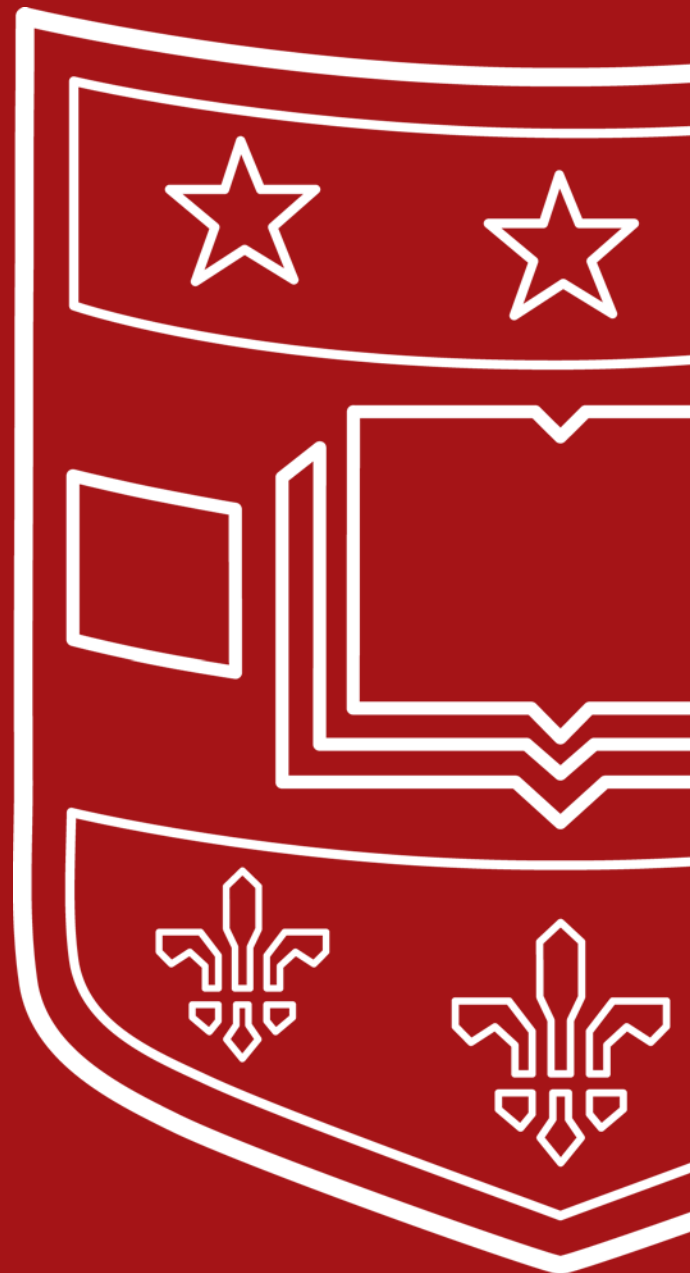


Carbonaceous Aerosol from Biomass Burning: Observational insights into Transformation Processes and Parameterizations

Rajan K. Chakrabarty

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Fresh Brown Carbon: 1.5 yr long physicochemical measurements from Boreal and Indonesian Peatland smoldering combustion as a function of Fuel Packing Density (FPD), Moisture Content (MC), and Depth of fuel collection. WashU Biomass Chamber (24 m³ stainless steel)

Spherical morphology; C:O ratio: 12:1 (XPS) 10:1 (EDX); **Particle Density:** 1-1.2 g/cm⁻³

- **Single Scattering Albedo** (mean): 0.93 ($\lambda=375$ nm) to 0.96($\lambda=405$ nm) to 0.99 ($\lambda=532$ nm).
- **Absorption Angstrom Exponents** (mean): 11 (375 – 405 nm), 6(405 – 532 nm), and 1.5 (532-1047 nm)
- **Complex Ref. Index** ($m = n+ik$): $n=1.5\sim1.7$ invariant with FPD, depth and MC.
- **AAE, SSA, κ are sensitive to fuel packing density (FPD), invariant with depth and MC**

Closed form model: Kramers-Kronig dispersion relation of a Damped Harmonic Oscillator

$$k = \frac{a \gamma v}{(v_0^2 - v^2)^2 + (\gamma v)^2}$$

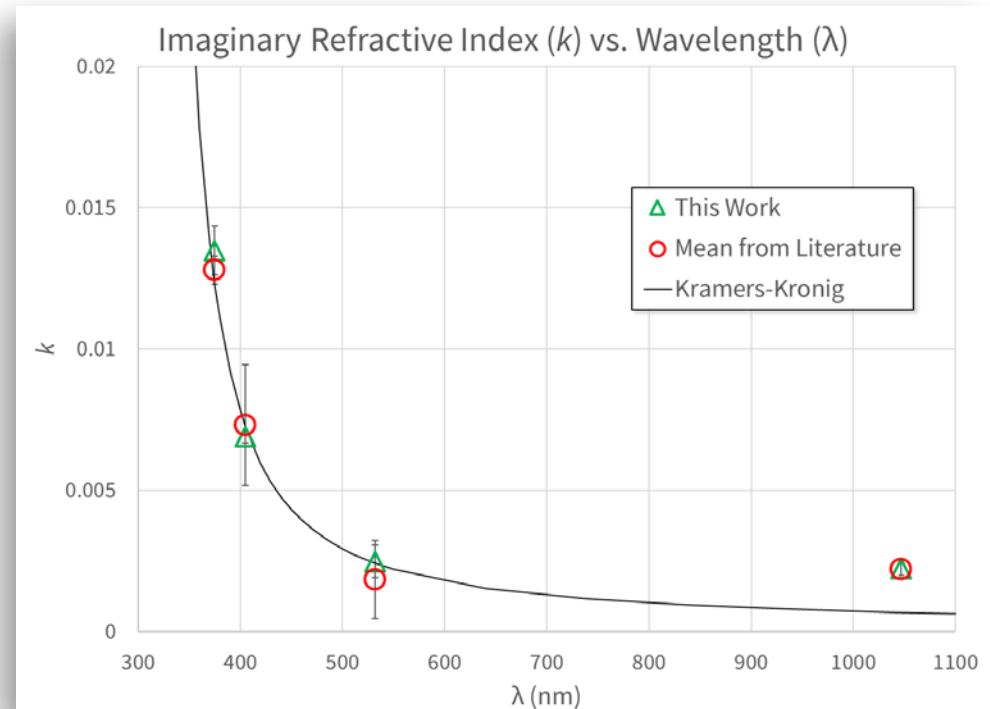
$$a = 10^{28} \text{ s}^{-2}$$

$$\gamma = 2 \times 10^{12} \text{ s}^{-1}$$

$$v = c/\lambda$$

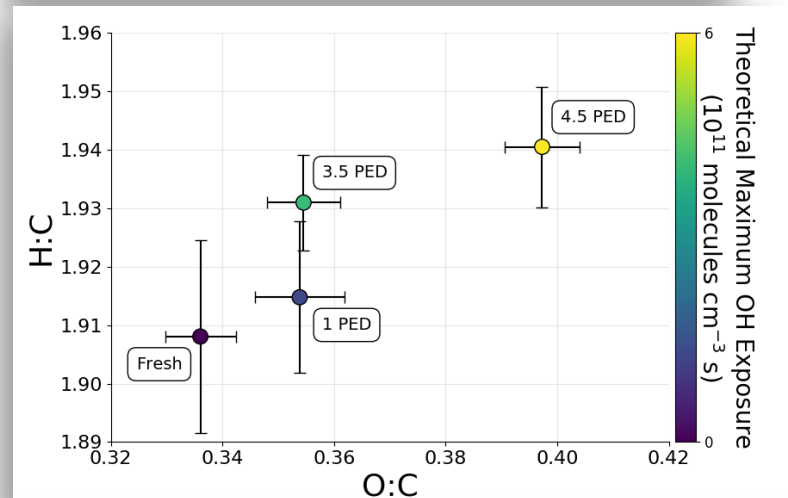
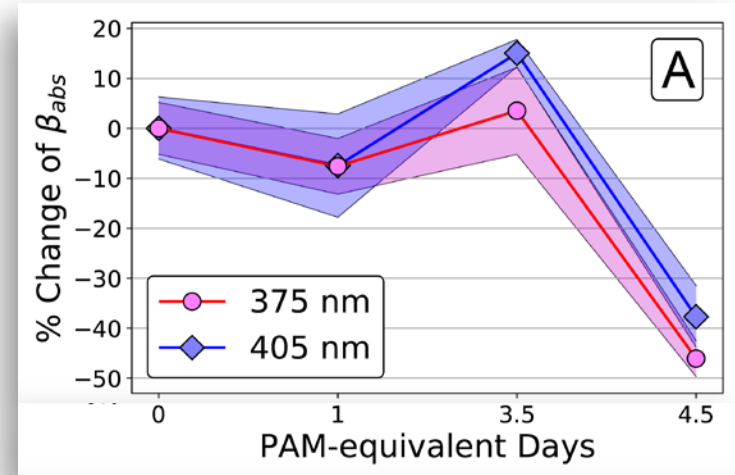
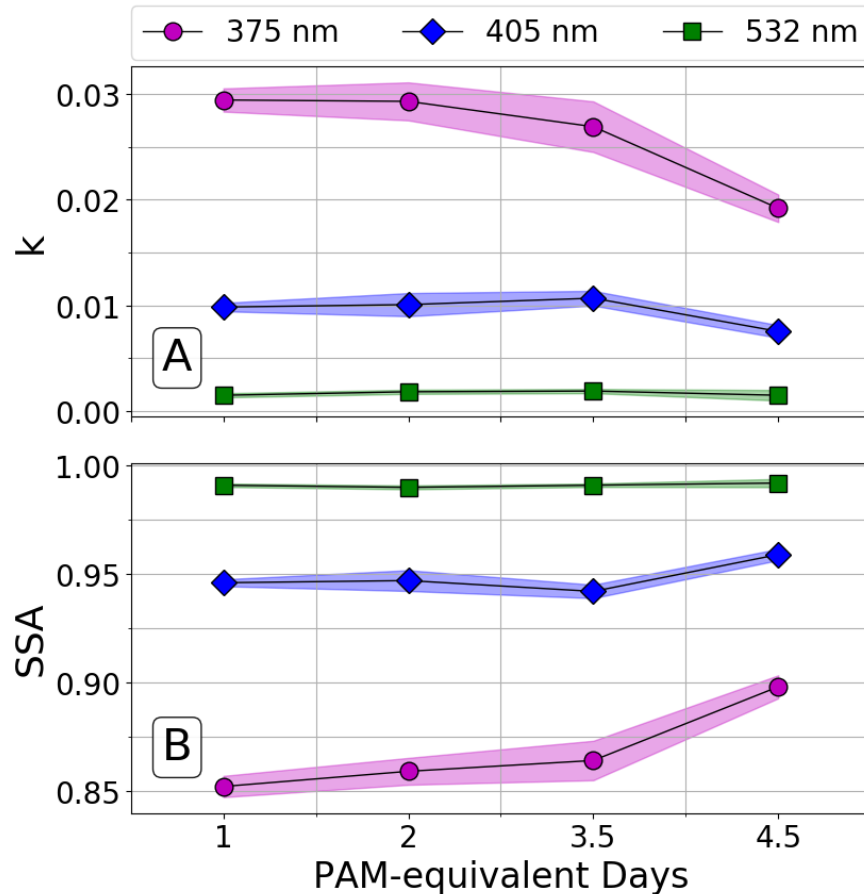
$$\lambda_0 = 300 \text{ nm.}$$

$$375 \text{ nm} \leq \lambda \leq 532 \text{ nm}$$



Aging of Brown Carbon: Experiments carried out using Potential Aerosol Mass (PAM) reactor to photo-oxidize selectively the aerosol phase emissions.

Details in: Sumlin, B. J., et al. (2017). *Env. Sci. Technol. Lett.* 4 (12), 540-545



- Previously shown that at O:C ~ 0.4 , fragmentation dominates the oxidation process (Kroll et al. 2009).
- Enhanced diminishment between 3.5 and 4.5 PAM-equivalent days (PED) could be a result of this mechanism.

Black Carbon mixed with Organic (coated): The 1/3 Scaling Laws for BC Mass Absorption Cross section (MAC_{BC}) and Enhancement of MAC_{BC} ($E_{MAC_{BC}}$).

