High frequency GPR measurements in comparison to detailed snow profiles

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Introduction

❄ Snow stratigraphy in Antarctica is highly complex.
Accumulation on a yearly scale is often masked by intermediate erosion and deposition events.

❄ We performed GPR measurements at Kohnen Station, which is suited for investigating the complex stratigraphy due to its high accumulation rate.

❄ The GPR measurements were compared to detailed snow profiles, translucent profiles and near-infrared photography of the snow pits.

Ground Penetrating Radar in use

Materials and Methods

❄ High frequency GPR system (1.6 GHz)

❄ Parallel GPR profiles

❄ Detailed snow profiles

  ❄ Density measurements

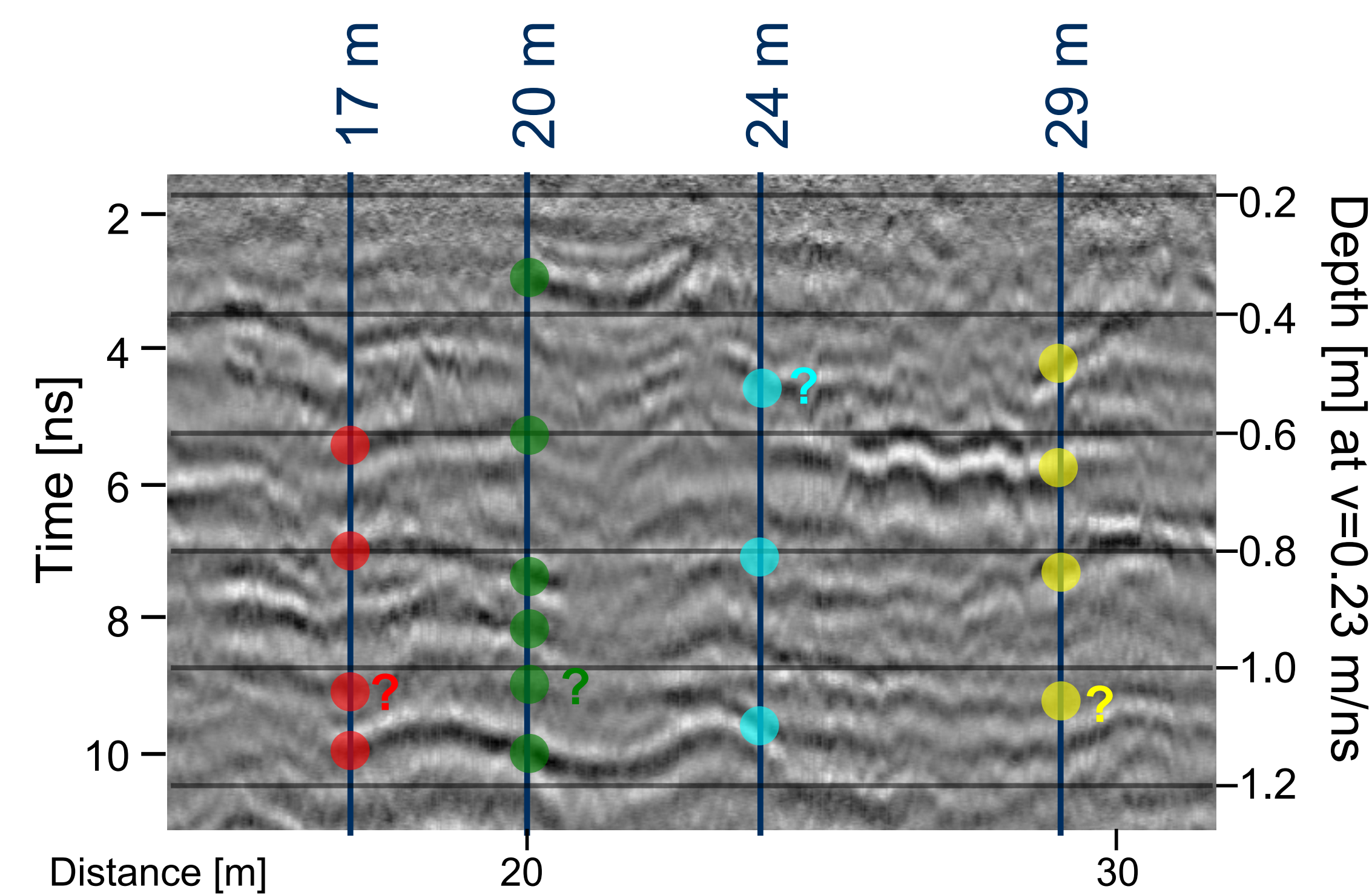 ❄ Translucent and near-infrared photography

Results

Fig. 1: Parallel GPR tracks; GPR radargrams 1 and 2 are put on top of each other to receive an average of both; highly reflective features are visible throughout both radargrams.
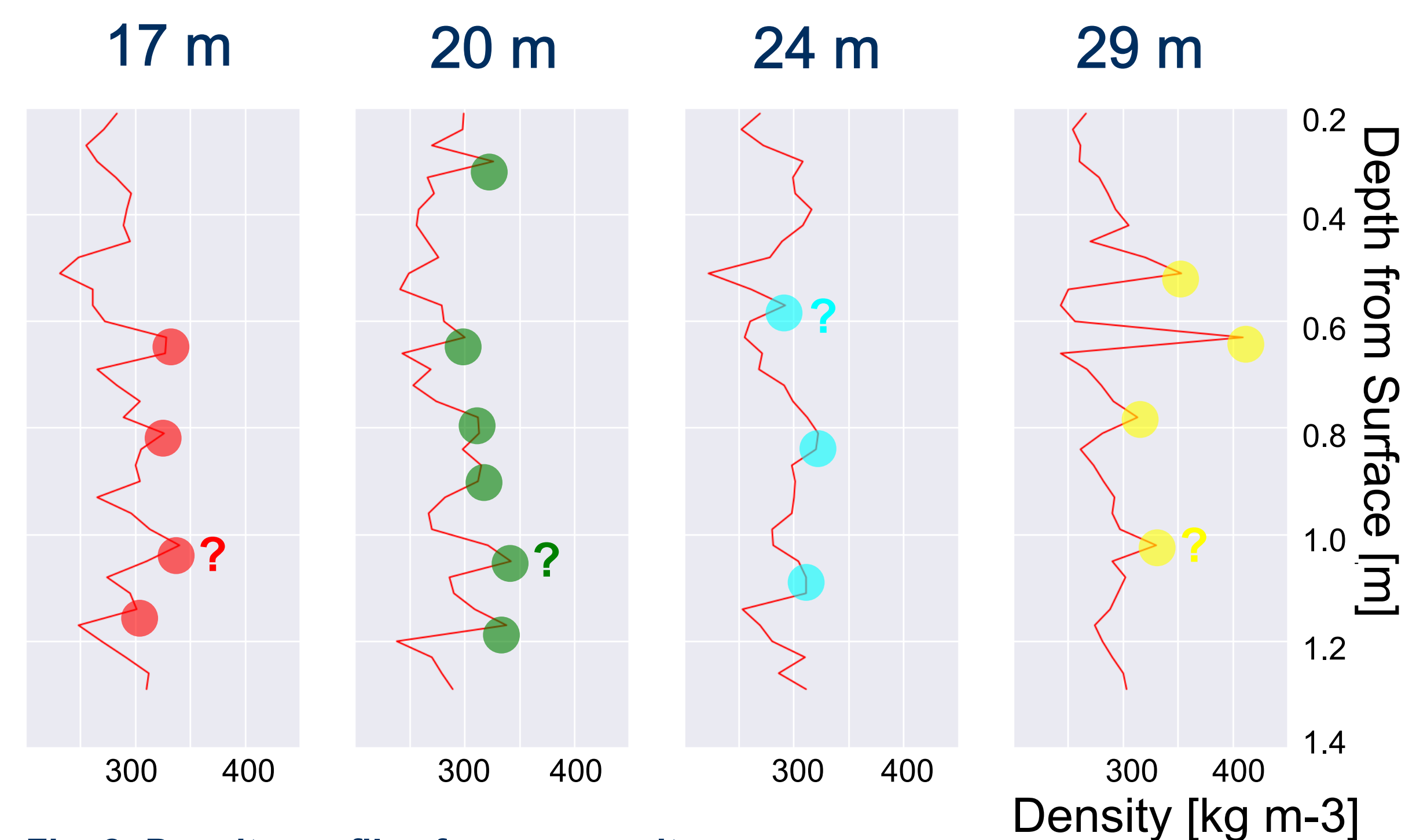
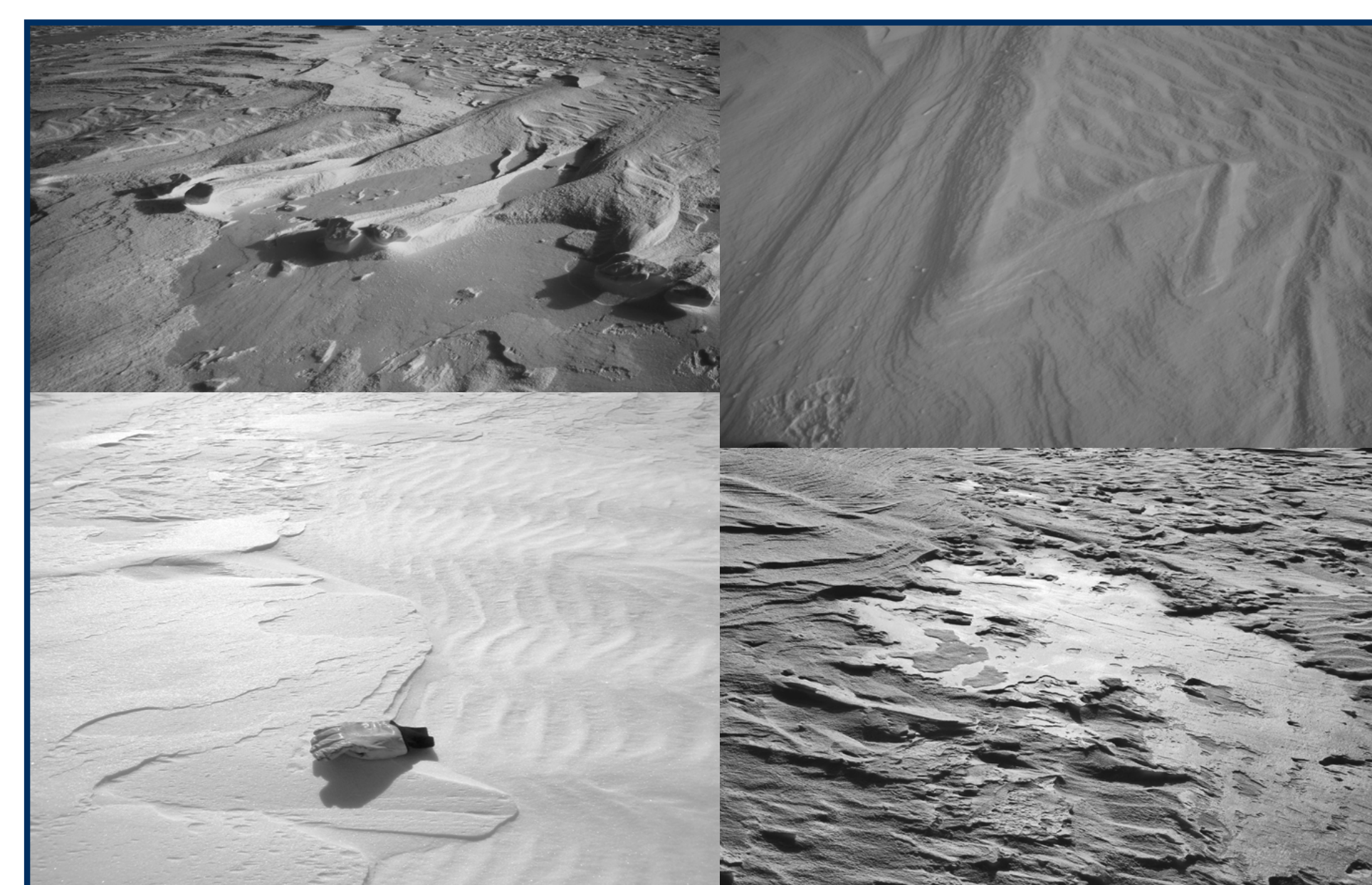Fig. 2: Density profiles from snow-pits; corresponding layers are marked in matching colors.

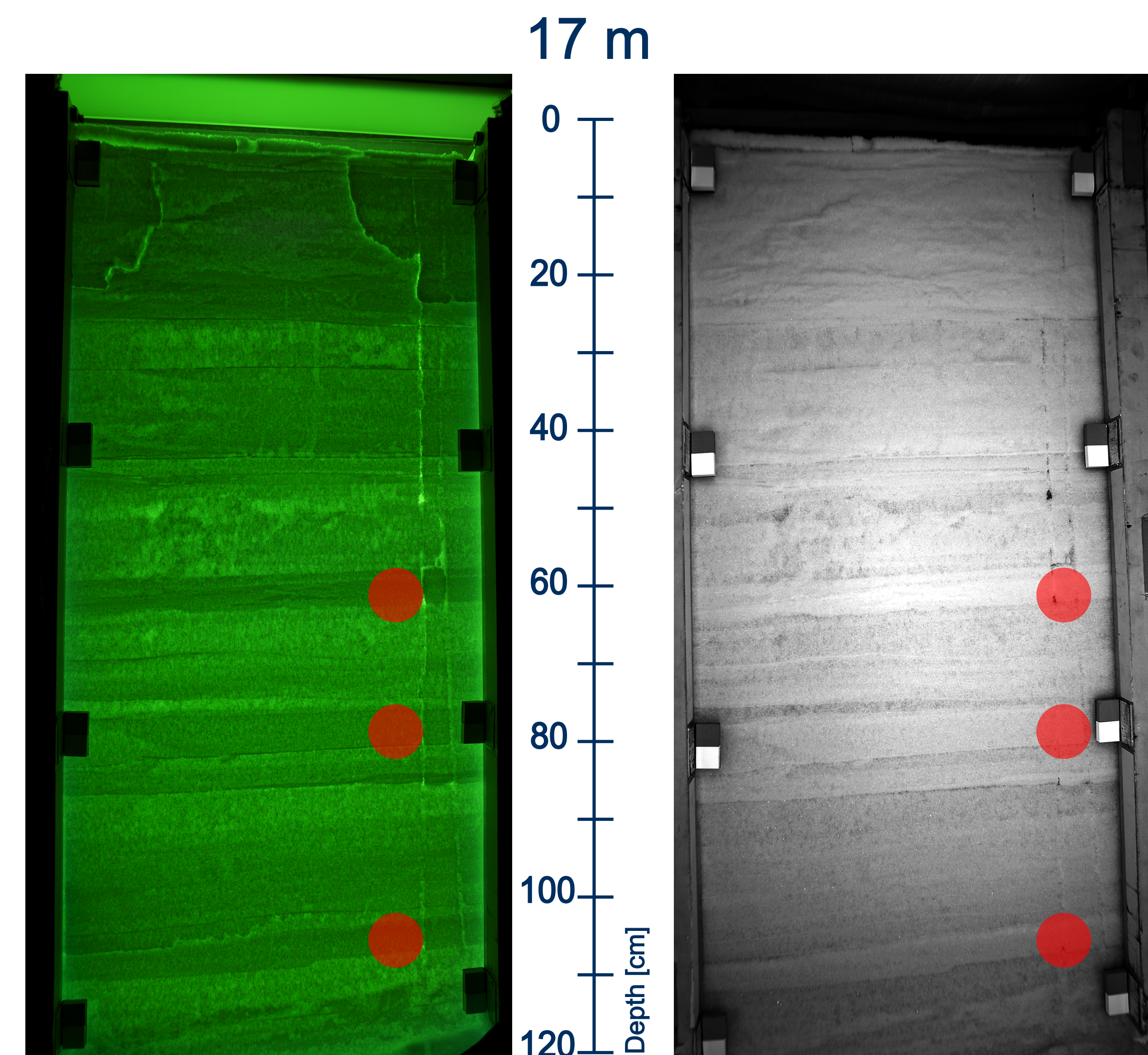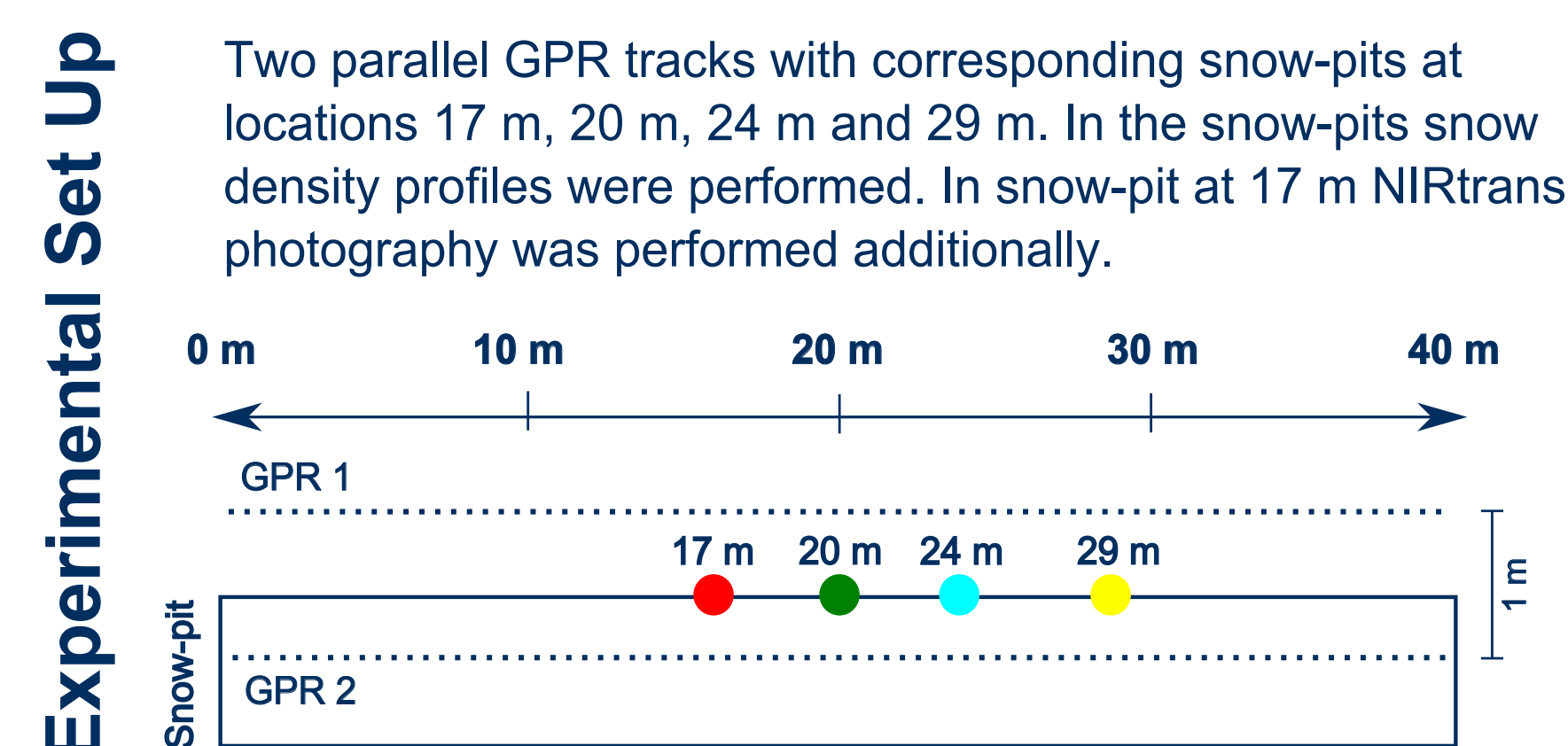Fig. 3: Diversity of snow surface structures

Experimental Set Up

Two parallel GPR tracks with corresponding snow-pits at locations 17 m, 20 m, 24 m and 29 m. In the snow-pits snow density profiles were performed. In snow-pit at 17 m NIRtrans photography was performed additionally.

0 m   10 m   20 m   30 m   40 m
GPR 1
17 m 20 m 24 m 29 m
Snow-pit
GPR 2

Fig. 4: Translucent photography

Fig. 5: Near infrared photography

17 m

Conclusion

❄ It is difficult to make a good connection between the different methods from correlation, but comparison on a visual basis is possible.

❄ Snow stratigraphy varies within a small scale (cm).

❄ Highly reflective stratigraphic features can be followed through parallel GPR tracks and can then be related to layers that are apparent in the density measurements.

Outlook

❄ GPR has potential for visualizing Antarctic snow stratigraphy.

❄ Interpretation of radargrams not yet completely understood.

❄ A 3D grid application and the combination with Snow Micro Pen

Acknowledgments