The clear skies of Central Otago make Lauder an ideal place for atmospheric research.

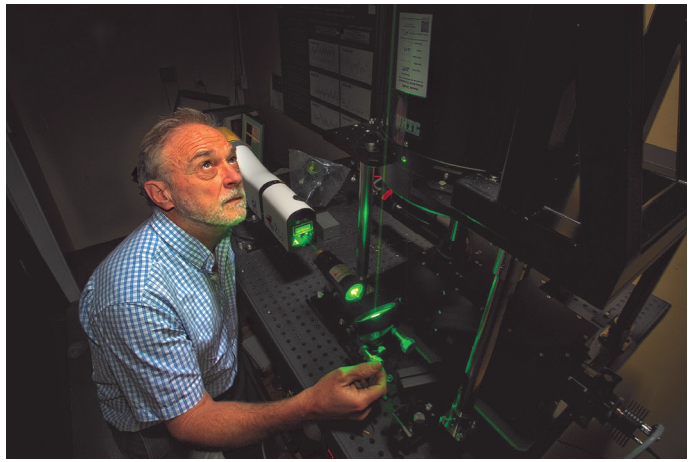
Our research contribution

Lauder's mid-latitude, Southern Hemisphere location is in a data-sparse part of the world. Our clear skies and clean, background-level air makes our measurements valuable to NIWA scientists and international colleagues alike. Lauder-based measurements are used to validate data collected by satellites and are fed into climate models around the world. We are actively involved in international assessments of ozone depletion and ultraviolet (UV) light and their impacts, and of climate change, including significant contributions to the internationally significant CarbonWatch NZ project being led by NIWA.

Lauder is a key site in the Total Carbon Column Observing Network (TCCON), a global network of ground-based instruments that measure the column abundance of the main greenhouse gases in the atmosphere. The TCCON sites provide vital validation of satellite missions that map these greenhouse gases over the Earth including the Orbiting Carbon Observatory missions (OCO), Greenhouse Gases Observing Satellites (GOSAT) and upcoming MethaneSat mission.

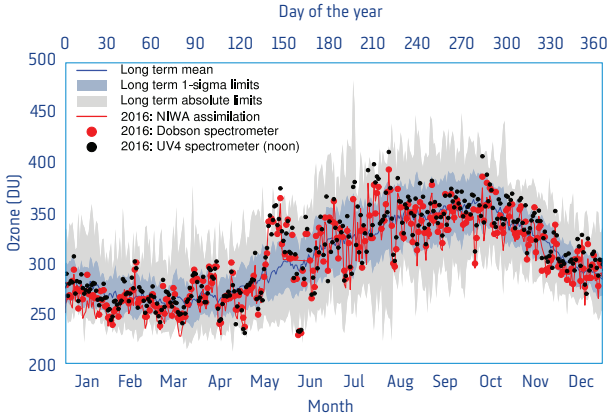
In 2015 Lauder became just the fourth upper-air research site in the world to be recognised by the World Meteorological Organization (WMO) with a Global Climate Observing System (GCOS) Reference Upper Air Network (GRUAN) certified measurement programme. This was a significant international endorsement of the capabilities at Lauder as a world-class upper-air measurement site.

Lauder's atmospheric and radiation measurements are submitted to major international databases including the Network for Detection of Atmospheric Composition Change (NDACC), Baseline Surface Radiation Network (BSRN) and World Ozone and Ultraviolet Radiation Data Centre (WOUDC), and the above mentioned TCCON and GRUAN. We host and maintain numerous instruments from other countries and collaborate with agencies across the globe such as NASA and NOAA in the United States and the Bureau of Meteorology in Australia.



Japan's Meteorological Research Institute (MRI) aerosol LIDAR at Lauder.

Daily column ozone measurements at Lauder



New Zealand is committed to long-term monitoring of ozone and ozone depleting substances. This graph shows daily ozone measurements at Lauder over a typical year compared with past years. NIWA's measurements at Arrival Heights, Antarctica add to our understanding of Antarctic ozone hole chemistry.

Find out more

NIWA's Lauder Atmospheric Research Station is a working scientific site. Visitors are welcome, but by appointment only.

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For more information about our work see:
www.niwa.co.nz/lauder

March 2021

NIWA
Taihoro Nukurangi

Lauder
Atmospheric Research Station

NIWA's atmospheric research station at Lauder, 35km from Alexandra in Central Otago, is deliberately remote to take advantage of the clear skies and clean air that surround it.

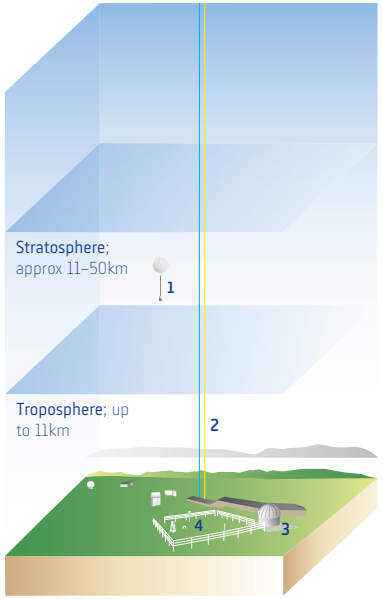
Set up in the early 1960s by the former Department of Scientific and Industrial Research (DSIR), Lauder's main role was to observe aurorae – the ghostly lights emanating 100-400 kilometres above the earth's surface caused when charged particles from the sun interact with the atmosphere.

By the late 1970s, the ozone layer, which protects us from excess UV radiation, was under threat from man-made gases. Research at Lauder shifted to investigating the causes and effects of ozone depletion in the stratosphere 11-50km above the surface.

The focus has since shifted again, this time to encompass the lower atmosphere, or troposphere, which at Lauder extends to just 11km above the earth's surface. Here we research questions about climate change and the interactions between global warming and ozone depletion.

Our facility, staffed by about 10 scientists and technicians, has a range of world-class instruments and contributes daily data to several globally important networks.

KEY:
Lauder Atmospheric Research Station –
1. Ozone sonde balloon.
2. Lidar.
3. Dobson spectrometer.
4. Weather station.



What we do

We measure the atmosphere, its many trace gases and particles, and the sun's radiation which passes through the atmosphere. Our high-quality measurements include chlorofluorocarbons (CFCs), ozone, ultra-violet radiation (UV) and greenhouse gases (GHGs). Some Lauder measurements go back as far as 1980. These long-term datasets are extremely important to the scientific community in identifying small trends and changes over time.

How we do it

There are two basic types of measurements: remote-sensing and in situ. At Lauder, we specialise in remote-sensing, typically using the detailed spectrum of sunlight after it has passed through the atmosphere, reaching our instruments on the ground. Gases absorb known wavelengths of light, and the resulting spectra are carefully analysed to infer trace gas concentration and location (profile) within the atmospheric column.

"In situ" measurements directly sample the atmosphere at ground level, or at height using a balloon-borne instrument. For example, we fly balloons weekly which carry sensors that directly measure ozone, humidity and temperature profiles up to burst point (about 35 km).

These in situ balloon measurements can be complemented by a ground-based LIDAR (Light Detection and Ranging) instrument. Here beams of pulsed UV laser light are sent vertically up to altitudes of around 100 km. A small fraction of the light is backscattered by aerosols and atmospheric molecules, including ozone, and is collected by a telescope - another example of remote sensing. Our measurements are submitted to major international databases.

High precision instruments are used for observing atmospheric chemistry and radiation.

NIWA's Lauder staff also maintain a range of atmospheric instruments at Arrival Heights and Scott Base, in Antarctica. We have an instrument at Macquarie Island and we service Lauder-designed instruments in the U.S. and Australia.

NIWA technician Penny Smale admires the view as a LIDAR gathers atmospheric data from the upper atmosphere. The instrument emits beams of pulsed laser light vertically to altitudes of about 100km.