Black Carbon Measurements at the Cape Grim Baseline Air Pollution Station, Tasmania

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Cape Grim Baseline Air Pollution Station

Black carbon measurements

<table>
<thead>
<tr>
<th>Year</th>
<th>Instrument</th>
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</thead>
<tbody>
<tr>
<td>1990-2007</td>
<td>Aethalometer- Magee Scientific AE10</td>
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<td>2007</td>
<td>Thermo MAAP 5012 (670nm)</td>
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<tr>
<td>Sep 2015</td>
<td>Photoacoustic Extinctiometer DMT PAX – 870nm</td>
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<tr>
<td>June 2016</td>
<td>Tricolor Absorption Photometer (TAP-NOAA/Brehtel)</td>
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10m mast via 18 mm diameter outlet

RH controlled heater (RH < 40%)

BGI 1 μm VSCC
Initial climatology of BC (1990-1997)

- **Main contributors to BC**: Northern TAS and Melbourne/eastern VIC (peak BC autumn/winter)
- **Baseline conditions**: peak BC in spring attributed to long-range transport of smoke
- **Baseline sector**: potentially wind-related artefacts due to scattering or re-suspended soil

Figure 1. Mean BCa concentration by local wind direction at Cape Grim for 1990-1997.
Origins of air masses at Cape Grim

[Diagram showing wind direction frequency for different sectors: Continental Australian sector, Tasmanian sector, Baseline sector.]

- Continental Australian sector
- Tasmanian sector
- Baseline sector
What are the sources of BC at Cape Grim?

Long-range transport of smoke

Black carbon measurements at Cape Grim | Fabienne Reisen
Black carbon concentrations 2011-2017

Baseline Air

![Graph showing black carbon concentrations from 2011 to 2016. The graph includes box plots for each year with outliers marked by an 'x'.]
Daily median BC – highlighting few large events

![Graph showing black carbon measurements at Cape Grim over time]

Key dates:
- 20-21 May
- 7 April
- 22 March
- Jan/Feb 2016
- 7 April 2016
Tasmanian Fires 2016

At least 70 separate fires that spread quickly burning an area of ~ 100,000 ha over a 6-week period.

This was one of the largest and most ecologically damaging fires to occur in Tasmania in recent history.
Tasmanian Fires 2016

25 Jan 2016

EF_{BC} = 0.3 \text{ g/kg fuel}

12 Feb 2016
Potential sources of high BC
High BC pollution events from continental sector
High BC pollution events from continental sector
High BC levels from Tasmanian sector
Seasonal cycles for baseline sector

Baseline sector

Continental sector

Tasmanian sector

TAS fires

[Graph showing seasonal cycles for baseline sector, continental sector, and Tasmanian sector with data points from 2011 to 2017.]
Seasonal cycles for baseline sector

Additional criteria for baseline conditions:
Radon < 100 mBq m⁻³
Seasonal BC concentrations

- Autumn peak for continental sector – increased biomass burning from prescribed burns & woodheaters
- Winter peak for Tasmanian sector – domestic woodsmoke
- Slight spring peak for baseline sector
Future work

- Extend analysis of BC measurements to years prior 2011
- Investigate long-term trend in BC concentrations at Cape Grim
- Evaluate the TAP and PAX
Thank you

Oceans and Atmosphere
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