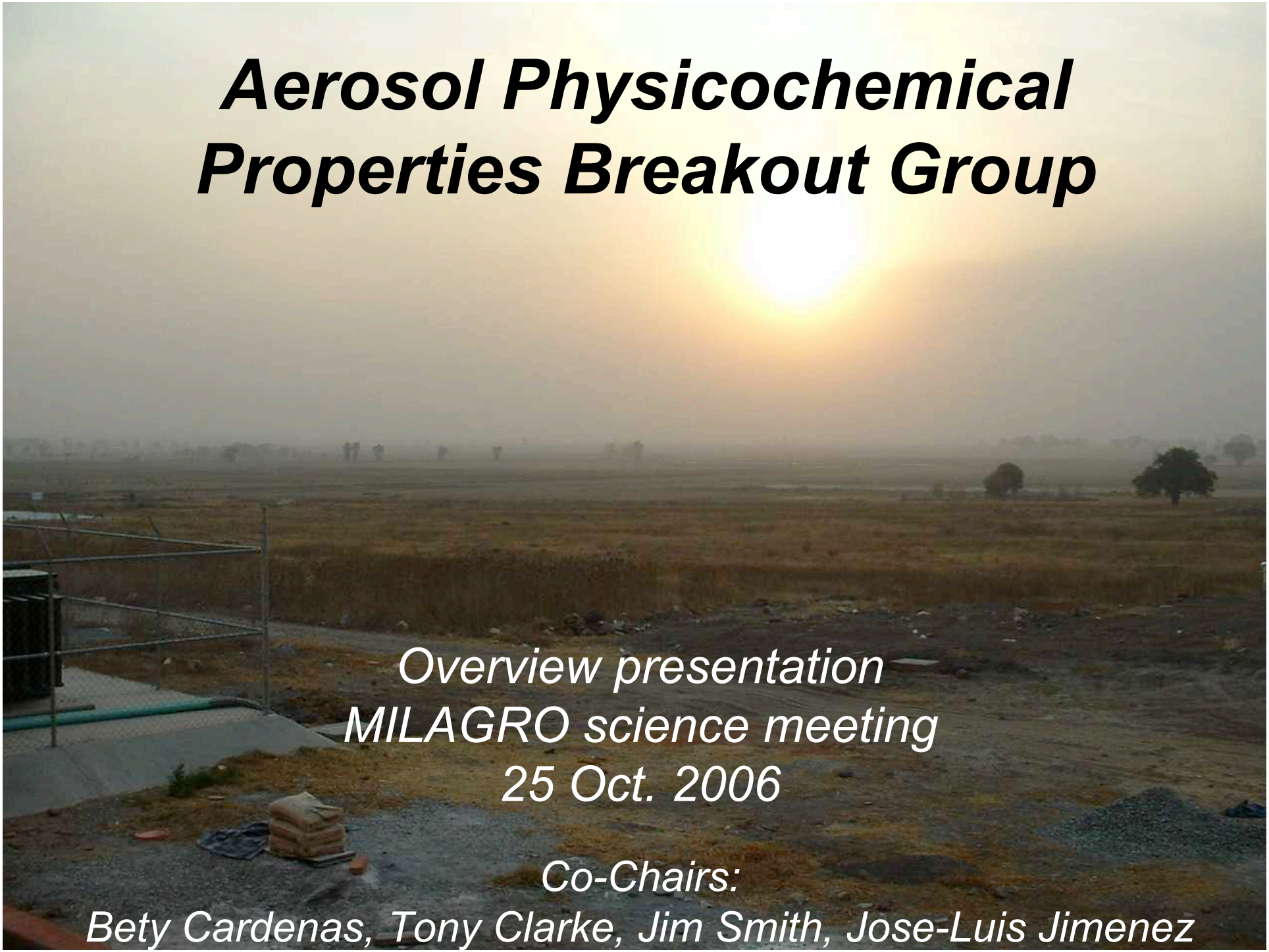

Aerosol Physicochemical Properties Breakout Group

Overview presentation
MILAGRO science meeting
25 Oct. 2006

Co-Chairs:
Bety Cardenas, Tony Clarke, Jim Smith, Jose-Luis Jimenez

List of topics and number of proposed papers

- Emissions / Sources (3)
- Physical properties (12)
- Chemical properties (23)
- Hygroscopicity & CCN (6)
- Evolution of properties (9)
- New Particle Formation (5)
- Models (2)
- Satellites (0)
- Health effects (6)

Part 1: Nuggets

(i.e. preliminary findings)

Nuggets: Emissions/Sources

- Lead as a major component of $PM_{2.5}$
  - Pb, along with Zn, and Cl are high in $PM_{2.5}$ particles at T0
  - Pb is predominantly associated with SO_4^{2-} particles at T0
  - Plumes of almost 1 $\mu g\ m^{-3}$ of Pb at Tula

Nuggets: Physical Properties

- Internal mixing happens quickly (~ few hrs).
- Fractal soot particles get coated and become spherical over the course of the morning, J. Slowik, BC & ARI
  - Consistent observations with T0 and T1 (more fractal at T0 usually)

Nuggets: Chemical Properties

- Regarding Ca in course mode particles:
  - T1: Ca dominates $PM_{2.5}$ – PM_1 during dusty period up to March 21
  - PM coarse fraction at Tula is dominated by Ca. Many unidentified compounds (60% of mass) in $PM_{10.}$
  - T0: Ca dust comes from Tula region.
- Regarding nitrate:
  - Rapid partitioning of NO_3^- between gas and aerosol phase (from G-1). HNO_3 equilibrium w/ particles changes w/ photochemical age.
  - High nitrate in growing newly formed particles at T1.
  - Shift in NO_3^- partitioning due to dilution between T0 and Pico Tres Padres

Chemical Properties (Cont)

- Most of $(NH_4)_2SO_4$ particles are internally mixed with Si and K from TEM results.
- Regarding organics in particles at T0:
  - High proportion of oxygenated organics than primary
  - Oxygenated organics were less volatile than primary organics at T0
- Higher concentrations of metals and Hg at T1 than T0. But total gaseous Hg higher at T0 than T1.

Nuggets: Hygroscopicity/CCN

- During new particle formation, the population of particles that activated at S=0.15 are smaller and less hygroscopic than at other times.
- S-classified particles are less hygroscopic than would be predicted.
- Hygroscopicity increases with age in Mexico City plume from C130 measurements.
- At T1 hygroscopicity increases at midday, coinciding with NPF events. CCN indicates high fraction of insoluble material in activated particles.

Nuggets: Evolution of Properties

- While NOx/NOy going from 1 to 0.1, ratio of organics/CO increases x10. Light absorption/CO increases x2. (G-1)
- These increases continue for longer time scales (1-day, comparing to C-130).
- Same effect comparing T0 and Tres Padres, but smaller presumably because of shorter times.

Nuggets: New Particle Formation

- Regarding measurements at T1:
  - NPF occurred frequently, ion-induced nucleation did not contribute significantly to it.
  - Can infer particle sub 5-nm growth rates from charge distributions.
  - “L parameter” successfully determines whether NPF would occur.
  - New particles varied proportionally to H_2SO_4.
  - Enhancement of both NH_4^+ and dimethylamine in new particles from nucleation (10 nm).
- NPF frequently occurred at boundary between BL and free trop, also boundaries of plumes.

Nuggets: Health Effects

- Personal exposure to $PM_{2.5}$ > 45 $\mu g\ m^{-3}$, higher at T1.

Part 2: Collaboration Ideas / Suggestions / Needs

Collaborations: General Issues

- Need a data catalog that lists all the measurements that exists and how to get them. Does not exist currently. L. Kleinman.
- Jerome Fast & Ben de Foy have generated many model products for meteorology. Some of them on the web (mce2.org), they'd be happy to share with people interested in various analysis
- It is important to compare the meteorological data at T1 between the different datasets available. T. Castro.
  - There are some gaps, not clear yet whether there are disagreements. Groups at T1 should be aware of this.

Collaborations: General Issues II

- How to merge the measurements of the aircraft and the surface sites? (*G. Sosa*)
  - Compare directly the aircraft measurements directly over the urban area (*R. Zaveri*).
  - Use back-trajectories arising from the Mexico City are, to flag the times in which the C-130 and the DC-8 saw air from the city (*T. Clarke*).

Collab: Emissions / Sources

- Need chemical characterization of various sources for CMB analysis. *Elizabeth Vega, IMP.*

Collab: Physical Properties

- Help on validating and interpreting RAMA network's new $PM_{2.5}$ measurements (TEOM, Beta, etc.). *B. Cardenas, CENICA.*
- Need information relating to volatilization of aerosols entering aircraft. *T. Clarke, Hawaii.*
- Many groups performed various microscopy techniques, good opportunity to compare & collaborate. *B. Cardenas, CENICA.*

Collab: Chemical Properties

- Interest in collaborations investigating:
  - PAHs (*G. Mejia / Marr / Gaffney / Jimenez*)
  - Metals (*Sosa / Onasch / Salcedo / Laskin*)
  - Organic nitrates (*Gaffney/Jimenez*)
  - Organosulfates *(Jimenez)*
  - Amines (*Moffet / Jimenez*)
  - Oxalic acid (*Moffet*)
  - Nitrate in nanoparticles (*J. Smith*)
  - U, Th, and K in filters (*E. Herrera*)
  - Size-resolved composition (*Mamani / Castro / Laskin / Sosa / Onasch / Jimenez*)

Collab: Chemical Properties II

- Multiple groups are going to investigate SOA formation rates and yields, need to collaborate across time scales. (*Kleinman, DeCarlo, Volkamer, Worsnop, Jimenez, etc*.)
- Relative importance of burning in urban emissions and concentrations (POA and SOA) (*many groups)*
- Relative importance of dust vs. fine particles (*J. Dibb)*

Collab: Hygroscopicity & CCN

Collab: Evolution of Properties

- Issue of “clocks” for evolution was discussed in detail in aerosol optics & radiation session. It is important for that group, to correlate optical evolution with physico-chemical properties evolution.
  - Needs collaboration between these two groups

Collab: New Particle Formation

- Comparisons between ground and aircraft for NPF would be very useful, not usually done.
  - *P. McMurry & Tony Clarke* will collaborate on this.
- Comparisons between ground sites on dynamics of NPF are possible
  - Most extensive data at T1 (*McMurry / Smith), also at Pico Tres Padres (Worsnop) and T0 (Jimenez)*
  - Mexico City had “tomato events” instead of “banana events” (*P. McMurry*)

Collaborations: Models

- Need gas and particle data to compare with model output (*R. Zaveri*)

Collaborations: Satellites

- Need aerosol data to study how well and how far can MC plume be detected from satellites, and on which conditions this depends. Also trying to classify particle types. *Summary of morning discussion from S. Massie, NCAR.*

Collaborations: Health Effects

- Want to test toxicity of T0 vs T1 samples. *Need information on composition.* Will use EPR to measure release of oxidants from particles. *Alvaro Osornio*.
- Information available on ultrafine particles at T0 and T1 which is a hot topic in health effects. *Jim Smith / J. Jimenez*.