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Scientific Report
A short visit to the Institute for Snow and Avalanche Research (SLF)

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The aim of our meeting in Davos, Switzerland, was to coordinate the next steps after our joint expedition to Antarctica. During the last Antarctic field season (2012/2013) at Kohnen Station we combined sampling for stable isotope measurements and studies of the snow microstructure. We took images in the near infrared (NIR) combined with translucent snow pit profiles to measure the reflectance and transmission of the slab. Near infrared photography is a fast method to quantify the specific surface area, and density can be calculated from transmitted light in 2D.
In Davos we discussed first results, talked about the time line of my PhD and visited the institute.

Description of the work and main results

Throughout the water cycle, water changes its isotope composition continuously. Therefore the stable water isotopes in an ice core show a seasonal signal. At lower temperatures the isotopic ratio is lighter than at warmer temperatures (Dansgaard 1964).
In ice cores, the seasonality of stable water isotopes can be used to date the cores. But snow pit studies in Antarctica show that the isotopic signal in snow seems to be too periodical compared with their depositional events. Within my PhD I will compare the isotope signal and deposition events from snow pits around Kohnen station in Antarctica to show if the seasonality of stable water isotopes in the snow is a depositional signal or is generated after deposition, possibly due to snow metamorphism.

Analyzing the images from our snow pits in the area of Kohnen, Antarctica, we can identify different depositional events. Snow profiles are often purely described by physical and index properties, as a one-dimensional line. This is the standard method in current snow science. However, in the early 1960s, perennial snow was rather analyzed as geologic strata, with the main difference that a snow pack requires often a two-dimensional description. Here, we started to discuss and identify depositional events based on the NIR-image and translucent image from one of our snow pit profiles. We identified the events of deposition and discussed the used method.

As soon as the snow samples, taken in Antarctica, will reach Bremerhaven (preliminary date April 2013) we will start with the isotopic measurements at AWI in Bremerhaven. The CT-measurements at AWI and SLF should be started with the samples taken next to these isotope snow samples.

We also had a look at specific crusts which can be identified perfectly from the images and discussed their genesis. This crusts are horizontally arranged and in some cases crossing layers. Their genesis is not yet understood in detail. It seems to be that they are not following the surface shape, so they can’t be of aeolian origin.

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Future collaboration with host institution

Together we will continue the work we had started in Antarctica. Martin Schneebeli will supervise the snow related part of my PhD work.
The identification of different snow deposition events from the NIR-images, as a next step, should be done by each of us first independently, and then we will combine our results, to minimize subjectivity. We plan a next meeting in spring 2013 to compare and discuss our results.

Projected publications resulting or to result from your grant

In the paper I am working on, and for which the meeting was useful, I will compare the signal of stable water isotopes and the identified depositional events. It is the question if the seasonality of the stable water isotopes in the snow is a depositional signal or appears due to metamorphism in the snow.