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Exploring the relationship between snow surface height variations and the isotopic composition at EastGRIP

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Quantifying spatial and temporal changes of the snow surface height are important for the modelling and understanding of processes that control the mass balance of ice sheets, but also for understanding the palaeoclimate signal stored in the isotopic composition of ice cores. However, previous estimates of surface height changes are often limited to single point measurements and thus cannot provide a two-dimensional resolution.

Here, we present first results from a field study in which we applied a novel approach to investigate the spatial and temporal changes of the snow surface height at the drilling site of the East Greenland Ice-Core Project (EastGRIP). Our approach is based on a camera system which was mounted on a sledge and dragged along a 40 m long transect aligned perpendicular to the prevailing wind direction. Images of the predefined area of 200 m^2 were taken every day of the 80-day field period. The images were processed to daily digital elevation models. To compare the surface height variations to variations in isotopic composition (δ^{18}O and δD) of the surface snow, snow samples were taken at several positions along the same transect throughout the period of investigation.

The surface height data indicate a changing snow surface from small-scale dunes and troughs in the beginning towards a flatter surface in the end of the field season. Furthermore, we observe a strong anti-correlation between the relative initial snow height and the amount of accumulated snow. This indicates that not only precipitation is forming the snow surface but also meteorological parameter as e. g. wind can cause changes in the snow surface height. The combination of the surface height data with the isotopic composition allows us to directly relate changes in surface height to the spatial and temporal variability of the isotopes.

Our approach provides a deeper insight in the relationship between relative snow surface height and isotopic composition and is therefore important for an improved understanding of palaeoclimatic data derived from ice cores.