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Quantifying the influence of refreezing melt water on the mass balance and runoff of Freya Glacier in Northeast-Greenland

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Refreezing of melt water is known to play an important role in both the mass and energy budgets of Arctic glaciers as internal accumulation leads to a systematic error in mass balance calculation if it is not accounted for. A variety of measurements with the aim of quantification of refreezing of melt water have been done in August 2011 on Freya Glacier, 6 km long valley glacier situated on Clavering Island, 10 km southwest of the Zackenberg research station (ZERO), situated on the northeast coast of Greenland. Its surface area is 6,6km2, reaching from 330 m to 1250 m a.s.l. and is mainly oriented to NW. Since 2007, the mass balance of Freya-Glacier is measured directly, using around 15 stakes, which represents a unique database in this area. Besides surface mass balance, firn and ice stratigraphy in shallow cores and with GPR, also discharge measurements have been done. Thermistor strings have been drilled into the ice and mounted on poles for continuous data collection of ice- and snow temperatures during the winter season. Furthermore, an AWS near the ELA has been set-up for measuring all terms needed for energy balance calculations. Shallow ice cores (2m) and snow pits serve as point information in combination with data collected by a 900Mhz GPR-profile along the flow line and the SI-zone to identify annual SI-Layers. Mapping of the retreat of the snowline with GPS, frequent reading of the ablation stakes and snow depth in combination with discharge measurements have been carried out through the ablation season, to get information about meltwater retention on a basinscale. These data serve as input for a thermodynamic, physical based mass-balance and runoff model to investigate melt water retention and water balance on a basin scale.

In this poster we present first results of data analysis, especially on bias and variability between discharge measurements and stake-based mass balance calculations. Besides that, a comparison between these measurements and data from the AWS is shown. Mass balance 2010/2011 is shown in comparison to earlier data.