

## **Long term aerosol observations at Kennaook Cape Grim and CAPE-k**

### **Melita Keywood, CSIRO Australia**

Marine aerosol is globally one of the most important natural aerosol systems, contributing to the Earth's radiative budget, biogeochemical cycling, impacts on ecosystems and regional air quality. The Southern Ocean is one of the cleanest regions of the globe and is often referred to as a proxy for the pre-industrial atmosphere. It is also a region where Earth System models show a strong bias in radiative forcing, attributed to the inability of these models to accurately simulate cloud frequency and phase over the Southern Ocean.

While the past ten years have seen an increase in the number of observation campaigns that will contribute data needed to resolve these biases (e.g. Humphries et al., 2021), observations of aerosol properties at the Kennaook/Cape Grim Baseline Air Pollution Monitoring Station (KCGBAPS) have been ongoing since the late 1970s, resulting in invaluable long term data sets of aerosol properties. These records provide temporal context for the recent shorter term campaign data and provide information to assess changes to Southern Ocean aerosol properties over time.

In this presentation some features of the long-term aerosol records will be described. For example, a preliminary assessment of the long-term (1978-2020) trend in the CN3 concentrations measured under baseline conditions indicates a slight, but significant increase in baseline CN3 concentrations (1.1% per year). The greatest rates of change occur during the Southern Hemisphere spring and summer seasons, with no increase observed over the 48 years during the winter months. In this presentation these insights into changes in the background marine boundary layer particle number concentration will be discussed in the context of trends observed at other background and regional locations.

This presentation will also include an update on the Cloud And Precipitation Experiment at Kennaook (CAPE-K), a 17 month deployment of the US Atmospheric Radiation Measurement's (ARM) Mobile Facility to complement the extensive observational program already at KCGBAPS. CAPE-k, led by PIs Jay Mace and Roger Marchand will provide detailed cloud and precipitation observations from April 2024 to September 2025 –capturing a full annual cycle as well as two winter seasons. CAPE-k data sets will be used to understand the large model uncertainty in the surface radiation budget due to clouds and precipitation in the region where strong latitudinal gradients in cloud feedbacks have been observed.

### **Biography**

Dr Melita Keywood is a Senior Principal Research Scientist in the Environment Business Unit of CSIRO. Dr Keywood has 28 years of experience in aerosol research and has authored 100 peer reviewed journal publications and over 70 client reports.

Melita acted as the inaugural Research Director for the Climate Atmosphere and Ocean Interactions Program of the Environment Business Unit between December 2022 and November 2023 and is currently a Science Leader for Climate and Atmosphere.

Melita completed her PhD in environmental geochemistry at the Australian National University in 1996 and has worked at CSIRO since, with two six-month breaks taken up with maternity leave. Between 2002 and 2004 Melita visited the Californian Institute of Technology, working with Professor John Seinfeld on the laboratory simulation of secondary organic aerosol.

Melita's research expertise lies in the chemical and microphysical properties of atmospheric aerosol which she uses in a variety of applications ranging from tracking long term changes in aerosol

microphysics and chemical composition of the remote marine boundary layer, to understanding aerosol growth and secondary organic aerosol in urban airsheds and biomass burning plumes.

Melita is a co-leader of the Aerosols, Reactive Gases and Multiphase Atmospheric program at the Kennaook Cape Grim Baseline Air Pollution Monitoring Station and was an author on the 2016 and 2022 State of Environment Reports. Melita is the 2019 recipient of the Werner Strauss Clean Air Achievement Award from the Clean Air Society of Australia and New Zealand.