Southern Great Plains 2013 New Particle Formation Study (NPFS-2013)

Jim Smith

ASR working group meeting

5 November 2013

GoAmazon 2014 – Planned observations relating to aerosol nucleation and growth

T3 site:

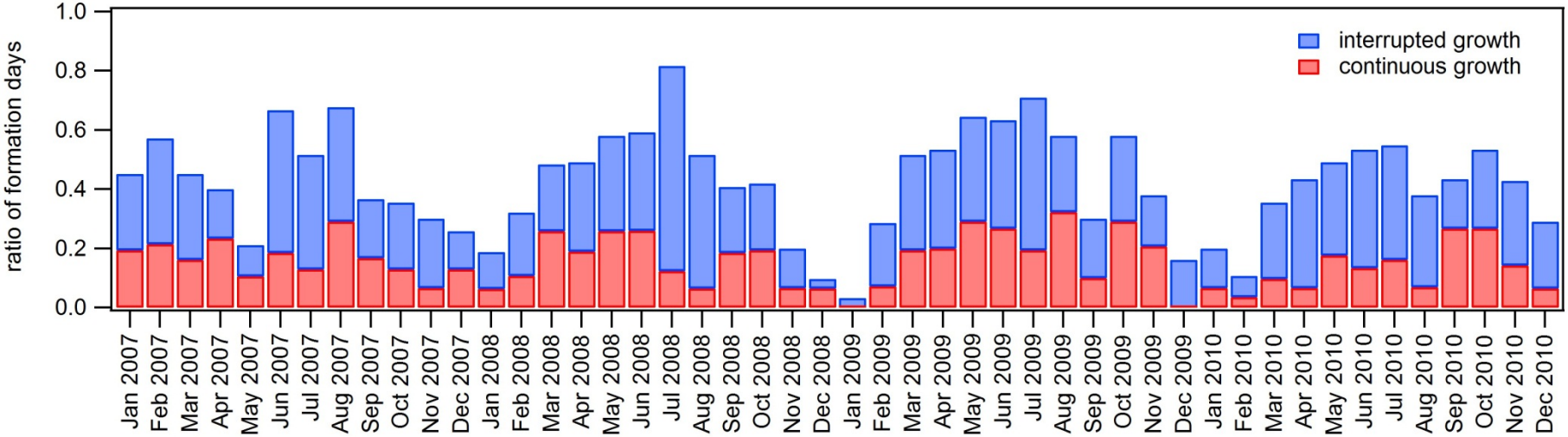
- H2SO4 (SICIMS, UC Irvine and NCAR)
- Ambient ion and neutral clusters (NAIS, U Helsinki)
- Nanoparticle size distribution down to 1 nm (SMPS with a DEG-CPC, BNL)
- Nanoparticle composition (TDCIMS, NCAR)

Why Southern Great Plains? ARM infrastructure!

Existing SGP Central Facility Instruments and Support

- hygroscopicity (TDMA)
- PM1 composition (ACSM)
- cloud condensation nuclei (CCNc)
- aerosol optical properties
- remote sensing data (radars, lidars, etc.)
- frequent balloon-borne sounding launches
- Calibration facilities, engineering support, regular gas deliveries, …

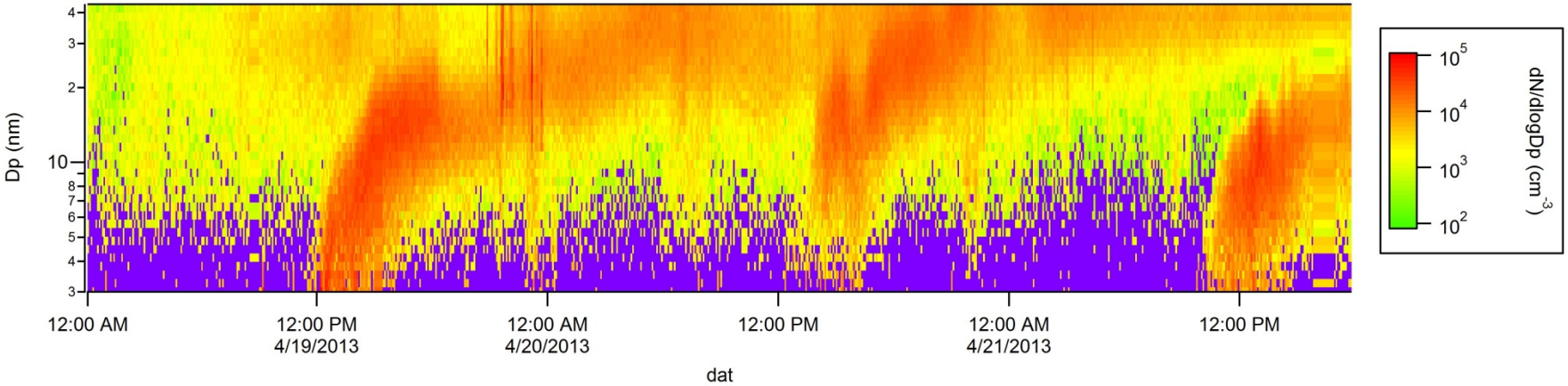
Why Southern Great Plains? Frequent particle formation events



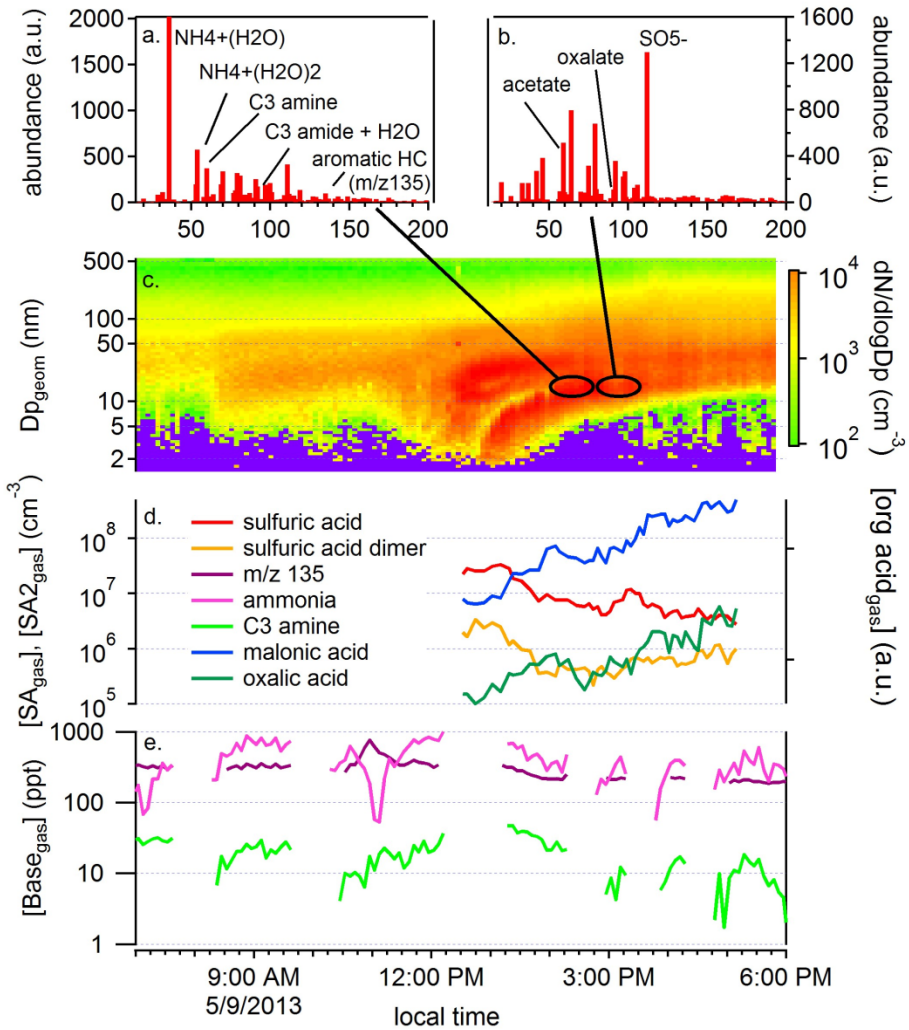
- New particle formation is observed in SGP during over half the summer months
- Classic formation and growth events are more common in May and September (meteorological effect?)

TDMA data from SGP: Analysis by John Ortega (NCAR)

First 3 days of the campaign



NPFS-2013: Some preliminary results



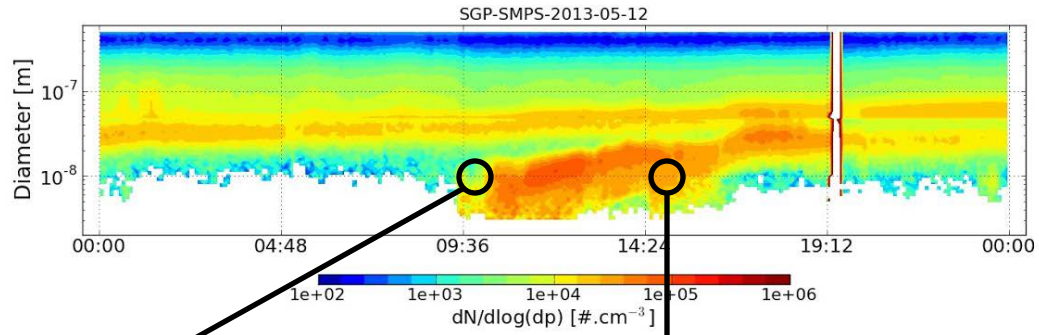
nanoparticle composition measurements with the TDCIMS confirmed the role of organic salt formation in growth

we observed new particle formation events such as this one on several occasions

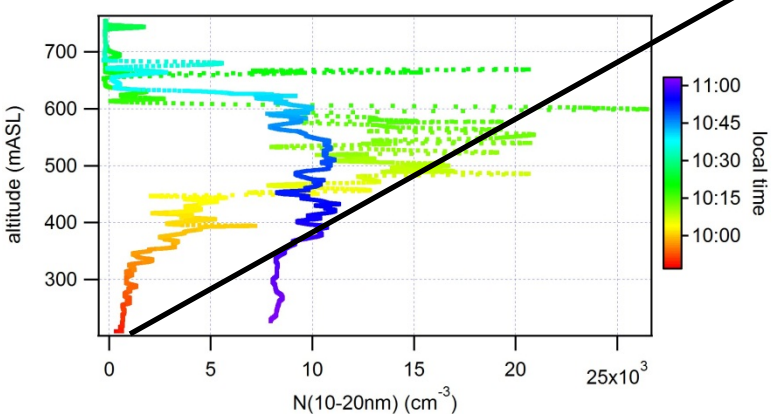
we observed sulfuric acid clusters as expected, but high concentrations of gas phase organic acids such as malonic and oxalic acids.

during the campaign we observed significant amine concentrations

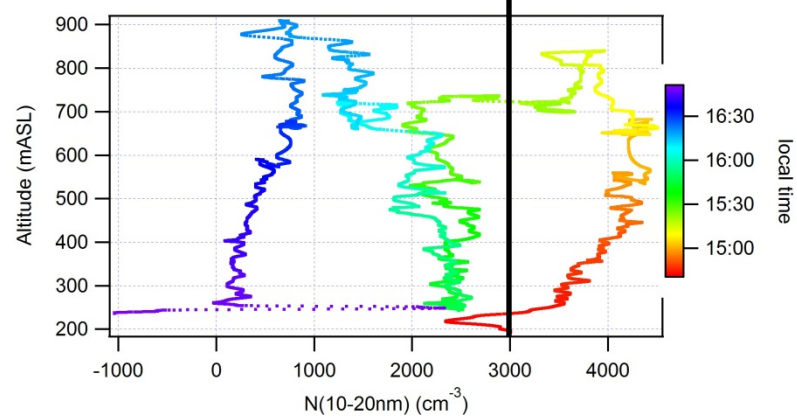
NPFS-2013: vertical profiles of 10-20 nm diameter aerosol



morning



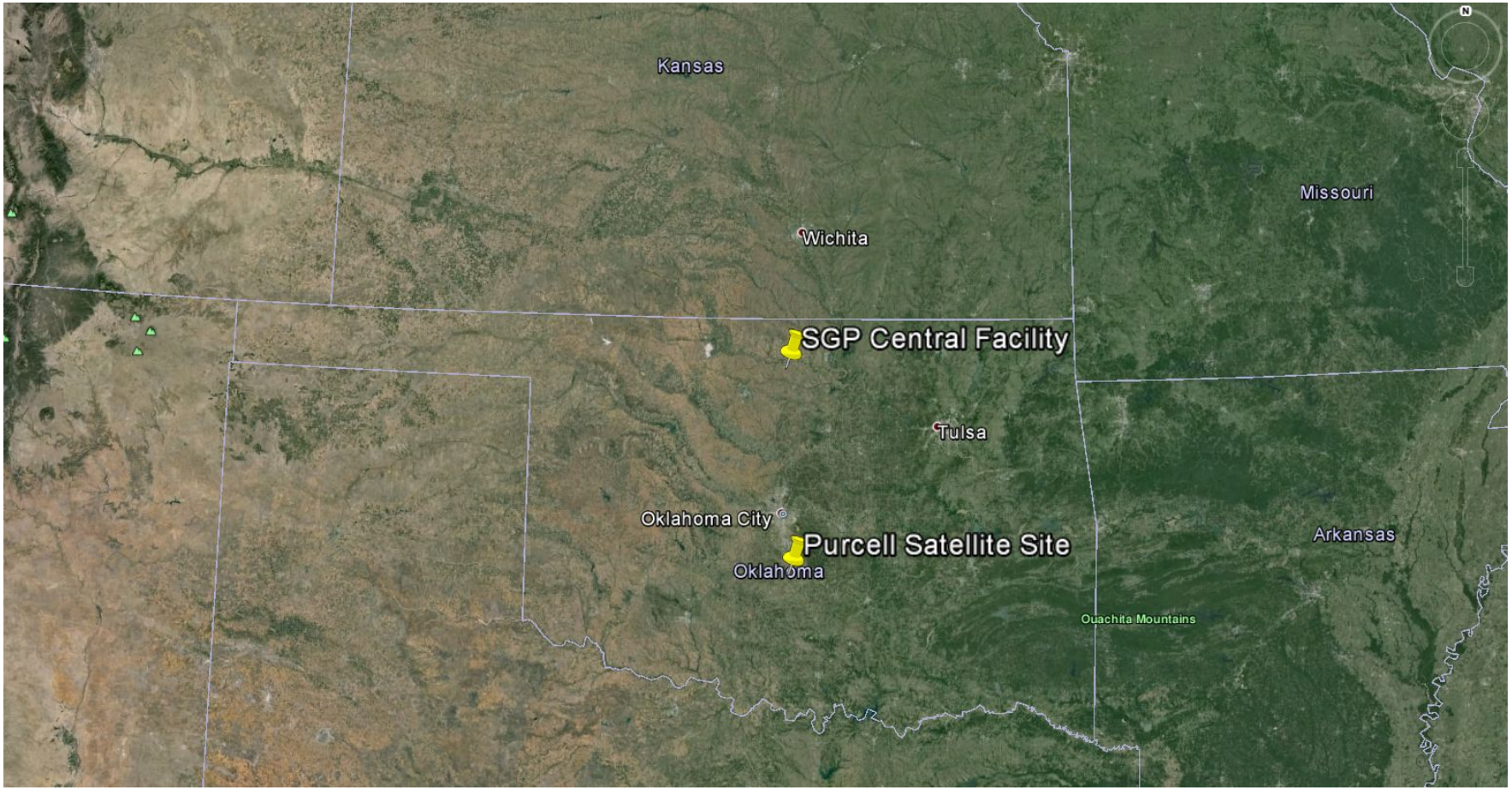
afternoon



in the morning most of the 10-20 nm diameter particles are aloft, with highest concentrations at 500 m ASL

the afternoon was characterized by a well-mixed boundary layer, with nanoparticle concentrations relatively constant for the remainder of the event

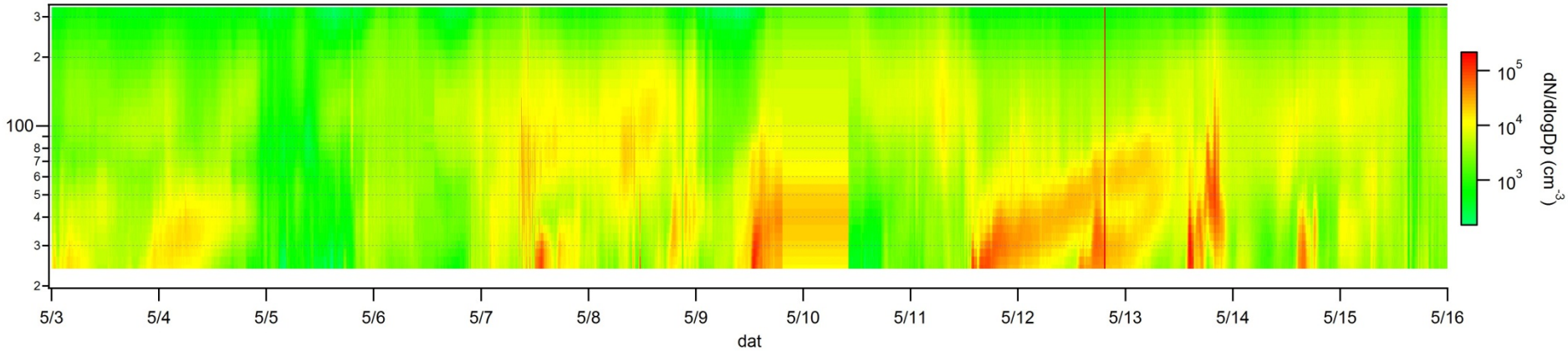
Sites


Kansas
Missouri
Wichita
SGP Central Facility
Tulsa
Oklahoma City
Purcell Satellite Site
Oklahoma
Arkansas
Ouachita Mountains

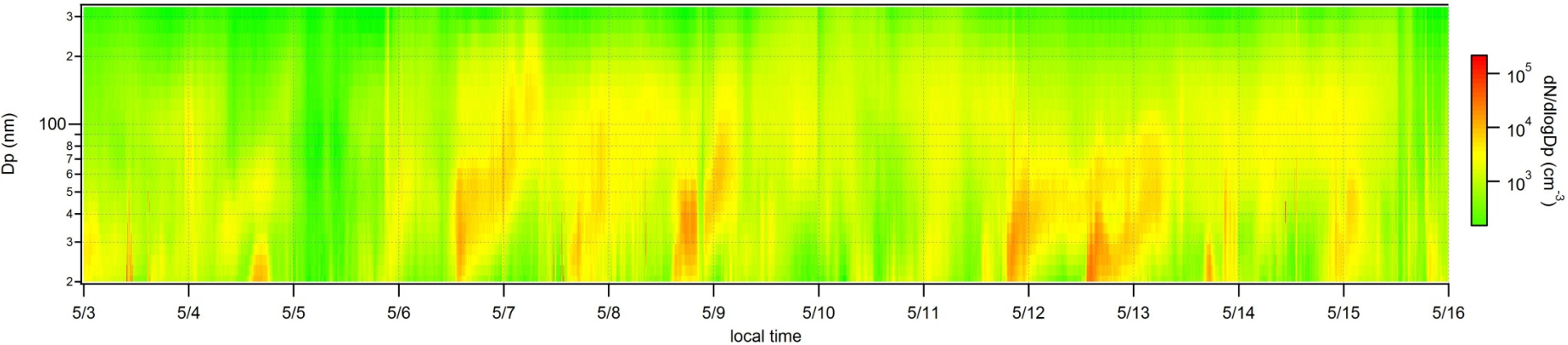
NPFS-2013: satellite site in Purcell, OK

SMPS data from ~2 weeks during study

SGP Central Facility



Purcell site



Southern Great Plains 2013 New Particle Formation Study (NPFS-2013)

- Campaign ran from 13 April – 26 May 2013
- Participation by 6 different research groups from NCAR, Univ. of Minnesota, Augsburg College, and Univ. of Delaware (the latter with funds from NSF)
- Measurements were made of new particle formation and important gas phase precursors at a “supersite” at SGP’s Central Facility, at a “satellite site” in Purcell, OK, and vertically-resolved using a tethered balloon system
- Overall, the best observational dataset we have obtained on the physical and chemical properties of freshly nucleated aerosol

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