It is generally assumed that snow depth exhibits a large spatial variability, whereas snowpack density changes over space are much less. Snow studies typically want information about snow water equivalent (SWE). Manual snow surveys thus aim to collect as much snow depth data as possible, and rely on a few density measurements that are considered sufficient to estimate the distribution of SWE. However, mountainous terrain is characterized by complex topography which affects the evolution of the physical properties of snowpack, and consequently snowpack density varies spatially.

Two intensive snow density surveys (9 days in total) were conducted in February and April of 2010 in the Tena valley of the Spanish Pyrenees Mountains. More than 160 measurements were taken in each survey to investigate the spatial variability of snow density, and these were related to several parameters such as elevation, slope, aspect, snow depth and presence of forest cover. The measurements show that snow density varies noticeably over space. In some cases differences were greater than 100%. The February survey illustrated a larger spatial variability than the survey conducted in April. Although, there are significant correlations between snow density and elevation, snow depth, slope aspect and forest cover at the local scale; it is difficult to adequately model snow density across the entire basin. Therefore, snow surveys must consider snow density as a spatially variable. Understanding spatial density changes is necessary to obtain reliable estimates of SWE over a given area.