Long-term measurements of the arctic atmosphere  
An idea for an International Polar Year activity  
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This idea involves long-term measurements of the Arctic atmosphere, snow and other Earth system components at an expanded Summit Greenland Environmental Observatory (GEOSummit), and other locations. The GEOSummit facility is located at an elevation of 3,100 m on the Greenland ice sheet at the site of the GISP2 ice core, which was completed in 1993. GEOSummit has been a site of atmospheric, snow and other geophysical measurements ever since. It is currently the only high-altitude site for atmospheric and related measurements in the Arctic.

As global atmospheric temperatures rise, the Arctic environment is expected to undergo more rapid change in response to human influences than are other parts of the Earth system, in part due to feedbacks related to decreasing snowcover and sea-ice extent. Observed changes in Arctic temperature, atmospheric chemistry and atmospheric circulation are expected to have potentially broad but uncertain effects on Arctic systems. A number of processes that could amplify atmospheric change need consistent measurements and systematic study. For example, recent evidence indicates that important atmospheric chemical constituents undergo temperature-dependent exchange with ice/snow, and that some species are photochemically transformed and/or produced within the sunlit surface snowpack. Because changes in Arctic atmospheric circulation are cyclic over 4-5 year or longer times, long-duration measurements of the snow, troposphere and stratosphere are needed to understand circulation and to place observed changes in a long-term perspective.

The U.S. National Science Foundation (NSF) has made a five-year commitment to maintain and operate GEOSummit as a long-term site for year-round disciplinary and interdisciplinary measurements and research. Baseline measurements being supported by NSF and the U.S. National Oceanic and Atmospheric Administration (NOAA) are those that have broad interest in the atmospheric sciences and related communities. A number of U.S. and European investigators carry out additional year-round and shorter-term investigations at the site.  

Two workshops in winter 2004 highlighted the great interest among the science community in having a long-term observatory and research platform on the Greenland Ice Sheet.  

It has become clear that the current facilities at GEOSummit have a limited life, and that a new facility is needed to serve the growing science interest in this unique location as a polar research and measurement observatory. At the workshops, U.S., European and Japanese scientists strongly encouraged further development of GEOSummit as an international observatory. The measurements at a new Greenland observatory have wide applicability for detecting, understanding and modeling Arctic change, and are responsive to a number of community initiatives, including the World Meteorological Organization’s Global Atmospheric Watch, SEARCH (A Study of Environmental Arctic Change), OASIS (Ocean-Atmosphere-Sea Ice-Snowpack Interactions), AICI (Air-Ice Chemical Interactions) and other proposed initiatives. As such, this observatory provides the platform and baseline measurements for a wide number of scientists and individual research projects. As an environmental observatory, GEOSummit

1 See http://www.geosummit.org for a history of measurements and research at the site, and a summary of ongoing projects.  
enhances infrastructure for research and education. It also serves as a vehicle to broadly disseminate scientific understanding of the Arctic system by making data and information widely available, both real time data and scientific understanding that is developed using those data.

GEOSummit was chosen as the site for long-term measurements because it is in the remote free troposphere, and the chemical compositional changes observed in the long term reflect wide-scale change, uncomplicated by local biochemical processes, or by local changes in land use or emission patterns. The international science community has chosen Summit for multidisciplinary, multi-investigator studies, infrastructure is in place, and a number of Arctic researchers are collaborating there. GEOSummit also provides the northern hemisphere point of comparison to high-elevation Antarctic sites where similar measurements are made, e.g. Dome C and South Pole. It is a key piece in our understanding of the polar and global atmosphere.

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