



Snow metamorphism – past, present, and future

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During the first decades of the 20th century snow scientists very soon recognized the importance of snow metamorphism on many if not all properties of snow on the ground. Moreover, the driving mechanisms behind snow metamorphism were also rapidly unveiled. Despite this early knowledge, further insight into the process was hindered by the fact that almost exclusively destructive methods of observations had to be used. These allowed only very limited access to study either the aggregates of particles themselves or their evolution with time. Indeed, scientists knew that in fact the configuration of the ice and air spaces in snow, that is snow microstructure, needed to be investigated to better understand snow metamorphism and its implications. So, for many decades, improvements in our understanding of this phenomena relied on very simplified models of the real microstructure, often based on an regular assembly of spherical particles. Only recently powerful techniques such as X-ray tomography started to reveal the full complexity of snow microstructure. Using these techniques in cooled laboratories let us finally investigate the time evolution of snow microstructure on one and the same snow sample. The presentation will review the developments of our understanding of snow metamorphism from the early stages until today. The interdisciplinary aspect that was and will always be involved is emphasized. Finally, we will address the challenges posed by newest experiments on our ability to model metamorphism in snow-cover simulation models. Indeed, the heavily parameterized process, mainly based on properties of single particles such as size, will have to be reformulated in light of more appropriate parameters that we just start to discover and understand.