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## Terrestrial Radar Interferometry – A Method to Detect Millimetric Snow Glide Deformation Hours to Days Before Wet Snow Avalanche Release

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The use of microwave remote sensing for the determination of snow properties has a long tradition.

In the past few years, lightweight coherent radar interferometers were developed and brought to an operational level allowing fast and reliable measurements on different surfaces. While initially the main purpose was to detect and measure small displacements on the earth-surface related to geologic and geomorphologic processes (landslides, rockslope deformations etc.), applications in the field of ice and snow are currently emerging. Using short repetition intervals between few minutes and few seconds, coherent observations of snow and ice are possible, supporting applications as glacier velocity mapping and monitoring or the detection of the small precursory deformations in the wet snow pack leading to full-depth snow glide avalanches. Further on, using the phase coherence, disturbances of the snow surface induced by avalanches can be detected and mapped, and this even during heavy snow and rainstorms with poor optical visibility.

We present results of snow and ice campaigns performed with the Ku-band (17.1-17.3 GHz) Gamma Portable Radar Interferometer (GPRI). The examples shown include snow glide and the related avalanche activity on the Dorfberg area near Davos in 2014 and 2015. The interferometric snow glide measurements in 2015 could be validated

with conventional geodetic methods. Continuous measurements with repeat intervals of 2 minutes allowed tracking of the snow pack gliding over time. Results show, that patches of differential glide movement appear distributed over the slope. Snow glide activity (number of single patches and velocity of snow glide) increased with increasing air temperatures, leading to a large number of full depth snow glide avalanches in spring. Snow glide resulting in avalanches is measurable hours, sometimes even days before avalanche release.

We give an overview of the conclusions drawn from the campaigns at Davos Dorfberg Hasliberg, and Fluelapass, and discuss potential, limitations, and open questions including questions concerning interferometric phase changes during transitions from dry to wet snow.