Collaboration with other national and international research groups both inside and outside of NOAA, as well as reimbursable support from NOAA and non-NOAA sponsors

The following is a list of organizations that ARL has collaborated with during the period 2000 – 2010, with a brief description of the collaboration. Greater detail is available upon request.

International Collaborations

Canada

Environment Canada

- Scientific studies and monitoring programs addressing major ions found in precipitation and dry deposited from the atmosphere
- Scientific studies and monitoring programs addressing atmospheric mercury measurements and regional and global modeling
- Collaborations addressing energy issues, long-range transport of material, development and protection of pristine areas through participation in the International Joint Commission/International Air Quality Advisory Board
- Collaborations concerning air quality issues, particularly with sulfur, nitrogen, ozone, and particulate matter, through the U.S.-Canada Air Quality Agreement
- Collaborations concerning programs to develop monitoring and assessment infrastructure for chemicals of concern through the Canada-Mexico-U.S. Commission for Environmental Cooperation
- Collaborations with the Canada Reference Climate Networks
- Collaborations on drought monitoring using soil moisture measurements through a formal Memorandum of Understanding. The U.S. Department of Agriculture and Agri-Food Canada are co-collaborators
- Collaborations on studies of stratospheric temperature change with the Canadian Centre for Climate Modeling and Analysis

Other collaborations with Canada concerns business associated with the International Joint Commission/International Air Quality Advisory Board. Collaborators include the Ontario Ministry of the Environment, New Brunswick Department of Environment, Fisheries and Oceans Canada, and Health Canada.

World Meteorological Organization

ARL collaborates with the Global Atmosphere Watch, which consists of many international groups, on understanding deposition of major ions and mercury in precipitation, as well as dry deposition of various sulfur and nitrogen compounds.

ARL collaborates with various Global Climate Observing System (GCOS) Reference Upper Air Network (GRUAN) committees. GCOS is a joint undertaking of the WMO, the

Intergovernmental Oceanographic Commission of the United Nations Educational Scientific and Cultural Organization, the United Nations Environment Programme, and the International Council for Science.

Mexico

ARL has on-going collaborations with the Instituto Nacional de Ecología - INE (part of the federal government of Mexico), involving modeling the atmospheric fate and transport of dioxin with a special version of the ARL HYSPLIT model

Spain

ARL collaborates closely with the University of Huelva (Spain, near Seville) on various modeling topics such as local arsenic transport and Saharan dust transport

United Kingdom

ARL collaborates on studies of upper-air climate change with United Kingdom Meteorological Office

ARL has collaborative research on stratospheric temperature change with the University of Reading

ARL has collaborated on studies of upper-air and high elevation temperature changes with the University of Portsmouth

Russia

ARL collaborated on analysis of radiosonde observations for climate research with the All-Russian Research Institute for Hydrometeorological Information

National Collaborations

National Oceanic and Atmospheric Administration

National Weather Service (NWS):

- ARL collaborates with NWS National Center for Environmental Prediction (NCEP) and the NWS Alaska Region regarding the NOAA volcanic ash program.
- ARL's Field Research Division has an ongoing collaboration with the Pocatello, ID Weather Forecast Office (WFO) on sharing local modeling products and observations. The WFO makes extensive use of observations from ARL's 35 tower meteorological network when issuing forecasts, watches, and warnings.
- ARL Collaborates on the design, deployment, and maintenance of the U.S. Regional Climate Reference Network

- ARL collaborated with NCEP on the verification/validation of the 2-D 5km Real Time Mesoscale Analysis (RTMA) and on evaluation of techniques to predict boundary layer mixing heights for the 3-D RTMA product.

Oceanic and Atmospheric Research:

- ARL collaborated with the Earth System Research Laboratory's (ESRL) Physical Sciences Division and with the Atlantic Oceanographic and Meteorological Laboratory in developing specialized observation systems for measuring turbulence and fluxes in hurricanes.
- ARL collaborates with ESRL and the Department of Energy (DOE) in improving forecasts for renewable energy applications. This includes a planned field study starting in 2011.
- ARL collaborates with ESRL's Global Systems Division (GSD) in evaluating the High Resolution Rapid Refresh model for applications to both dispersion forecasting and renewable energy.
- ARL collaborated with ESRL on research on the representation of planetary boundary layer in models used for tracking atmospheric carbon dioxide.
- ARL worked collaboratively with the Geophysical Fluid Dynamics Laboratory (GFDL) on research on upper-air temperature observations and climate change and on the representation of the planetary boundary layer in climate models.
- ARL collaborates with researchers from ESRL's Global Monitoring Division (GMD) to integrate some of the specialized features of STILT (a HYSPLIT variation developed by Harvard) used for carbon tracking into HYSPLIT.
- ARL collaborated with the GFDL on the wind-blown dust modelling component of the National Air Quality Forecast Capability.
- ARL collaborated with ESRL's GSD and Chemical Sciences Division as part of NOAA's Volcanic Ash Working Group.
- ARL collaborates with ESRL's GMD in hosting a Surface Radiation Network Station at the Desert Rock Weather Observatory located on the DOE's Nevada National Security Site in Southern Nevada.

National Ocean Service:

- ARL collaborates with the Office of Response and Restoration in linking the model ALOHA/CAMEO with HYSPLIT. This future integrated model will be a keystone in NOAA's dispersion models.
- ARL collaborates with the National Centers for Coastal Ocean Science concerning deposition to coastal estuaries of nutrients and mercury in precipitation.

National Environmental Satellite, Data, and Information Service:

- ARL collaborated with the National Climatic Data Center on identifying the planetary boundary layer in radiosonde data and on studies of upper-air temperature trends.
- ARL collaborated with the Center for Satellite Applications and Research on the balloon drift climatology, analysis of uncertainty in comparing satellite and in situ observations, and on changes in cloud cover, as well as collaborations on future volcanic ash products.

- ARL collaborates with the Synoptic Analysis Branch regarding the NOAA volcanic ash program.
- ARL has a collaborative effort with NESDIS to analyze data collected by the University of Tennessee Space Institute to measure spatial variability of surface temperatures around Climate Reference Network stations.

Other Federal Government

- ARL has collaborated with the Department of Defense, Department of Homeland Security, DOE, and the Environmental Protection Agency (EPA) in conducting atmospheric tracer studies to improve dispersion modeling in various situations.
- ARL's Field Research Division collaborates with the DOE through a Memorandum of Understanding to provide emergency response support associated with accidental releases of hazardous substances and wildfires, and it operates a meteorological network in collaboration with the DOE Idaho National Laboratory.
- ARL's Special Operations and Research Division (SORD) collaborates with the DOE to provide plume dispersion expertise for consequence management support for the Nevada National Security Site (NNSS) and to operate a meteorological network on the NNSS to examine boundary layer parameters in support of national security experiments and activities.
- ARL's SORD collaborates with the National Park Service (NPS) and the EPA to provide coordination and technical oversight of the Interagency Monitoring of Protected Visual Environments (IMPROVE) Network. SORD also provides expertise on particulate matter and visibility effects to aid in the development and implementation of national air quality policy.
- ARL's Atmospheric Turbulence and Diffusion Division (ATDD) collaborates with the DOE Oak Ridge National Laboratory's Environmental Sciences Division on the collection of data at two forest research sites on the DOE Oak Ridge Reservation.
- ARL collaborates with the Department of Agriculture, the NPS, the EPA, the U.S. Forest Service (USFS), and the U.S. Geological Survey (USGS) in the National Atmospheric Deposition Program, concerning the concentration and deposition of major ions and mercury in precipitation, as well as speciated mercury in air.
- ARL collaborated with the USFS on inclusion of the HYSPLIT interface as part of their Vegetation Smoke modelling system.
- ARL has a new collaborative effort with the Cooperative Program for Operational Meteorology, Education, and Training program to update the HYSPLIT training materials and examples designed to support the forecasters at the WFOs.
- ARL collaborates with the University of Hawaii, the NPS, and the USGS in response to increased SO_2 emissions (2000 T/day) following the opening of a new vent on Kilauea in 2008. An operational HYSPLIT plume forecast product has been developed to track SO_2 and $SO_4^=$ emissions.
- ARL collaborates with the USGS, the Federal Aviation Administration, the Air Force, the National Aeronautics and Space Administration, and the Smithsonian Institution

concerning the National Volcanic Ash Operations Plan for Aviation and Support of the ICAO International Airways Volcano Watch.

- ARL has been collaborating with the NASA Soil Moisture Active Passive (SMAP) mission in the algorithm development and calibration/validation of remote sensing soil moisture products. SMAP satellite project is due for launch in 2014. Discussions are ongoing for potential field campaigns in 2012/2015.
- ARL's ATDD has established long-term flux tower networks for measurements of energy, water, and carbon fluxes in the key land-vegetation regions in the U.S. Products of Normalized Difference Vegetation Index from radiation measurements from the flux towers have been useful in validating NASA Moderate Resolution Imaging Spectroradiometer products in support of biogeochemical and ecological data and model efforts.
- Meetings were held with the Pentagon Force Protection Agency (PFPA) to discuss the use of DCNet data to support the PFPA mission.
- The Defense Intelligence Agency (DIA) – meetings have been held to discuss the installation of a DCNet instrument suite at DIA Headquarters to improve DIA's site protection capabilities.
- The DOE Forrestal Headquarters Building - Collaborations with staff from this DOE facility have been particularly important in producing extensive studies of the turbulent wind flow within the first 200 meters above the rooftops of downtown District of Columbia

Non-Governmental Organizations

- ARL has collaborations with the Canaan Valley Institute for the monitoring of wet and dry depositions of major ions, acidity, and mercury. Canaan Valley Institute also hosts a Climate Reference Network station, and a GEWEX tower.
- ARL is collaborating with Harvard University and Aurora Flight Sciences in research linking ARL's Best Atmospheric Turbulence (BAT) probe and expertise in airborne turbulence measurement with the Harvard group's innovative cavity-oscillation spectrometer capable of high-sample-rate measurement of methane, CO_2, H_2O and their isotopologues. The collaboration will provide airborne flux data for greenhouse gases in the Arctic.
- ARL is collaborating with Duke Energy, Inc. to develop improved forecast capabilities for wind turbine hub height winds at Duke Wind farm facilities.
- ARL is collaborating with Catch The Wind, Inc. to conduct collaborative research and development on the capabilities of their laser anemometer measurement systems.

State and Local Government

ARL collaborates with the following state and local governments

- State of Maryland concerning atmospheric mercury research and development of surrogate surface samplers for mercury concentrations and deposition
- State of Texas concerning photochemical modeling
- State of Pennsylvania for mercury speciation monitoring at Allegheny Portage, PA

- State of Tennessee – Forestry Division and Air Quality Division use ATDD Raman observations
- District of Columbia Sports and Entertainment Commission – A 2009 planetary boundary layer intensive study was conducted at RFK Stadium
- The District of Columbia Homeland Security and Emergency Response Agency in locating DCNet instrument suites in particular locations around the District

Tribes

Cherokee Indian Nation – Smoky Mountain air quality

Universities

University of Alabama – Collaborated in establishing a program of airborne environmental research involving remote sensing and in-situ sampling of air-surface exchange using the BAT probe and collaboration on upper-air temperature changes
Harvard University – Collaborating with Harvard University and Aurora Flight Sciences in research linking the BAT probe and expertise in airborne turbulence measurement with the Harvard group's innovative cavity-oscillation spectrometer capable of high-sample-rate measurement of methane, CO_2, H_2O and their isotopologues
Southern Methodist University – Collaborating in data collection for experiments in infrasound.
University of Maryland – Atmospheric chemistry and meteorology, various projects
Pennsylvania State University – Atmospheric chemistry and deposition
University of Delaware – Precipitation chemistry and nutrient deposition to coastal areas
University of Illinois – Precipitation chemistry and nutrient deposition; regional climate studies
University of Virginia – Nitrogen in the environment
Cornell University – Precipitation chemistry and nutrient deposition; coastal eutrophication
University of Houston – Photochemical modeling in Texas
National Center for Atmospheric Research – Collaboration on analysis of the tropopause, stratospheric temperature trends, and tropical belt expansion, and on the representation of the planetary boundary layer in climate models
University Corporation for Atmospheric Research – Air quality forecasting programs
University of California, Berkeley/Lawrence Livermore National Lab – Collaboration on trends in the tropical temperature profile
University of Washington – Collaboration on upper-air temperature trends
University of Utah – Collaborative research on the expansion of the tropical belt
CalTech/Jet Propulsion Lab – Collaboration on the use of GPS radio occultation observations to study the planetary boundary layer and tropopause region
University of Alaska – Volcanic ash
University of Tennessee Space Institute – Collaborative effort to measure spatial variability of surface temperatures around Climate Reference Network stations
West Virginia University – Education outreach programs and study project with the WVU Environmental Research Center
University of Tennessee – Air quality and dispersion field projects with a focus on East Tennessee Air Quality

Jackson State University – Atmospheric chemistry and deposition. Studies investigating the sea breeze circulation in the vicinity of Gulfport, MS were conducted in 2009 (coastal dispersion)
Howard University – In collaboration with the HU Physics Department, a number of intensive field studies have been conducted on the HU campus including a 2007 roughness sublayer study and a 2009 planetary boundary layers depth study. Urban Dispersion/DCNet.

Reimbursable Support from Non-NOAA Sponsors

During this time period, ARL received (or currently receives) reimbursable support from the following federal agencies:

- Department of Energy: Collaborative dispersion research and technical services associated with the DOE Idaho National Laboratory
- Department of Energy: To provide meteorology and dispersion expertise for the Nevada National Security Site operations, national security experiment support, and emergency response activities
- Department of Homeland Security: Dispersion research in urban environments such as Midtown Manhattan
- Department of Defense: Dispersion research in the area of the Pentagon and in other urban environments
- Environmental Protection Agency: Dispersion research on the effects of roadway sound barriers on pollutant concentrations; mercury deposition
- National Park Service and Environmental Protection Agency: To provide coordination and oversight of the IMPROVE network and particulate matter and visibility effects expertise
- Office of Naval Research: Early development of the Extreme Turbulence (ET) probe for hurricane research and funding for aircraft measurements of fluxes over the ocean in both low- and high-wind conditions
- U.S. Weather Research Program: Early development work on the ET probe

During this time period, ARL received (or currently receives) reimbursable support from the following state agencies and institutions:

- Florida Department of Environmental Protection: Nitrogen deposition to coastal areas
- University of Houston: Photochemical modeling in Texas
- Texas Commission for Environmental Quality: The improvement of meteorological modeling though the indirect soil moisture assimilation and use of high resolution land use and land cover data