Different Methods of Monitoring PM

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Improving PM10 Monitoring in NZ

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CSIRO Marine and Atmospheric Research

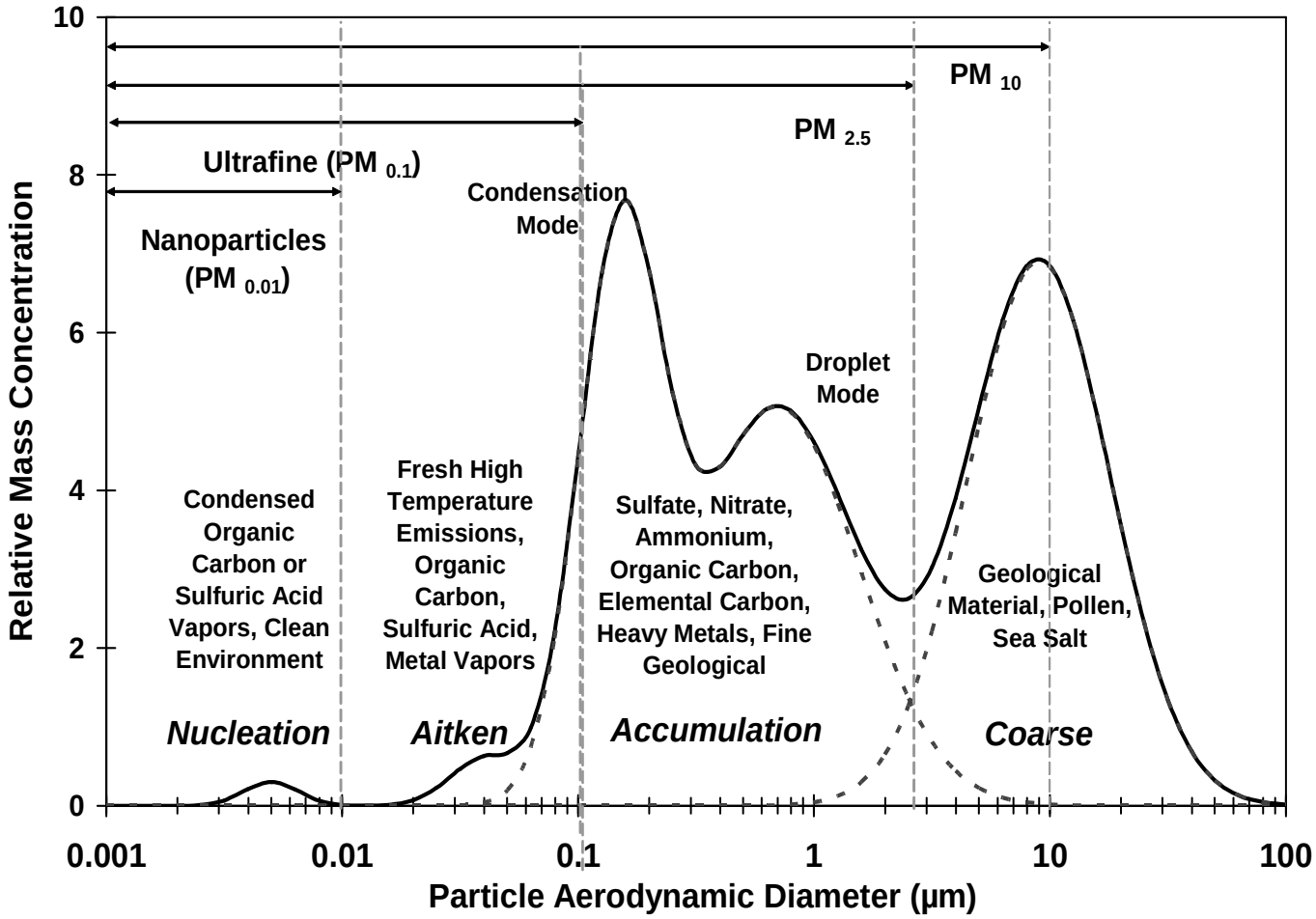
Methods

- Integrated filter sampling
  - Impactor or cyclone
  - Filter
  - High or low volume
- TEOM
  - gravimetric mass determined by change in frequency of an oscillating microbalance
  - TEOM FDMS
- BAM
  - beta attenuation, direct mass calibration
- Light Scattering
    - Eg Dusttrak, GRIMM, Nephelometer

Why doesn't the data always agree?

- Different properties of aerosol are being measured
  - Gravimetric mass v light scattering
  - E.g. TEOM and Dusttrack
- Sample treatment
  - Heating sample (loss of semi-volatiles)
  - Filter handling (contamination, partitioning of semi-volatiles after sample collection)
  - E.g. HiVol and TEOM
  - Size-selective inlets (sharp slope, particle bounce, cleanliness of inlet)

Size selective inlets



Intercomparison Studies

- **Supersite Program**
  - Objective to evaluate measurement methods (Chow, presentation to CSIRO, May 2005)
  - Lee et al., 2005 CAMM, RAMS, TEOM, integrated filter, PM2.5 Houston Supersite
  - Jaques et al., 2004, Differential TEOM, TEOM, MOUDI, FRM, Claremont Supersite LA
  - Demerjian, 2005 http://www.epa.gov/ttn/amtic/files/ambient/super/pmtacs.pdf
- **Intercomp2000**
  - Aerosol subproject of Eurotrak
  - Hitzenberger et al., 2005, integrated filter, TEOM, cascade impactors, filter types Leipzig 2000 (only 2 weeks)

TEOM HiVol comparison Australia

- National Environment Protection Measure (NEPM) for PM10 adopted in 1998 with PM2.5 Advisory (2005)
  - Australian Standard, HiVol,TEOM, Partisol/dichotomous sampler
  - Fine particle measurement calibration study (EA)
    - 17 sites, systematic difference, ambient temperature
    - Recommendations for the collection and reporting of TEOM data
    - 1. Site specific correction factors
    - 2. Apply national temperature adjustment factor
    - 3. Apply factor of 1.3 to 1.4
    - 4. Report as “TEOM DATA”, explanation of uncertainty and accuracy

Comparisons in NZ

- **Christchurch**
  - St Albans , ECan TEOM FDMS, BAM, HiVol
    - Cal factor for historical TEOM data
  - Burnside site, MfE,TEOM, TEOM FDMS, BAM, HiVol , 2005
  - University of Canterbury, TEOM, MiniVol, Dusttrak, winter 2004
    - Algorithm to adjust TEOM data
- **Auckland**
  - 4 sites, ARC, TEOM, BAM, HiVol,1997-2003
    - Seasonal (temperature) trends in TEOM HiVol discrepancy, BAM > HiVol
  - Newmarket, NIWA, TEOM FDMS, Partisol, May & June 2005
- **Wellington**
  - Marsterson, Greater Wellington, GENT, HiVol, 2003 & 2004

Good stuff

- Some studies have been multi-year
- Pooling of resources in collaborative studies
- Publication of results in peer reviewed journals
- Comparison with most recent technology (FDMS)
- NES User Guide will be updated to allow for technology changes

What else can be done?

- Collate, critically assess all available data and from this design an intercomparison measurement campaign that can fill in the gaps
- Carry out comparisons for at least one year to determine seasonal difference
- Carry out comparisons in other regions
- Explain the differences eg. particle sources, meteorology, use supporting data such as CO, NOx, particle chemistry

Aligns with the recommendations in the Gap Analysis

If only…..

- **Comparability across NZ**
  - so we know the correction factors, but how comparable are the data collected in different regions?
  - standard operating procedures including QA/QC for each instrument
  - travelling PM standard
- **Supersite**
  - The more we know the more we can explain e.g. size resolved chemical composition to explain seasonal discrepancies

Contact

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Thank You

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Different PM measurement methods

- **Why is this discussion important?**
- **What methods are used?**
- **Why are there differences in the data?**
- **What have other countries done about this eg. Australia?**
- **What is NZ doing?**
- **What else can NZ do?**
- **Gap analysis recommendations**
- **If only…….**

Surrogates to Gravimetric Mass

- **Light scattering**
  - Mie scattering
    - Refractive Index
      - Composition
    - Size
  - Nephelometer, Dusttrak, GRIMM