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Tokyo, Japan
5 March – 9 March 2012

Session 5

Lauder Report for ICM-4 Meeting, Tokyo, 5 – 9 March 2012

(Submitted by Karin Kreher)

Summary and Purpose of Document

This document contains a site report from Lauder/ Nz for the ICM-4 Meeting.

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Introduction

Our goal is to align relevant Lauder NDACC measurements with GRUAN requirements so we can maximise our contribution to GRUAN's goals. Lauder is currently not nationally funded for GRUAN operations, but it does receive support from NOAA to make frost point hygrometer (FPH) flights and to help move Lauder towards this alignment. In the following we show the position of Lauder in this regard. The requirements sections in italics are from the WMO GCOS and WG-ARO documents.

Radiosonde Measurements

GCOS-121 Radiosonde Site Requirements:

- *1 x weekly production radiosonde with the best technology currently available at the site.*
- *1 x monthly radiosonde capable of capturing moisture signal in the UT/LS and all other priority 1 variables to the best level possible with current technology, launched together with weekly radiosonde.*

Lauder is flying a radiosonde together with other sensors, from the surface to ~ 32 km on a weekly schedule. This programme started in 1986, in collaboration with NOAA, to establish a long term archive of ozone profiles at southern mid-latitudes. This work is a component of New Zealand's NDACC commitment.

Two measurement configurations are used:

1. An RS92-SGPW with a Droplet Technologies (formerly EN-SCI) model Z ECC ozone sensor.
2. An I-met 1-RSB radiosonde with GPS receiver and an EN-SCI model 2Z ECC ozone sensor, plus a "Micro-Controlled Digital Frost Point Hygrometer" (under a NOAA contract). For all of the 2011 calendar year an RS92-SGPW radiosonde was also added to this configuration to improve the consistency of the weekly radiosonde measurements (GRUAN "best technology currently available").

Note: During the 2011 calendar year we improved our performance and got very close to meeting the weekly schedule for radiosonde flights and the monthly schedule for FPH flights (52/year incl 12 FPH flights). We are still struggling with a very tight funding situation and resulting staff overload.

Total for 2011:

49 radiosonde flights, including 10 FPH flights. 2 of the FPH ceased early due to leaky valves on the balloons. 2 flights (an ozonesonde & frostpoint sonde) were on the same day, 30/6/2011, – the FPH flight was a night flight to support the lidar intercomparison. Additionally: 4 RS92-only flights were undertaken to support Hippo aircraft overpasses.

Radiosonde Calibrations and Processing

- RS92-SGP sondes are pressure tested in a vacuum chamber pre-flight at 10 hPa. and combined with ground pressure measurements to correct pressure sensor offset and slope.
- Marwin ground station processing is available, but not used for ozone profiles. These are processed using modified Viasala ground checks – multiple Temp, Press, and Humidity

tests are averaged and applied to flight data after the flight. The flight data are processed using an in-house computer program for higher temporal resolution (1 sec).
- Ozone ECC**:** WMO standard operating procedure, with 0.5% buffer soln, 3 ml of cathode soln.

Data availability
These data are generally available through the NDACC and WOUDC archives but not yet for 2011 (issues with file formatting, this is currently being worked on).

Guidelines used
NDACC and WMO guidelines are used for radiosonde and ozone measurements.

Data dissemination practice
Currently NDACC, but alternative quicker release of data will be possible.

Ground-Based Instrumentation and Observing Practices (GCOS-121):

GNSS-PW measurements:

A Trimble NetR9 receiver unit and Zephyr Geodetic 2 antenna was obtained by NIWA in late January 2012. A suitable location at Lauder has been identified and construction of a suitable mount is under way (to be will be completed by Mid-March 2012). Once the hardware is installed it will be configured and incorporated into the New Zealand GEOnet network (http://www.geonet.org.nz/). This network is compliant with GRUAN GNSS-PS requirements.

We are still in the installation and testing phase and plan to have the system operating by June 2012. We have established a rapport with - and already received considerable support from - the GRUAN GPS-PW TT community (Kalev and Junhong), John Braun (UCAR) and John Bevan (NZ GEOnet project).

The list for additional ground-based instruments (GCOS-112, priority 2) encompasses six instruments:

- *surface radiation instruments*:
  Lauder BSRN station measurements are:

  Incoming Longwave Radiation - Pyrgeometer
  Incoming Shortwave Radiation – Pyranometer (global, diffuse and direct)
  Aerosol Optical Depth - 4 Wavelengths (412, 500, 610, 778 nm)

  The Lauder BSRN station is calibrated by Bureau of Meteorology, Melbourne.

- *Skyradiometer:*
  Aerosol optical depth – 11 wavelength from UVA to NIR
- *microwave radiometer*:
  None at Lauder (other than stratospheric O_3 and H_2O emission measurement instruments).

- *multi-channel infrared radiometer (e.g. FTIR*):
  Bruker HR direct sun viewing spectrometer used to measure trace atmospheric species column amounts with some profile distinction. However, it is not a calibrated radiance measurement.
- *Lidar (e.g. Raman Lidar)*:
  Aerosol lidar makes regular NDACC measurements at night – approx. 4 times per month; by day measurements are made to coincide with GOSAT overpasses.
- *integrated trace gas measurements and sun photometer*:
  Suite of composition measurements, NDACC trace plus greenhouse gases (CO_2, CO, CH_4, N_2O) as part of TCCON.
- *cloud radar (may also be useful)*:
  None at Lauder.

These data are available through the NDACC, WOUDC and BSRN archives. The appendix tabulates the GRUAN status of Lauder with respect to GCOS-121 specifications.

Lauder Resource Status:
Adding a GRUAN station, at an estimated NZ$1 million/year for a 2 radiosonde flights a day operation together with the other priority 1 & 2 measurements is beyond our current resources at Lauder. We very strongly embrace the vision and goals of GRUAN, and recognise the urgency of better balancing the hemispheric coverage, but the current funding situation in New Zealand makes increased resource support unlikely for the near future. However, together with the WMO Permanent Representative of New Zealand, we will continue to explore every opportunity.

Options that are currently explored: To work with the NZ Meteorological Service's GUAN Station in Invercargill, 180 km away, to provide an adequate twice daily radiosonde protocol

With continuing support from NOAA we expect to maintain our weekly best-available radiosonde programme, and monthly water vapour measurements.

The existing levels of NDACC trace species, column and in-situ carbon, and radiation measurements are expected to be reviewed and some may be reduced due to the current economic situation.

Possible Future Developments:
If researchers from other countries wanted to use the Lauder site for their GRUAN experiments we would endeavour to host them (this may need to be cost neutral to us).

Appendix: Lauder status with respect to GCOS-121 specifications

Variable	Temperature	Water Vapour	Pressure
Priority (1-4)	1	1	1
Measurement Range	170 – 350 K	0.1 – 90000 ppmv	1 –1100 hPa
Vertical Range	0 – 50 km	0 to ~30 km	0 – 50 km
Vertical Resolution	0.1 km (0 to ~30 km) 0.5 km (above ~30 km)	0.05 km (0 – 5 km) 0.1 km (5 to ~30 km)	0.1 hPa
Precision	0.2 K	2% (troposphere) * 5% (stratosphere)	0.01 hPa
Accuracy	0.1 K (troposphere) 0.2 K (stratosphere)	2% (troposphere) * 2% (stratosphere)	0.1 hPa
Long-Term Stability	0.05 K *	1% (0.3%/decade) *	0.1 hPa
Lauder Status	**Two measurement configurations are used:** • **An RS92-SGP with EN-SCI Z1 model ECC Ozone sensor and GPS.** • **An RS92-SGP plus an I-Met 1 RSB with EN-SCI Z1 model ECC Ozone sensor and GPS receiver, plus a "Micro Controlled Digital Frost Point Hygrometer".**		

Variable	Wind Speed	Wind Direction*
Priority (1-4)	2	2
Measurement Range	0 – 300 m/s	0 – 360 degrees
Vertical Range	Surface to stratopause	Surface to stratopause
Vertical Resolution	0.05 km (troposphere) 0.25 km (stratosphere)	0.05 km (troposphere) 0.25 km (stratosphere)
Precision	0.5 m/s (troposphere) 1.0 m/s (stratosphere)	1 degree (troposphere) 5 degrees (stratosphere)
Accuracy	0.5 m/s *	5 degrees
Long-Term Stability	0.1 m/s (troposphere) 0.5 m/s (stratosphere)	1 degree (troposphere) 5 degrees (stratosphere)
Lauder Status	**Accuracy 0.5 m/sRMS**	**?**

Variable	Ozone	Carbon Dioxide	Methane
Priority (1-4)	2	3	2
Measurement Range	0.005 – 20 ppmv	350 – 450 ppmv	200 – 1800 ppbv
Vertical Range	Surface to stratopause	Surface to stratopause	Surface to stratopause
Vertical Resolution	0.5 km (stratosphere) 0.2 km (troposphere)	1 km (stratosphere) 0.5 km (troposphere)	2 km
Accuracy	3% (total column) 5% (stratosphere) 5% (troposphere)	1 % (total column) 3 ppmv (profile)	2 % (total column) 20 ppb (profile)
Long-Term Stability	0.2% (total column) 0.6% (strat) 1% (trop)	1 ppmv	
Lauder Status	**Surface to ~ 32 km** **EN-SCI Z1 sonde** **Electrochemical cell** **Resolution: < 10m** **Accuracy** **0 - 10 km 5%** **10 - 30 km 3%** **30 km - 10 hPa 3%** **> 10 hPa 8%** **(Hassler, et al., 2008)**	**Surface (Licor)** **(0.1 ppm)** **Total Column** **(solar FTIR)** **(precision 0.2% clear sky, accuracy 0.5%)**	**Surface (FTIR cell)** **(0.35ppb)** **Total Column** **(Solar FTIR)** **(precision 0.2% clear sky, accuracy 0.5%)**

B. Hassler, G. E. Bodeker, and M. Dameris. Technical Note: A new global database of trace gases and aerosols from multiple sources of high vertical resolution measurements
Atmos. Chem. Phys., 8, 5403–5421, 2008

Variable	Net Radiation	Incoming Shortwave Radiation	Outgoing Shortwave Radiation
Priority (1-4)	2	2	2
Measurement Range	-300 – 1500 W/m2	0 – 2000 W/m2 *	0 – 1365 W/m2
Lauder Status	**No Measurements**	**BSRN Diffuse + Direct**	**No Measurements**

Variable	Light Scattering	Light Absorption
Priority (1-4)	2	2
Lauder Status	**No Measurements**	**No Measurements**

Variable	Incoming Longwave Radiation	Outgoing Longwave Radiation	Radiances
Priority (1-4)	2	2	2
Measurement Range	50 – 700 W/m2	50 – 900 W/m2	Full spectral range 100 – 1700 cm-1 190 K<Tb<330 K
Vertical Range	Surface	Surface	Surface to top of atmosphere.
Precision	N/A	N/A	N/A
Accuracy	1 W/m2 *	1 W/m2 *	0.01%
Long-Term Stability	3 W/m2 *	3 W/m2 *	0.15%
	0.1 W/m2	0.1 W/m2	0.03% per decade
Lauder Status	**BSRN Pyrgeometer**	**No Measurements**	**Total Sky Imager only**

Variable	Aerosol Optical Depth	Total Mass Concentration	Chemical Mass Concentration
Priority (1-4)	2	2	2
Measurement Range	0.005 – 5	0.1 – 100 µg m-3	0.1 – 30 µg m-3
Accuracy	0.005	10%	10%
Long-Term Stability	0.005	10%	10%
Lauder Status	**BSRN 4 Wavelength (412, 500, 610, 778nm)**	**No Measurements**	**No Measurements**

Variable	Cloud Amount/Frequency	Cloud Base Height	Cloud Layer Heights and Thicknesses
Priority (1-4)	2	2	2
Lauder Status	**No Measurements**	**No Measurements**	**No Measurements**

Variable	Cloud Top Height	Cloud Top Pressure	Cloud Top Temp
Priority (1-4)	3	3	3
Lauder Status	**No Measurements**	**No Measurements**	**No Measurements**

Variable	Cloud Particle Size	Cloud Optical Depth	Cloud Liquid Water/Ice
Priority (1-4)	4	4	4
Lauder Status	**Aerosol Lidar provides some info.**	**UVA Transmission UV Spectroradiometer**	**No Measurements**

GRUAN Survey of Site Measurement Inventory 8 February, 2012

Site: Lauder, New Zealand Representative: Paul Johnston / Karin Kreher

Measurements	Instrument	Frequency	Already Exists	Are Being Developed
P, T, U - profile	Vaisala RS92-SGP	1/week	X	
Winds (u,v) - profile	Vaisala RS92-SGP	1/week	X	
O3 - profile	EnSci ECC	1/week	X	
O3 – column	Dobson	2-5/day	X	
O3 - surface	TEI (in-situ)	5 min	X	
H2O - profiles	NOAA FPH	1/month	X	
H2O - column	GNSS-PW	10 min		X
H2O –column & profile	FTIR	2-3/week		X
Incoming Longwave Radiation	Pyrgeometer (collab. With BoM)	1/minute	X	
Incoming Shortwave Radiation	Pyranometer (collab. with BoM)	1/minute	X	
Aerosol profile	LIDAR (collab. with MRI)	8/month	X	
Aerosol Optical Depth	Sun photometer (collab. BoM)	continuous	X	
Aerosol Optical Depth	Sky radiometer (collab. NIES)	continuous	X	
CO2 - column & profile	FTIR	2-3/week		X
CH4 - column & profile	FTIR	2-3/week		X
CO2 – surface	In-situ closed-path FTIR	10 min		X
CH4 - surface	In-situ closed-path FTIR	10 min		X