ICECAPS

Integrated Characterization of Energy, Clouds, Atmospheric state, and Precipitation at Summit

http://www.esrl.noaa.gov/psd/arctic/observatories/summit/

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Areas of contribution
Polar atmospheric processes
Observations
Land processes

Summary
ICECAPS entails intensive atmospheric measurements at Summit Station, Greenland to operationally characterize properties of the atmosphere, clouds, radiation, and precipitation. Routine measurements include cloud radar, lidar, microwave radiometer, spectral infrared radiometer, precipitation sensor, sodar, and twice daily radiosondes. Coordinated measurements at Summit (provided by other projects) include broadband radiation and surface accumulation. Measurements have been ongoing since May 2010 and are currently funded through August 2018.
The Integrated Characterization of Clouds, Atmospheric state, and Precipitation at Summit (ICECAPS) is an observational effort on the top of the Greenland Ice Sheet at Summit Station that is designed to comprehensively and operationally characterize properties of the atmosphere, clouds, radiation, and precipitation. The primary scientific motivators are to understand atmospheric variability and properties over Greenland and to understand the atmospheric processes that drive the surface energy and mass budgets in the central Greenland Ice Sheet. The measurement suite includes cloud radar, lidar, microwave radiometer, spectral infrared radiometer, precipitation sensor, sodar, and twice daily radiosondes. Coordinated measurements at Summit (provided by other projects) include broadband radiation and surface accumulation. Based on these measurements a number of derived products are also being developed, including cloud properties, snowfall rates, and surface energy budget terms. The suite of measurements has been intentionally designed to coordinate with similar atmospheric observatories that are operating in Barrow and Oliktok Point (Alaska), Eureka (Canada), and Ny’Alesund (Norway). All of these sites comprise nodes of the International Arctic Systems for Observing the Atmosphere (IASOA) network. The ICECAPS measurements in particular have been ongoing at Summit since May 2010 and are currently funded through August 2018. Support for ICECAPS is provided by the US National Science Foundation, with key support also provided by the US Department of Energy's Atmospheric Radiation Measurement (ARM) program, the US National Oceanic and Atmospheric Administration, and Environment Canada.

Over the past six years ICECAPS measurements and analyses have provided some important impact on the Arctic and Greenland research communities, including the following key highlights:
1) Contributed towards understanding the significant melt event of summer 2012, including the important role of clouds and cloud radiative effects.
2) Developed the first detailed characterization of cloud properties over Greenland, including the presence of liquid water-containing clouds.
3) Determined the annual cycles of all surface energy budget terms and how cloud and atmosphere variability drive these.
4) Determined the annual cycle of snowfall and how that relates to surface height change.
5) Contributed towards developing new measurement techniques and instruments for observing the atmosphere.
6) Provided important observational data for evaluating models and re-analyses in the challenging Greenland domain.
7) Supported satellite validation activities over Greenland, specifically for evaluating cloud properties and surface energy budget process relationships.
8) Provided twice-daily radiosonde measurements for the operational modeling community.
9) Provided key, legacy data sets for the Arctic and Greenland science communities.
10) Educated numerous students in field work and analysis, including four completed degrees to date.

ICECAPS data is publicly available in near-real time via the NOAA Arctic web pages (www.esrl.noaa.gov/psd/arctic/observatories/summit/), which include daily quicklook imagery for most data streams and links to data that are available via an ftp site. Ingested and quality controlled data are available via the ARM data archive (www.archive.arm.gov). The free availability of ICECAPS data and willingness of ICECAPS investigators to collaborate has facilitated broad use of the ICECAPS data sets for numerous applications.

ICECAPS can play a distinctive role for YOPP in that it provides a sophisticated and comprehensive atmospheric data set in a unique polar environment, namely that of the central Greenland Ice Sheet. The
comprehensiveness of the data set and its continuity in time spanning from well before YOPP through the YOPP period is a key asset that can contribute to understanding and constraining the Greenlandic atmosphere and how it is represented in models. Importantly, the interaction between the atmosphere and the Greenland Ice Sheet is a challenge for models to represent but is essential for understanding climatically important processes related to the Greenland surface energy and mass budgets, sea-level rise, and potentially regional ocean circulation. Moreover, ICECAPS and its primary investigators have strong links with other atmospheric observations across the Arctic (including Barrow, Oliktok, Eureka, Ny'Alesund, MOSAiC), providing the possibility for critical pan-Arctic synergy on topics such as cloud processes and radiation. This synergy and coordination is essential for maximizing the benefit of Arctic observations for YOPP objectives. Lastly, ICECAPS investigators will engage with those from the YOPP community to facilitate the use of these measurements and associated data products, and to ensure coordination with key YOPP activities.

ICECAPS will be active during both Arctic Special Observing Periods (SOPs); throughout SOP-NH1 and at least through half of SOP-NH2.

More information at www.esrl.noaa.gov/psd/arctic/observatories/summit/ or icecaps.ssec.wisc.edu.

Timeline

2015-05-01 - 2018-08-25

Regional emphasis

Northern hemisphere: Yes

Southern hemisphere: No

Key project deliverables

Observations from cloud radar, lidar, microwave radiometer, spectral infrared radiometer, precipitation sensor, sodar, and twice-daily radiosondes.
Derived products on cloud liquid water path, cloud microphysical properties, atmospheric water vapor amounts, atmospheric temperature profiles, precipitation rates.

Data management

Long term data is archived at the US DOE ARM archive (www.archive.arm.gov). All data (raw and processed) is also available via the NOAA Arctic data web pages and ftp site (www.esrl.noaa.gov/psd/arctic/observatories/summit/).
Data will also be available on the Arctic Data Center (www.arcticdata.io)

Is data provided to WMO Global Telecommunication System

Yes

Real-time provision

Radiosonde data are automatically uploaded to GTS twice daily in BUFR and TEMP format.