Evaluation of snow water equivalent via acoustic experiments

Domain: Snow hydrology  
Advisor: Prof. Paolo Perona  
Supervisors: Antoine Petrelli, Dr. Benoît Crouzy

Character of the work (Basic Research, Applied Research, Engineering): AR  
Type of work (Experimental, Numerical, Theoretical): E

No of students: 1,2  
Requested Courses:  
Requested skills: Good knowledge of time series analysis and computer programming (LabView and Matlab).

Description:  
Nowadays, the most common way to determine snow water equivalent on the field is to dig a hole in the snow and measure density and depth. Some studies have focused on finding snow properties indirectly through sounding using different range of wavelength. The idea is to extract snow properties from the reflection data due to snow / ground surface, data collected at the top of the snowpack, and basically less invasive. Few studies focusing on acoustic sounding investigated the relationship between the reflection of snow layers and snow properties, and how to extract from such and the snow density information the related water equivalent. The long term aim of this research is to obtain a continuous measure of the water equivalent.

This Master thesis will support such a research by initially exploring efficient ways to assess acoustic parameters for the sounding of the snowpack under different snow conditions, and then improve the relationships between the characteristics of the reflection and snow properties to calculate snow water equivalent. Experiments in the field after new snowfall are also foreseen as part of the duties, as well as helping mounting an instrumentation setup accounting for distance measurement sensors for the snow height, temperature and relative humidity sensors, etc.