

Global Monitoring Division Collaborations



GLOBAL MONITORING DIVISION COLLABORATIONS

2007- Present

JOINT INSTITUTES:

- **Cooperative Institute for Research in Environmental Sciences (CIRES):** NOAA Cooperative Institute at the University of Colorado. Extensive joint research and atmospheric monitoring projects are conducted at the Boulder facilities.
- **Cooperative Institute for Arctic Research (CIFAR):** NOAA Cooperative Institute at the University of Alaska. Cooperative research in arctic atmospheric science at the Barrow and Boulder facilities.
- **Cooperative Institute for Mesoscale Meteorological Studies (CIMMS):** NOAA Cooperative Institute at the University of Oklahoma. GMD provides large amounts of high quality data for modelers.
- **Cooperative Institute for Research in the Atmosphere (CIRA):** NOAA Cooperative Institute at the Colorado State University. Joint research projects are conducted at the Boulder facility.
- **Joint Institute for Marine and Atmospheric Research (JIMAR):** NOAA Cooperative Institute at the University of Hawaii. Studies of long range transport of mercury flowing from Asia to Hawaii.

NOAA Collaborations:

- **GFDL (Geophysical Fluid Dynamics Lab):** GMD cooperates in conducting Global Carbon Cycle modeling and Global Climate Model results compared to observed radiation.
- **PMEL (Pacific Marine Environment Lab):** GMD conducts joint aerosol chemical composition measurements and analyses with PMEL.
- **AOML (Atlantic Oceanographic and Meteorological Lab) and PMEL:** GMD conducts cooperative carbon cycle and halocarbon measurements in the marine environment along with the study of sulfur particulates in the global atmosphere with these labs.

- **ARL (Air Resources Lab):** GMD Radiation Project utilizes some ARL field sites and is developing a plan for future collaboration in surface energy budget monitoring activities with ARL. GMD collaborates with ARL on stratospheric ozone, Pacific Basin mercury measurements, atmospheric chemical modeling, and air quality research.
- **NESDIS (National Environmental Satellite, Data, & Information Service):** GMD hosts and supports a polar satellite data downlink antenna for NESDIS at the Barrow Observatory. The Barrow and Mauna Loa Observatories host **NESDIS Climate Reference Network (CRN)** sites. Dobson ozone network at MLO, Alaska and continental US (7 sites total) provides data for NESDIS satellite validation program (JPSS).
- In addition, **NOAA CRN** sites are hosted at **SURFRAD** sites at Bondville, Ill; Goodwin Creek Miss; Ft Peck, Montana; and Sioux Falls, South Dakota.
- GMD obtains carbon cycle flasks from the “Ships of Opportunity Program” operated by **NESDIS**.

NOAA OAR PROGRAMS:

- **Climate Program Office:** GMD conducts climate, stratospheric ozone, air quality research and monitoring of radiatively important trace gases on a global scale with funding from this office. GMD is also active in the SEARCH program.
- **Arctic Research Program:** GMD participates in experiments to determine emissions of methane in the Russian Arctic at a site in Cherskiy and in the operation of the Tiksi arctic observatory funded in part by NOAA through the Arctic Research Program Office.
- **National Weather Service (NWS):** GMD has total-column ozone and/or solar radiation instrumentation and cooperative operations at seven NWS stations across the U.S.

OTHER FEDERAL AGENCIES:

- **Department of Energy (DOE):** GMD hosts the **Atmospheric Radiation Measurement (ARM)** North Slope of Alaska site at the Barrow facility. GMD scientists operate the surface and airborne aerosol monitoring programs at the DOE/ARM Southern Great Plains site in Oklahoma and the surface aerosol monitoring program at the ARM Mobile Facility. ARM also provides funding for GMD to development better UV instruments
- The **ARM** Mobile Facility has deployed with GMD cooperation and staff at Point Reyes, CA; Niamey, Niger; Heselback, Germany; Shouxin, China; Azores Islands; Nainital, India and Cape Code, MA.

- ESRL cooperates with DOE Environmental Energy Technologies Division to operate the Tall Towers in Walnut Grove and Sutro, California.
- **The Northeast Regional Center of the National Institute for Global Environmental Change (NIGEC)** provides funding to both GMD and Harvard University to monitor important trace gases at the Harvard Forest tower site, Massachusetts.
- **Battelle-Northwest Laboratories:** ESRL samples for Persistent Organic pollutants (POPS) in the arctic at the Barrow Observatory.
- **National Aeronautics and Space Administration (NASA):** GMD is host to, and provides manpower for a NASA Advanced Global Atmospheric Gas Experiment (AGAGE) site in American Samoa. It also hosts the NOAA/NASA **Network for the Detection of Atmospheric Composition Change (NDACC)** facility at Mauna Loa, Hawaii and conducts NDACC measurements at the South Pole, Boulder, Colorado and Summit, Greenland. GMD provides ozone sonde and Dobson total ozone column and profile data for satellite validation. GMD participates in various NASA organized validation/research campaigns (SEAC4RS, SEACIONS, TC4, ARCTAS, CALTEX).
- GMD provides airborne trace gas instrumentation and data analysis for NASA airborne campaigns on aircraft, balloon, and unmanned aircraft for **NASA** missions. MOHAVE 2009, MACPEX 2011,
- **NASA** supports the observation and analysis of surface radiation budget projects in GMD permitting NOAA to fulfill international obligations to the WMO and for the management of the Baseline Surface Radiation Network managed by GMD.
- **NASA** Wallops Island Flight Center, VA is host to and operates a GMD Dobson.
- GMD is the co-investigator in the **NASA Southern Hemisphere Additional Ozonesonde (SHADOZ)** project; GMD operates three international ozonesonde stations in the network in the Pacific.
- GMD operates surface radiation sites at Kwajalein and Bermuda with NASA funding. GMD contributes a major component to the **NASA Clouds and Earth's Radiant Energy System**.
- GMD is host to the **NASA AERONET** sunphotometer project's primary calibration site at Mauna Loa Observatory.

- **National Institute of Standards and Technology (NIST)** Cooperative activities in the development and maintenance of long-term absolute UV calibration standard references trace gas standards.
- Mauna Loa Observatory hosts the **National Center for Atmospheric Research (NCAR) High Altitude Observatory** facilities supported by the National Science Foundation.
- GMD participates in two intensive campaigns utilizing the **NCAR Gulfstream- 5** aircraft to survey trace gas distributions in the UT/LS from high northern to high southern latitudes in different seasons.
- GMD and **NCAR** participate in extensive trace gas intercomparisons to maintain intercomparability and consistency of measurements.
- **United States Department of Agriculture (USDA):** GMD hosts the USDA solar radiation baseline calibration site at Mauna Loa, Hawaii and operates precipitation gauges at the Barrow Baseline station for the **USDA**.
- GMD operates the Central UV Calibration Facility in direct support of the **USDA** US UV network.
- **United States Geological Survey (USGS):** The USGS Arctic Magnetic Observatory is located adjacent to the GMD Barrow Observatory and is operated by GMD staff.
- Mauna Loa Observatory is host to a **USGS** seismometer and tilt and strain well to monitor local lava flows and earthquakes.
- GMD collaborates with the **USGS Alaska Science Center** and **Russian National Academy of Sciences** in a study of arctic climate variability.
- **Department of Interior (Parks Service):** Mauna Loa Observatory maintains two helicopter landing sites used by the Parks Service for patrols, rescues and facility repairs.
- **Environmental Protection Agency (EPA):** The EPA studies long-range transport of mercury in the atmosphere in a joint project with GMD at Mauna Loa Observatory through the NOAA Air Resources Laboratory.
- GMD operates a small network of Brewer UV spectrometers for the **EPA** for ozone and UV measurements..
- **Federal Aviation Administration (FAA):** Mauna Loa Observatory is host to an FAA GPS system for controlling aircraft in the Pacific Basin.

- **United States Army:** Mauna Loa Observatory is host to a command and control radio system used by the **U.S. Army** for the Pacific Army live fire base on the Island of Hawaii.
- GMD operates a solar radiation facility with the **U.S. Army** on Kwajalein Island, Pacific Ocean.
- **United States Navy (USN):** Mauna Loa Observatory is host to a Navy camera system for the control and monitoring of bombing in the Pohakuloa live fire range.
- **United States Air Force (USAF):** The USAF ships helium, free of charge, to GMD balloon sites from a depot in Texas to any airbase in the world that is near an ESRL balloon site.
- The **Air Force** samples air flasks for GMD on Ascension Island in the mid-Atlantic Ocean.
- The Barrow Observatory operates a radioactive aerosol sampling facility for the **USAF**
- A **USAF** contract scientist at GMD maintains and updates the MODTRAN radiative transfer code for the **USAF**.
- Mauna Loa Observatory hosts a **USAF-supported Civil Air Patrol emergency** radio rebroadcast facility covering the State of Hawaii.
- Support is given to the BRW Observatory by the **USAF** Long Range Radar Site in Barrow, including snow removal and road maintenance.
- **The United States Coast Guard (USCG):** The USCG in Kodiak, Alaska, carries a suite of GMD greenhouse gas and ozone instruments, free of charge, on board its C-130 aircraft during Arctic Domain Awareness reconnaissance flights.
- **National Science Foundation (NSF):** GMD operates the NSF-owned Clean Air Facility (CAF) at the South Pole, and the NSF Summit, Greenland, atmospheric research facility. GMD collects air samples in the Drake Passage aboard the L.M Gould operated by NSF. Air samples are collected at the NSF Palmer, Antarctica Station.
- GMD is host to a wide range of **NSF**-sponsored university research projects (in excess of 30) across the six GMD observatories.
- **U.S Fish and Wildlife Service:** Collection of air samples at Midway Island.

- **Lawrence Berkeley National Laboratory:** Tall Tower sites at Walnut Grove and Sutro, California.

STATE and MUNICIPAL AGENCIES:

- **Hawaii State Department of Health (DOH), Honolulu:** Mercury samples collected at Mauna Loa Observatory are analyzed by the DOH.
- **Hawaii County Police, Hawaii:** Mauna Loa Observatory hosts a radio rebroadcast facility for the police and Hawaii Civil Defense radios covering all of the Island of Hawaii.
- **Illinois State Water Survey, Urbana, Illinois:** This agency hosts the GMD Bondville aerosol monitoring site that has been monitoring the climate forcing properties of aerosols at that location since 1994.
- **Colorado Department of Public Health and Environment, Air Pollution Control Division:** GMD provides background values for a number of trace gases of interest to the division.
- **Texas Agricultural Experiment Station:** Tall Tower site in Texas.
- **Wyoming Department of Air Quality:** Wintertime ozone research at GMD.
- **Utah Department of Air Quality:** Wintertime ozone research at GMD.
- **California Air Resources Board:** Greenhouse gas emissions.
- **University of Alaska at Fairbanks:** Operates NOAA's Dobson instrument
- **Humboldt State University:** Maintains ozone measuring instruments at Trinidad Head observatory.
- **University of Alabama in Huntsville and Rhode Island U.:** Launch ozone sonde balloons for the GMD Air Quality program.
- **U. of Colorado.** Hosts the surface ozone measurements at the Mountain Research Center in CO, and at Pico, Azores.
- **Metro Wastewater Reclamation District, Colorado:** Local solar radiation environment.
- **Denver Water Board, Colorado:** Local solar radiation environment.

Collaborating Networks

- AGAGE
- BIPM
- BSRN
- GAW (WMO)
- GCOS
- GOSS
- GRUAN
- GUAN
- ICOS
- NDACC
- SHADOWS

NON-GOVERNMENT, NON-UNIVERSITY PARTNERSHIPS:

- Allen Scientific Glass, Boulder, Colorado: Air sampling flasks
- Atmospheric Environment Research (AER), Cambridge, Massachusetts: Airborne halocarbon data and modeling support.
- ATSC, Norman, Oklahoma: Activities at the Kwajalein BSRN site
- Bermuda Biological Station for Research, Inc.: Flask sampling.
- Biospheric Instruments, Inc., California: Solar radiation instruments. calibration.
- DuPont Company, New Jersey: Halocarbon emission estimates.
- ENSI, Colorado: Ozonesondes
- Eppley Laboratory, Rhode Island: Instrument design, modification, and
- Fort Peck Indian Tribes; Fort Peck SURFRAD site operations.
- Friends of Midway: Air sampling at Midway Island.
- High Precision Devices, Boulder, Colorado: Air sampling equipment.
- Illinois State Water Survey, Bondville, Illinois: Field site operations.
- M&D Consulting, Germany: Provides halocarbon emission data.

PARTNERSHIPS AT GMD OBSERVATORIES:

Some universities/agencies have projects at more than one baseline observatory and some have a number of different projects at one observatory.

Barrow Observatory, Alaska

Department of Energy: Atmospheric Radiation Measurement (ARM) site.

Environment Canada: Persistent Organic Pollutants.

Institute of Arctic Biology – Arctic climate change studies, snow gauge studies.

Japan - JAMSTEC: Isotopic H₂O.

NOAA/NESDIS/NCDC: Climate Reference Network (CRN).

NOAA/NESDIS: POES Satellite uplink and downlink facility.

NOAA/OAR/PMEL: Aerosol filters.
Princeton University, California: Oxygen in air flask sampling
San Diego State University: CO₂ Flux.
Scripps Institution of Oceanography: CO₂, ¹³C, N₂O (flask), O₂/N₂:
State University of New York, Albany: Thaw depth in permafrost.
UNAVCO: SoumiNet GPS.
University of Alaska, Fairbanks: Snow Cover Camera.
University of California, Davis: Black Carbon.
University of California, Irvine: Hydrocarbons.
University of Tokyo, Japan: Magnetic micro-pulsations, black carbon
University of Washington, Washington: Arctic coastal ice optical characteristics.
US Air Force: 460 radiation monitoring.
USDA/Snow Survey: Precipitation gauge.
USGS: Geomagnetism.

Mauna Loa Observatory, Hawaii

California Institute of Technology, California: Cosmic dust fluxes.
Central Connecticut University: Clidar aerosol lidar project.
Colorado State University, Fort Collins: Ultraviolet radiation project.
CSIRO (Australia): ¹³C/¹²C and ¹⁸O/¹⁶O in CO₂.
Environment Canada: Persistent Organic Pollutants (POPs).
FAA/Stanford University: GPS test bed.
Hawaii Volcano Observatory: Volcano activity.
HPA: Communications.
Kinki University, Japan: Solar radiation calibrations for satellites.
Meteorological Research Institute, Japan: Spectral radiation calibrations.
Mount Washington Observatory: Ground Winds lidar.
MSC Canada: Column O₃.
NASA Goddard Space Flight Center: AERONET Photometers.
NASA Goddard Space Flight Center: pyranometer.
NASA Jet Propulsion Laboratory: Stratospheric O₃ & Temp Profiles.
Naval Research Labs: Water vapor.
NCAR FTS: Solar Spectra.
NDACC: Stratospheric Climate and Atmospheric Composition Change
NIES: CO₂, ¹³C, N₂O.
NOAA Air Resources Lab: Carbon monoxide.
NOAA Air Resources Lab: Hg⁰, Hg⁺², Hg^{gp}.
NOAA Air Resources Lab: Particulates.
NOAA Air Resources Lab: Surface O₃, and SO₂.
NOAA and NIWA: BrO.
NOAA and NIWA: NO₂.
NOAA and NIWA: UV.
NOAA Earth System Research Lab (GSD): Meteorology.
NOAA National Weather Service: Meteorology.
NOAA National Weather Service: Rainfall at Kulani Mauka site.

NOAA Pacific Tsunami Warning Center: Seismic activity.
NOAA/NESDIS/NCDC: Climate Reference Network (CRN).
Pohakuloa Training Area Range Surveillance System: Video Surveillance.
Scripps Institution of Oceanography, La Jolla: Carbon cycle gases and oxygen.
Scripps Institution of Oceanography: CO₂, ¹³C, N₂O (flask).
Scripps Institution of Oceanography: O₂/N₂.
SIO – Earth Networks Center for Climate Research: CO₂/CH₄.
Stanford University, California: GPS derived column water vapor.
State University of New York, Stonybrook: Carbon monoxide and its isotopes.
University of California, Davis - Delta group: Long transport of Aerosols.
University of California, Davis: Aerosol Chemistry..
University of California, Irvine: Trace gas sampling.
University of Colorado, Boulder: Water isotope.
University of Denver: FTIR columns spectra of atmospheric gases.
University of Hawaii - Institute for Astronomy: Variable Young Star Survey.
University of Hawaii, Honolulu: Sulphate chemistry.
University of Hawaii, Manoa: Corrosion Project.
University of Massachusetts, Amherst: Stratospheric ozone profiles.
University of Michigan: Atmospheric lidar measurements.
University of Nations: Calibration of Microtops ozone meters.
University of New Hampshire/NIWA: Stratospheric ozone.
University of New Hampshire: GROUNDWINDS lidar.
USGS: Seismometer.
World Radiation Center: Filter Radiometer/PMOD.

Trinidad Head Observatory, California

Humboldt State University, California: Operation of the Trinidad Head Observatory.
Humboldt State University, California; Weekly release of ozonesondes.
NASA/Goddard Space Flight Center: AERONET Photometers.
NASA/Goddard Space Flight Center: MPLNET Cloud Profiling.
Scripps Institute of Oceanography, La Jolla, California: flask samples and sharing data..

Samoa Observatory, American Samoa

Environment Canada: Persistent Organic Pollutants (POPs).
NASA/AGAGE: CFC-11, CFC-12, CFC-113, CCl₄, CH₃CCl₃, CH₄, N₂O, CHCl₃.
NASA/AGAGE: Flasks.
Princeton University: AARDVARK (flasks).
Scripps Institution of Oceanography: CO₂, ¹³C, N₂O (flask).
Scripps Institution of Oceanography: O₂/N₂.
University of California, Irvine: Hydrocarbons.
University of Miami: Aerosol Chemistry Filters.

South Pole Observatory, Antarctica

CSIRO (Australia): CO₂, CH₄, CO, H₂, N₂O, ¹³C/¹²C and ¹⁸O/¹⁶O in CO₂.
Environment Canada - Brewer – Ozone.
Georgia Institute of Technology: Sulphate and nitrogen chemistry.
NASA/Goddard Space Flight Center: AERONET Photometers.
NASA/Goddard Space Flight Center: MPLNET Cloud Profiling.
National Institute of Polar Research (Japan) - NIPR All Sky Camera.
Scripps Institution of Oceanography, La Jolla Sampling of firm air.
Scripps Institution of Oceanography, La Jolla: Carbon cycle gases and oxygen.
Scripps Institution of Oceanography: CO₂, ¹³C, N₂O (flask).
Scripps Institution of Oceanography: O₂/N₂.
Scripps Institution of Oceanography: Oxygen Isotopes.
University of Arizona: Hydrogen peroxide.
University of California, San Diego: Isotopes of oxygen.
University of Idaho: Radiation measurements.

Summit Observatory, Greenland

Georgia Institute of Technology: Aerosol light absorption and scattering.

UNIVERSITY PARTNERSHIPS (other)

Niwot Ridge, Colorado, High Altitude Sampling Facility

Institute for Alpine and Arctic Research (INSTAAR). Carbon isotope research program.
University of Colorado, Mountain Research Station: Research operations at Niwot Ridge, Colorado.

Cooperative Dobson ozone total column spectrometer, surface ozone, and/or ozonesonde network.

Bismarck, ND National Weather Service Office.
Bermuda Biological Station, Tudor Hill, Bermuda.
Bureau of Meteorology, Perth, Australia.
Caribou, ME National Weather Service Office.
Center for Remote Sensing, Department of Geography, Boston University,
Centre National de la Recherche Scientifique (CNRS), University of Riems, Haute
Provence, France.
Hanford, CA National Weather Service Office
Humboldt State, Arcata, California.
Meteorological and Hydrological Service, Marcapomacocha, Peru.
Meteorological and Hydrological Service, San Cristobal, Galapagos, Ecuador.
NIWA, Lauder, New Zealand.
Old Hickory, TN National Weather Service Office.
University of Alabama, Huntsville.

University of Alaska, Fairbanks.
University of Colorado, Boulder.
University of Rhode Island, Rhode Island: Weekly balloon-borne ozonesondes,
University of the South Pacific, Suva, Fiji.

GMD and University of Colorado/CIRES cooperative water vapor/ozone sonde network

Finnish Meteorological Institute, Sodankylä, Finland.
German Weather Service, Lindenberg, Germany.
Howard University, Beltsville, MD.
Instituto Nacional de Meteorología é Hidrología, Galapagos Island, Ecuador.
JPL Table Mountain Facility, Wrightwood, California.
Kiribati Weather Service, Tarawa, Kiribati.
LAPAN, Bandung, Indonesia.
LAPAN, Biak, Indonesia.
LAPAN, Kototabang, Indonesia.
LAPAN, Watukosek, Indonesia.
Mauna Loa Observatory, Hilo, Hawaii.
Met Service of Vietnam, Hanoi, Vietnam.
National Weather Service, Midland, TX.
Universidad Nacional and Instituto de Meteorología Nacional, Costa Rica.
University of La Reunion Island, Indian Ocean, France.

Cooperative sampling program for carbon cycle and halocarbon gases, including aircraft sampling programs not listed under Carbon Cycle Network and Halocarbon Network Collaborations: National Sites.

Bowdoin College, Maine.
Grant for the study of carbonyl sulfide interactions with the terrestrial biosphere.
Harvard Forest Observatory: Carbon cycle and halocarbon gases.
Harvard University, Boston, Massachusetts.
Penn State University: Wisconsin Tall Tower site.
Princeton University, New Jersey.
Princeton University: Ice firn research.
Southern California Marine Institute..
Stanford University; modeling and measurement comparisons of carbonyl sulfide.
University of Colorado, Boulder.
University of Iowa: Iowa Tall Tower site.
University of Maine: Argyle, Maine Tall Tower site.
University of New England Bigelow, Laboratory: Joint ocean trace gas research.
University of Wisconsin: Wisconsin Tall Tower site.
Woods Hole Oceanographic Institution: Joint ocean trace gas research.

Cooperative Aerosol Measurements and Research

Air Resource Specialists, Inc., Fort Collins, CO: Aerosol research.
Alfred Wegener Institute for Polar and Marine Research, Germany: Aerosol research.
Appalachian State University: Cooperative aerosol measurements and research.
Brookhaven National Laboratory: Cooperative aerosol measurements and research.
Center for International Climate and Environmental Research, Norway: Aerosol research.
China Meteorological Agency, China: Cooperative aerosol measurements and research.
CNRS-Universite Blaise Pascal, France: Aerosol research.
Colorado State University, Fort Collins, CO: Aerosol research.
Desert Research Institute, Steamboat Springs, CO: Aerosol research.
Environment Canada: Cooperative aerosol measurements and research.
Federal Office of Meteorology and Climatology, Switzerland: Aerosol research.
Finnish Meteorological Institute, Finland: Aerosol research.
Georgia Institute of Technology: Cooperative aerosol measurements and research.
German Weather Service, Germany: Aerosol research.
Hanscom Air Force Base, Hanscom AFB, MA: Aerosol research.
Harvard University, Cambridge, MA: Aerosol research.
Institute for Nuclear Research and Nuclear Energy, Bulgaria: Aerosol measurements
Institute of Atmospheric Sciences and Climate, Italy: Aerosol research.
Izaña Atmospheric Research Centre, Spain: Aerosol research.
Korea Meteorological Agency, Cooperative aerosol measurements and research.
Leibniz Institute for Tropospheric Research, Germany: Aerosol research.
Lund University, Sweden: Aerosol research.
NASA Ames Research Center, Moffett Field, CA: Aerosol research.
NASA Goddard Space Flight Center, Greenbelt, MD: Aerosol research.
NASA Langley Research Center, Hampton, VA: Aerosol research.
National Central University, Taiwan: Cooperative aerosol measurements and research.
National Institute of Aerospace Technology (INTA), Spain: Aerosol research.
National Park Service, Fort Collins, CO: Aerosol research.
National University of Ireland Galway, Ireland: Aerosol research.
Naval Research Lab, Washington, DC: Aerosol research.
NOAA/ESRL/CSD, Boulder, CO: Aerosol research.
Norwegian Institute for Air Research, Norway: Aerosol research.
Norwegian Polar Institute, Norway: Aerosol research.
Pacific Marine Environmental Laboratory, Seattle, WA: Aerosol research.
Pacific Northwest National Laboratory: Cooperative aerosol measurements.
Paul Scherrer Institute, Switzerland: Aerosol research.
Physics Instrumentation Center, Moscow, Russia: Aerosol research.
Science Systems and Applications, Inc., Hampton, VA: Aerosol research.
Scripps Institution of Oceanography, La Jolla, CA: Aerosol research.
Seoul National University, Republic of Korea: Cooperative aerosol measurements.
South Africa Weather Service, South Africa: Cooperative aerosol measurements.
Spectral Sciences Inc, Burlington, MA: Aerosol research.
State University of New York at Albany, Albany, NY: Aerosol research.

Texas A&M University, College Station, TX: Aerosol research.
UJF-Grenoble, France: Aerosol research.
Universidad Nacional Autónoma de México, Mexico: Aerosol research.
University of British Columbia, Canada: Aerosol research.
University of Crete, Greece: Aerosol research.
University of Eastern Finland, Finland: Aerosol research.
University of Helsinki, Finland: Aerosol research.
University of Illinois, Urbana-Champaign: Cooperative aerosol measurements.
University of Leeds, United Kingdom: Aerosol research.
University of Manchester, United Kingdom: Aerosol research.
University of Maryland, College Park, MD: Aerosol research.
University of Nevada: Cooperative aerosol measurements and research.
University of Pannonia, Hungary: Cooperative aerosol measurements and research.
University of Puerto Rico: Cooperative aerosol measurements and research.
University of Valencia, Spain: Aerosol research.
University of Washington, Seattle, WA: Aerosol research.

Cooperative Solar Radiation Measurement Programs

Biospherical Instruments Inc.
Chinese Meteorological Institute
Colorado State University: IR Calibration exchange and UV calibrations.
DRI: Calibrations
ENA, Italy, Calibrations
Eppley Laboratory, Rhode Island: Instrument design and Calibration.
EU Joint Research Center at Ispra
Hampton University: Balloon-borne radiative flux measurements.
METEO Swiss: Calibrations
Meteorological Service of Canada
NASA Goddard: Instrument modifications and calibrations.
National Institute of Water & Atmospheric Research (NIWA)
National Resource Ecology Lab, CSU: Calibrations.
Queensland University of Technology : Calibrations.
Rosario National University, Argentina, Calibrations
School of Geography & Environmental Studies
Sinte Gleska University, South Dakota: Educational partnership
Smithsonian Institute, SERC
Swiss Institute of Technology (ETH), Zurich: BSRN calibrations.
University of Alabama: Cloud detection automation.
University of California, San Diego, Scripps: ABC radiation calibrations.
University of Houston Institute for Climate & Atmospheric Science: Calibrations.
University of Idaho: Dome Concordia (Antarctica) Satellite (AIRS)
University of Maryland: Radiometer calibrations
University of Rome
University of Tasmania, School of Geography
University of Texas El Paso (UTEP): Calibrations
University of Toronto, Canada: SEARCH and CNDAC

University of Washington: Study of snow-air interactions and radiation
WMO, Geneva: Calibrations

GMD operates an international sampling and research program for carbon Cycle, halocarbon gases and other trace gases.

Alert, Nunavut, Canada : Meteorological Service of Canada.
Arembepe, Brazil: Instituto de Energeticas e Nucleares Bureau of Meteorology
Ascension Island: USAF.
Assekrem, Algeria : Office de la Meteorologie.
Baltic Sea, Poland : Morski Instytut Rybacki.
Black Sea, Constanta, Romania: Marine Research Institute.
Bukit Kototabang, Indonesia:
Cape Grim, Tasmania, Australia : CSIRO.
Christmas Island, Kiribati: Dive Kiribati.
Crozet Island, France: Centre des Faibles Radioactivities.
Dalhousie University, Canada: Joint ocean trace gas research.
Deutscher Wetterdienst.
Easter Island, Chile : Direccion Meteorologica de Chile.
Gobabeb, Namibia: Desert Research Foundation.
Halley Station, Antarctica : British Antarctic Survey.
Hegyhatsal, Hungary: Hungarian Meteorological Service.
Hohenpeissenberg, Germany: ENEA.
Institute of Experimental Meteorology, Obninsk, Russia
Kenya Meteorological Department, Mt. Kenya, Kenya
Lampedusa, Italy:
Mace Head, Ireland: University College Galway.
Mahe Island, Seychelles : Seychelles Bureau of Standards.
Mariana Islands, Guam : Guam Marine Laboratory.
Mt. Waliguan, China: Chinese Academy of Meteorological Sciences.
National Central University.Lulin, Taiwan:
National Science Foundation: Summit, Greenland, NSF.
Ny-Alesund, Svalbard: Norway Meteorological Institute.
Ocean Station M, Norway : Norway Meteorological Institute.
Ochsenkopf, Germany : Max Planck Institute.
Pacific Ocean, N/A : Volunteer Ship Program.
Pallas-Sammaltunturi, Finland: Finnish Meteorological Institute.
Plateau Assy, Kazakhstan: Institute of Environment.
Ragged Point, Barbados : Private Party.
Sand Island, Midway: U.S. Fish and Wildlife Service.
Santarem, Brazil: LBA INPE/CPTEC.
Sary Taukum, Kazakhstan : Institute of Environment.
Sede Boker, Israel: Weizmann Institute of Science.
Shemya Island, Alaska : PIQUNIQ Management Corp.
Shemya Island, Alaska: PIQUNIQ Management Corp.
South Pacific Ship, N/A : Voluntary Observing Ship.

St. Davids Head, Bermuda : Bermuda Biological Station.
Storhofdi, Iceland : Icelandic Meteorological Office.
Syowa Station, Antarctica: Japan Institute of Polar Research.
Tae-ahn Peninsula, South Korea: Korea-China Centre for Atmospheric Research.
Tenerife, Canary Islands : Instituto Nacional de Meteorologia.
Terceira Island, Azores, Portugal : Instituto de Meteorologia.
Tierra Del Fuego, Argentina: Servicio Meteorologico Nacional.
Tudor Hill, Bermuda : Bermuda Biological Station.
Ulaan Baatar, Mongolia: Blue Sky Aviation.
Ulaan Uul, Mongolia: Mongolian Hydromet.
Universitaet Frankfurt, Germany: Institut fuer Meteorologie und Geophysik.
University College, Galway, Ireland.
University of Bristol, England.
University of East Anglia,; carbonyl sulfide measurements..
University of Fiji.
University of Guam.
University of Sao Paulo, Brazil.
Weizmann Institute of Science, Israel: US-Israeli Bi-national Science Foundation.

OTHER INTERNATIONAL PARTNERSHIPS

GMD has a variety of Partnerships, Cooperative Agreements and Memorandum of Understandings with agencies in other countries to conduct measurements and research not covered above.

Alfred Wegener Institute, Bremerhaven, Germany: Cooperation in the operation of the WCRP BSRN data archive and various polar aerosol optical depth studies.
Algerian Meteorological Service, Tamanrasset, Algeria: Operates SURFRAD site, collects carbon cycle flasks.
Brazilian Meteorological Service: Measurements at Bahia GAW.
Bureau of Meteorology, Perth, Australia: Operates a Dobson spectrophotometer under supervision of GMD.
Centre National de la Recherche Scientifique, France: Operates a Dobson spectrophotometer under supervision of ESRL and University of Reims.
China Meteorological Administration, Chinese Academy of Meteorological Sciences (CAMS): Cooperative aerosol measurements at Mt. Waliguan GAW station.
Czech Hydrometeorological Institute: Collaboration on calibrations of Dobson Instruments through WMO/GAW.
Deutscher Wetterdienst, Germany: Calibrations of Dobson spectrophotometers through WMO/GAW.
Environment Canada Meteorological Service: SEARCH, and joint research operations at Alert and Eureka.
German Aerospace Center (DLR), Oberpfaffenhofen, Germany.
Indonesian Bureau of Meteorology and Geophysics: Measurements at Sumatra GAW station.
Instituto Nacional de Pesquisas Espaciais (INPE), Brazil: Dobson spectrophotometer

Calibrations with assistance from GMD; joint WMO/GAW operations.
 Japan Meteorological Agency, Collaboration on calibrations of Dobson Instruments through WMO/GAW
 Leibniz Institute for Tropospheric Research, Leipzig, Germany: Collaborative aerosol measurements at Barrow, joint workshop participation to improve aerosol instruments and measurement methodologies.
 Max Planck Institute for Chemie, Mainz, Germany.
 National Academy of Sciences, Russia: Cooperation on BSRN site.
 National Institute of Polar Research, Japan: Studies of polar aerosol optical properties.
 National Institute of Water & Atmospheric Research, New Zealand : Operates a Dobson spectrophotometer under supervision of GMD.
 Paul Scherrer Institute, Villigen, Switzerland.
 Roshydromet, Russia: SEARCH, and establishment of climate monitoring station in Northern Siberia.
 Servicio Nacional de Meteorología e Hidrología del Perú : Operates Dobson spectrophotometer under supervision of GMD.
 South African Weather Service: Calibrations of Dobson spectrophotometers through WMO/GAW, aerosol measurements at Cape Point GAW station.

University of Kiel, Institute für Meereskunde, Kiel, Germany: Halocarbon measurements.
 WMO – World Climate Research Program -GEWEX: ESRL provides international management of the WCRP Baseline Surface Radiation Network.
 World Climate Research Program, Geneva: BSRN and GEWEX activities
 World Meteorological Organization, Switzerland : BSRN, GAW, and GCOS activities.
 World Radiation Center, Switzerland: Radiometer calibration and characterization studies.

OTHER RESEARCH COLLABORATIONS SUMMARY: NON-NOAA

- Aerodyne Research Inc.
- Alfred Wegener Institute for Polar and Marine Research
- Bay Area Environmental Research Institute
- Baylor University
- Belgian Institute for Space Aeronomy
- Brookhaven National Laboratory
- California Institute of Technology
- Centre National de la Recherche Scientifique
- Centre National d'Etudes Spatiales
- China Meteorological Administration
- Colorado State University
- Denver University
- Department of Energy Pacific Northwest Laboratory
- Department of Interior Mineral Management Service\
- Desert Research Institute
- DLR Institute of Atmospheric Physics
- DOE Argonne National Laboratory

- DOE Los Alamos National Laboratory
- Droplet Measurement Technologies
- Duke University
- Ecotech Pty Ltd
- Eidgenössische Technische Hochschule
- Environment Canada
- Environmental Protection Agency
- European Centre for Medium-Range Weather Forecasting
- European Commission
- European Space Agency
- Federal Aviation Administration
- Florida State University
- Forschungszentrum Jülich
- Fort Hayes State University
- French Meteorological Service
- Georgia Institute of Technology
- German Aerospace Institute
- Harvard University
- Hokkaido University
- Howard University
- Ibaraki University
- Institut Pierre Simon Laplace
- Japan Meteorological Agency
- Johns Hopkins University
- Keio University
- Laboratoire d'Aérodynamique, Toulouse
- Laboratoire des Sciences du Climat et de l'Environnement
- Laboratory for Atmospheric and Space Physics
- Lamar University
- Lawrence Livermore National Laboratory
- Los Angeles World Airports
- Max-Planck-Institut Hamburg
- McGill University
- Met Office, U.K.
- Met Service of Slovenia
- National Aeronautics and Space Administration
- National Center for Atmospheric Research
- National Institute of Standards and Technology
- National Institute of Water and Atmospheric Research
- National Science Foundation
- Netherlands Environmental Assessment Agency
- Nordic Envicon Oy
- North Carolina State University
- Norwegian Institute for Air Research
- Oregon State University
- Pennsylvania State University

- Physical Sciences Inc.
- Plymouth State College
- Portland State University
- Rice University
- Royal Dutch Meteorological Institute
- Scripps Institution of Oceanography
- Stanford University
- Technical University of Munich
- Tennessee Valley Authority
- Texas A&M University
- Texas Tech University
- U.S. Coast Guard
- University of California Berkeley
- Universidad Nacional de Autonoma Mexico
- Universite de Pierre et Marie Curie
- University of Alabama Huntsville
- University of Bremen
- University of California Davis
- University of California Irvine
- University of California Los Angeles
- University of California Santa Cruz
- University of Cambridge
- University of Central Florida
- University of Colorado Boulder
- University of East Anglia
- University of Edinburgh
- University of Helsinki
- University of Houston
- University of Iowa
- University of Jerusalem
- University of Leeds
- University of Leicester
- University of Manchester
- University of Maryland
- University of Massachusetts
- University of Miami
- University of New Hampshire
- University of Reading
- University of Rhode Island
- University of Stockholm
- University of Texas
- University of Toronto
- University of Virginia
- University of Washington
- University of Wisconsin
- Valparaiso University

- Volpe National Transportation Systems Center
- Washington State University
- Weismann Institute
- Western Michigan University
- Woods Hole Oceanographic Institution