Summit Greenland Environmental Observatory
Multi-Year Science Requirements
August 2001

During 2000-2001 about 20 U.S. and European groups of investigators made use of the Summit Greenland Environmental Observatory (GEO Summit), either by an on-site presence or through analysis of samples and data collected by on-site personnel. These investigators include:

Carnegie-Mellon University: Cliff Davidson. Analysis of major ions collected year-round on aerosol filters.

Cold Regions Research and Engineering Laboratory, U.S. Army Corps of Engineers. Mary Albert. Characterization of snow & firn physical characteristics on year-round samples and during summer experiments.

Desert Research Institute. Joseph McConnell. Analysis of year-round surface snow for development of high-resolution trace element records.

Laboratoire de Glaciologie et Géophysique de l'Environnement. Jean Luc Jafrezzo. Year-round sampling of atmospheric aerosols and gaseous species.

National Institute of Standards and Technology: George Klouda: Year-round high-volume aerosol filters for carbonaceous aerosols.

National Oceanic and Atmospheric Administration, Climate Monitoring and Diagnostics Laboratory. Sam Oltmans, Ozone and Water Vapor Group; and Pieter Tans and Tom Conway, Carbon Cycle Group. Year round measurements on atmospheric ozone; and year-round analysis of flask samples of air for carbon-cycle compounds.

National Survey and Cadastre, Denmark. Trine Dahl-Jensen and Soren Gregersen. Continuous seismic monitoring at GEO Summit.

Michigan Technological University. Richard Honrath, Sarah Green and Matt Peterson. Summer experiments, snow and atmospheric photochemistry.

Purdue University. Paul Shepson and Ann-Louise Sumner. Summer experiments, snow and atmospheric photochemistry (collaborative with R. Honrath, Michigan Tech.).

Swiss Federal Institute of Technology. Atsumu Ohmura. Year-round measurement of incoming and outgoing radiation, turbulence and energy balance. The investigation of the structure of the atmospheric boundary layer, especially its coupling with the atmosphere above (collaborative with K. Steffen, U. Colorado)

University of Arizona: Roger Bales, Manuel Hutterli, Hans-Werner Jacobi, Dee Belle-Oudry and Markus Frey. Air-snow exchange of H_2O_2, HCHO and related species. On-site year-around measurements of snow and atmosphere, and summer experiments.

University of California, Irvine: Donald Blake and Nicola Blake. Year-round canister samples for hydrocarbon, halocarbon and alkyl nitrate; and summer experiments, snow and atmospheric photochemistry (collaborative with R. Honrath, Michigan Tech).

University of Colorado. Konrad Steffen and Detlev Helmig. Year-around meteorological and energy-balance measurements (collaboration with A. Ohumra, Swiss Federal Institute of Technology); summertime vertical profiling of meteorological parameters and ozone within the planetary boundary layer from a tethered balloon platform.

University of New Hampshire: Jack Dibb. Accumulation stake array, analysis of major ions in snow, atmospheric photochemistry, and summer experiments (photochemistry experiments in collaboration with R. Honrath, Michigan Tech). PI for proposed 3-year continuation of photochemistry experiments.

University of Michigan. Robert Clauer and Vladimir Papitasvili. Continuous geomagnetic field measurements in the vicinity of GEO Summit and Raven Training Facility. The only maintenance requirement is for a 1 or 2-week summer visit to the sites to download data and service equipment.

University of Washington: Eric Steig. Year-round samples of water vapor for analysis of stable isotopes.

University of Wisconsin, Milwaukee. Jonathan Kahl. Year-round modeling of back trajectories for Summit.

All are interested in continuing to carry our measurements and experiments at GEO Summit, and several additional groups have expressed interest in using the facility. Some have approved or pending projects. They include:

Aerodyne. Mark Zanhiser. Year-round atmospheric chemistry measurements using tunable diode laser; collaborative work with P. Shepson at Purdue U., who was PI, and R. Bales at U. Arizona. (initial proposal rejected; resubmission under consideration).

Danish Meteorological Institute. Torben Jorgensen. Radiation measurements, stratospheric chemistry. (plans pending)

Georgia Institute of Technology. Greg Huey. Snow and atmospheric photochemistry experiments. (collaborative with J. Dibb, U. New Hampshire).

National Oceanic and Atmospheric Administration, Environmental Technology Laboratory. Wynn Eberhard. Lidar measurements for cloud products (presence, base height, phase, etc.) and possibly aerosol profiles. (under consideration; no active proposal yet)

Rice University. Arthur Few. Atmospheric electricity measurements. (plans pending)

Stanford Research Institute. Jeff Thayer, John Kelly, Richard Doe. Rayleigh lidar to study stratospheric ozone, middle atmosphere temperature and noctilucent clouds. (proposal being formulated for 2003 or later deployment)

University of Bonn. Günther Heinemann. Aircraft measurements of boundary layer structure. (planned summer 2002)

University of Bremen. Klaus Kunzi and Nicole Buschmann. Millimeter-wave radiometer for measurement of stratospheric ozone, nitrous oxide, water vapor, chlorine monoxide and other minor constituents, under a project dubbed RAMAS (Radiometer for Atmospheric Measurements at Summit), supported by the European Union. Instrument will be deployed in 2002; along with one person for year-round measurements.

University of California, Davis. Cort Anastasio. Snow and atmospheric photochemistry experiments. (collaborative with J. Dibb, U. New Hampshire).

University of East Anglia. William Sturges. Atmospheric chemistry experiments. (plans on hold; no immediate proposal planned)

University of Houston. Edgar Bering, III. Atmospheric electricity measurements. (plans pending)

University of Maine. Gordon Hamilton. Firn densification studies. (plans pending)

University of Pennsylvania. Mark Hermanson. Year-around snow sampling for measurements of pesticides and other organic pollutants. (plans pending)

University of Texas, Dallas. Brian Tinsley. Atmospheric electricity measurements. (plans pending)

A summary of future requirements follows, grouped by discipline:

Snowpack photochemical studies. A group of 19 investigators from 12 institutions submitted a proposal to NSF to continue and extend the investigations of photochemical processing in the snowpack at Summit. The initial proposal was rejected; resubmission is under consideration As currently defined, the project would need 3 field seasons at GEO Summit, two in summer and one in spring (ideally March – April). The first summer campaign would probably involve 10-15 individuals, with 20 persons on site for the subsequent campaigns. No request for scientific staff support from VPR is anticipated. Most measurements would be made at and near the new "clean air" sampling site discussed at the meeting with VPR in January 2001. Requirements for this site include a warm structure (approx 600 square feet) located at least 3 km from the Greenhouse toward the south-south-west (past the GISP2 drill dome). There should be no combustion sources at this new facility and vehicle traffic will be forbidden except during set-up and tear-down each season. Power requirements are estimated at 200 amps of 110V service (208V or 220V if future European participation). The structure should be relocated several 100's of meters each season owing to drifting and snow compaction. Clean power is preferred (e.g., wind, solar, fuel cells or a combination).

Year-round atmospheric and surface snow sampling. Current 2-yr project ends in spring/summer 2002. Proposal pending to extend for 3 more years (through spring/summer 2005). Requires year-round presence (same staffing level and lab facilities as current program) plus access during summers for experiment setup and intensive sampling. Also requires maintenance of clean air sector and minimization of camp generated pollution. PI: Joe McConnell, Desert Research Institute; 8 institutions participating. If additional proposals are forthcoming (e.g. tunable diode laser), an expansion lab space by a few hundred square feet would be required, as would a relatively high skill level for operation of the instrument.

Process studies, snow-atmosphere transfer function. Summit has become the primary location for a variety of studies of snow-atmosphere exchange related to interpretation of ice cores. Besides year-round sampling, GEO Summit needs to be available for continued process studies by individual investigators. These are generally in spring or summer, though late-fall and early spring access are also important. The capability for 1-2 scientists to be on site for short periods during spring and fall is important, similar to the February 2001 deployment of M. Hutterli to GEO Summit.

Accumulation variability. The accumulation stake array should be maintained, and possibly expanded to serve as a ground control point for the IceSat/GLAS mission.

Firn densification studies. The Summit station is a very useful as a place to base process-level studies of firn densification. A better understanding of firn densification is key for interpretation of the soon to be arriving IceSat/GLAS data from NASA. Ample power and wintertime maintenance is very important for such studies. Would require current staffing/facilities levels. Gordon Hamilton (University of Maine) is already doing some work; he and Joe McConnell (Desert Research Institute) are planning to expand this activity very soon.

Ice coring activities. Continued summertime access to Summit is very important for studies of spatial variability in annual layers and/or rapid climate change events that may involve drilling and/or remote probes. For the latter, year-round access is also needed.. Both require heavy lift aircraft access and approximately the current levels of staffing/facilities.

Pollution studies: There is interest in continuation and expansion of pollution-related studies at Summit (e.g., trifluoroacetate, trace metals, pesticides) and access to Summit (both year-round and summer only) is important both for sampling and for process-level studies. Sampling would impose a small increment to that being done under the current winter-over program.

Radiation and energy balance. Atsumu Ohmura and Konrad Steffen plan to continue work through at least 2004. This plan is especially oriented for detecting important changes in radiation fluxes, such as the effect of major volcanic eruptions and the potential increase in anthropogenically caused infrared radiation. If other groups get approval to implement additional measurements, an expansion of lab space could be required.

Stratospheric and upper atmosphere measurements. Implementation of programs under consideration would require a significant expansion of lab space, and additional year-round berthing for science personnel.

Seismology. The recorder needs periodic checking, so having year-round personnel on site is required. No change in power requirements.

Atmospheric electricity measurements. If implemented, an expansion of lab space would be required.