



Parent material geochemistry as a driver of contrasting patterns of plant matter input and soil organic carbon stocks in alpine ecosystems

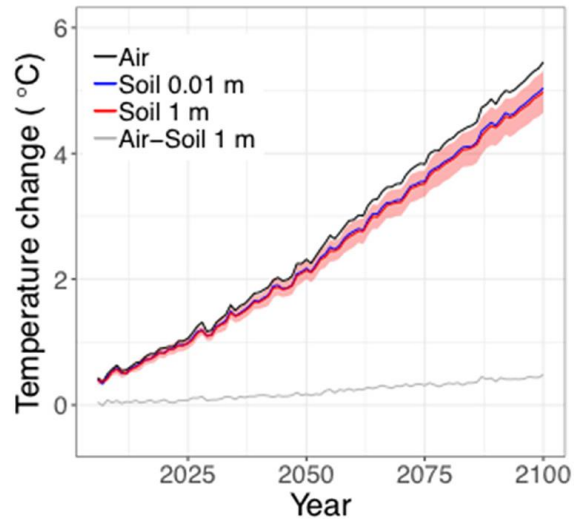
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Soil organic carbon (SOC) stabilization in changing environments

- SOC as an important player in terrestrial C cycle
- Climate change → warmer soil temperatures predicted
- Need for a more comprehensive understanding of the drivers of SOC stabilization
- Pivotal role of geochemical parameters such as **parent material**, but not integrated in ESM as predictor of SOC



Soong et al. *Biogeosciences* (2020).

SOC stabilization in alpine ecosystems

➤ SOC stabilization mechanisms

Lützow et al. *European Journal of Soil Science* (2006).

Selective
preservation

Spatial
inaccessibility

Interactions with
mineral surfaces
and metal ions

➤ Alpine ecosystems

- highly vulnerable to climate change

- insight in relatively young soils

Hagedorn et al. *Biogeochemistry* (2010).

Dahms et al. *Geomorphology* (2012).

➤ Research Questions

Can soil organic carbon concentrations in alpine ecosystems be better predicted using soil fertility or soil mineralogy parameters?

- What effect do differences in parent material (and thus soil geochemistry) have...
 - ...on the extent of variation in biomass input (above- and belowground)?
 - ...on soil organic carbon stocks?

5 sites in alpine ecosystems with varying parent material



Map: <https://www.stepmap.de/karte/stumme-karte-alpen-VByqxOw9Vc> (27.10.2020)

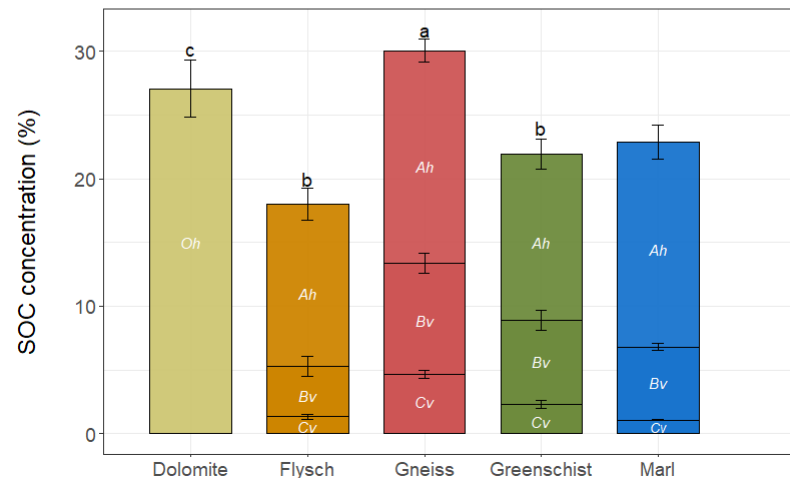
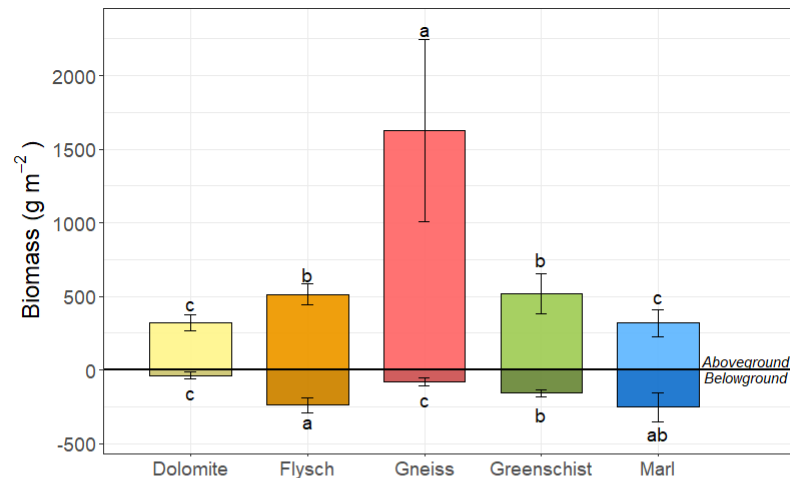
- **Gneiss** (Siliceous, felsic, metamorphic)
Dischma Valley, Davos / Switzerland
- **Greenschist** (Siliceous, mafic, metamorphic)
Crap da Radons, Bivio / Switzerland
- **Flysch** (Intermediate, sedimentary)
Val Curtegn, Savognin / Switzerland
- **Dolomite** (Calcareous, Mg-rich)
Region Zugspitze / Germany
- **Marl** (Calcareous, sedimentary)
Region Zugspitze / Austria

Biomass input and SOC concentration across geologies

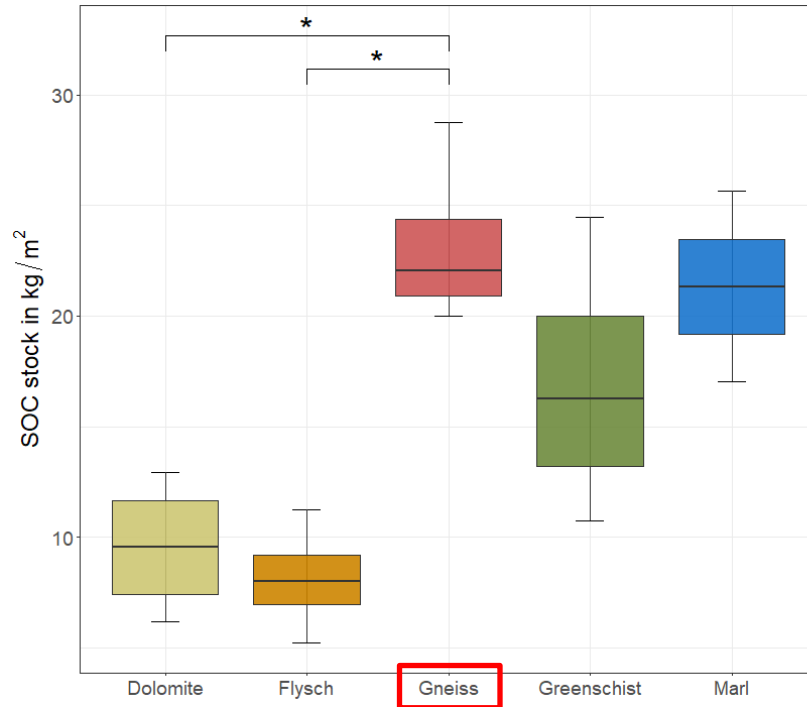
- Highest aboveground biomass input at Gneiss site
- Counteracted by high belowground biomass at Flysch and Marl site?
- SOC concentrations per horizon → most SOC in organic horizon at Dolomite site



Where to expect the highest SOC stocks?

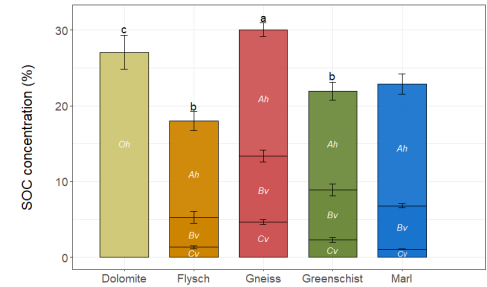
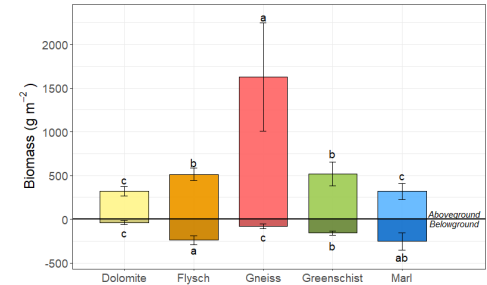
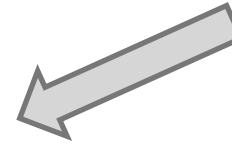


Largest whole-profile SOC stocks on Gneiss

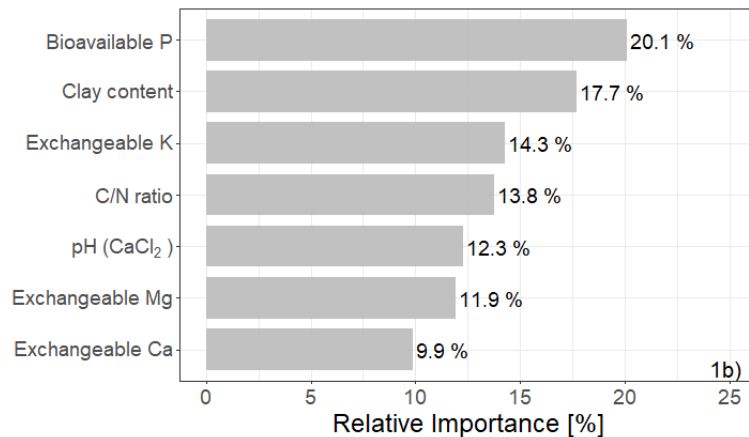
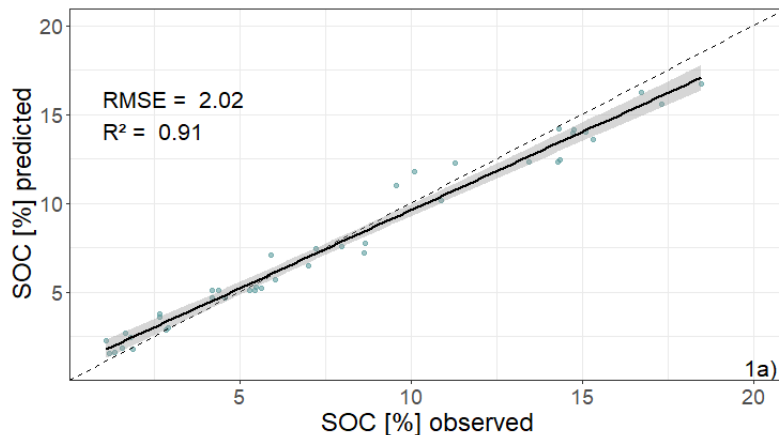


Geology

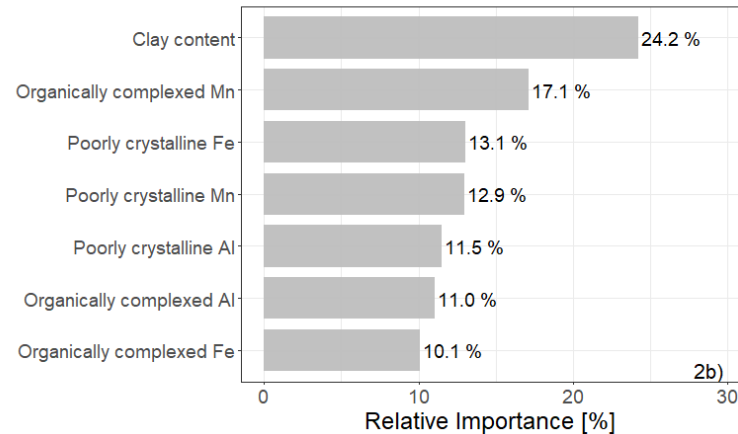
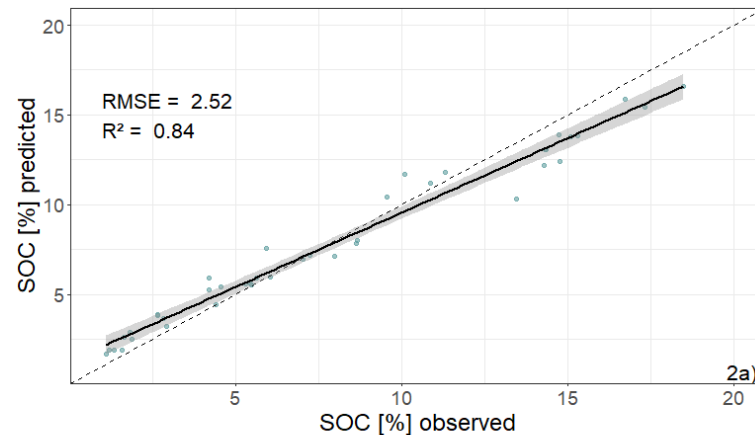
- Dolomite
- Flysch
- Gneiss
- Greenschist
- Marl



Soil Fertility Model



Soil Mineralogy Model



Outlook

- Above- and belowground C input
- Integration of soil moisture
- Mineral-associated organic carbon → assess drivers of stable SOC

Better understanding of SOC stabilization mechanisms and role of soil geochemistry



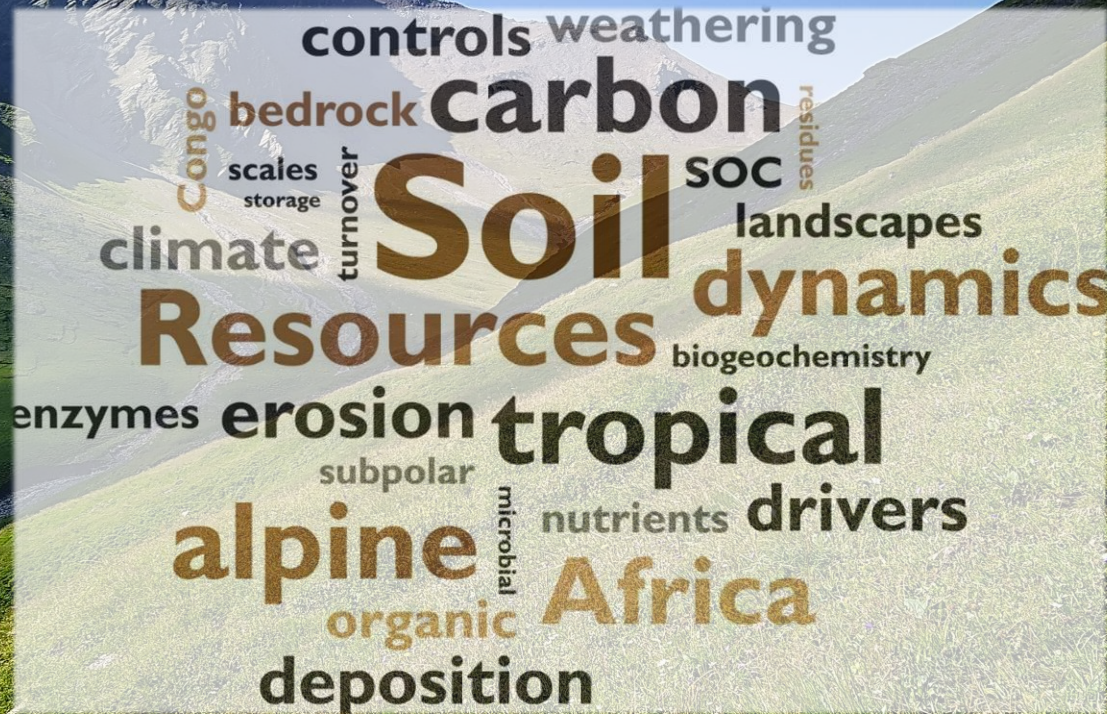
Integration of soil geochemistry as predictor for soil organic carbon in ESM models



More accurate predictions how SOC will change as response to climate change



Thank you!



Thanks for voting!

