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Alpine areas are strongly affected by increasing temperatures. In the Swiss Alps, 90% of the glaciers have a negative mass balance, which leads to the exposure of fresh rocks on unvegetated land surfaces. Young soils developing in glacier forefields are accumulating C, probably more than soils in old 'mature' ecosystems, where higher C inputs are balanced by higher decomposition rates.
The main goal of this tracer study is to investigate the influence of initial soil development on the C and N cycling in a glacier forefield. Plant and microbial communities change with soil age, and weathering as well as C accumulation alter the 'activity' and 'sorptivity' of mineral surfaces, which all affect soil organic matter (SOM) turnover. To identify the fate, the turnover and the transformation of new litter C and old SOM in different soil ages we added isotopic labelled litter (2.5g Leucanthemopsis alpina with 13C = +110%■ and 15N = +900%■) in June 2009 along a chronosequence (10yr, 70yr, 120yr & >1000yr) at the granitic Damma Glacier forefield, Switzerland. At every point along the chronosequence soil respiration was measured as well as gas and soil water samples were taken every week June to October 2009. Both contents and isotopic signatures of C and N were analysed in SOM, leached DOC and respired CO2.
First results show an exponential increase in soil C within each soil age and a gap between the different soil ages. The annual rates of soil respiration, compared to net C accumulation, indicate that the latter is an order of magnitude lower than the annual flux of C through the system. Soil respiration increased five fold with increasing soil age. The signal of the labelled litter in soil-respired CO2 declined rapidly within the first month after litter addition in the whole glacier forefield. At the younger sites, the contribution of litter to the soil CO2-efflux was three times higher compared with the older sites. This must be the result from higher respiration rates of old SOM as well as root respiration by the greater stock of living biomass at the older sites. Leaching of DOC increased similar to soil respiration along the chronosequence. In summary, the development of C- and N cycling coincides with increasing biological activity. Only a small fraction of the plant C inputs is accumulating in soils.