Geophysical Research Abstracts
Vol. 18, EGU2016-2773, 2016
EGU General Assembly 2016
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A more holistic understanding of soil organic matter pools of alpine and pre-alpine grassland soils in a changing climate

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In southern Germany, the alpine and pre-alpine grassland systems (> 1 Mio ha) provide an important economic value via fodder used for milk and meat production and grassland soils support environmental key functions (C and N storage, water retention, erosion control and biodiversity hot spot). In addition, these grassland soils constitute important regions for tourism and recreation. However, the different land use and management practices in this area introduce changes which are likely to accelerate due to climate change.
The newly launched SUPSALPS project within the BonaRes Initiative of the German Ministry for Education and Research is focused on the development and evaluation of innovative grassland management strategies under climate change with an emphasis on soil functions, which are on the one hand environmental sustainable and on the other hand economically viable.
Several field experiments of the project will be initialized in order to evaluate grassland soil functioning for a range of current and climate adapted management practices. A multi-factorial design combines ongoing and new plant-soil meso-/macrocosm and field studies at a multitude of existing long-term research sites along an elevation gradient in Bavaria.
One of the specific objectives of the project is to improve our knowledge on the sensitivity of specific soil organic matter (SOM) fractions to climate change. Moreover, the project aims to determine the processes and mechanisms involved in the build-up and stabilization of C and N pools under different management practices. In order to derive sensitive SOM pools, a promising physical fractionation method was developed that enables the separation of five different SOM fractions by density, ultrasonication and sieving separation: fine particulate organic matter (fPOM), occluded particulate organic matter (oPOM>20μm and oPOM<20μm) and mineral associated organic matter (sand and coarse silt, > 20 μm; medium + fine silt and clay, < 20 μm). Methods to further characterize SOM (NMR, 13C and 15N stable isotopes, SEM, NanoSIMS) and the dynamics of plant and microbial communities will help us to fill knowledge gaps in the interaction of C and N dynamics in alpine and pre-alpine grassland soils and the rhizosphere under climate and land management changes.