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The first year of the GlacioBasis glacier mass and energy balance monitoring program at A.P. Olsen ice cap (NE Greenland)

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The Arctic is expected to undergo a marked warming in the coming decades, and a significant effort is already being focused in collecting climate information on the Greenland ice sheet through the establishment of monitoring networks such as the US Greenland Climate Network (GC-Net), the Danish Programme for Monitoring of the Greenland Ice Sheet (PROMICE) and the Dutch Kangerlussuaq transect (K-transect). Glaciers and ice caps have been identified as the major contributors of mass to sea-level rise in the 21^{st} century. This outlook, and the present scarceness of field observations at glaciers and ice caps in Greenland, prompted the establishment of GlacioBasis, a new monitoring program started in 2008 and funded by the Dancea program at the Danish Ministry for Climate and Energy.

GlacioBasis is now producing a continuous and consistent record of quantitative field observations at the A. P. Olsen Ice Cap (74.6˚ N, 21.5˚ W) and along the outlet glacier flowing down into the Zackenberg drainage basin. Two Automatic Weather Stations (AWS) at different elevations in the ablation zone along the central flowline have been operating since March 2008. The main AWS provides input for complete punctual energy balance, plus snow depth, ice ablation and GPS position. The main AWS transmits quasi real-time data from the whole sensor suite to Copenhagen through an Iridium satellite link both during summertime and, at a reduced data rate, during wintertime. The second AWS collects a subset of parameters and provides the gradients of physical parameters needed for modeling. A third AWS will be set up at the summit of the ice cap during 2009. After validation, AWS data will be made available to the scientific community. During the first field season, a network of 14 ablation stakes has been set up and snow density measured from snow pits. A GPR (Ground Penetrating Radar) survey with a 500 MHz antenna has been carried out to estimate the magnitude and spatial variability of snow accumulation. These investigations will be repeated during the 2009 field season and in the following years.

We show our results from the first year of operation, and the results of distributed modeling of melt over the glacier from the energy balance, which compare well with instrumentally measured ablation at the AWS site. Accumulation values in 2008 resulting from the GPR snow depth survey and the fluctuation of the transient snow line from remote sensing datasets (ASTER and Landsat) will also be presented.

GlacioBasis data complement the datasets produced by the other monitoring programs running in the Zackenberg River catchment area area, such as gauge records of water discharge rates in the river system, snow cover outside of the glacierized area, and climatic data from the AWSs at lower elevations in the Zackenberg valley. This has already proved to be of particular interest during the glacial lake outburst flood that occurred on 26 November 2008, when the lake dammed by the investigated glacier suddenly drained producing a flood which propagated downstream for 35 km before flooding an area of 12 km^2 over the frozen surface of Tyrolerfjord.

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