



## **Driving factors of carbon dynamics in grassland soils of Southern Germany between 1986 and 2016**

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The soil database of long-term monitoring of grassland soils (1989-2016) in Bavaria was used to study changes in soil organic carbon (OC) contents and identify controlling factors. The use of a Random forest model showed that the main controlling factors were climatic parameters: i) summer temperature change, ii) summer precipitation change + winter temperature change, iii) and total precipitation change. Other factors, such as management practices (addition or not addition of organic fertilizer), grassland type (meadow, hay meadow and pasture), and topographic and genetic parameters (elevation + pH + clay content + initial OC content) were other relevant, but minor controlling factors for OC contents in grassland soils. The development of soil OC stocks in the monitored grassland sites showed differing trends: 15 % showed an increase, 25% a decrease and 60% remained constant. The changes (increase or decrease) observed in OC stocks were found mainly for Alpine and Pre-alpine soils. The addition of organic fertilizers led to an increase of the OC stocks. Our results demonstrate the complexity of climate change effects, where the role of seasonal climatic parameters (summer temperature, winter temperature, winter rain and summer rain) on soil OC stocks are different depending on management practices and soil type.