

# PILS Measurements of Water-Soluble Compounds

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# Instruments

## 1. PILS1: Online PILS-IC for PM1.0

- Anions:  $\text{Cl}^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$
- Cations:  $\text{Na}^+$ ,  $\text{NH}_4^+$ ,  $\text{K}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$
- 1.25 min integration time, 2.7 min duty cycle

## 2. PILS2: PILS-Fraction Collector (PM1.0)

- Collect water soluble species in vials for offline analyses (options discussed below).
- 2 to 4 min integration and duty cycle

# Objectives PILS1

## 1. PILS1: Ions

- Provide PM1 data to support heterog. chemistry objectives, (HOHO, ClNO<sub>2</sub>), aerosols of Cl<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, Na<sup>+</sup>, NH<sub>4</sub><sup>+</sup>.
- Particle ions, HNO<sub>3</sub>, NH<sub>3</sub> & thermodynamic model:
  - Assess artifacts due to sample-air heating ( $T_{\text{cabin}} > T_{\text{amb}}$ )
  - Identify internally mixed ions (NaCl, NaNO<sub>3</sub>, NH<sub>4</sub>NO<sub>3</sub>, (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>... ) (limitation, not size resolved), test by partitioning of HNO<sub>3</sub> and NH<sub>3</sub>
  - Predicted particle water and pH spatial distribution
  - Contrast results (pH, etc) to analysis of summer study in similar region (NEAQS summer 2004)

# Thermodynamic Model and pH

- pH is a critical parameter needed to understand secondary aerosol formation; partitioning of inorganic species, organic acids, SOA (isoprene).
- ion balances, molar ratios inadequate, lead to wrong conclusions

*Guo, H., L. Xu, A. Bougiatioti, K. M. Cerully, S. L. Capps, J. R. Hite, A. G. Carlton, S.-H. Lee, M. H. Bergin, N. L. Ng, A. Nenes, and R. J. Weber (2014), Predicting particle water and pH in the southeastern United States, Atmos. Chem. Phys. Disc., 14, 27143-27193.*

*Hennigan, C. J., J. Izumi, A. P. Sullivan, R. J. Weber, and A. Nenes (2014), A critical evaluation of proxy methods used to estimate the acidity of atmospheric particles, Atm. Chem. Phys. Discuss., 14, 27579-27618.*

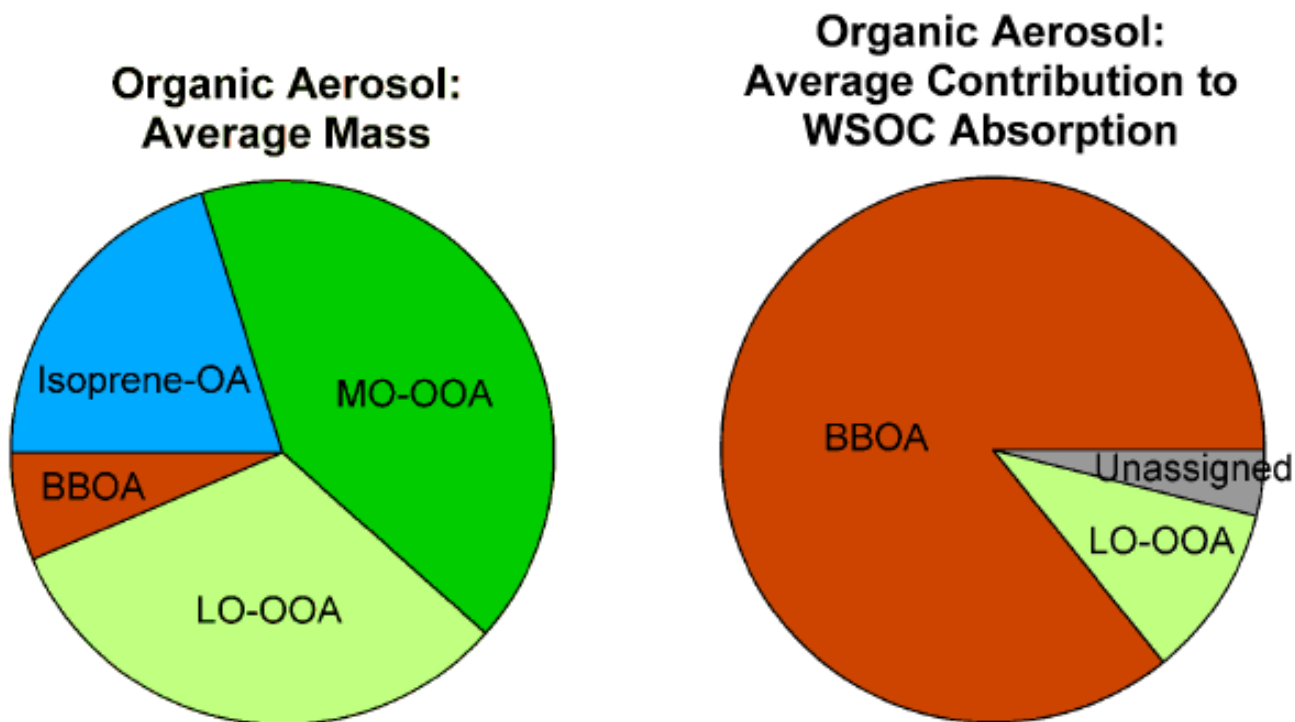
# Objectives PILS2

PILS2: Offline analyses provides measurement flexibility. Depending on a flight objectives, or our interests, could measure:

1. More complete range of ions, including organic acids, support/inter-compare online IC data.
2. **Carbohydrates: Smoke markers levoglucosan, mannosan, and galactosan provides insights on burning emissions (use AMS OOA instead of WSOC) (*Sullivan et al ACP 2014*)**

### 3) WS\_Brown Carbon and relation to smoke: sources, spatial distribution, aging (stability), ...

SOAS: BBOA small mass fraction, but main source for BrC



Rebecca Washenfelder AAAR 2014

# 4) Aerosols and Health: Reactive oxygen species (ROS), sources, spatial distribution, aging...

