Particulate Matter

Using the composition of particles to understand sources of particles

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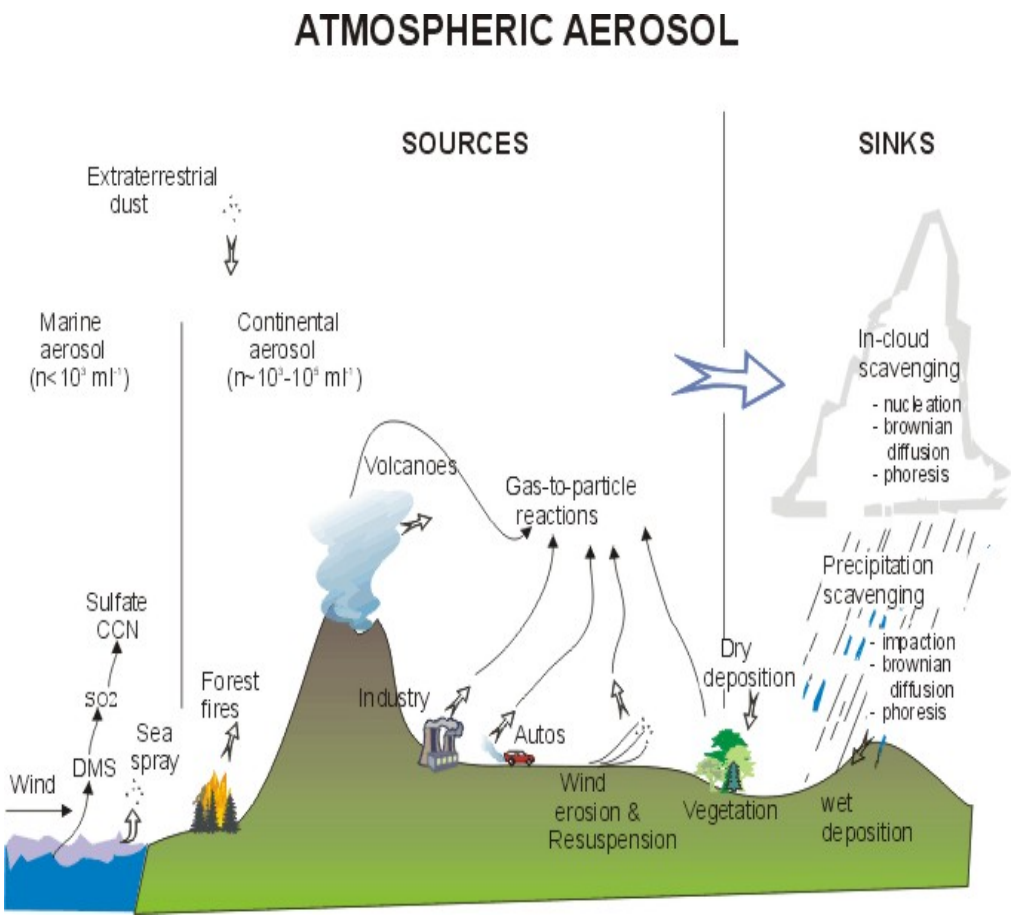
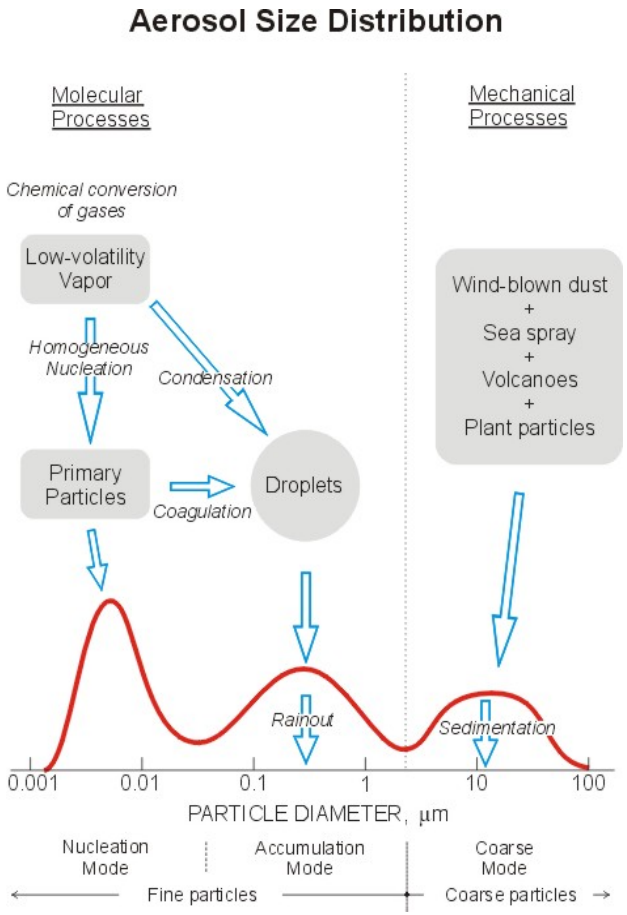
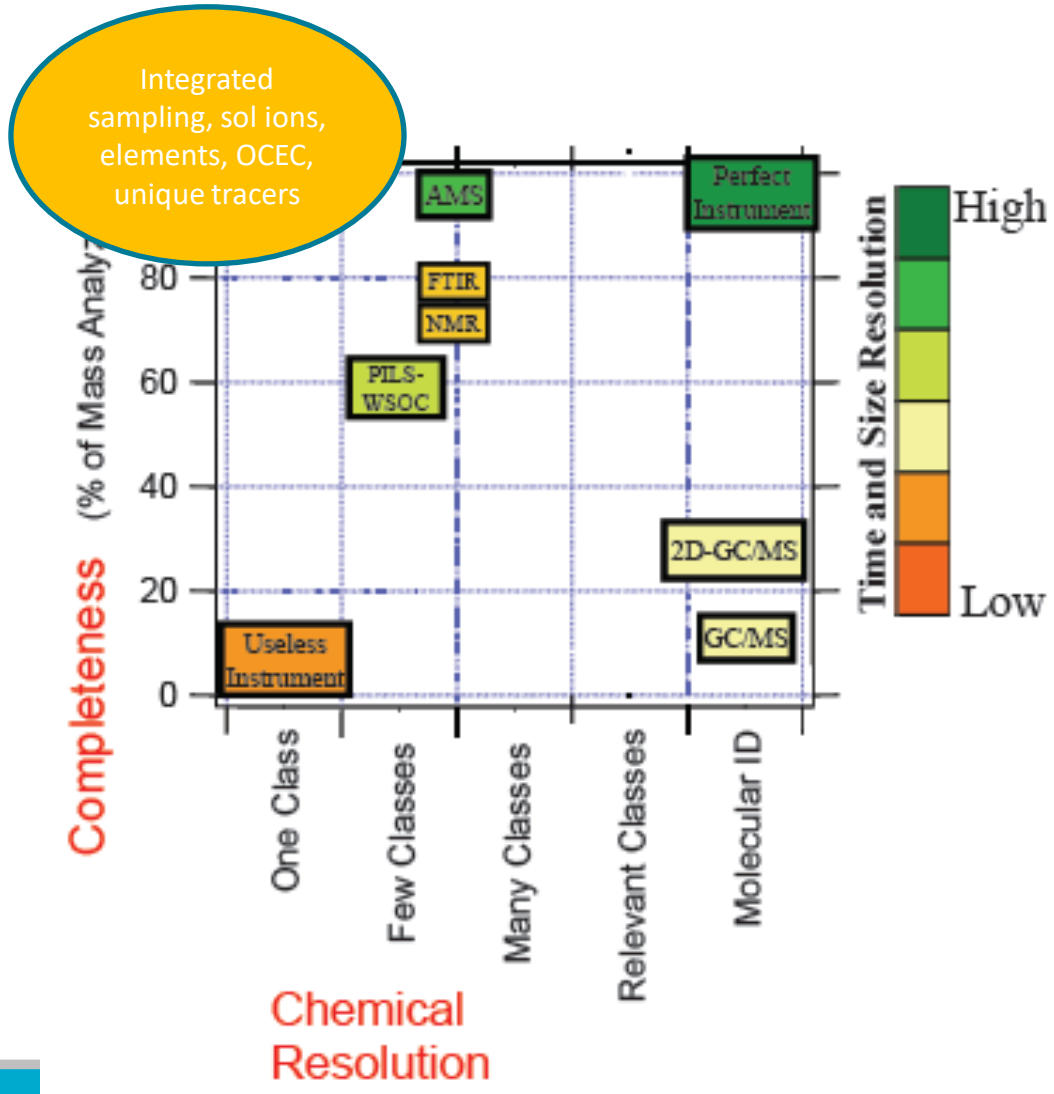
27 August 2018

Particles are a complex mixture of different sizes and composition





The ideal instrument/methodology



Hallquist et al., 2009

Particle chemical composition from filters

Collect on a filter

- High or low volume
- Size selective inlet
- Filter material

Analysis

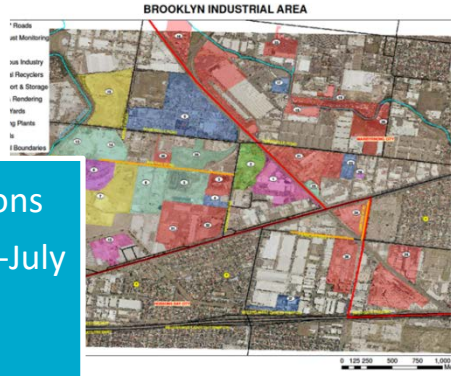
- Soluble ions
- Elements
- Organic and elemental carbon
- Organic speciation

Interpretation

- Source apportionment
- Process understanding

Brooklyn Particle Characterisation Study

Pollution from road and dust concrete recycling plant



2 locations

July 2010-July 2011

Aim

Determine composition and major sources contributing to PM10 concentrations in the Brooklyn airshed

PM10 (HiVol and Partisol)

EPA VICTORIA | Environment Protection Authority Victoria

CSIRO

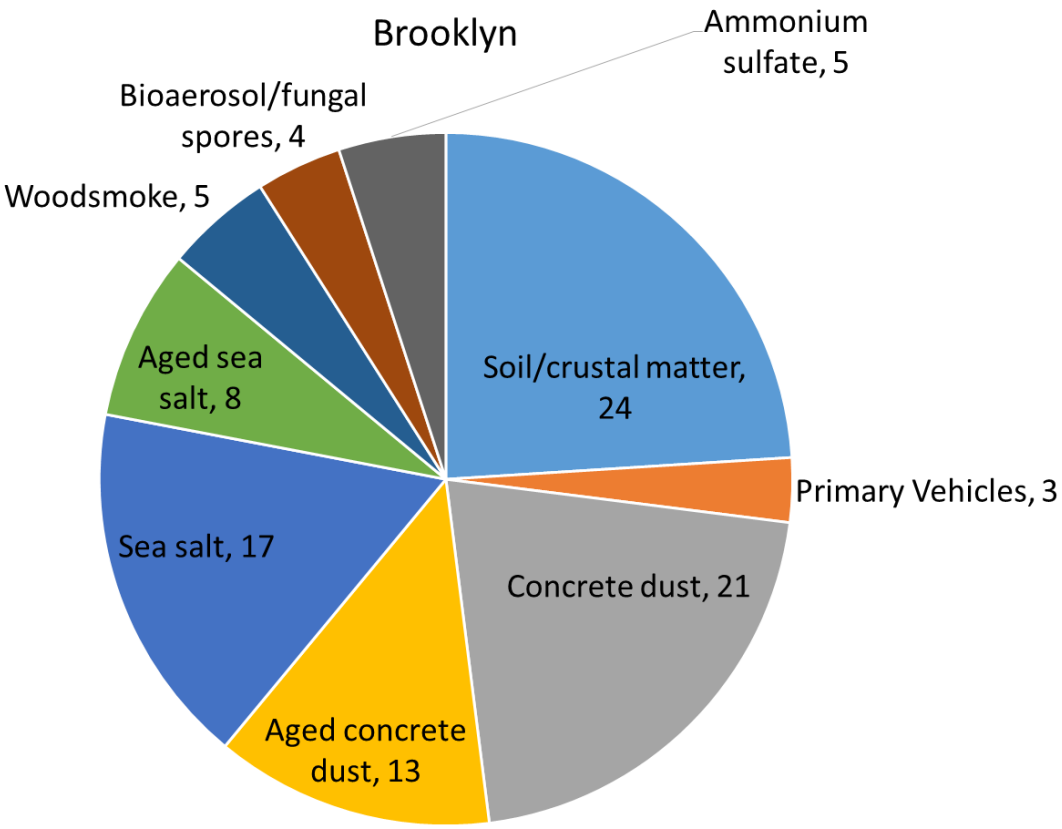
Australian Government

ansto

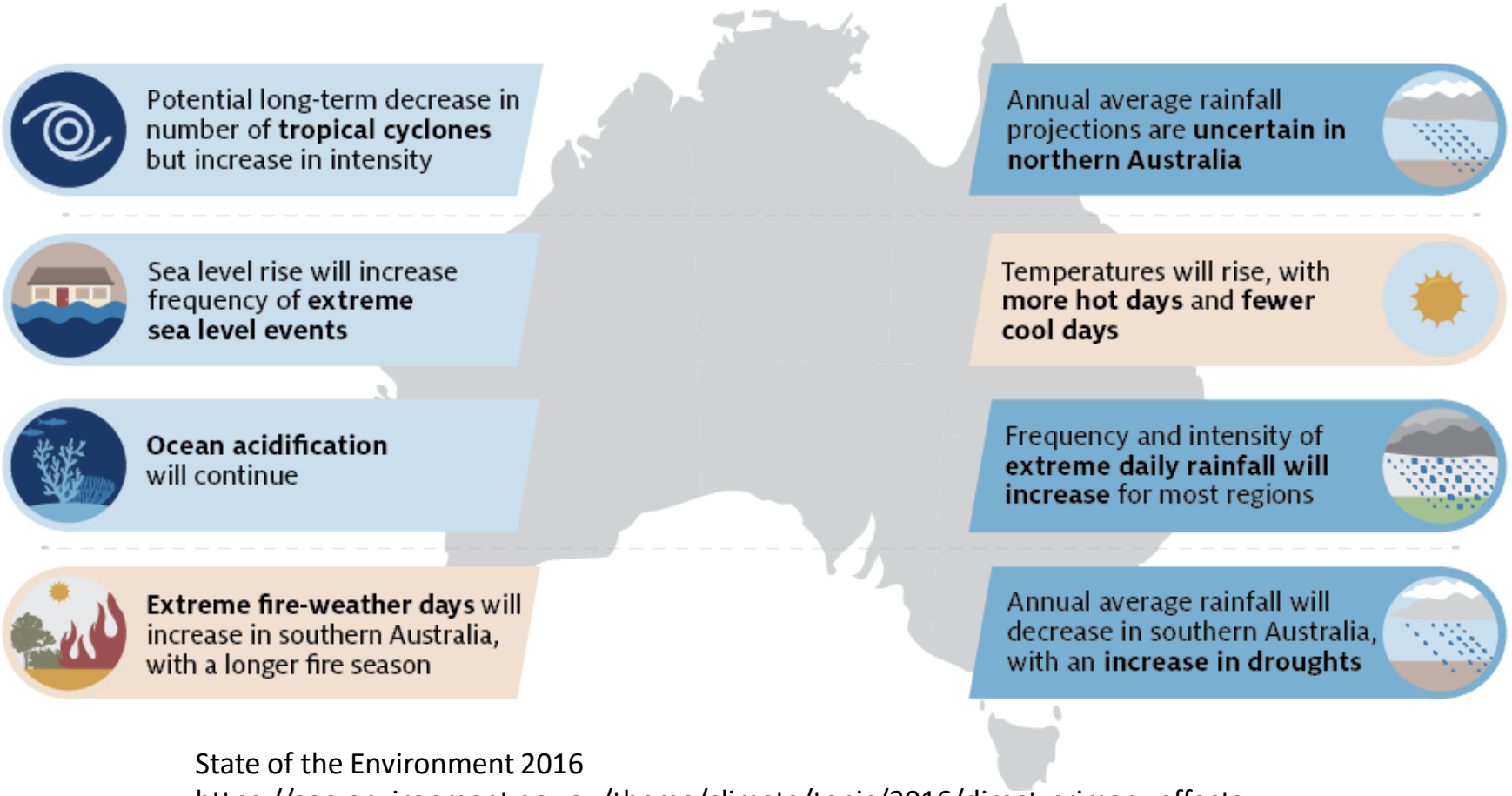
CSIRO

Brooklyn Particle Characterisation Study

- Species correlations and time series identified at least 7 sources
- PMF solution – 9 factors
  - Tracer species enabled extra sources to be identified
  - Species ratios used for source identification
  - Excellent agreement between two methods for Sea salt (16% vs 17%)
- Concrete dust made up 34% of total mass
  - Concrete Dust 21%
  - Aged Concrete Dust 13%



Climate Risk



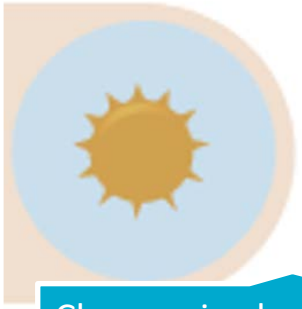
State of the Environment 2016
https://soe.environment.gov.au/theme/climate/topic/2016/direct-primary-effects-pressures-climate#figure-atm17summary-of-climate-change-projection-scenarios-for-australia--117856

Air Quality Risk

Increasing temperature

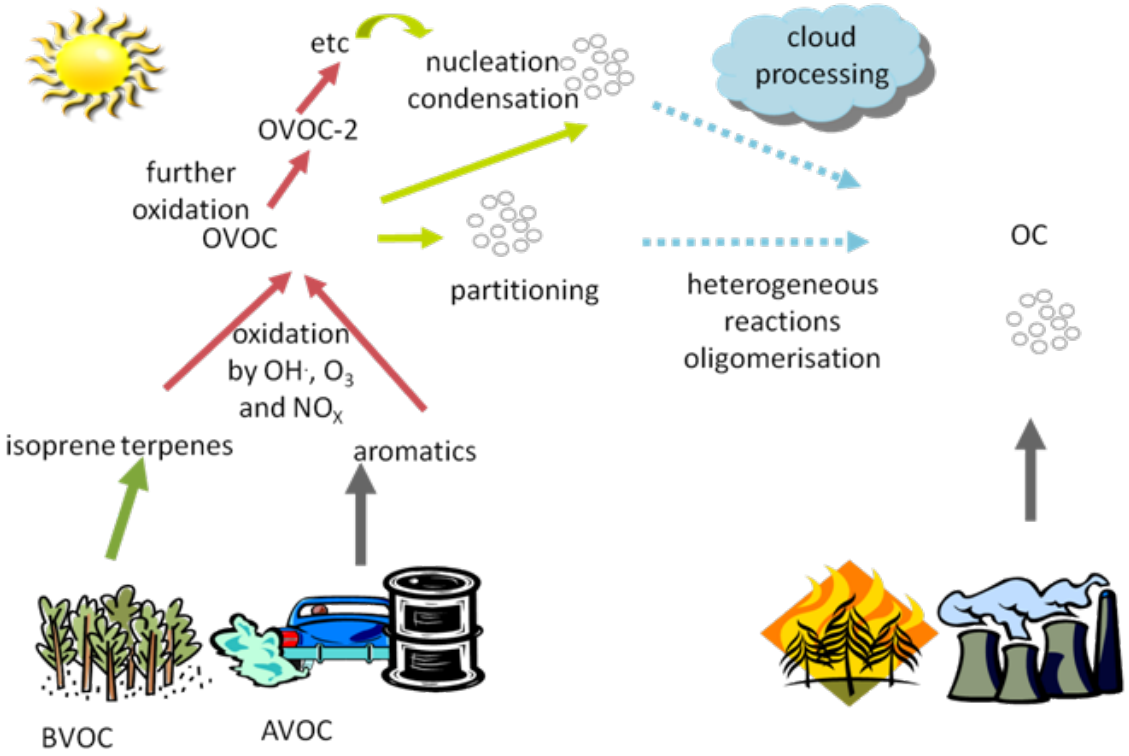
Increased bushfire smoke

Increased dust

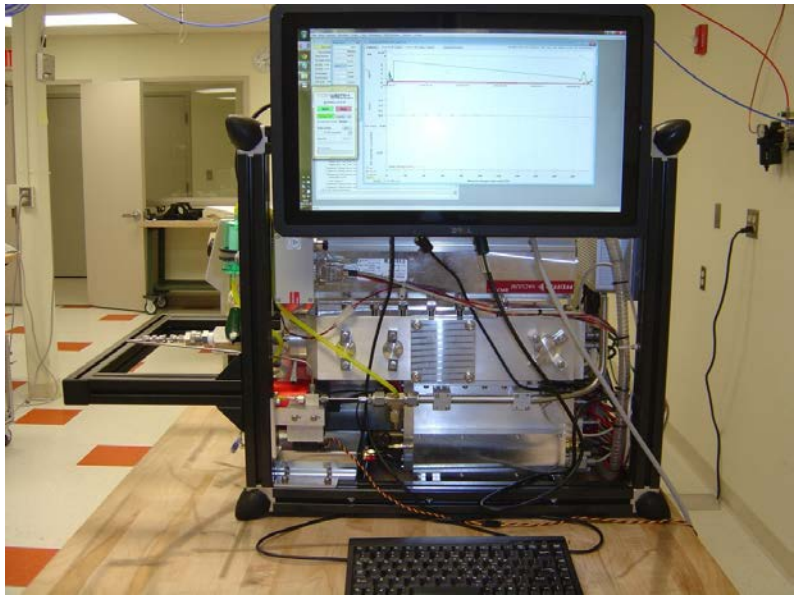


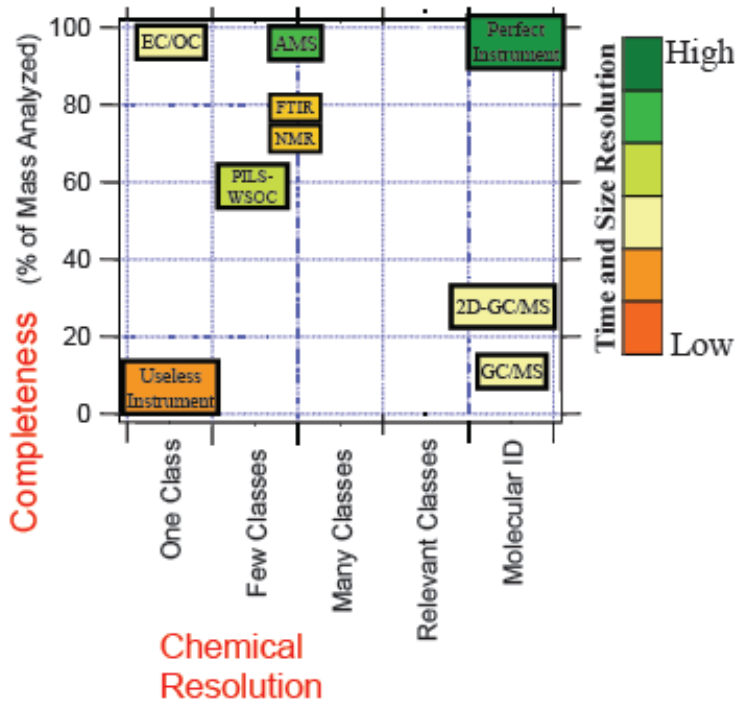
Changes in chemical reactivity

Particle formation and growth in urban settings- SOA



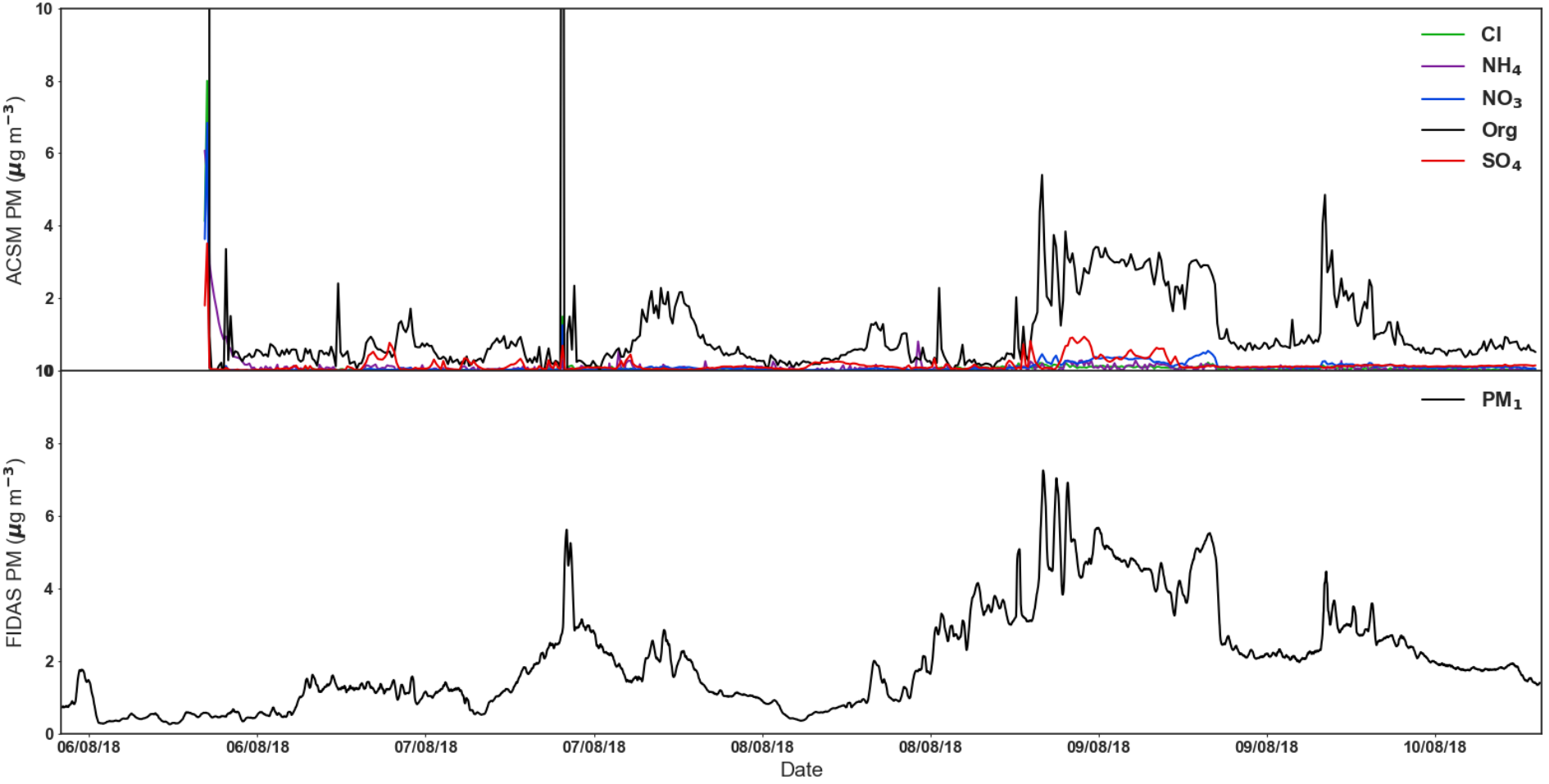
Time of Flight-Aerosol Chemical Speciation Monitor (ToF-ACSM)



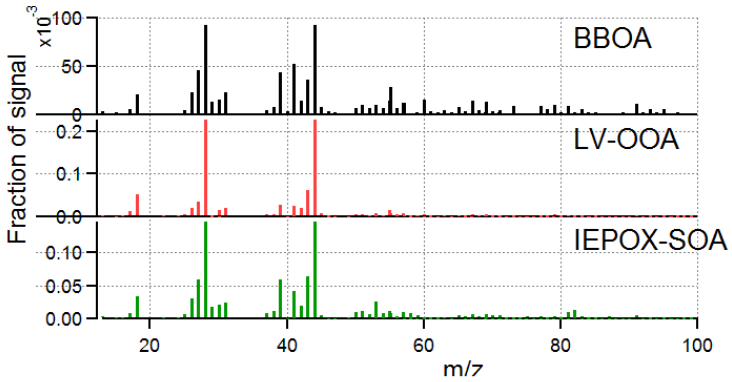


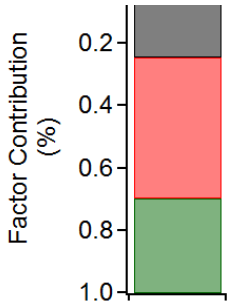
- Continuous online measurements of chemical composition & mass of non refractory submicron particles.
- Thermal vaporization (~ 600C) followed by electron impact ionization.
- Detection by compact time of flight mass spectrometer

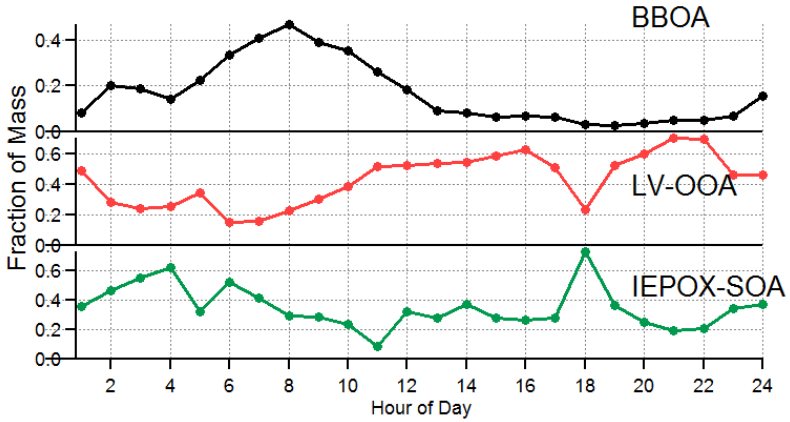
Continuous aerosol chemical composition



Continuous aerosol chemical composition

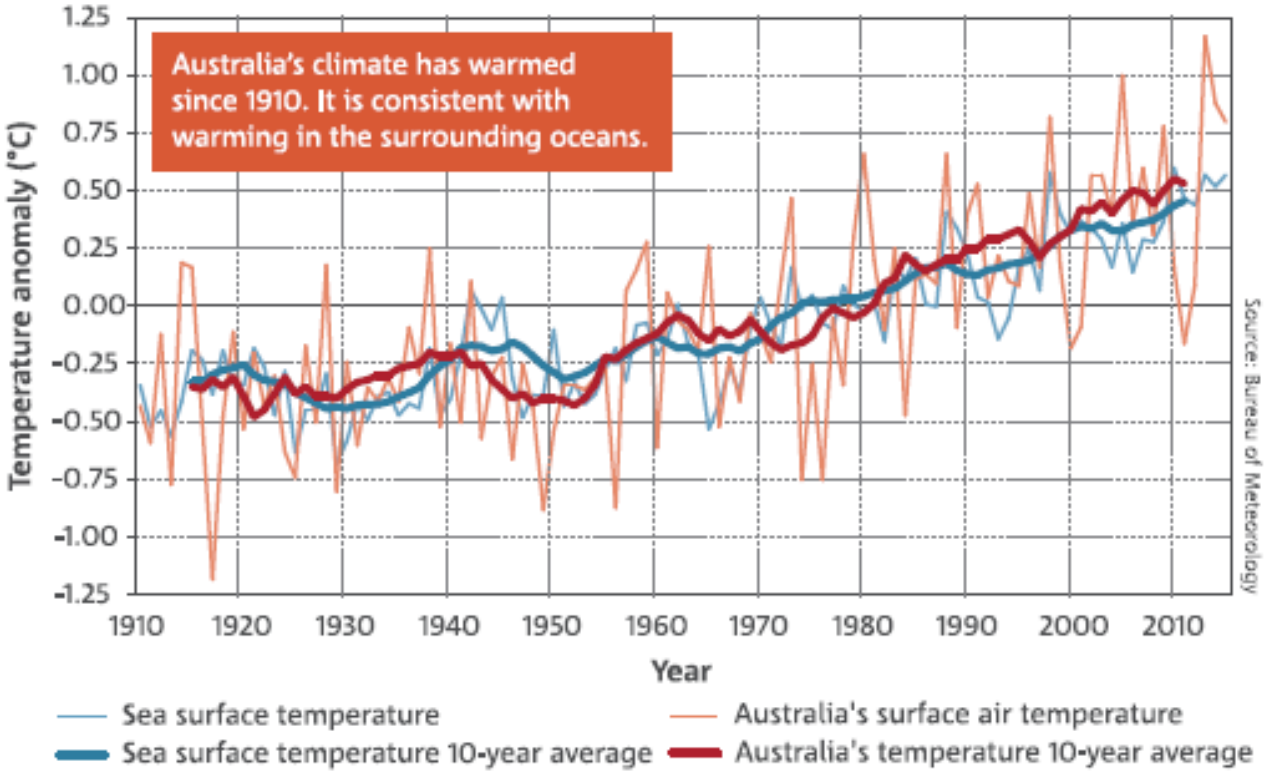






Milic A et al. (2017). Atmospheric Chemistry and Physics 17(6): 3945-3961. doi: 10.5194/acp-17-3945-2017

Increasing temperatures



State of the Climate 2016 (BoM and CSIRO) http://www.bom.gov.au/state-of-the-climate/State-of-the-Climate-2016.pdf

Top-down urban and regional scale GHG emissions estimates

COP21 · CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

Nations check and reassess their emission reductions

Global Stocktake established in Article 14 of the Paris Agreement

First stocktake will occur in 2023, then every five years, and that countries should "update and enhance" individual plans at that and future meetings

70 percent of the world's energy related GHG emissions come from cities

Atmospheric measurements and modelling-integrated and independent assessment of emissions

http://www.ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities