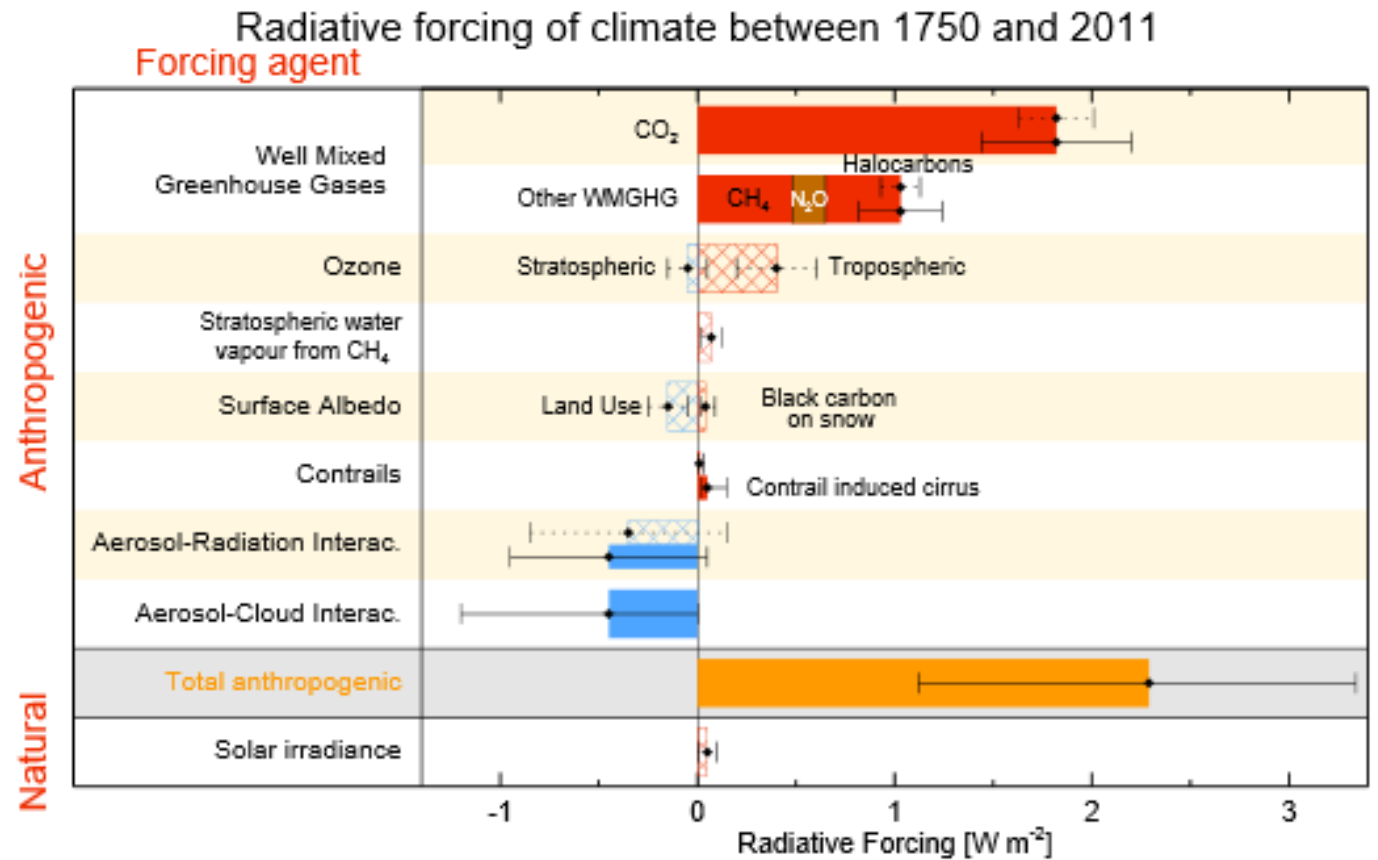
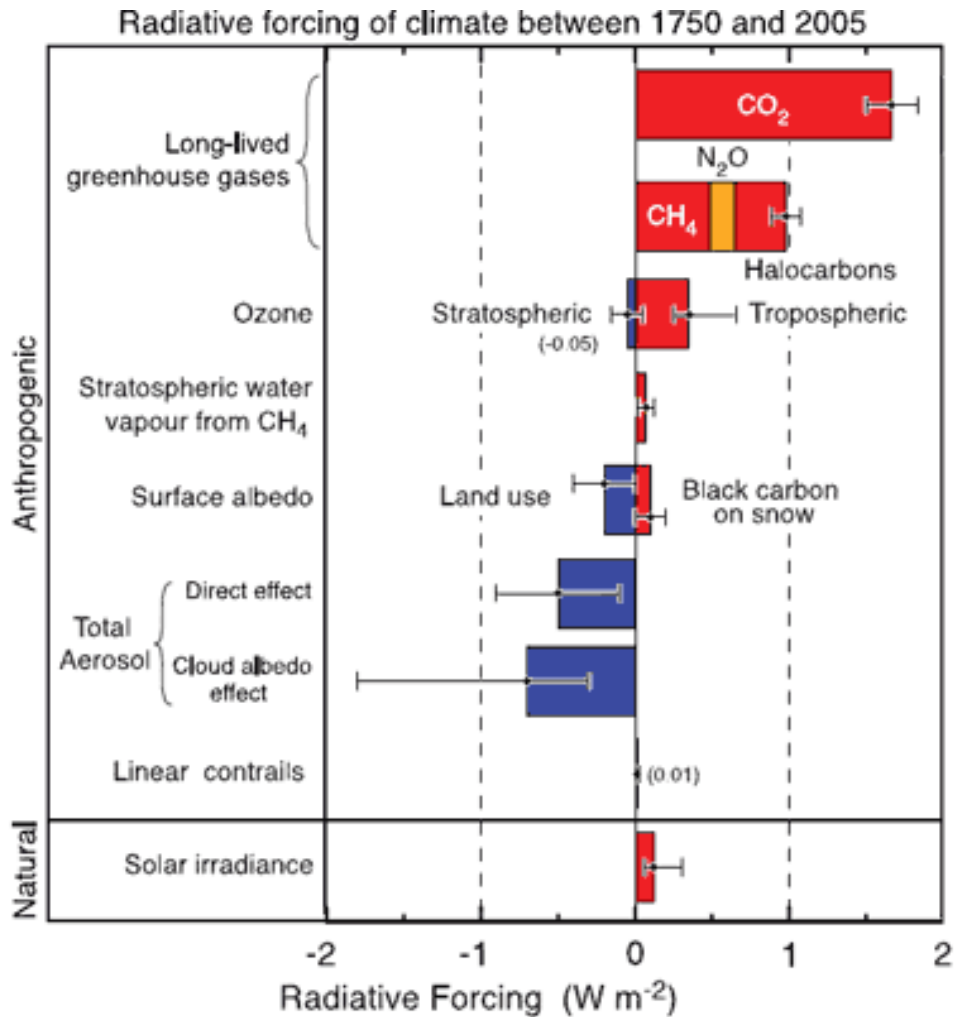
Scattering aerosols



Absorbing aerosols



CONTRIBUTION TO CLIMATE



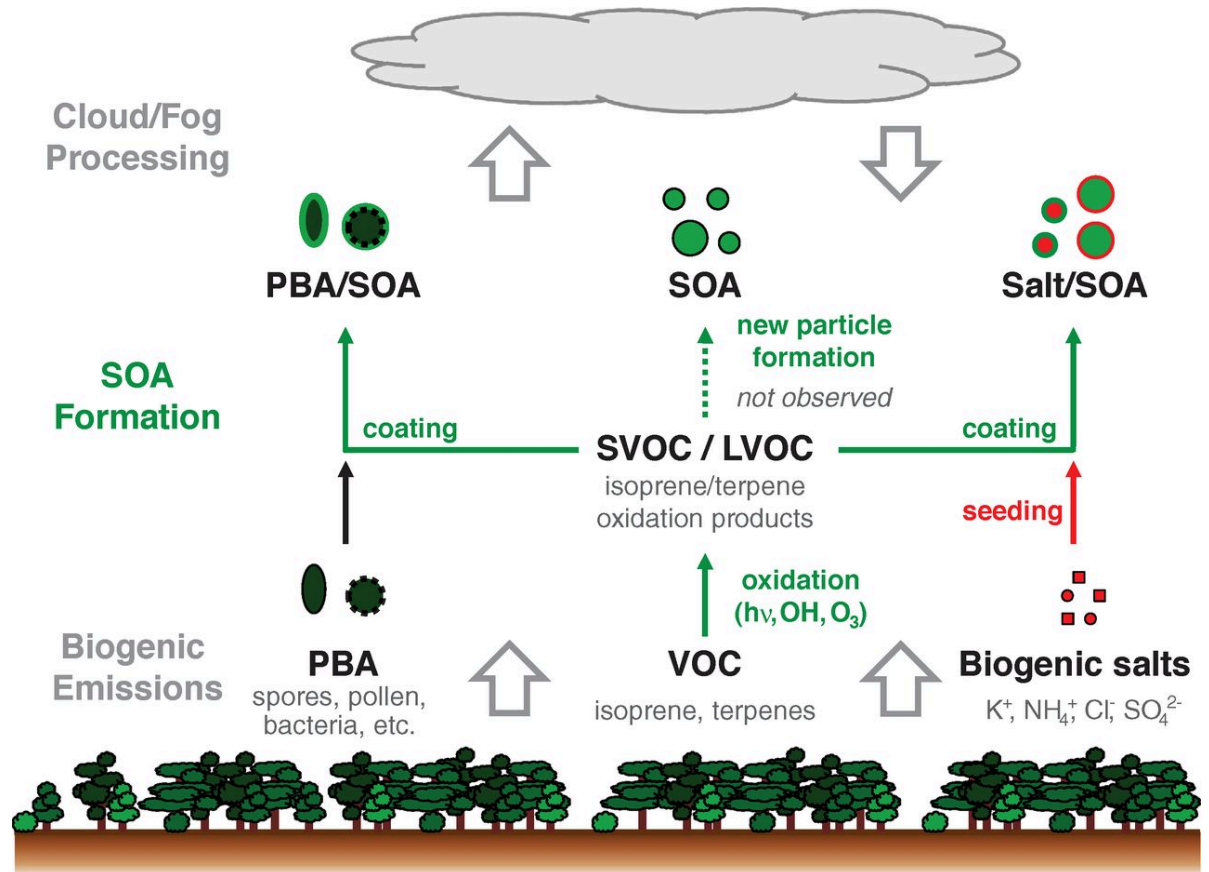
LIGHT ABSORBING CARBON

- Atmospheric light absorbing carbon (LAC), plays an important role in global climate change.
 - Black Carbon (~500nm)
 - Soot
 - Brown Carbon
 - Secondary Organic Aerosol Particles (SOA)



FORMATION OF SECONDARY ORGANIC AEROSOLS

- Originates from a variety of sources
- SOA formed in the atmosphere
 - VOC's react w/ anthropogenic aerosols
- Several studies have been done on SOA, but no quantifiable values
 - MAC
 - (k) Values

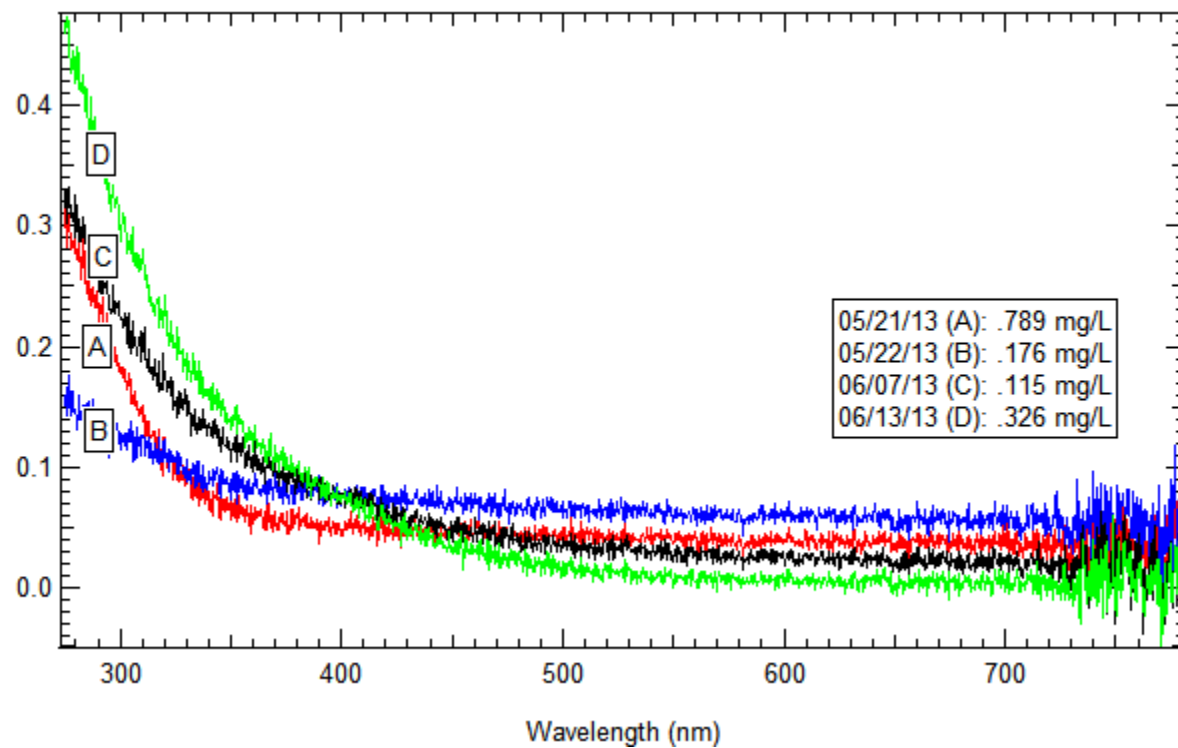
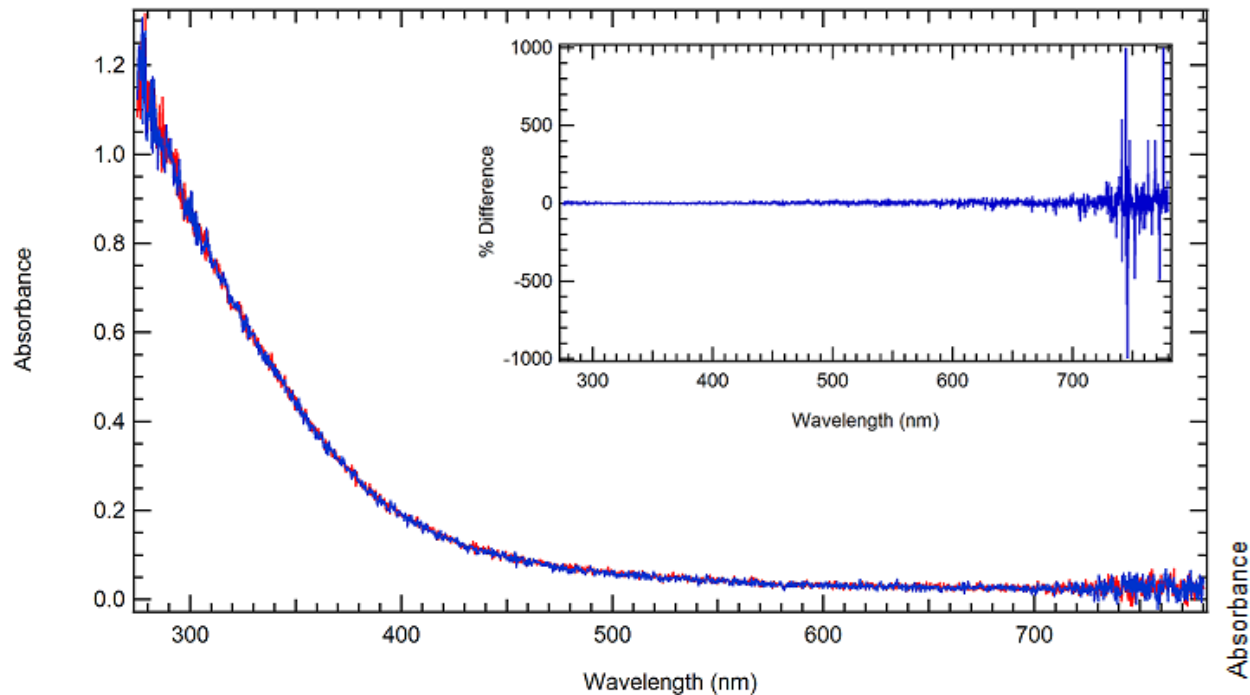


EVALUATION OF SECONDARY ORGANIC AEROSOLS

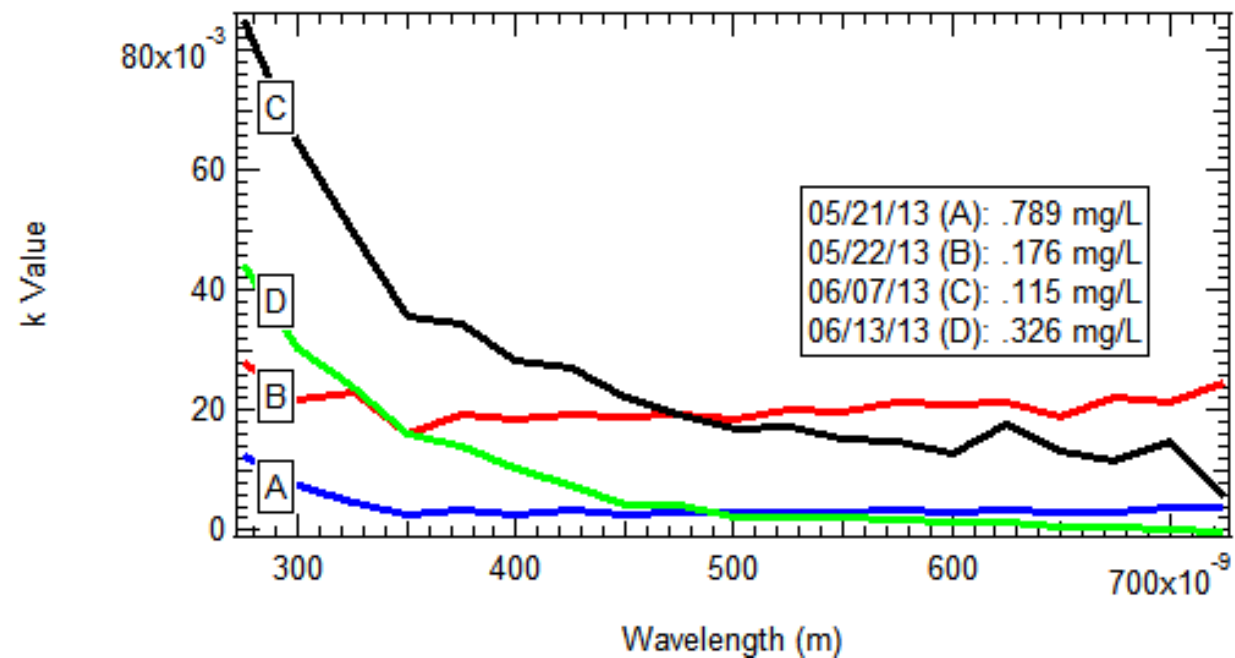
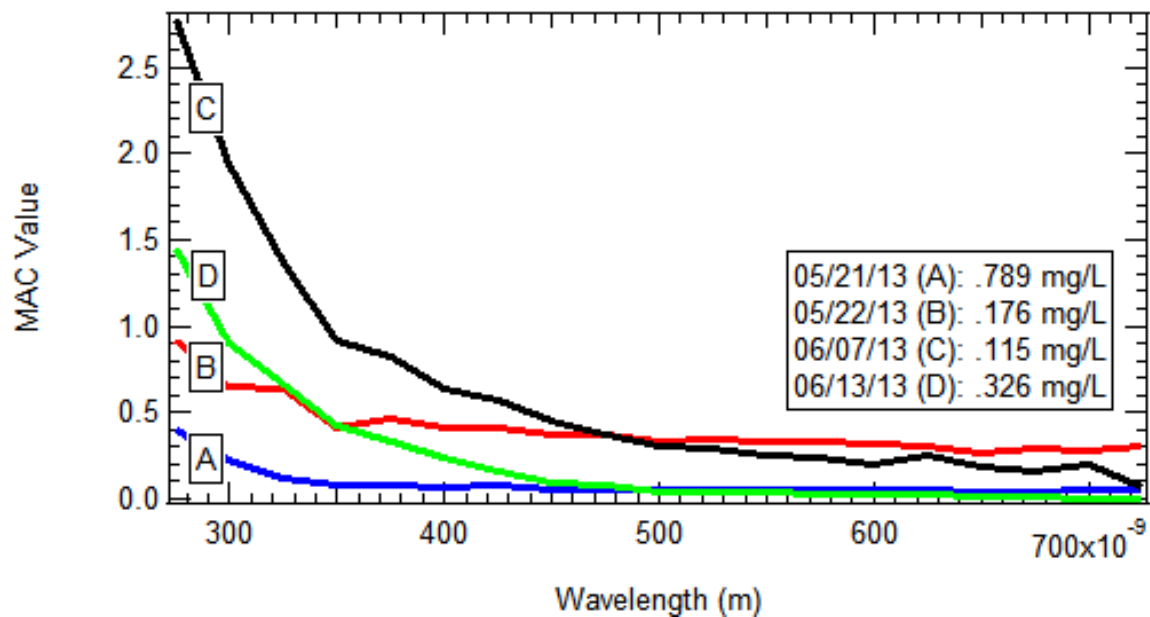
Date	Oxidant	[TMB]	[NO]	[NO _x]	[ozone]
05/21/2013	H ₂ O ₂	170.4	1.94	2.1	21.22
05/22/2013	HONO+O ₃ +RH	189.7	22	1673.7	5.85
06/07/2013	HONO+RH(naifon)	173	642.2	854.7	3.08
06/13/2013	HONO+RH+seed	158.9	575.5	799.2	3.08

- Produced in the aerosol chamber at PNNL in their Atmospheric Measurements Lab.
 - Analyzed using UV/Vis spectroscopy
- Fulvic Acid used as a model
- MAC & *k* values calculated using equations from literature

RESULTS



RESULTS



CONCLUSIONS

- Difference in absorption of SOA depending on conditions
 - Organo-nitrate groups

	Experimental	Literature
MAC	<0.0140 to 0.4171	<0.001 to 0.088
(k) Value	.0006 to .0188	.0001 to .025

$$MAC = \frac{A}{L [FA]_e} \quad k = \frac{(MAC)(\lambda\rho)}{4\pi}$$



FUTURE WORK

- Determine the chemical composition of SOA
- Collect more samples of SOA
 - Look for trends
 - Difference between reactants
 - Studies using a control/controlled environment

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Oregon Academy of Sciences



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