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DEGREE:	Philosophiae Doctor
FACULTY:	Faculty of Mathematics and Natural Sciences
DEPARTMENT:	Department of Geosciences
AREA OF EXPERTISE:	Remote Sensing of the Cryosphere
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DISSERTATION TITLE: *Improved measurements of cryospheric processes using advanced photogrammetry*

Et varmere klima påvirker kryosfæren som er frossent vann på Jorda slik som isbreer, iskapper og permafrost. Studier av kryosfæren er dermed viktig for å forstå klimaendringer. I denne avhandlingen brukes fotogrammetri for å forstå endringsprosesser i kryosfæren, og det er utviklet nye metoder som muliggjør en forbedret målingsmetode for å forstå pågående prosesser i den Arktiske kryosfæren utfra tilgjengelige data fra satellitter og fotomateriale.

The Arctic is experiencing some of the most drastic warming in the world. Landforms with frozen water (such as glaciers and permafrost, constituting the cryosphere) respond relatively rapidly to changes in weather patterns, temperature, and precipitation. As result of ongoing climate change, we see decreasing sea ice extent, thinning and retreat of glaciers, and thawing permafrost. Therefore, understanding the processes in the cryosphere is critical to predicting and projecting the effects of future climate change.

Photogrammetry, the science of making geometric and radiometric measurements using photographs, has a century-long history of providing data for geoscience research. Stereo series of pictures allow precise measurements of three dimensional terrain surfaces. Furthermore, multiple acquisitions through time provide a unique ability to study the evolution of ongoing processes with unprecedented spatial resolution.

In this doctoral thesis, Luc Girod develops and applies leading edge photogrammetric methods (e.g. structure from motion) to the measurement of cryospheric processes through a variety of scales. At the finest resolution, processes operating on sub-centimeter per year scale were uncovered within sorted circles on Svalbard. At the coarsest resolution the new method development on space-borne images has unlocked data from the globally free ASTER satellite archive from 2000 to today for studies of precise terrain changes. Findings in Girod's work provides the methodological framework to estimate glacier elevation and volume changes at annual time scales using both the most modern data acquisition systems, and century-old historical archive photos. These methodical advancements provide the means for necessary observations to better understand critical changes in the frozen (and unfreezing) parts of our planet.