

## **IIa. NDACC Intermittent or Campaign Measurement Activities (Listed According to Latitude)**

### **Northern Hemisphere High-Latitude Stations (60°N - 90°N)**

#### **Eureka, Canada (80.05°N, 86.42°W)**

FTIR P. Woods, B. Bell, C. Paton-Walsh, and T. Gardiner (NPL) – Bruker 120M (0.004 cm<sup>-1</sup> resolution) used for intercomparisons and campaigns (see subsequent entries). Measurements in Eureka were made in May 1999 but the data are not in the NDACC archive.

#### **Ny Ålesund, Spitsbergen (78.92°N, 11.93°E)**

FTIR P. Woods, B. Bell, C. Paton-Walsh, and T. Gardiner (NPL) – Bruker 120M (0.004 cm<sup>-1</sup> resolution) used for intercomparisons and campaigns. Measurements were made from May to June 1995.

Lidar (Aerosol, Ozone, Temperature, and Water Vapor) T. J. McGee (GSFC), L. Twigg (SSAI), and G. Sumnicht (SSAI) – The STROZ lidar retrieves ozone vertical profiles in the stratosphere from 10 to 50 km. Temperature to ~80 km and aerosols (at 355 nm) to 35 km also are measured. The instrument has also been modified to measure water vapor from near the ground to ~10 km. As a mobile intercomparator, it has participated in an ozone intercomparison in Ny Ålesund in September 1997 and January – February 1998.

Lidar (Aerosol) O. Schrems and F. Immler (AWI) – Mobile Aerosol Raman Lidar (MARL), participated in the NAOMI intercomparison in Ny Ålesund in January/February 1998. However, these data are not in the NDACC archive.

Microwave (Ozone and Water Vapor) N. Kämpfer (IAP, Uni Bern) - Operation of microwave radiometers for ozone and water vapor in operation from September 2015-April 2018.

#### **Thule, Greenland (76.53°N, 68.74°W)**

Microwave (CO) G. Muscari (SUNY) – Winter only campaigns in 2002, 2003, and from 2009 onwards (except for 2013 and 2015). Vertical profiles from 25 to 75 km altitude with a ~30-minute time resolution.

Microwave (ClO) R. de Zafra (SUNY) – Two mm wave spectrometers (a rebuild of the original SUNY instrument and a new unit) have operated in a campaign mode. Measurements were conducted at Thule for the winters of 1992 and 1993. N<sub>2</sub>O measurements are also available at Thule for these winters.

Microwave (Ozone) G. Muscari (SUNY) – Winter only campaigns in 2002, 2003, and from 2009 onwards (except for 2013 and 2015). Vertical profiles from 18 to 75 km altitude with a ~30-minute time resolution.

**Resolute, Canada (74.7°N, 95.0°W)**

Sondes (Aerosol) D. Tarasick (EC) and J. Rosen (U. Wyoming) – Backscatter measurements of aerosol profiles available for October 1991.

**Andoya, Norway (69.28°N, 16.01°E)**

Microwave (Wind) N. Kämpfer (IAP, U. Bern) – Microwave wind radiometer operating on a daily basis from April 2016 – April 2018 for wind profiles (30 – 70 km).

**Esrangle, Sweden (67.9°N, 21.1°E)**

FTIR G. C. Toon (JPL) – Operation of a home-built interferometer (JPL MkIV with 0.006 cm<sup>-1</sup> resolution). Archived database exists from SOLVE/THESEO campaign (winter 1999/2000), the SOLVE2 campaign from January to April 2003, and also January – February 2007. Balloon-borne data for this instrument also exist from flights above Esrange.

### **Sodankylä, Finland (67.37°N, 26.65°E)**

Lidar (Aerosol, Ozone, Temperature, and Water Vapor)	T. J. McGee (GSFC), L. Twigg (SSAI), and G. Sumnicht (SSAI) – The STROZ lidar retrieves ozone vertical profiles in the stratosphere from 10 to 50 km. Temperature to ~80 km and aerosols (at 355 nm) to 35 km also are measured. The instrument has also been modified to measure water vapor from near the ground to ~15 km. As a mobile intercomparator, it has participated in an ozone intercomparison at Sodankylä during March – April 2006 and in February 2007.
Microwave (Water Vapor)	N. Kämpfer (IAP, U. Bern) – Profiles (~35 – 70 km) obtained with a water vapor radiometer on a daily basis from June 2011 to March 2013.
Microwave (Wind)	N. Kämpfer (IAP, U. Bern) – Horizontal wind profiles (~35 – 70 km) obtained with a wind radiometer on a daily basis from October 2011 to July 2012.

### **Søndre Strømfjord, Greenland (66.99°N, 50.95°W)**

FTIR	J. Hannigan, M. Coffey, and W. Mankin (NCAR) – Campaign data have been archived for the period October 1994 to March 1995.
Sondes (Aerosol)	J. Rosen (U. Wyoming) and N. Larsen (DMI) – Backscatter profile measurements available for January 1995 and January 1996.

### **Salekhard, Russia (66.5°N, 66.7°E)**

Sondes (Aerosol)	J. Rosen (U. Wyoming) and V. Yushkov (CAO) – Backscatter measurements of aerosol profiles available for March 1999 and January 2000.
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### **Fairbanks, AK, USA (64.82°N, 147.87°W)**

FTIR	G. Toon (JPL) – Operation of a home-built interferometer (JPL MkIV with 0.006 cm <sup>-1</sup> resolution). Ground-based and balloon data obtained during the POLARIS campaign (summer 1997).
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**Arkhangel'sk, Russia (64.6°N, 40.5°E)**

Sondes (Aerosol)                      J. Rosen (U. Wyoming) and V. Khattatov (CAO) – Backscatter measurements of aerosol profiles available for November – December 1993.

**Harestua, Norway (60.2°, 10.8°E)**

FTIR                                      P. Woods, B. Bell, C. Paton-Walsh, and T. Gardiner (NPL) – Bruker 120M (0.004 cm<sup>-1</sup> resolution) used for intercomparisons and campaigns. Measurements were made from September – October 1994.

**Lerwick, UK (60.1°N, 1.1°E)**

UV/Vis. Spectrometer                G. Vaughan (U. Manchester) – SAOZ system operated during EASOE campaign (November 1991 – April 1992. See entry in Section Ia under Aberystwyth, UK for further details.

## Northern Hemisphere Midlatitude Stations (30°N - 60°N)

### Aberdeen, UK (57.15°N, 2.15°W)

FTIR	P. Woods, B. Bell, C. Paton-Walsh, and T. Gardiner (NPL) – Bruker 120M (0.004 cm <sup>-1</sup> resolution) used for intercomparisons and campaigns. Measurements were made during SESAME I for January to May 1994 and SESAME II for November 1994 to April 1995.
UV/Vis. Spectrometer	G. Vaughan (U. Manchester) – SAOZ system operated during the SESAME I campaign (February - April 1994). See entry in Section Ia under Aberystwyth, UK for further details.

### Prestwick, Scotland (55.50°N, 4.61°W)

Lidar (Aerosol)	O. Schrems and F. Immler (AWI) – Mobile Aerosol Raman Lidar (MARL), participated; campaign data were obtained at Prestwick from September to October 2000.
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### Lindenberg, Germany (52.52°N, 9.57°E)

Lidar (Aerosol)	O. Schrems and F. Immler (AWI) – Mobile Aerosol Raman Lidar (MARL), participated; campaign data were obtained at the Meteorological Observatory in Lindenberg, Germany from April to October 2003.
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### Hannover, Germany (52.39°N, 9.70°E)

Spectral UV	G. Seckmeyer (IMuK, U. Hannover) – IMuK UV spectroradiometer, approved as an NDACC traveling standard UV spectroradiometer. The instrument is based on a Bentham DTM300 scanning double monochromator spectroradiometer (0.5 nm bandwidth) and uses three detectors (PMT, silicon diode, PbS diode) for covering a spectral range of 280-2500 nm. The system affords measurements of spectral UV irradiance and spectral radiance distributions under all-weather conditions. The entrance optics are aligned by an all-weather two-axis positioning unit, which can also be used under Antarctic weather conditions. The system participated in the 2003 North American interagency intercomparison of ultraviolet spectroradiometers, which was organized at the Table Mountain Observatory close to Boulder, Colorado. This instrument currently has data archived for Izaña (Tenerife), Spain (see latter entry).
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**Hohenpeissenberg, Germany (47.80°N, 11.02°E)**

Lidar (Aerosol, Ozone, Temperature, and Water Vapor)

T. J. McGee (GSFC), L. Twigg (SSAI), and G. Sumnicht (SSAI) – The STROZ lidar retrieves ozone vertical profiles in the stratosphere from 10 to 50 km. Temperature to ~80 km and aerosols (at 355 nm) to 35 km also are measured. The instrument has also been modified to measure water vapor from near the ground to ~15 km. As a mobile intercomparator, it has participated in an ozone and temperature intercomparisons at Hohenpeissenberg in October 2005.

**Jungfrauoch, Switzerland (46.55°N, 7.98°E)**

FTIR

P. Woods, B. Bell, C. Paton-Walsh, and T. Gardiner (NPL) – Bruker 120M (0.004 cm<sup>-1</sup> resolution) used for intercomparisons and campaigns. Measurements were made in October 1992.

**Observatoire Haute Provence, France (43.94°N, 5.71°E)**

Lidar (Aerosol, Ozone, Temperature, and Water Vapor)

T. J. McGee (GSFC), L. Twigg (SSAI), and G. Sumnicht (SSAI) – The STROZ lidar retrieves ozone vertical profiles in the stratosphere from 10 to 50 km. Temperature to ~80 km and aerosols (at 355 nm) to 35 km also are measured. The instrument has also been modified to measure water vapor from near the ground to ~10 km. As a mobile intercomparator, it has participated in ozone intercomparisons at OHP for July – August 1992 and for June – July 1997.

Microwave (Wind)

N. Kämpfer (IAP, U. Bern) – Horizontal wind profiles (~35 – 70 km) obtained with a wind radiometer on a daily basis from November 2012 to May 2013.

**London, Ontario, Canada (43.1°N, 81.34°W)**

Lidar (Water Vapor)

D. N. Whiteman (GSFC), D. Venable (Howard University), M. Cadirola (Ecotronics), K. Vermeesch (SSAI), M. Walker (USRA), R. Forno (U. Mayor de San Andres). The ALVICE mobile laboratory contains a suite of instruments with major focus on water vapor measurements. See Beltsville entry for instrument details. The ALVICE system participated in the UWO-2012 campaign.

**Beltsville, MD, USA (39.054°N, 76.887°W)**

Lidar (Water Vapor) D. N. Whiteman (GSFC), D. Venable (Howard University), M. Cadirola (Ecotronics), K. Vermeesch (SSAI), M. Walker (USRA), R. Forno (U. Mayor de San Andres). The ALVICE mobile laboratory contains a suite of instruments with major focus on water vapor measurements. The 40' trailer contains a Raman-Rayleigh-Mie lidar that measures water vapor, aerosol, depolarization, cloud liquid and ice water, rotational-Raman temperature. The trailer contains ground station equipment for launching Vaisla and Internet radiosondes as well as the Cryogenic Frostpoint Hygrometer. The ground station equipment for receiving the NOAA Frostpoint Hygrometer also exists in the trailer. A SuoimiNet GPS station travels with the trailer to provide total column water measurements. There is also a ventiled surface reference station for continuous NIST traceable T, P, RH measurements and also for performing pre-launch radiosonde accuracy studies. The laser used is a Continuum 9050 laser with nominal output of 17.5W at 355 nm. Daytime water vapor profiles are available every 3 minutes to an altitude of 4-5 km. Nighttime water vapor profiles extending to the lower stratosphere are possible under clear viewing conditions with several hours of data acquisition. Measurement campaigns in which the ALVICE system has participated include MOHAVE-II (2007), N\_WAVES-2009, MOHAVE-2009, WAVES-2011, UWO\_2012. The WAVES campaigns are based at Beltsville.

**Greenbelt, MD, USA (38.9°N, 76.7°W)**

Lidar (Aerosol, Temperature, and Water Vapor) T. J. McGee (GSFC), G. Sumnicht (SSAI), and L. Twigg (SSAI) – The Aerosol and Temperature Lidar (AT Lidar) has been rebuilt, and now includes water vapor to ~15 km, temperature in the troposphere using rotational Raman backscatter, stratospheric temperature up to ~80 km, and aerosol parameters using elastic and Raman backscatter up to ~35 km. When not participating in campaigns, the instrument conducts measurements at the NASA Goddard Space Flight Center in Greenbelt, MD. The AT lidar participated in the WAVES 2006, 2007, 2008 and 2009 campaigns conducted in Beltsville, MD.

Lidar (Aerosol, Ozone, Temperature, and Water Vapor)	T. J. McGee (GSFC), L. Twigg (SSAI), and G. Sumnicht (SSAI) – The STROZ lidar retrieves ozone vertical profiles in the stratosphere from 10 to 50 km. Temperature to ~80 km and aerosols (at 355 nm) to 35 km also are measured. The instrument has also been modified to measure water vapor from near the ground to ~15 km. When not participating in campaigns, the instrument conducts measurements at the NASA Goddard Space Flight Center in Greenbelt, MD. The STROZ lidar participated in the ozone and water vapor comparisons during the WAVES 2008 and 2009 campaigns.
Lidar (Trop. Ozone)	<del>G. A. McCreary (ATMOS/ISSI/GSFC) – Tropospheric ozone DAIDS system in 1996 and 2009, upgraded and co-sited during NASA campaigns at various locations. Measurements are from 0.2 – 12 km during daytime and extend to near 14 km at night.</del>
Lidar (Water Vapor)	D. N. Whiteman (GSFC), D. Venable (Howard University), M. Cadirola (Ecotronics), K. Vermeesch (SSAI), M. Walker (USRA), R. Forno (U. Mayor de San Andres). The ALVICE mobile laboratory contains a suite of instruments with major focus on water vapor measurements. See Beltsville entry for instrument details.

**Mt. Barcroft, CA, USA (37.58°N, 118.24°W)**

FTIR	G. C. Toon (JPL) – Intermittent operation of a home-built interferometer (JPL MkIV with 0.006 cm <sup>-1</sup> resolution) from August 1994 to July 2002. This instrument was also launched on a balloon periodically between October 1989 and 2014. A database of MkIV column abundances from twelve different sites covering 1985-2015 is in the archive. Sites include Mt. Barcroft, JPL (Pasadena, CA; 34.20°N, 118.17°W), Table Mountain Observatory, McMurdo Antarctica, and Ft. Sumner New Mexico.
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**Table Mountain, CA, USA (34.4°N, 117.7°W)**

FTIR	P. Woods, B. Bell, C. Paton-Walsh, and T. Gardiner (NPL) – Bruker 120M (0.004 cm <sup>-1</sup> resolution) used for intercomparisons and campaigns. Measurements were made in October 1996. However, this data has not been archived.
FTIR	G. C. Toon (JPL) – Operation of a home-built interferometer (JPL MkIV with 0.006 cm <sup>-1</sup> resolution) from January to November 2009.
Lidar (Aerosol)	O. Schrems and F. Immler (AWI) – Mobile Aerosol Raman Lidar



(MARL), participated; campaign data were obtained during the STRAIT intercomparison campaign at TMF in February/March 1997.

Lidar (Aerosol, Ozone, Temperature, and Water Vapor)

T. J. McGee (GSFC), L. Twigg (SSAI), and G. Sumnicht (SSAI) – The STROZ lidar retrieves ozone vertical profiles in the stratosphere from 10 to 50 km. Temperature to ~80 km and aerosols (at 355 nm) to 35 km also are measured. The instrument has also been modified to measure water vapor from near the ground to ~15 km. As a mobile intercomparator, it has participated in ozone intercomparisons at the Table Mountain Facility February/March 1992, February/March 1997, June 2004, June 2005, October 2009 (MOHAVE), and February – March 2011.

Lidar (Aerosol, Temperature, and Water Vapor)

T. J. McGee (GSFC), G. Sumnicht (SSAI), and L. Twigg (SSAI) – The Aerosol and Temperature Lidar (AT Lidar) has been rebuilt, and now includes water vapor to >10 km, temperature in the troposphere using rotational Raman backscatter, stratospheric temperature up to ~80 km, and aerosol parameters using elastic and Raman backscatter up to ~35 km. It has participated in ozone intercomparisons at the Table Mountain Facility in June 2005 and in water vapor intercomparisons during the MOHAVE campaign of October 2006, 2007, and 2009.

Lidar (Water Vapor)

D. N. Whiteman (GSFC), D. Venable (Howard University), M. Cadirola (Ecotronics), K. Vermeesch (SSAI), M. Walker (USRA), R. Forno (U. Mayor de San Andres). The ALVICE mobile laboratory contains a suite of instruments with major focus on water vapor measurements. See Beltsville entry for instrument details. The ALVICE system participated in the MOHAVE-II (2007) and MOHAVE-2009 campaigns.

## **Northern Hemisphere Subtropical and Tropical Stations (0°N - 30°N)**

### **Izaña (Tenerife), Spain (28.30°N, 16.48°W)**

Spectral UV                                      G. Seckmeyer (U. Hannover) - Intercomparison campaign data for July 2005. See Hanover, Germany entry.

### **Mauna Loa, Hawaii (19.54°N, 155.58°W)**

Lidar (Aerosol, Ozone,                      T. J. McGee (GSFC), L. Twigg (SSAI), and G. Sumnicht (SSAI) –  
Temperature, and Water                      The STROZ lidar retrieves ozone vertical profiles in the stratosphere  
Vapor)    from 10 to 50 km. Temperature to ~80 km and aerosols (at 355 nm)  
to 35 km also are measured. The instrument has also been modified  
to measure water vapor from near the ground to ~10 km. As a mobile  
intercomparator, it has participated in ozone and temperature  
intercomparisons at Mauna Loa from June 1995 – February 1996,  
August 2002, November 2012 – August 2013, and January 2014.

### **Paramaribo, Surinam (5.75°N, 55.2°W)**

Lidar (Aerosol)                                      C. Ritter, O. Schrems, and F. Immler (AWI) – Mobile Aerosol  
Raman Lidar, participated in the STAR campaign at Paramaribo in  
November 2004. Measurements continue during the dry season each  
year from 2004 to 2012. Data are currently archived for 2004 and  
2006.

## **Southern Hemisphere Subtropical and Tropical Stations (0°N - 30°S)**

### **Reunion Island, France (St. Denis - 20.9°S, 55.5°E)**

Lidar (Aerosol, Ozone, Temperature, and Water Vapor)	T. J. McGee (GSFC), L. Twigg (SSAI), and G. Sumnicht (SSAI) – The STROZ lidar retrieves ozone vertical profiles in the stratosphere from 10 to 50 km. Temperature to ~80 km and aerosols (at 355 nm) to 35 km also are measured. The instrument has also been modified to measure water vapor from near the ground to ~15 km. As a mobile intercomparator, it will participate in ozone intercomparisons in Spring 2015 (dates postponed by 6-12 months due to transportation delays).
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### **Reunion Island, France (Maido Observatory - 21.1°S, 55.4°E)**

Microwave (Ozone)	N Kämpfer (IAP, U. Bern) - Profiles (~25 – 70 km) obtained with a water vapor radiometer on a daily basis from May 2014 to February 2015.
Microwave (Water Vapor)	N. Kämpfer (IAP, U. Bern) – Profiles (~35 – 70 km) obtained with a water vapor radiometer on a daily basis from August 2013 to February 2015.
Microwave (Wind)	N. Kämpfer (IAP, U. Bern) – Horizontal wind profiles (~35 – 70 km) obtained with a wind radiometer on a daily basis from August 2013 to February 2015 and from December 2016 – May 2018.

## **Southern Hemisphere Midlatitude Stations (30°S - 60°S)**

### **Lauder, New Zealand (45.04°S, 169.68°E)**

FTIR	P. Woods, B. Bell, C. Paton-Walsh, and T. Gardiner (NPL) – Bruker 120M (0.004 cm <sup>-1</sup> resolution) used for intercomparisons and campaigns. Measurements were made in February 1997 but have not been archived.
Lidar (Aerosol, Ozone, Temperature, and Water Vapor)	T. J. McGee (GSFC), L. Twigg (SSAI), and G. Sumnicht (SSAI) – The STROZ lidar retrieves ozone vertical profiles in the stratosphere from 10 to 50 km. Temperature to ~80 km and aerosols (at 355 nm) to 35 km also are measured. The instrument has also been modified to measure water vapor from near the ground to ~15 km. As a mobile intercomparator, it has participated in ozone intercomparisons at Lauder October – December 1992, March – October 1994, April 1995, September – December 2001, April 2002, June – July 2011, and April 2012.

### **Punta Arenas, Chile(53.17°S, 70.93°W)**

Lidar (Aerosol)	O. Schrems and F. Immler (AWI) – Mobile Aerosol Raman Lidar (MARL), participated in the INCA campaign in Punta Arenas in April 2000.
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## **Southern Hemisphere High-Latitude Stations (60°S - 90°S)**

### **McMurdo Station, Antarctica (77.85°S, 166.63°E)**

- Microwave (ClO) R. de Zafra (SUNY) – Deployments of a mm wave spectrometer for the austral springs of 1992 to 1995. N<sub>2</sub>O measurements are also available at McMurdo for the austral spring of 1994.
- R. de Zafra (SUNY) – Measurements (using the SIS receiver/spectrometer) were made at this site during the austral springs of 1997 and 1998 for an intercomparison with the Millitech instrument at Scott Base (see entries in Sections Ia and Ib).

### **South Pole Station, Antarctica (90.00°S)**

- Microwave (Ozone) R. de Zafra (SUNY) – Two mm wave spectrometers (a rebuild of the original SUNY instrument and a new unit) have operated in a campaign mode since 1990. Deployments at South Pole Station were for 11-month periods in 1993 and 1995. Also has retrieved N<sub>2</sub>O, and HNO<sub>3</sub>.

## **Ship-Based Measurements**

- FTIR O. Schrems (AWI) and J. Notholt (U. Bremen) – Bruker 120M (0.004 cm<sup>-1</sup> resolution), deployed 1992 to 1995 at Ny Ålesund (78.92°N, 11.93°E) and now utilized as a mobile instrument. Operated as part of the ALBATROSS ship-based expedition from 70°N to 40°S during October and November 1996. Participated in additional ship-based expeditions in 1999/2000 (from 80°N to 70°S), in June 2000, November 2002, January/February 2003, October/November 2003, and October/November 2005.
- Lidar (Aerosol) O. Schrems and F. Immler (AWI) – Mobile Aerosol Raman Lidar (MARL), participated in the ALBATROSS ship-based campaign from 70°N to 40°S during October and November 1996; the LIMPIDO ship-based campaign from 53°S to 53°N in May/June 2000; and another ship-based campaign from 53°N to 33°S in October to November 2003, and October to November 2005.