The Summit Radiation Experiment - SURE '07

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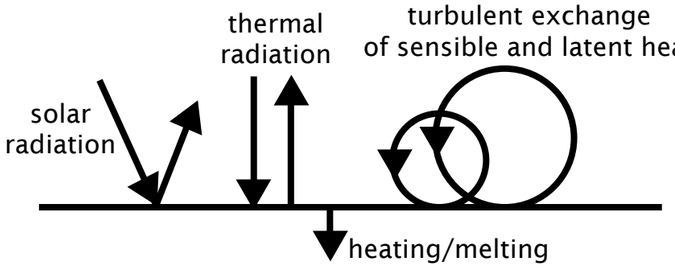
It all starts with radiation

The Sun plays a key role in the Earth's climate - its radiation provides the energy for all climatic processes on our planet. In polar regions, like the Greenland Ice Sheet, **solar** and **thermal** radiation make up the largest part of the energy balance at the surface. The amount of energy available at a snow-covered surface in its turn determines the amount of meltwater that is produced and subsequently can contribute to global sea-level rise.

In order to contribute to the understanding of the interaction between radiation, the atmosphere and the snow surface, the Summit Radiation Experiment SURE '07 has been designed.

Radiation, atmosphere and snow

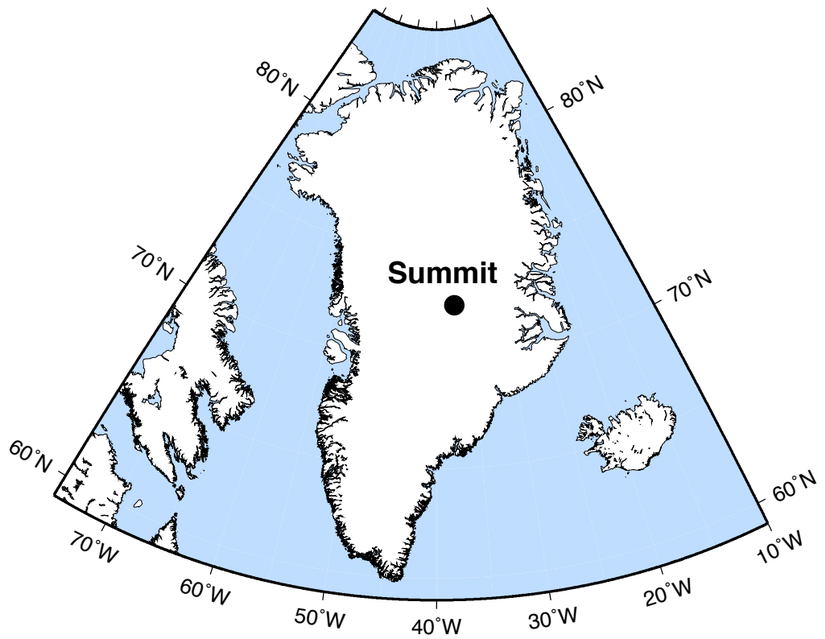
The **energy balance** at the surface consists of several energy fluxes, as shown in the diagram below.



Solar and thermal radiation are the dominant terms in the energy balance over a flat snow surface.

The interaction between solar radiation and snow is a two-way relation: solar radiation provides the energy for snow particles to grow, and larger snow particles reflect less solar radiation.

The amount of solar radiation arriving at the surface depends on the structure of the atmosphere. **Clouds**, for example, block a lot of solar radiation. Clouds also dramatically alter the thermal radiation flux to the surface.



Summit Camp, Greenland

Summit Camp (72°34'N, 38°28'W) is a large polar base located on the highest point of the Greenland Ice Sheet at an altitude of 3200 meter above sea level. The base is maintained by the United States through the National Science Foundation. They provide access from the coastal town of Kangerlussuaq, using ski-equipped Hercules cargo planes.

The clean atmosphere and the homogeneous surface at Summit provide a unique opportunity to fundamentally study the radiative transfer in the Earth's atmosphere.

The experiment will take place in June and July 2007, which means we can collect a 50-day continuous data set of high-quality measurements.

Experimental setup

The experiment will consist of four main parts:

(1) Measuring the complete energy balance of the snow surface using an **automatic weather station**. The weather station measures temperature, pressure, humidity, wind speed and direction, snow accumulation, snow temperature, and turbulent fluxes.

(2) Studying the atmospheric state, by launching **weather balloons**, measuring water vapor columns, and photographing the sky using a **rooftop camera**.

(3) Installing a variety of radiation instruments to study in high detail the incoming and outgoing shortwave radiation: a **spectral radiometer**, and radiation instruments that only record the radiation in specific wavelength bands from satellites (Landsat, AVHRR, MODIS, MISR). This provides a connection to satellite **remote sensing**.

(4) Analyzing the size and shape of **snow crystals** at the surface, using macrophotography and digital post-processing.