Organic Carbon Artifacts

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Blank or Artifact

- **Blank** Is a Constant Error Affecting the Physical Measurement and Can Be Evaluated With a 'Blank Determination' in Which All Steps of the Analysis Are Performed in the Absence of a Sample. Blanks Are Always Positive If They Occur.

- **Artifacts** Can Be Positive or Negative and Are Variable Errors That Affect the Physical Measurement and May Not Always Be Evaluated With a Blank. In Sampling They Occur Due to Collection of Gases on a Sampling Substrate or Volatilization of Sample Already Collected. Determining Artifact Impact May be Very Compliated.

- Organic Carbon Issues With Quartz-filters Are Artifacts.

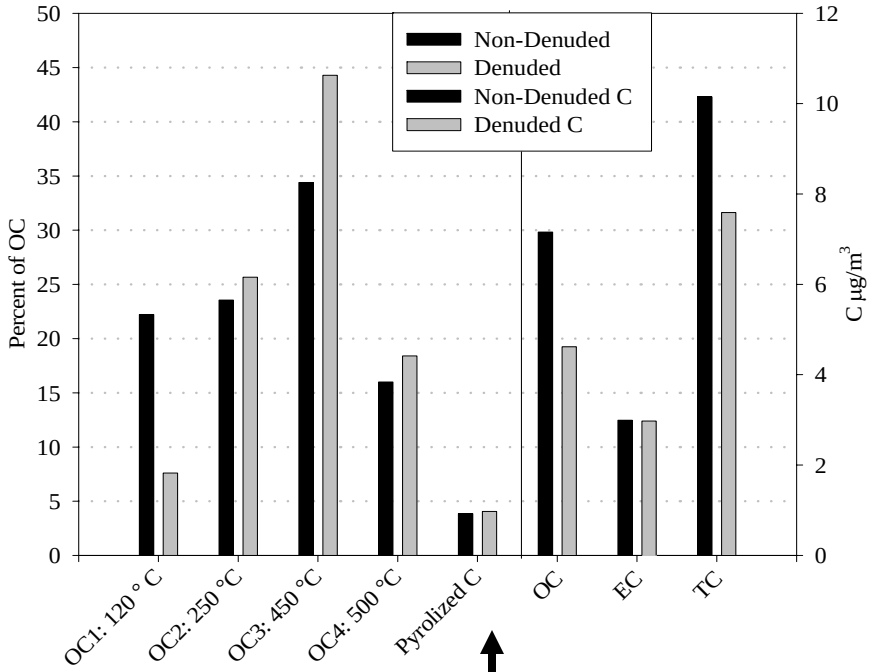
OC Artifacts

- **The OC Artifact Issue Is Very Complicated***
  - ✓ Passive vs Active Artifacts
  - ✓ Positive vs Negative
  - ✓ Affected by VOC and SVOC Ambient Concentrations and Species, Temperature, RH, Filter Lot, Filter Preparation, Storage, Flow Rate, Handling, Other Variables

*Pankow, McDow, Turpin, Huntzinger, Others

What Do We Know About OC Artifacts

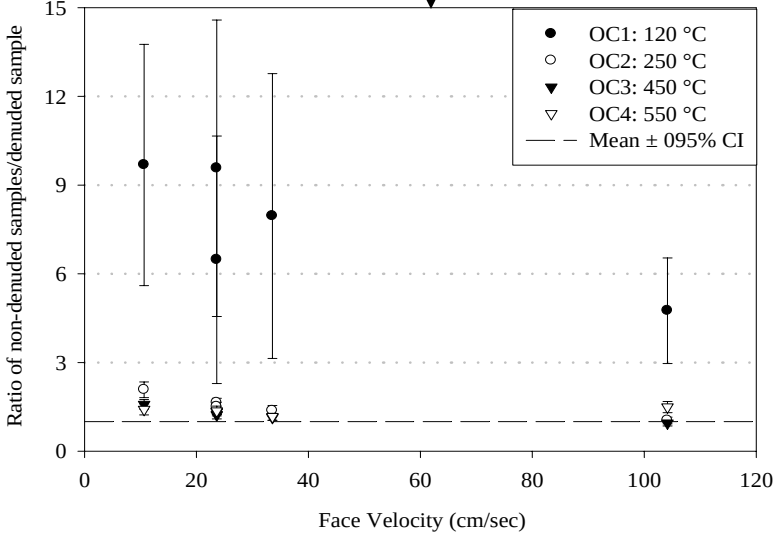
Artifact Appears to be More Volatile and Removed in the OC1 Temperature Step



Average of Denuded (5 samplers) and Non-denuded (1 sampler) OC Samples as a Function of the TOR Carbon Fractions.

From 4-City Study Report (Solomon et al. 2000, Analysis Performed by Norris, G.

Organic Carbon as a Function of Face Velocity

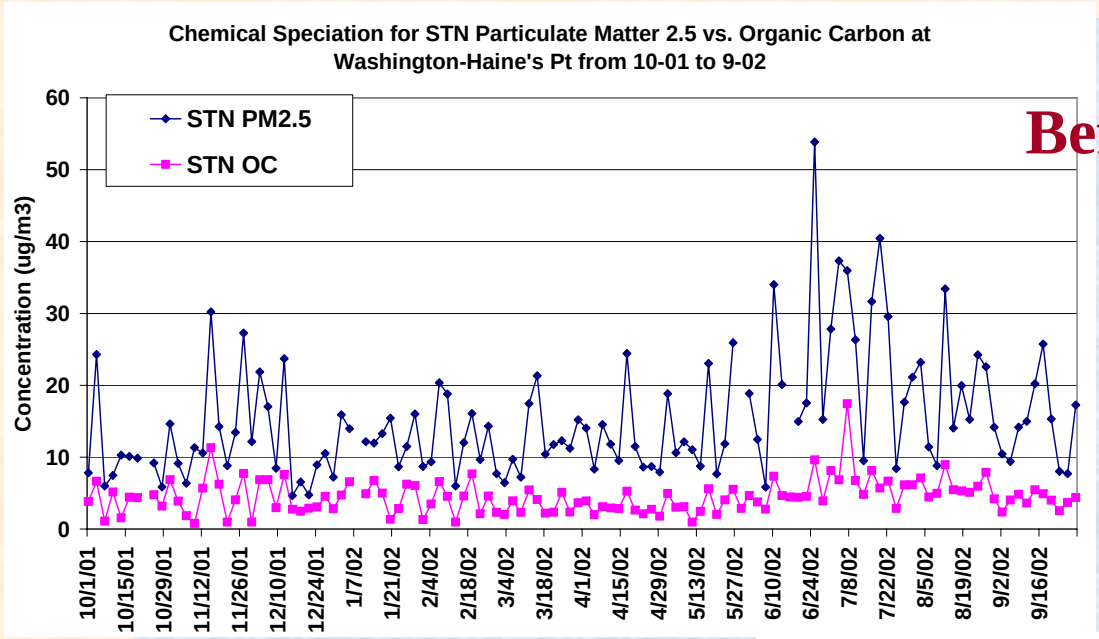


Artifact Appears to be a Function of Face Velocity (Pressure Drop) Across the Filter and Again Impacts More Volatile Species

Approaches in Use to Correct for OC Artifacts

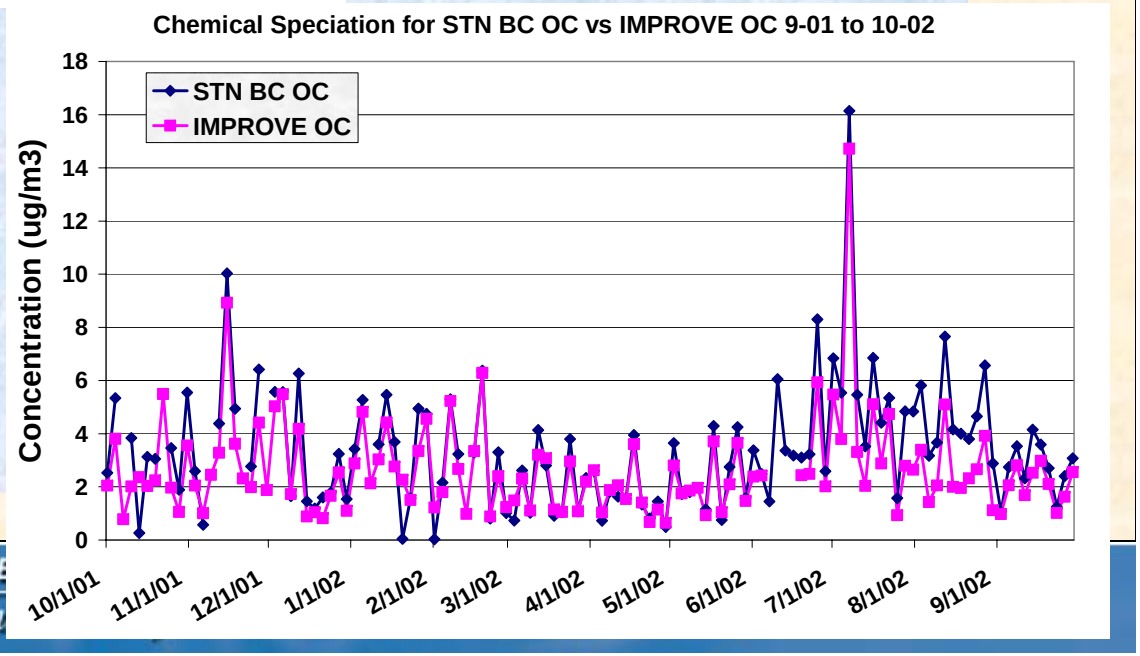
- Do Not Blank Correct
- Use Field Blanks and or Trip Blanks (STN)
- Use Back-up Quartz-fiber Filter Either Behind a Teflon Filter or Behind a Quartz-fiber Filter (IMPROVE)
- Use a Denuder (XAD, Carbon Impregnated, Other) to Remove Gas Phase Species
  - ✓ (May Enhance Negative Artifact)
- Use a Denuder With a Back-up Filter of Various Types (XAD Coated, Quartz, Carbon Impregnated) Following the Quartz-Fiber Filter
- Estimate OC Artifact Using Regression

OC Artifacts: Results from STN-IMP Comparison Study

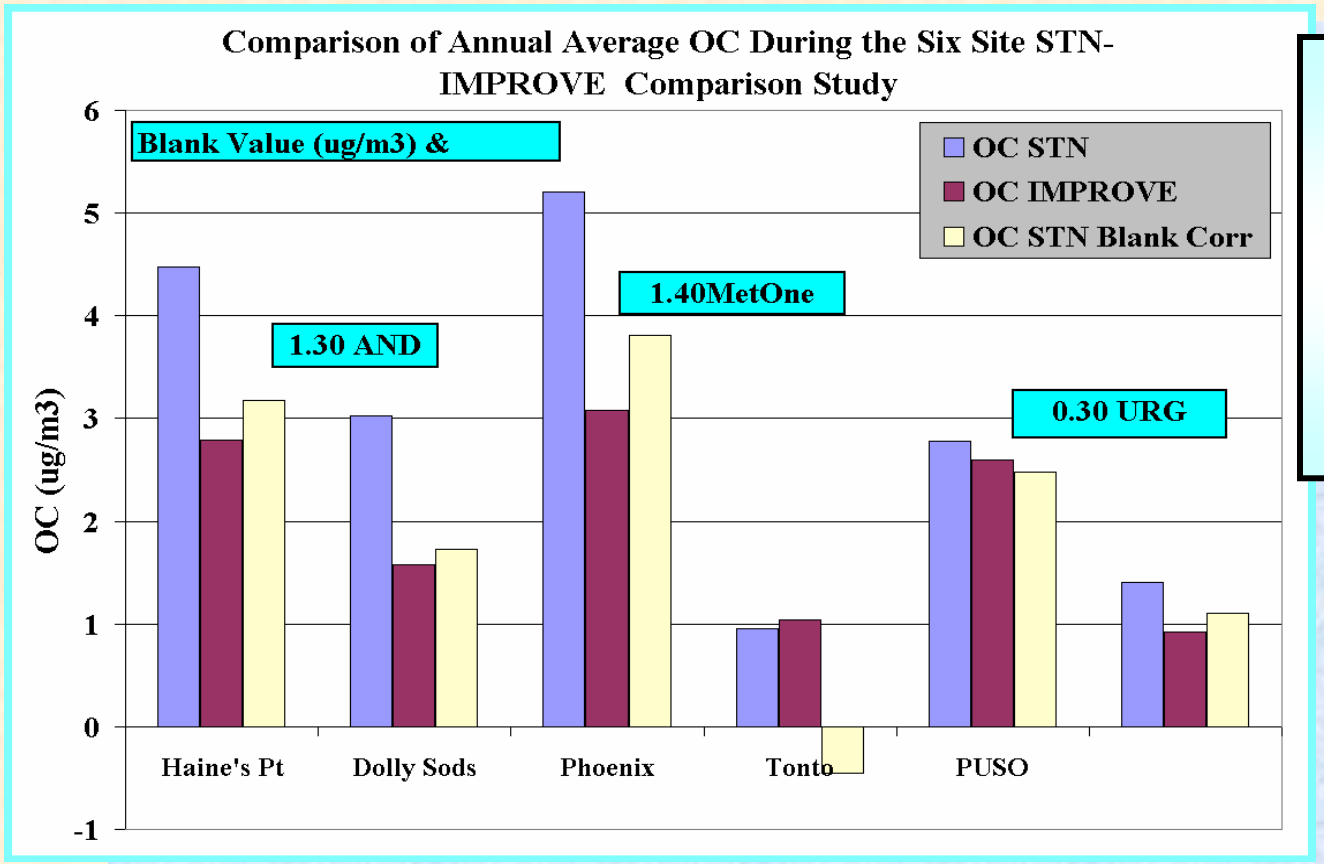


Before Blank Correction

After Blank Correction



STN-OC Blank Corrections (µg/m³)



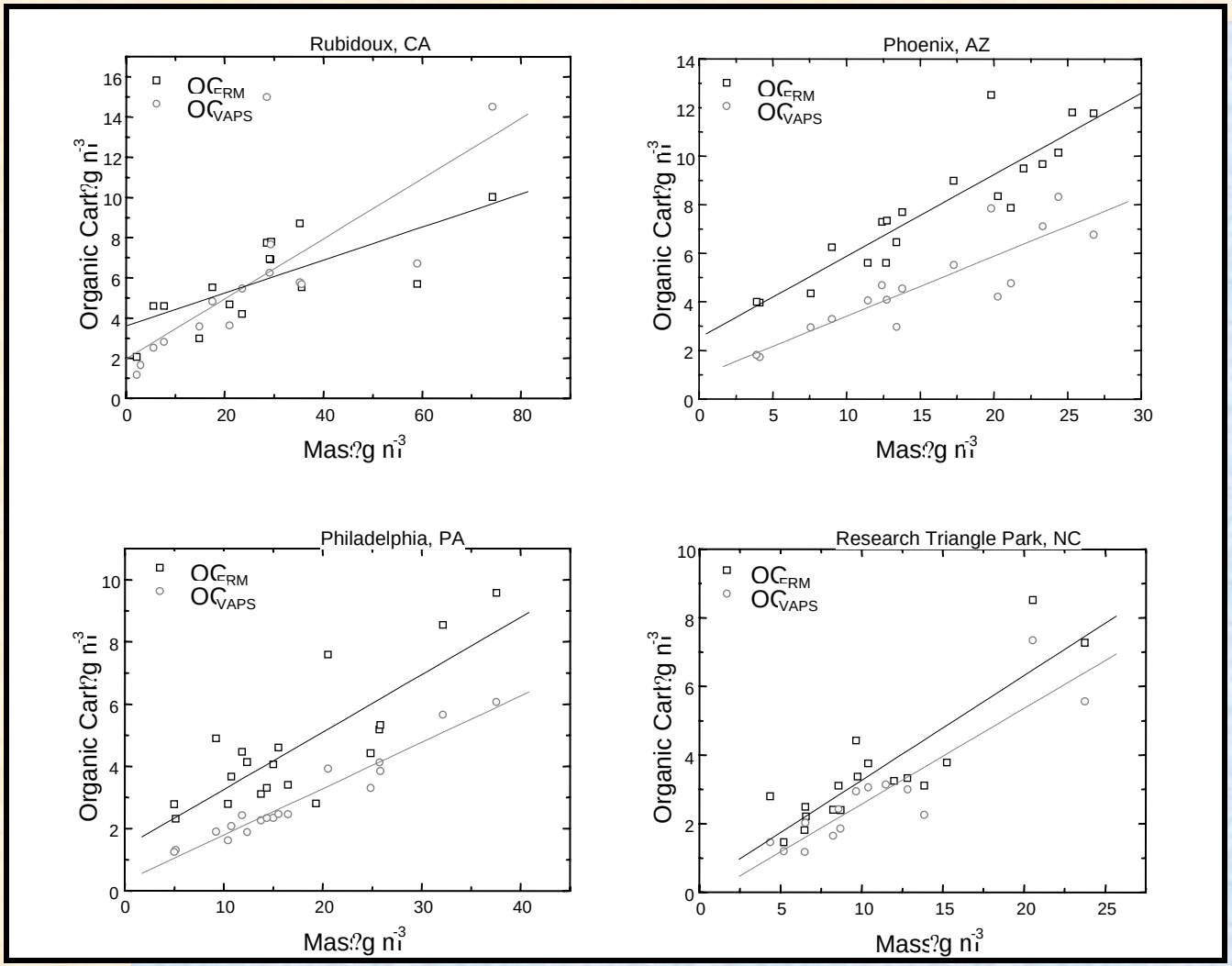
Blank Values Are Based on Trip and Field Blanks and Are Averaged Over the Time Period of the Study

Blank Correcting Improved the Comparison Between STN and IMPROVE at Most Locations

Attempt to Correct for OC Artifacts

- **Estimate OC artifact using regression**
  - ✓ **PM2.5 Mass (Teflon) vs OC (Quartz)**
    - ✘ Assumes at zero PM2.5 Mass there should be zero OC, thus an intercept represent the OC artifact
    - ✘ Assumes loss of OC from Teflon and Quartz similar
    - ✘ Appropriate since we are concerned with OC collected relative to the Teflon filter that is used for compliance purposes
    - ✘ Integrates across all aspects of the measurement

Regression Estimates & Denuded vs. Undenuded OC Results



FRM Mass vs OC by FRM or by VAPS, which used a XAD Denuder

Intercepts are Positive for FRM OC and close to Zero for VAPS OC

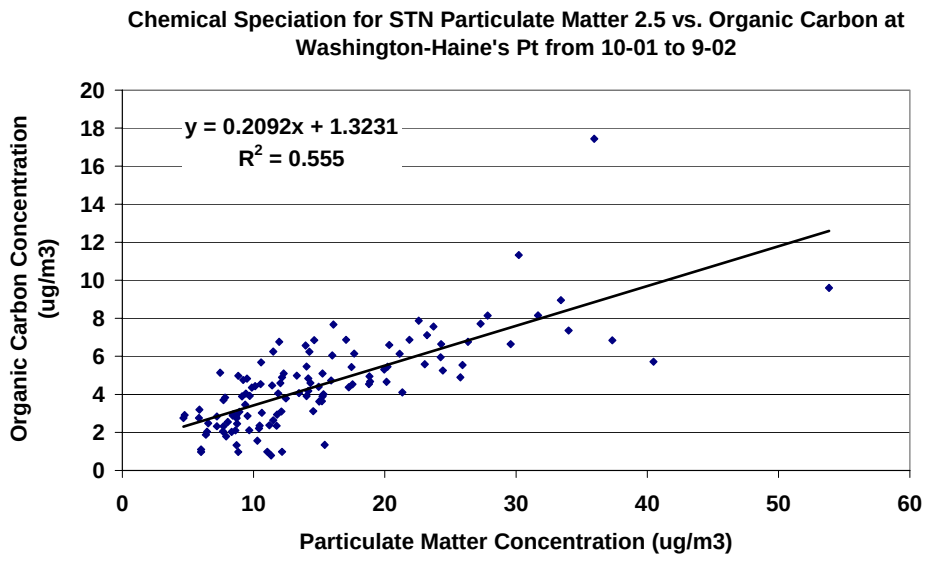
VAPS typically less than FRM Quartz

VAPS Intercept ~ 2 ug/m3 or less lower than FRM quartz

Approach First Reported in 4-City Study

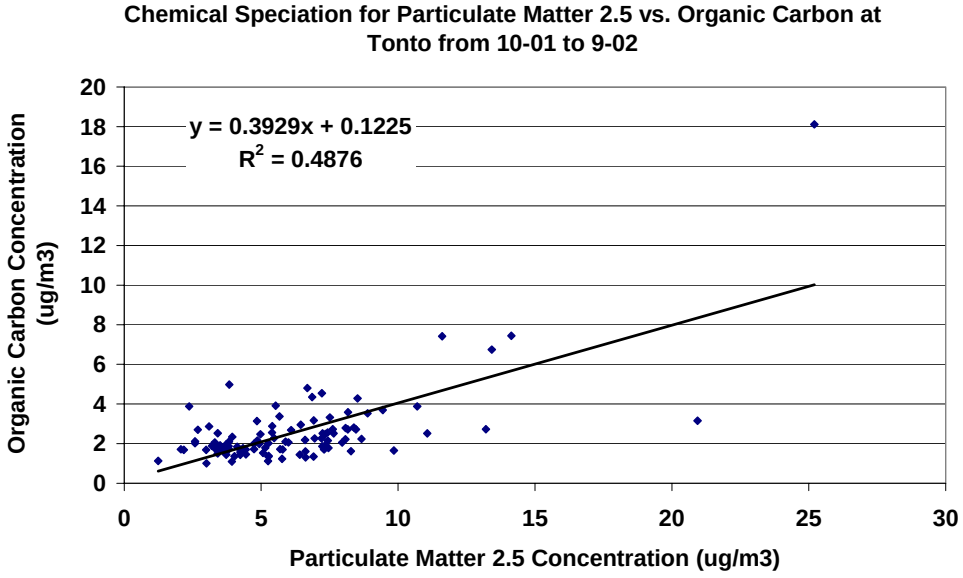
(Solomon et al. 2000 US EPA, Tolocka et al. AS&T, 34: 88–96 (2001)

OC Artifacts: Results from STN-IMP Comparison Study



Estimate From Field Blanks = 1.3
By Regression = 1.32

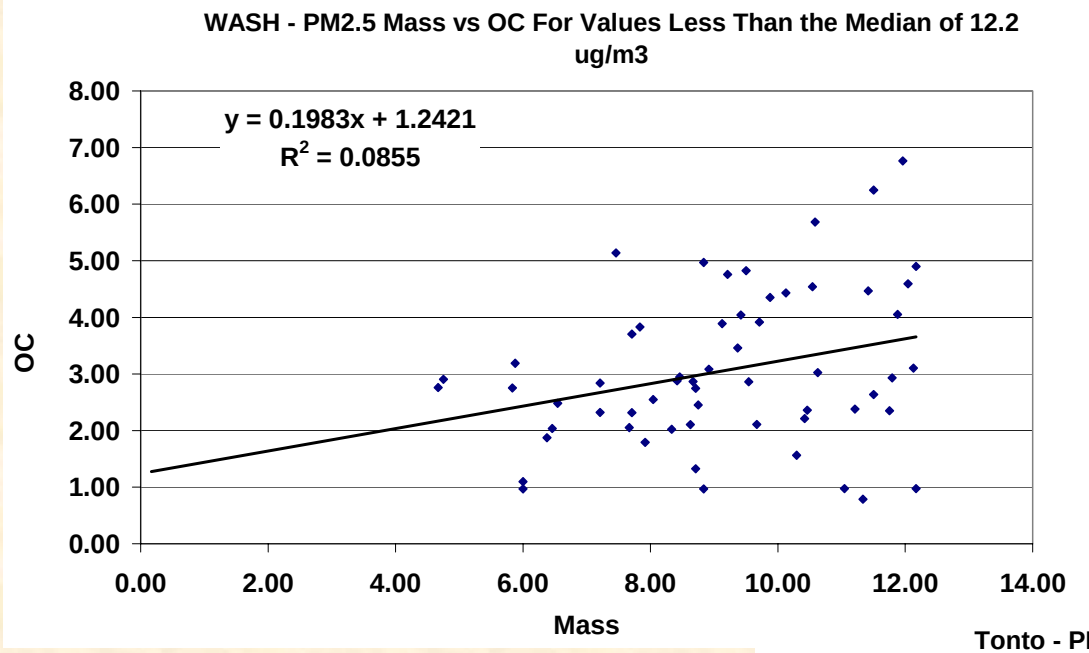
Estimate From Field Blanks = 1.4
By Regression = 0.12;
However Data Have Small Range and are Low Concentrations



OC Artifacts: Results from STN-IMP Comparison Study

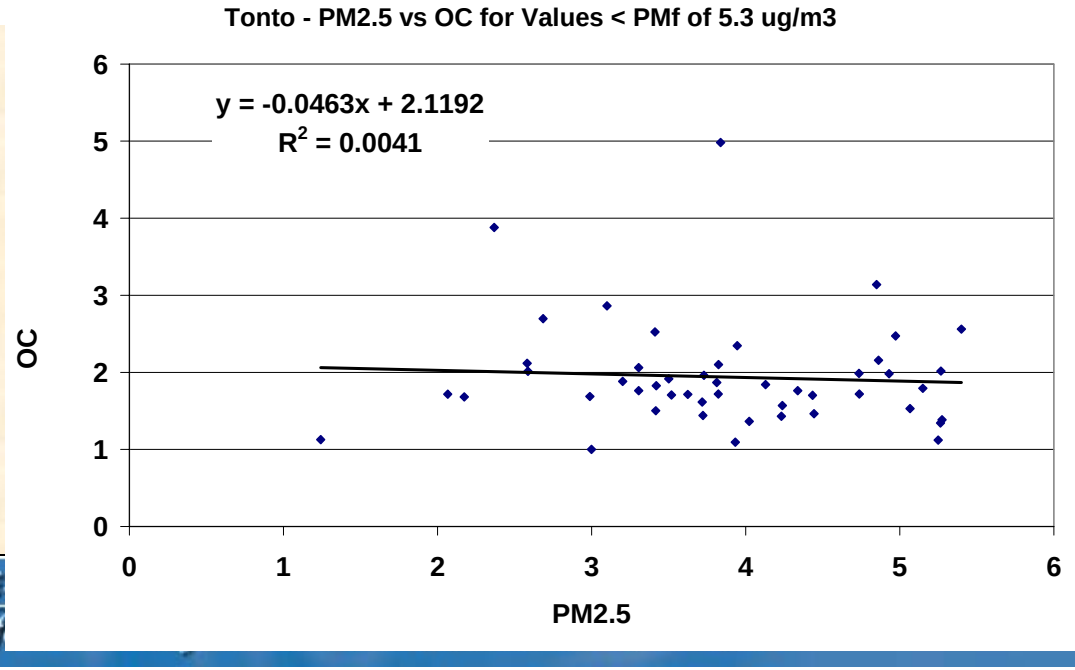
STN Estimated Blank Values in STN-IMPROVE Comparison Study			
	STN Estimate	Regression Estimate	Regression Equation, All Data
Haines Pt	1.3 ug/m3	1.32	y = 0.2092x + 1.3231 R2 = 0.555
Dolly Sods	1.3 ug/m3	1.4	y = 0.1397x + 1.4597 R2 = 0.3477
Phoenix	1.4 ug/m3	0.95	y = 0.383x + 0.951 R2 = 0.6033
Tonto	1.4 ug/m3	0.12	y = 0.3929x + 0.1225 R2 = 0.4876
Beacon Hill	0.3 ug/m3	0.3	y = 0.4054x - 0.3101 R2 = 0.8729
Mt Rainier	0.3 ug/m3	0.1	y = 0.3636x + 0.0999 R2 = 0.7837

Filter Data Above the Median



y = 0.1983x + 1.2421
R2 = 0.0855

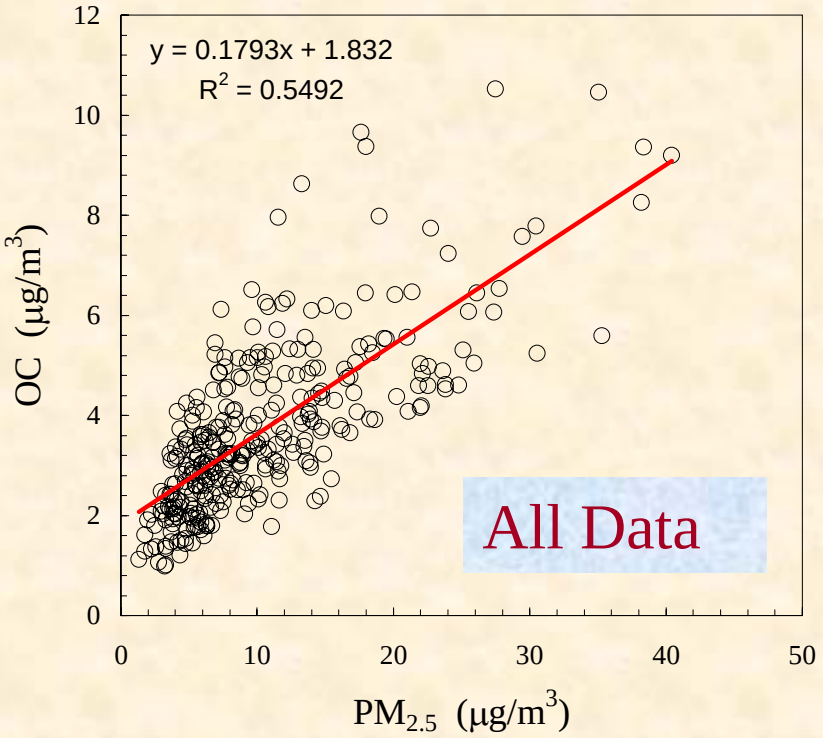
Filtering Data Can Impact the Result, therefore, additional Evaluation of this Approach is Needed. However, Results Look Extremely Promising



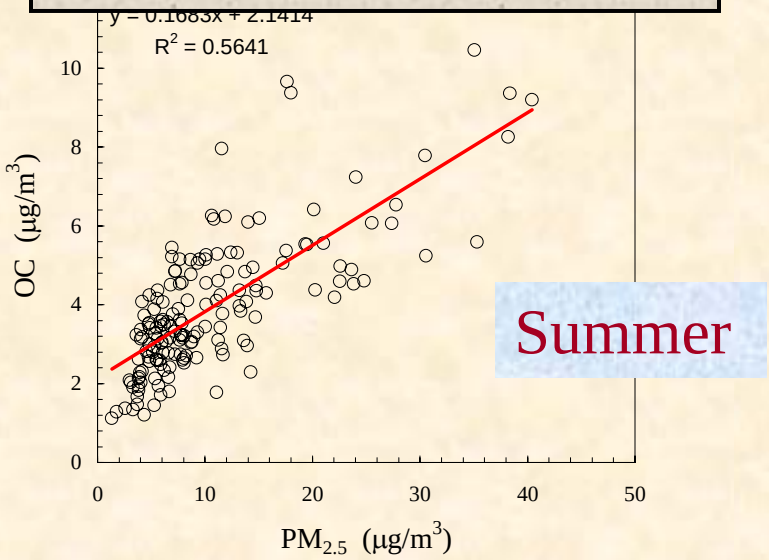
y = -0.0463x + 2.1192
R2 = 0.0041

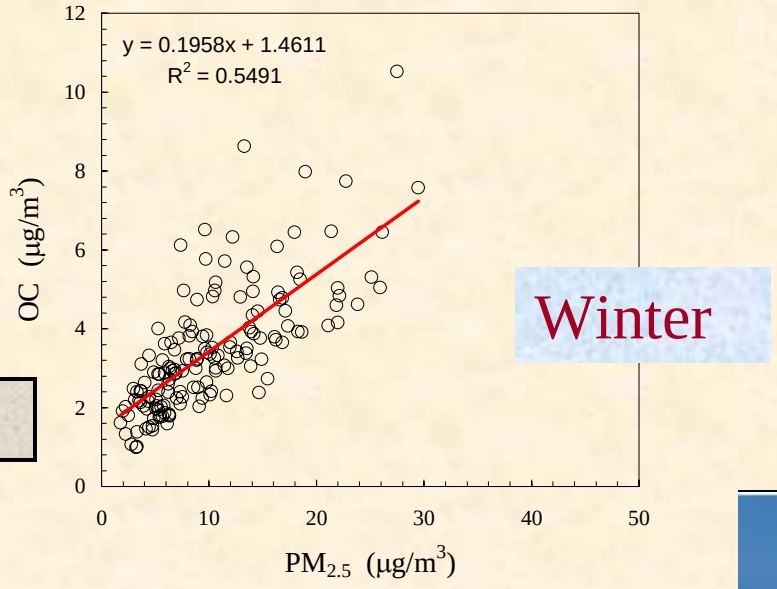
STN: Burlington, VT (Phil Hopke Analysis)

y = 0.179 + 1.8; R^2 = 0.549



y = 0.168 + 2.14; R^2 = 0.564





y = 0.196 + 1.46; R^2 = 0.549

Summary & Conclusions

- The OC Artifact Issue Is Very Complicated*
- Several Methods Have Been Attempted to Account for the OC Artifact due To Absorption of Gases
- For the STN, Field Blanks and Regression Analysis (Mass vs OC) Seem to Give Similar Results When OC Concentrations are Average to High
- Blank Correcting the STN Gives A Better Comparison Between STN and IMPROVE

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