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Collembolan trait patterns with climate modifications along a European gradient: the VULCAN case study

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Introduction

What are the links between collembolan functional traits and climatic gradients at a large scale?

Gradients as temperature are known to play a role in collembolan communities sorting. For example, in the VULCAN project, long-term adaptations have been shown in the taxonomic structure of collembolan communities (Fig. 1).

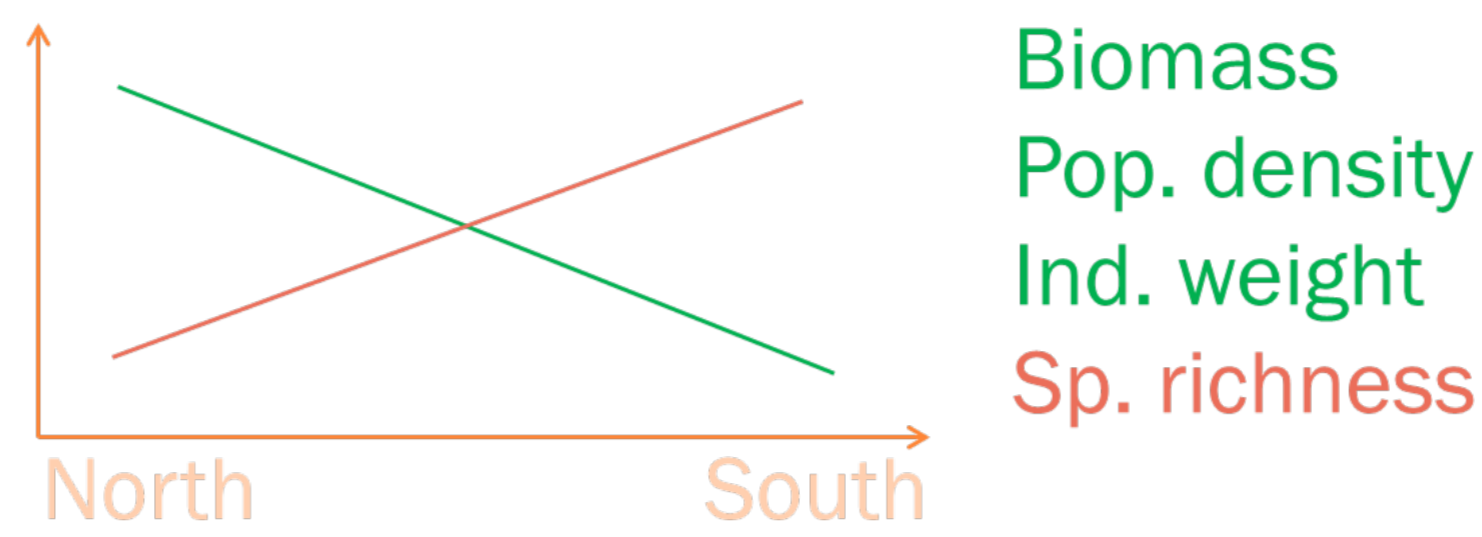
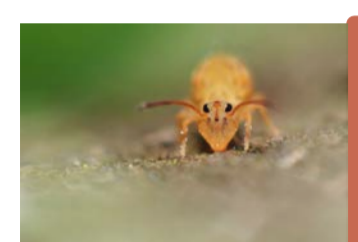


Fig. 1 – Latitudinal cline in taxonomic structure of collembolan communities (from Petersen 2011).

Work hypothesis

- ❑ We shall be able to establish functional profiles in collembolan communities along a North to South climatic gradient.
- ❑ At a large scale, climatic filtering will drive functional profiles characteristics.
- ❑ In the most constrained areas, functional profiles will converge and functional richness will decrease.



Methods

The VULCAN sites

- Shrublands
- Fauna samples include plant leaves, soil surface and soil
- 61 collembolan species
- North/South opposition in climate and in soil characteristics

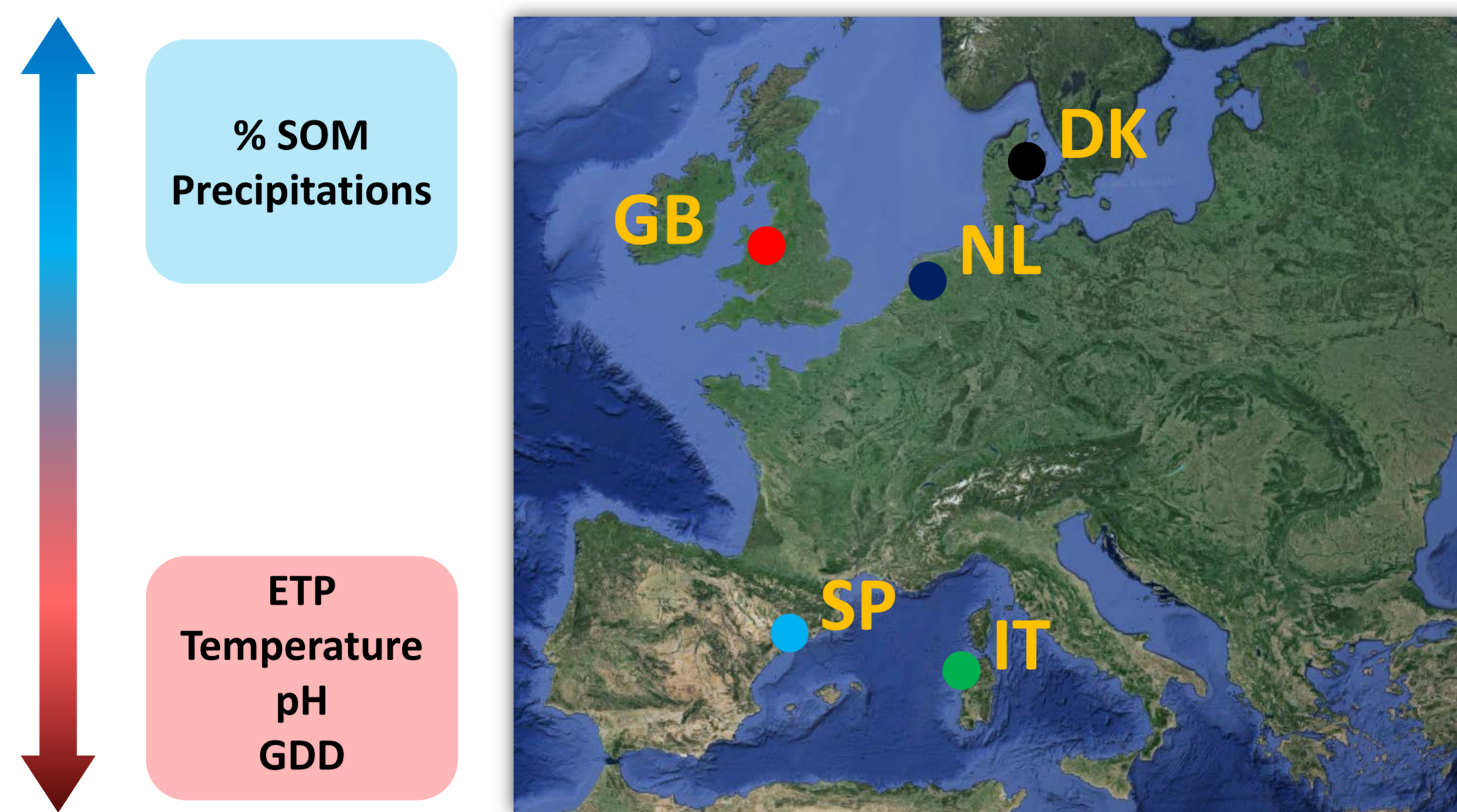


Fig. 2 – Location and main characteristics of the five VULCAN sites (from Beier *et al.*, 2009).

The trait-based analysis

- 2 collembola traits databases were used:
- BETSI.cesab.org
 - SoilBioStore.au.dk

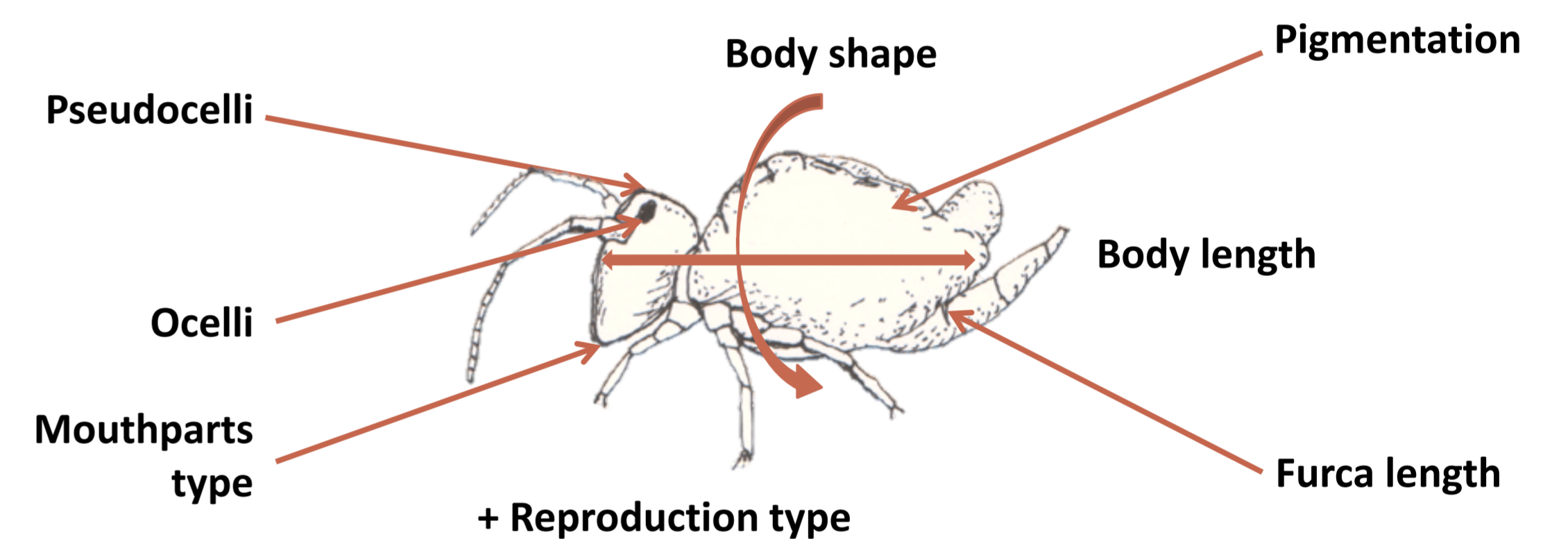


Fig. 3 – Traits collected from the databases and used in the analysis.



Results

Fig. 4 – Principal Component Analysis (PCA) representing Community Weighted Mean (CWM) of each trait and functional indices calculated for each community (n=25).

Axis 1 = 31.7% ; axis 2 = 25.5%

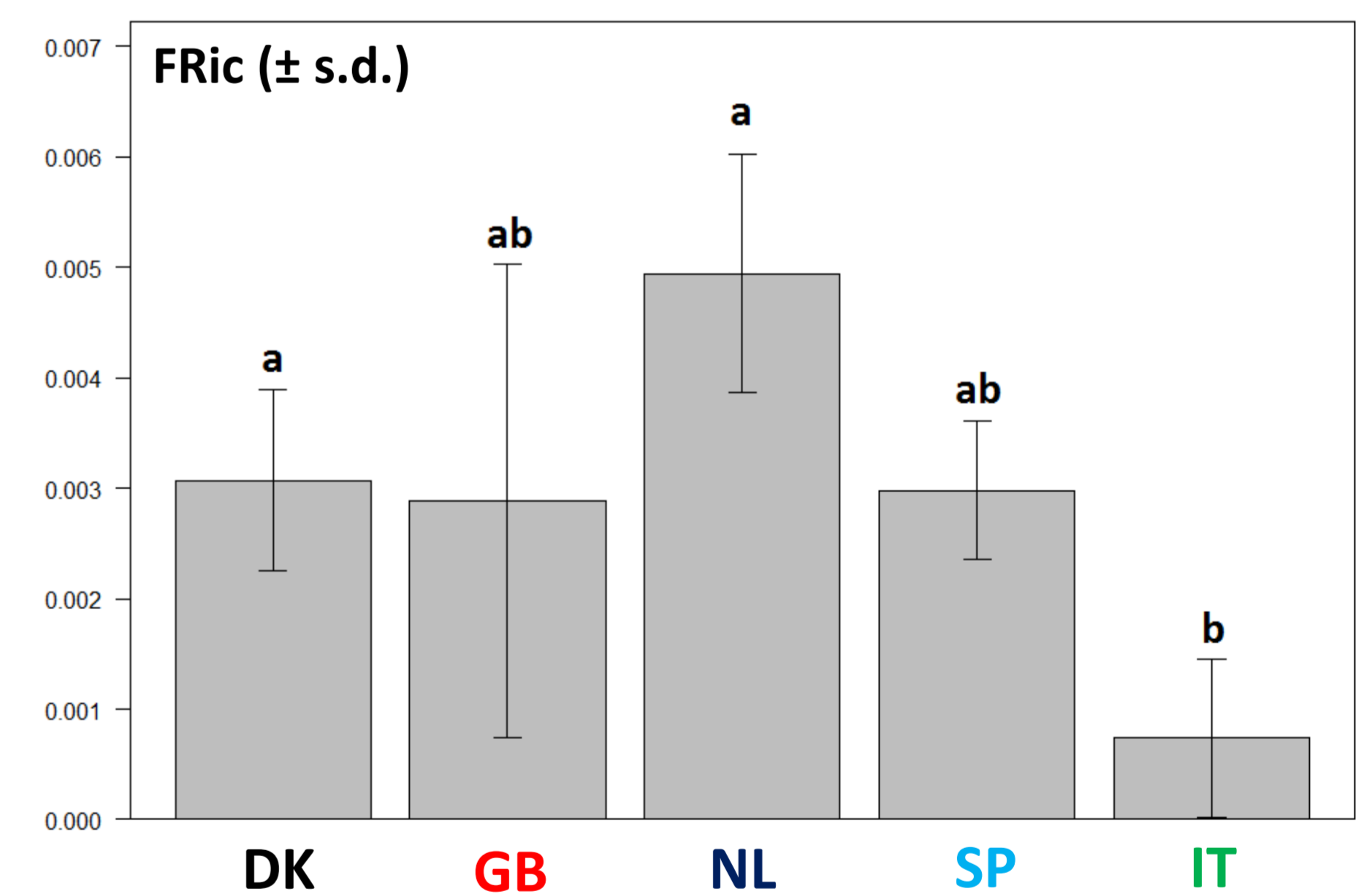
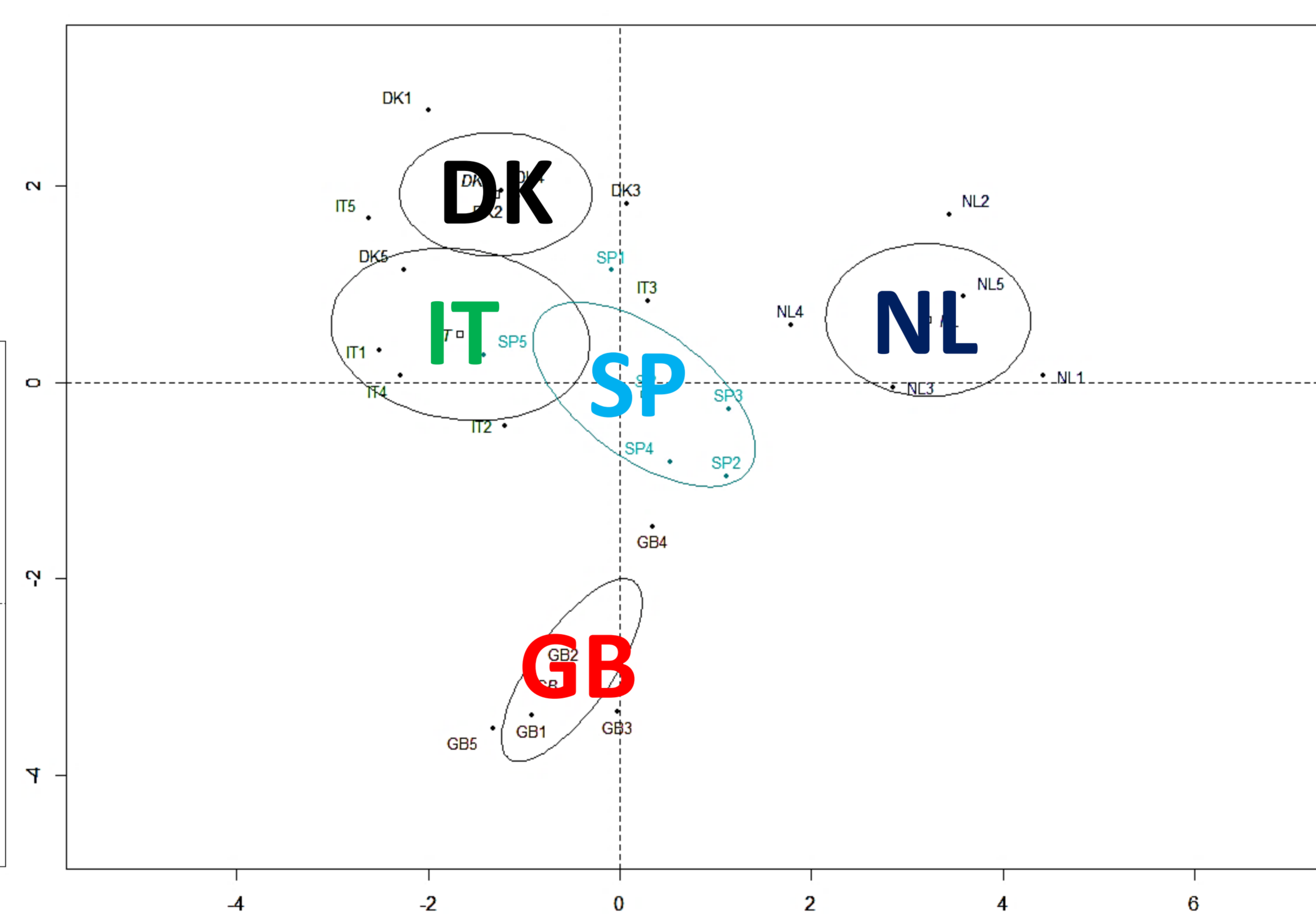
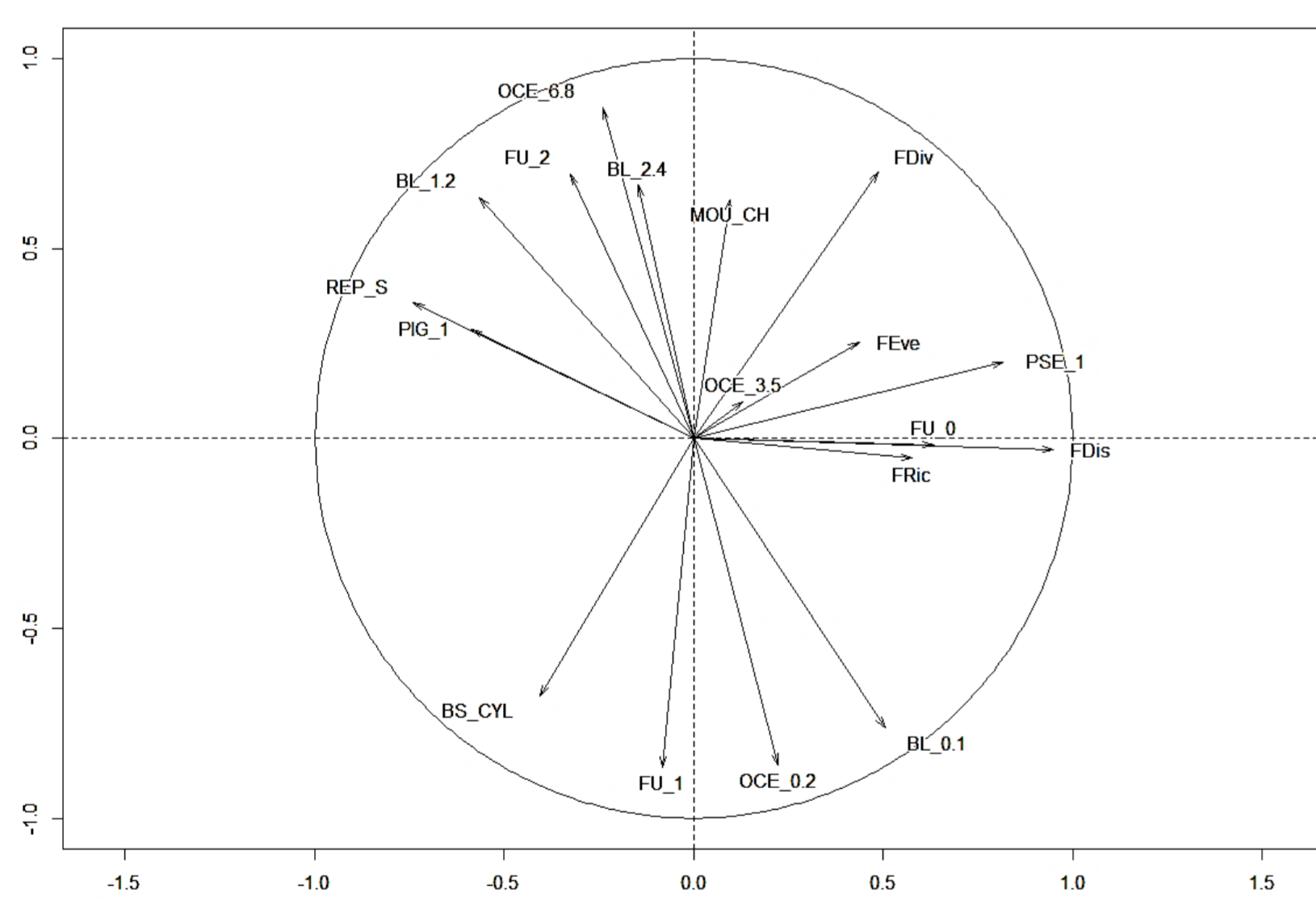


Fig. 5 – Mean value (± s.d.) of the Functional Richness (FRic) for each VULCAN site, ordered from North (left) to South (right). Significance level = 5%



Conclusions and prospects

- Highlighting different functional profiles was possible for each site at a community level.
- The North/South opposition remains unclear, and we observe a distortion of the functional profiles distances regarding to geographical distances.
- As expected, the more constrained sites (SP and IT) present the closest functional profiles, and FRic tends to decrease in these areas.
- Southern sites appear as subsets of northern-sites functional potentialities.
- Ongoing work: Exploring the trait shifts through collembola soil vertical distribution ; linking these results with vegetation traits.

Aknowledgments

- To the VULCAN project holders, for data accessibility
- To the BETSI database contributors, and the Tebis network (www.reseau-tebis.fr)
- To the SoilBioStore.au.dk database contributors

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