

ATMOSPHERIC PROCESSES

- 1) To establish a long term monitoring site on the shore of Lake Champlain to directly measure atmospheric deposition into the Lake.

Even though different air monitoring activities have been conducted for the last few years, such as the AIRMoN, NADP and Hg program at Underhill, none have directly measured direct atmospheric deposition of air pollutants, both gaseous and particulate species, into Lake Champlain. To fill in the gap in our current understanding of atmospheric depositions, this sampling site is proposed. An MICB sampler could be set up at an on-shore location that employs a surrogate water surface. The samples collected weekly can be analyzed for ionic species, including NH₃ (NH₄⁺), and trace elements. Analytical instruments are ICP-MS and ion chromatography. The most desirable approach is to have a denuder and filter pack sampler co-located so the direct deposition can be correlated to air-borne particulate and gaseous species concentrations. This new monitoring activity will provide very useful but yet currently unavailable data for modeling purpose, such as the MB modeling proposed above, and for a better understanding of the different systems in the Lake.

- 2) To conduct modeling which can determine source-receptor relationship for the Lake Champlain Basin.

Such studies utilize several multivariate analysis models and air trajectory-based models that incorporate chemical and meteorological data to identify contributing sources to the atmospheric pollutants detected in the Basin. The work would include source apportionment that can provide information on source profiles and source contributions. Such information is very important to various regulatory agencies, such as DEC, EPA, and NOAA and other researchers. There have been some preliminary studies that have identified up to 10 different contributing sources to air pollutants collected at Underhill, VT. The proposal is to continue and expand the modeling to include more chemical species and more data from other monitoring sites.

- 3) To continue air monitoring through AIRMoN at Underhill, VT for wet and dry deposition.

The Atmospheric Integrated Research Monitoring Network, funded by NOAA, has been monitoring wet deposition on an event basis and dry deposition on an integrated weekly basis at the VMC (Vermont Monitoring Cooperative) monitoring station in Underhill since Jan 1993. Its value is in providing chemical data for major ions in individual storms (essential for source identification) and in providing dry deposition data for sulfur and nitrogen compounds (essential for determining the total acid loading). Data are important to NOAA, acid rain scientists, source identification modelers and others. Results have been most recently published in Scherbatskoy et al. (1999), and show that dry deposition of acid compounds is significant in this region, and that dominant sources of this are to our west and south.

- 4) To continue the weather station on Colchester Reef that provides meteorological data for atmospheric and hydrodynamic modeling.

Meteorological monitoring has been conducted at Colchester Reef on Lake Champlain since August 1995, providing continuous data on wind (speed and direction), temperature (air and water), solar radiation (400-1100 nm), relative humidity, and barometric pressure. Data are reported by the National Weather service several time daily, and are archived by the VMC. This station was developed with support from the VMC and Lake Champlain Basin Program to provide data for atmospheric modeling and recreational information. These data are one of the NWS's most popular data products. Support for the maintenance of this station is now from NOAA.

- 5) To continue Hg program at Underhill, VT and tributaries.

Mercury in precipitation (event), vapor and aerosol (24-hour samples every 6 days) forms have been monitored at the VMC monitoring station in Underhill since Dec 1992, making this the longest continuous mercury monitoring program in the world. This work has been funded by EPA and NOAA, and carried out in conjunction with Jerry Keeler of the University of Michigan. In addition to monitoring, this program has also studied factors controlling the transport and fate of mercury within the forested watershed. The data have shown that atmospheric concentration and deposition rate have not changed during this period. These data are important for assessing the mercury loading and long term trends in this region, and are used in assessments by the VT Air Pollution Control Division (VT DEC), NESCAUM, and EPA Region I. Monitoring results have been most recently published in Scherbatskoy et al. (1999) and there are several manuscripts related to ecological processing of mercury ready for journal submission.

- 6) To continue NADP and UV-B monitoring program at Underhill, VT.

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Acid rain monitoring has been conducted at the VMC monitoring station in Underhill since June 1994 as part of the National Atmospheric Deposition Program. This site is funded by the USGS. Integrated weekly samples are analyzed and reported by the NADP program. The data are important in placing Vermont's acid deposition rate in perspective with the rest of the nation as well as providing data on loading of sulfur, nitrogen and other ions in the LC basin. Monitoring results have been most recently published in Scherbatskoy et al. (1999), and show that although sulfur concentrations in precipitation have declined recently, nitrogen and total acidity have not.

Continuous monitoring of UV-B exposures and related information has been conducted at the VMC monitoring station in Underhill since July 1996 as part of a national climatological network operated by the US DA. These data are used by public health and recreation managers, air quality specialists and biologists concerned with UV-B effects on foliage and aquatic life. The data are continuously posted on the USDA UV-B Program's web site.

Notes on these priorities from ARL (compiled by Rick Artz)

"- ARL does not support funding of the #1 priority for several reasons. For major ions (SO₄, Cl, NO₃, PO₄, Ca, Mg, K, Na, H⁺) the US standard precipitation chemistry collector is an Aerochem Metrics 301. The standard Canadian collector is the MIC-b. In order to be comparable with the 250 site national network, wet sampling should be conducted through NADP (either the NTN weekly program or the AIRMoN daily program). The MIC-b is a good collector, particularly for snow when compared to the Aerochem. You may wish to consider linking with the CAPMoN network if you plan to stay with the MIC-b collector. In no case should dry sampling be supported using a MIC-b with a surrogate water surface; such methodologies were discarded in the early 80's. Denuder, filterpack, or other realtime monitoring methodologies may be reasonable if a suitable location is determined, provided that supporting meteorological information is also collected following rigorous siting requirements addressing fetch and mixing. Over-water sampling is a fine idea but it must be done correctly.

You should also be aware that the Naval Research Laboratory is spending several millions of dollars to address this very issue. Deposition to coastal waters, particularly in high wind and very low wind conditions, is poorly understood. Methodologies being used to improve knowledge of such systems for dry deposited substances include the use of properly configured small aircraft outfitted with sophisticated fast chemical and fast meteorological sensors with GPS. Results will likely be coupled with fine grid mesoscale models.

- The #2 priority arguably should not be funded because of progress being made through the Vermont DEC (Paul Wishinski and Rich Poirot) in conjunction with ARL modelers. In addition, there is a study in preparation at the University of Virginia (William Keene and Jennie Moody) addressing trajectory clustering and other forms of data analysis that support the intent of this priority. Save your dollars for unfunded issues.

- We do, of course, support the #3 priority and feel that it is unwise to terminate basic monitoring to start something similar at a nearby location. Yes, over-water sampling is a noble goal, but probably no better than the regionally representative site at Underhill, given the relative proportions of the watershed to the water surface. In a perfect world, we would have both types of sites and more of each. In my opinion, soil retention issues constitute a greater unknown than direct deposition to water given the relatively huge watershed area. If you kill the present monitoring at Underhill, consider funding retention studies instead.

- The #5 priority cannot be fully achieved without additional (EPA?) support. This is tragic. If additional support is unavailable, make sure that the scope of work for this effort is limited and reasonable should you choose to fund it.