NOAA SEARCH - Element 2
Atmospheric Observatory Site Selection
Building National and International Linkages

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1. Objective

The SEARCH Element 2 objectives are focused on aiding the judicious selection of a site for the Arctic Atmospheric Observatory. Toward this goal, our first task was to research and compile information on existing environmental monitoring in the Arctic. Opportunities to build off or utilize existing measurements programs and infrastructure are an important consideration in recommending a possible location, and establishing these linkages requires communication with persons involved in monitoring efforts internationally. The three main tasks in this element are:

a. Provide recommendations on strategic locations for the atmospheric observing stations including considerations of existing measurement programs, infrastructure, and logistics.

b. Coordinate between the national and international polar programs and observing networks to maximize the SEARCH measurement program goals.

c. Complete a variability and trend analysis in the pan-Arctic region to evaluate locations, timescales and variables that are most likely to allow detection of climate trends for the Arctic.

2. Accomplishments to Date

One of the first steps in meeting the objectives above was to undertake a thorough and exhaustive cataloging of current circum-Arctic monitoring efforts. Obtaining this comprehensive list of environmental parameters required searching the published literature record and networking with scientists throughout the Arctic research community. Logistical details, including information about transportation, power, facilities, and equipment, were also compiled for Alert, Eureka, Thule, Kangerlussauq, and Abisko. The information was made available online at http://www.srrb.noaa.gov/arctic/arctic.html for dissemination to all interested parties.

The website information was organized using a pan-Arctic map showing monitoring locations for various environmental parameters. The information is organized both by region and by parameter.

Betsy Weatherhead and Amy Stevermer have also been closely involved in the Arctic Climate Impact Assessment (ACIA), an international effort to evaluate and synthesize information on climate variability and impacts of changes in climate and ultraviolet radiation in the Arctic. ACIA utilized projections from a number of atmosphere-ocean general circulation models (AOGCMs) to estimate the magnitude and distribution of changes in temperature, precipitation, and other parameters in the Arctic. These model projections are summarized in a report by Weatherhead, Räisänen, Walsh, Källén, and Kattsov, and show major differences in the regional distribution of changes. The magnitude of expected changes in various regions of the Arctic is an influential element when determining optimal locations for environmental monitoring.

The atmosphere-ocean models vary considerably in their regional distributions of expected climate changes. Some of the models predict the greatest warming over the Russian part of the Arctic, while others show the highest values over the high Arctic or over the Canadian part of the Arctic. In a few cases, patches of local cooling occur over the Atlantic sector. The scatter in temperature change between the different models is largest in the high-latitude sea areas and is likely linked to the close coupling between temperature response and ice cover in these regions (Räisänen, 2001). For precipitation, the models simulate, on average, a 20% increase in annual amounts over the high Arctic and about an 11% increase for the whole area 60º-90ºN. Sub-regional patterns of change vary strongly.

Natural variability is an important element in any attempt to evaluate either short- or long-term change. The signal-to-noise ratio present in the data becomes crucial in efforts to isolate a trend. The simulated natural temperature variability over the Arctic is known to be much larger than the variability at lower latitudes (Räisänen, 2001). Until natural variability is taken into account, it is not possible to use the large magnitudes of projected long-term temperature change to determine whether particular areas of the Arctic will be more optimal for detecting an anthropogenic signal. Furthermore, observations from Inuit in Nunavut, Canada, suggest that the day-to-day variability of weather and climate parameters in the Arctic has increased from previous years and a preliminary evaluation of temperature data may confirm this idea (Fox, 2004). If the natural variability of the Arctic climate system has increased, detecting a clear signal related to climate change may become more difficult. Still, certain regions may exhibit lower natural variability than others, and a more robust assessment of nature variability and expected trends will be completed in Year 2 of this project.

3. Plans for the Coming Year

a. Complete a variability and trend analyses on select Arctic parameters, which is expected to provide guidance in determining desirable regions for obtaining climatologically useful Arctic observations. Within these regions, logistical and networking considerations will be evaluated to determine optimal sites for the Arctic Atmospheric Observatory, and optimal placement for buoys. Networking activities are expected to also result in collaborative partnerships with other Arctic observing programs already in existence.

b. Continue to refine and update web-based list of Arctic monitoring locations.

c. Coordinate efforts among other research groups to maximize existing infrastructures and measurement capabilities.

4. Summary of Financial Expenditures to Date (Salary and Benefits; Equipment; Expendables; Travel; Overhead)

<u>FY03 Budget Request</u>		
Compiling Existing Monitoring Info/Preliminary Evaluation of Data:		
Betsy Weatherhead	(2 mo. salary + overhead)	20,060
Amy Stevermer	(2 mo. salary + overhead)	13,580
Janet Intrieri	(0.5 mo. salary +overhead)	6,300
Lab infrastructure charge (0.5 mo.)		2,050
Travel and networking:		
Weatherhead	(1 domestic, 2 international trips)	7,500
TOTAL		$49,490
<u>Expenditures to Date</u>		
Salaries & Benefits		
Weatherhead		18,082
Stevermer		12,362
Entrieri		6,300
Overhead		
CIRES 26% per HHS agreement		10,696
ETL Lab infrastructure charge		2,050
TOTAL		$49,490

5. Budget for Coming Year

FY04

Trend and Variability Analysis/Updating Monitoring Info:		
Betsy Weatherhead	(2 mo. salary + overhead)	21,860
Amy Stevermer	(1.5 mo. salary + overhead)	11,100
Janet Intrieri	(0.5 mo. salary +overhead)	6,600
Lab infrastructure charge (0.5 mo)		2,050
Travel and networking:		
Weatherhead	(1 domestic, 2 international trips)	7,800
TOTAL		$49,410