UNIVERSITÄT BERN

sdats

Swiss German Dialects Across Time and Space

Der neue schweizerdeutsche Sprachatlas

Reduction of survey sites in dialectology:

A new methodology based on clustering

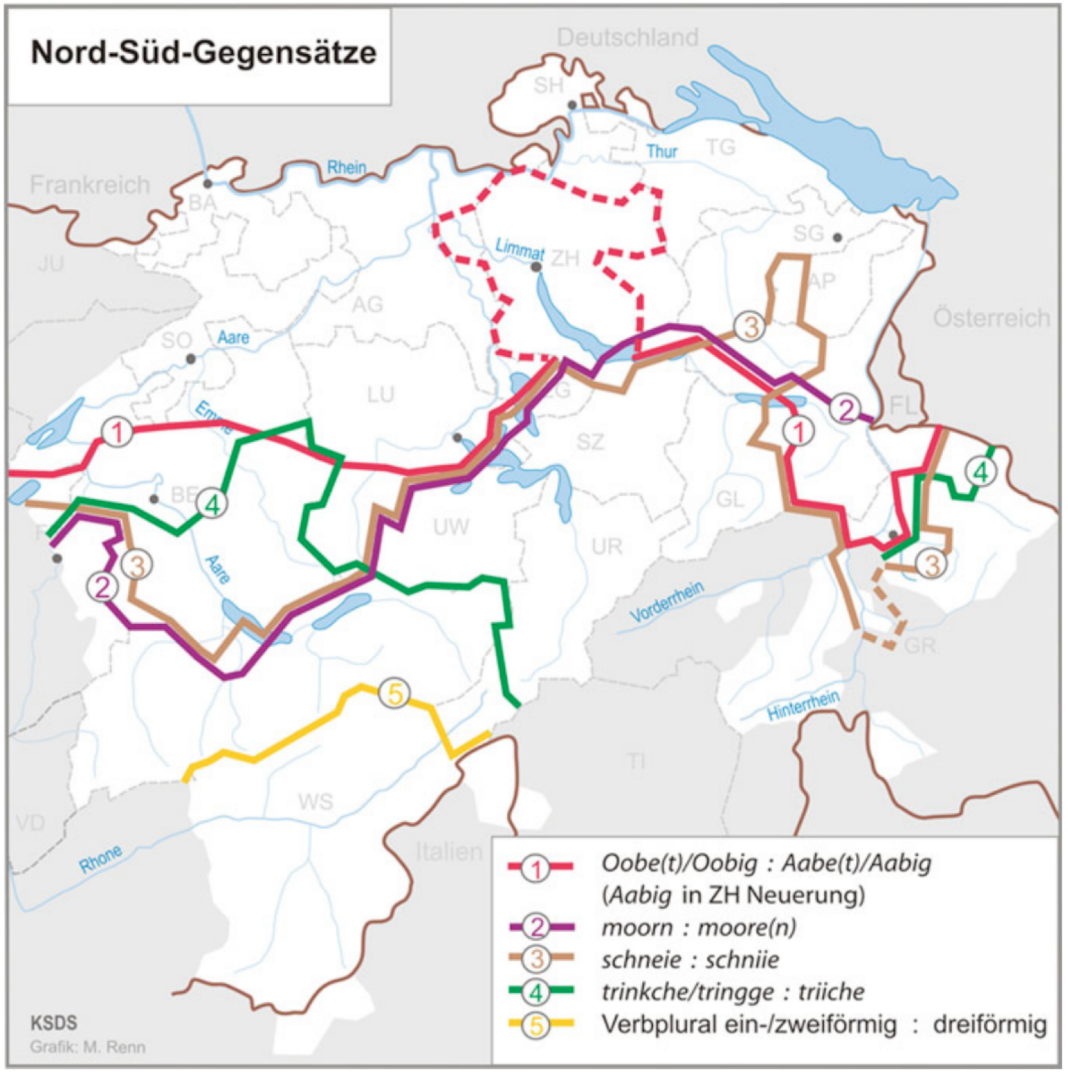
Péter Jeszenszky[1], Carina Steiner[1], Adrian Leemann[1]

Bern Data Science Day 2021
University of Bern

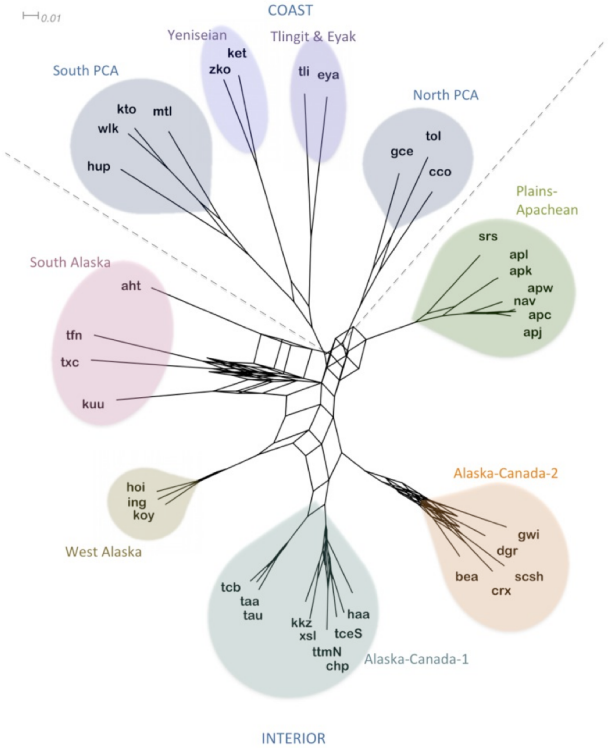
23.04.2021

[1]Center for the Study of Language and Society, Faculty of Humanities, University of Bern

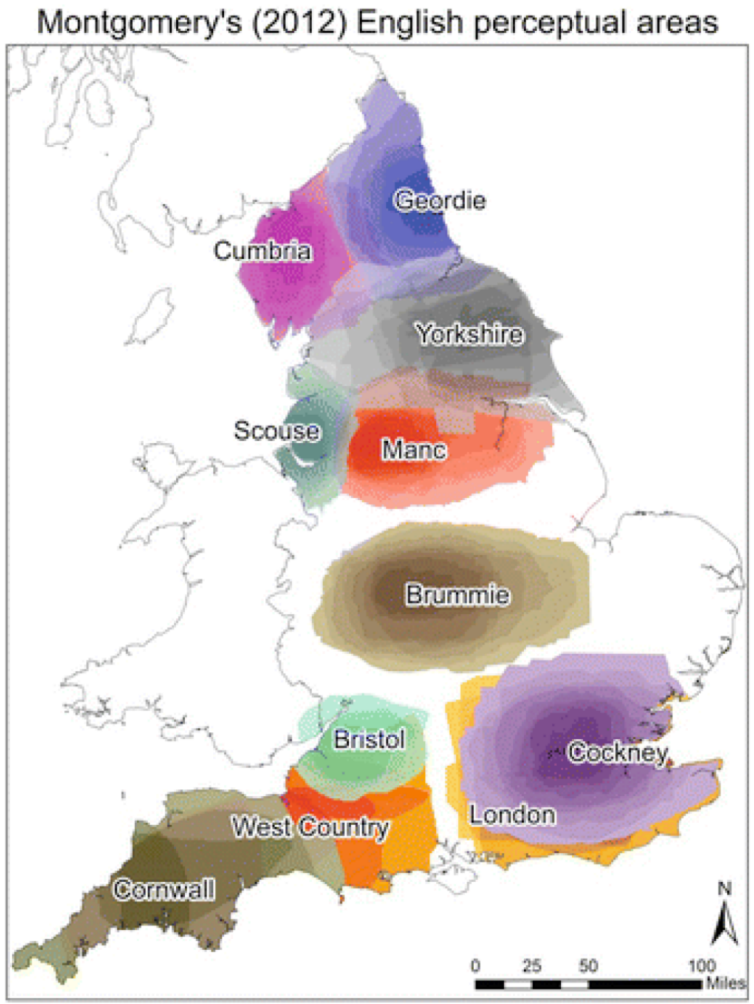
What is dialectology?



Christen, Glaser & Friedli, 2019



Sicoli & Holton, 2014



Montgomery, 2018

sdats

Swiss German Dialects Across Time and Space

Der neue schweizerdeutsche Sprachatlas

www.sdats.ch

- 2019-2024 – Investigating dialect change in Swiss German in comparison to ~1950
- **LARGE-SCALE SURVEY** in 125 Survey sites
- 1000 Speakers
  - 8 per location; 4 young, 20-35 (2F/2M); 4 old, 65+ (2F/2M)
  - Lived most of their life at the surveyed location
  - At least one parent from the region
  - Max. commute per day: 2h
- 315 Questions/Items, spontaneous speech, text translation, draw-a-map task etc.
- 300+ items of metadata recorded

Survey site reduction for dialectology

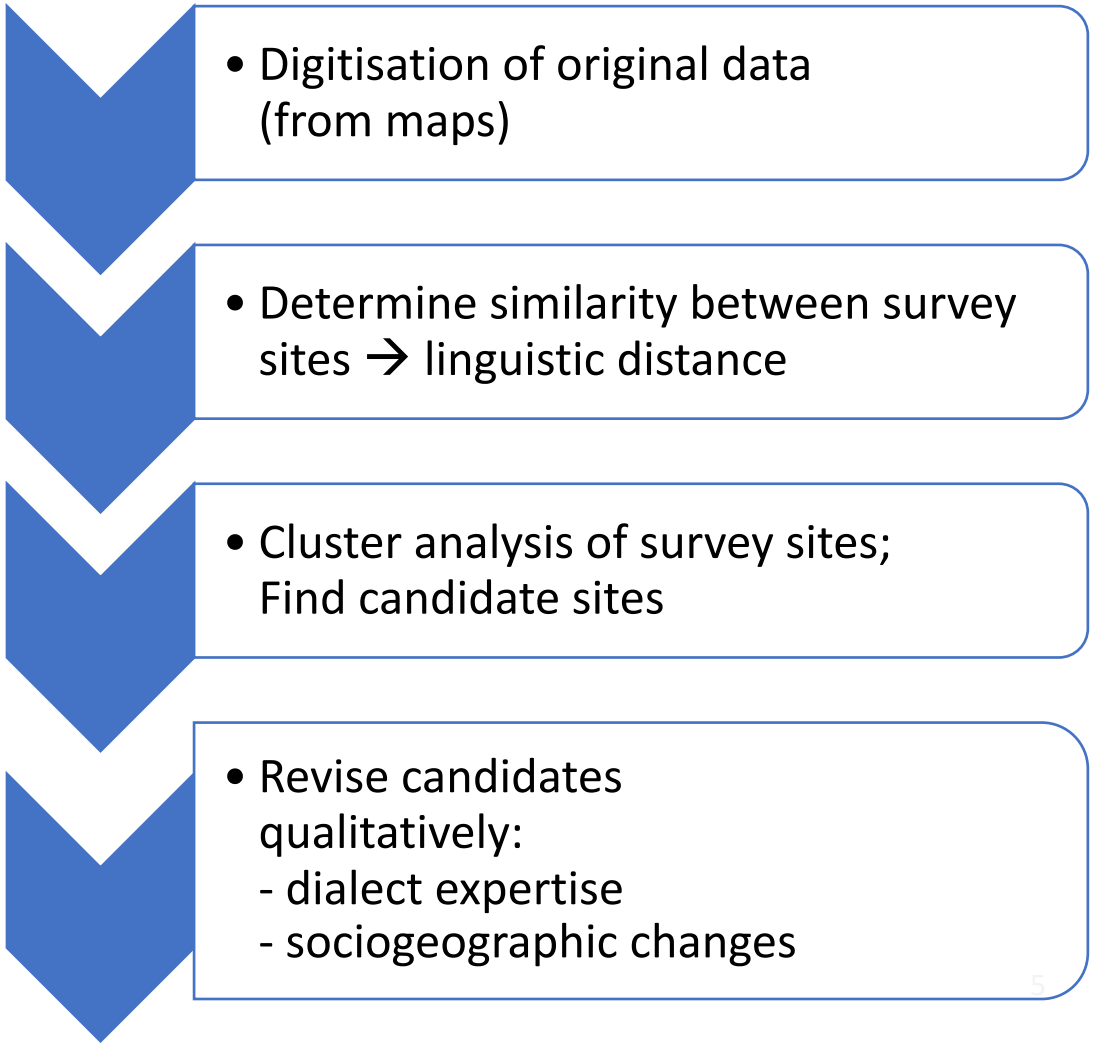
- Dialect change → dialects become similar to each other
  → less survey sites are enough to present the variation
- RQ: How to efficiently find a subset of survey sites that represent contemporary dialectal variation?
- Traditional dialectology: slower, purely qualitative, more bias
- Digital data available → higher objectivity possible
- We suggest a general methodology

Procedure of finding *n* optimal survey sites

Requirements of SDATS:

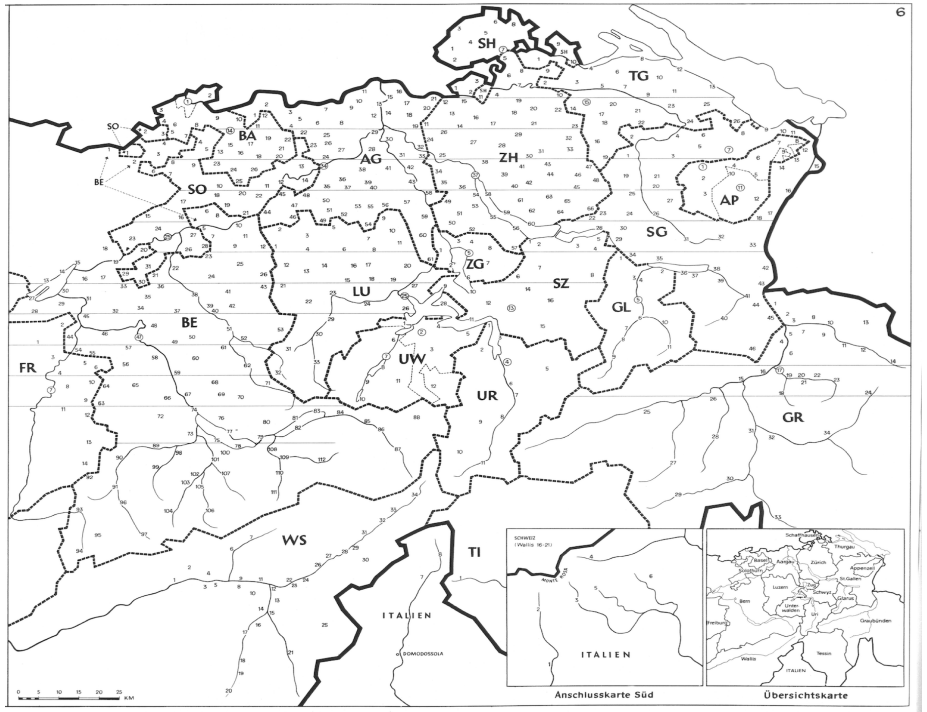
- Reduce 565 → 125 survey sites
  Due to dialect change and project budget
- Represent **contemporary** variation
  Address dialect change of 70 years
- Sites regionally representative?
  - Theory of linguistic gravity (Trudgill, 1974)
  - Clustering in linguistic space – assumed to cluster in geographic space as well

STEPS OF THE GENERAL METHODOLOGY



Linguistic distance calculation

Survey sites of the original data (~1950)



For each survey site pair:

$$D_{ij}^{ling} = \frac{\#differing\ items}{\#items\ answered\ at\ sites\ i\ and\ j}$$

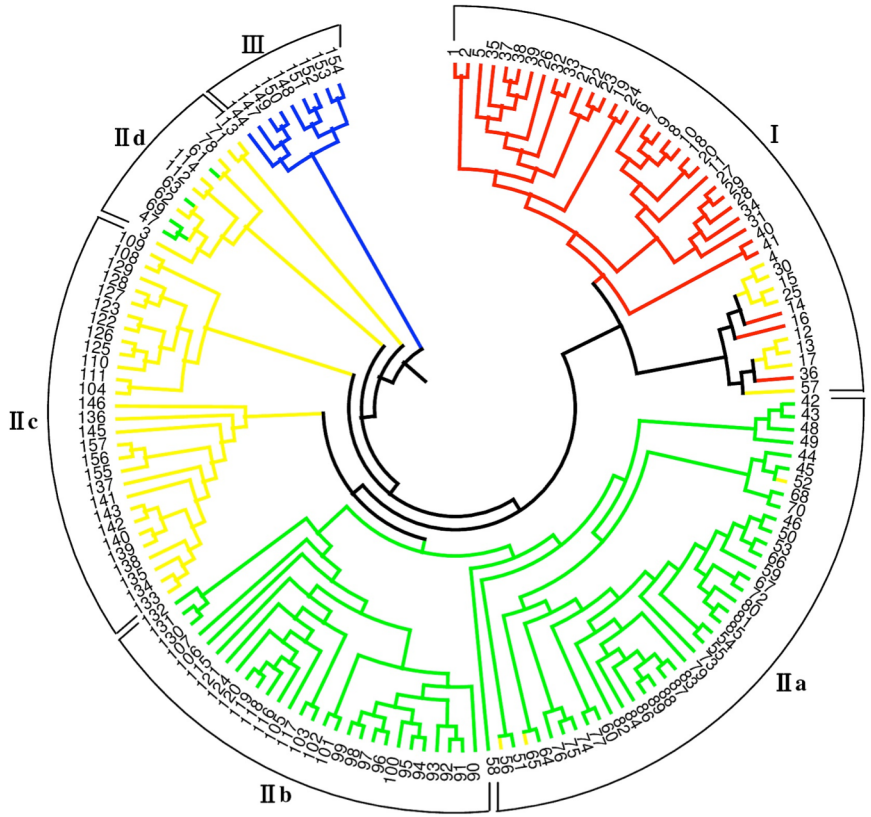
Site ✖ Site linguistic distance matrix

Linguistic distance	AG_01	. . .	LU_05	. . .	ZH_07
AG_01	0		0.38		0.23
. . .					
LU_05	0.38		0		0.51
. . .					
ZH_07	0.23		0.51		0

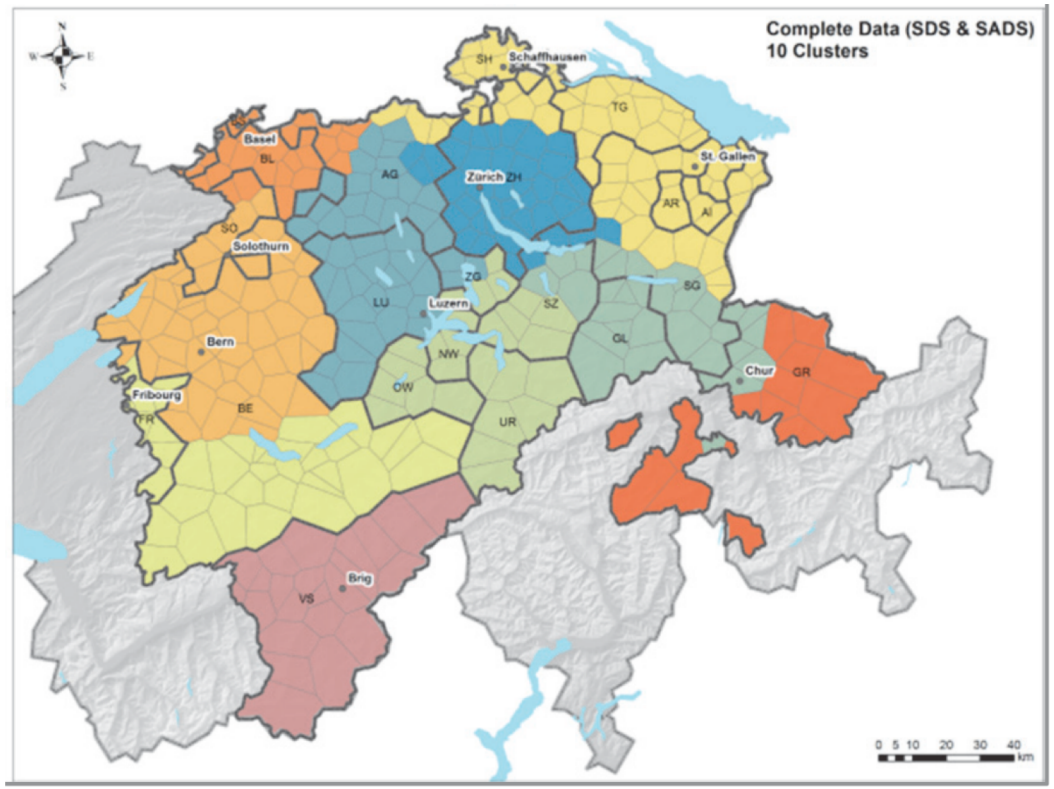
Based on Goebl, 1983 and Jeszenszky et al., 2019

Clustering in dialectology

- Used for determining dialect areas
- Not used for site reduction



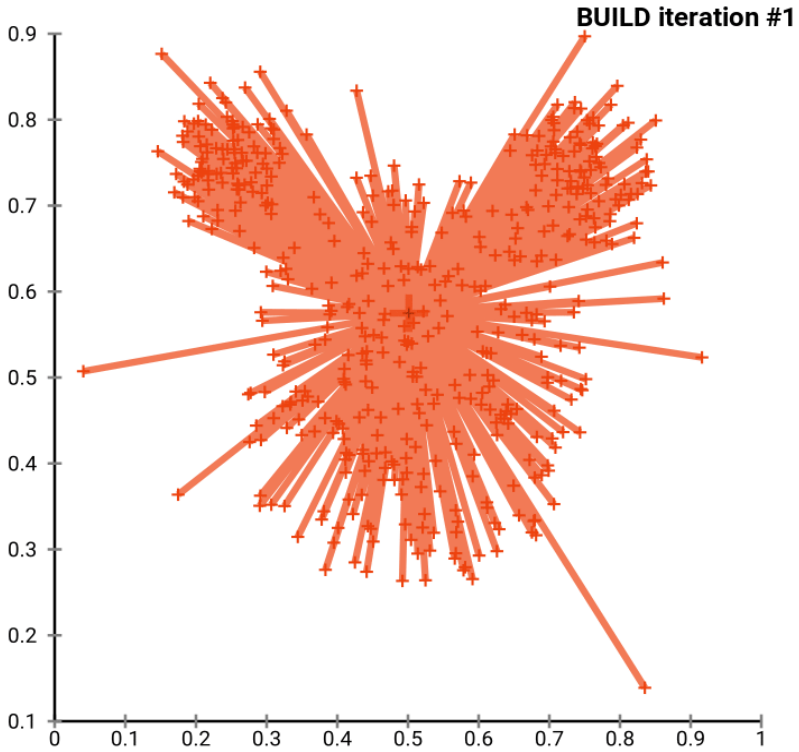
Zheng et al., 2017



Scherrer & Stoeckle, 2016

Partitioning Around Medoids (PAM)

Partitional clustering

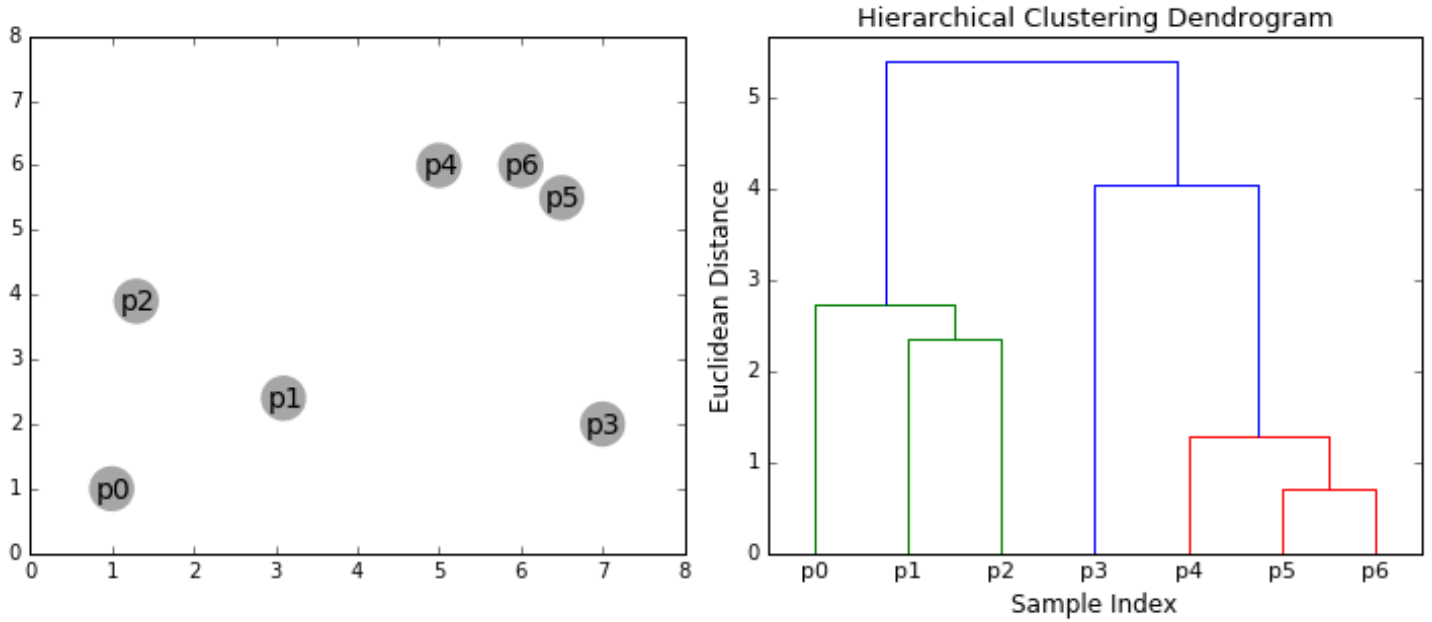


Kaufmann & Rousseeuw, 1987
Park & Jun, 2009
In linguistics:
- Cheshire et al., 2011
- Syrjänen et al., 2016

Unweighted Pair Group Method with Arithmetic mean (UPGMA)

Ward's method

Hierarchical clustering

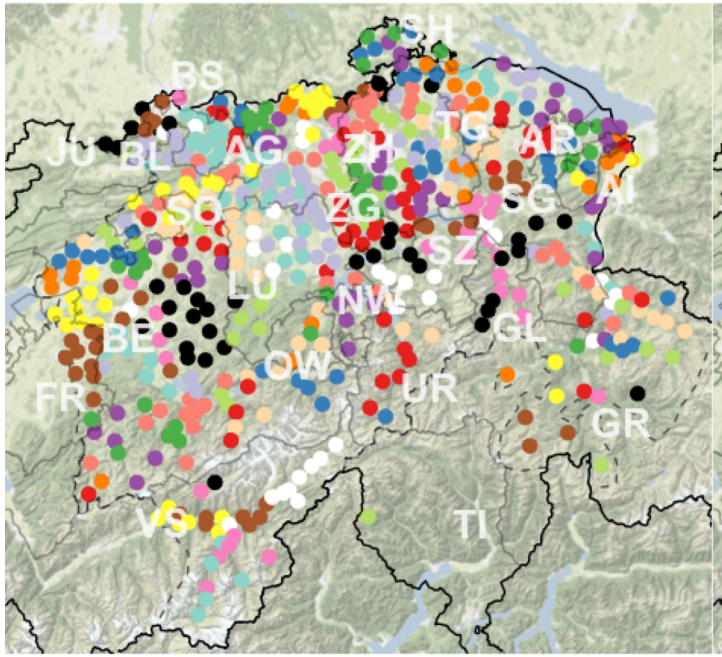


Ward, 1963
Wilks, 1995
In linguistics:
- Heeringa, 2004
- Prokić & Nerbonne, 2008
- Grieve et al., 2011

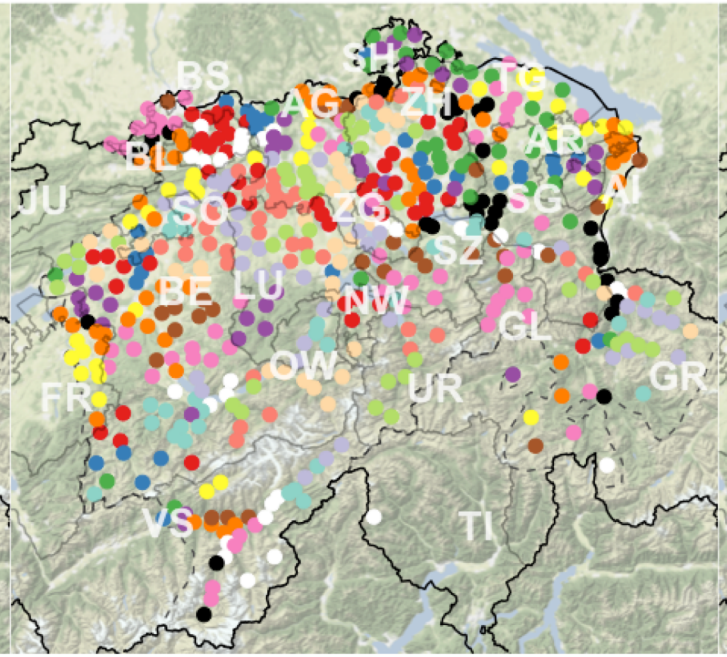
R packages used:
- `fpc` (Hennig, 2020)
- `cluster` (Maechler et al., 2019)

https://dashee87.github.io/data%20science/general/Clustering-with-Scikit-with-GIFs/

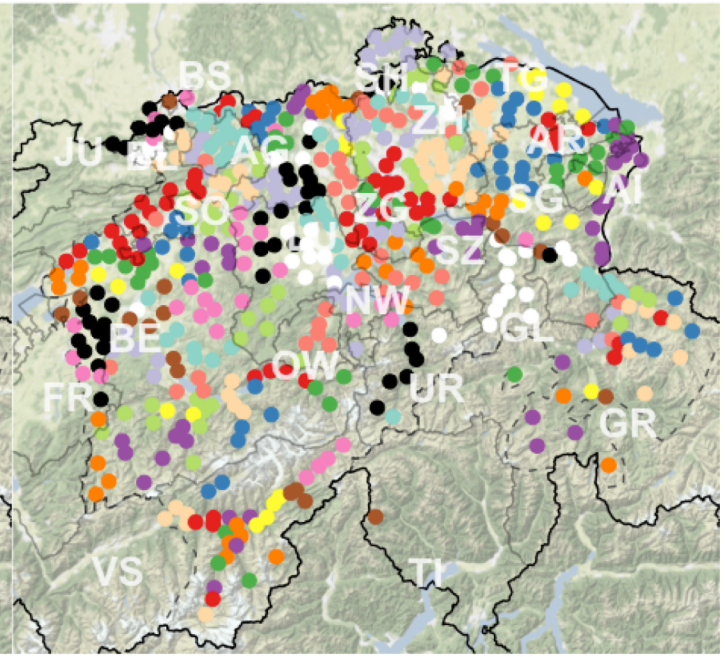
S20, Seed:102



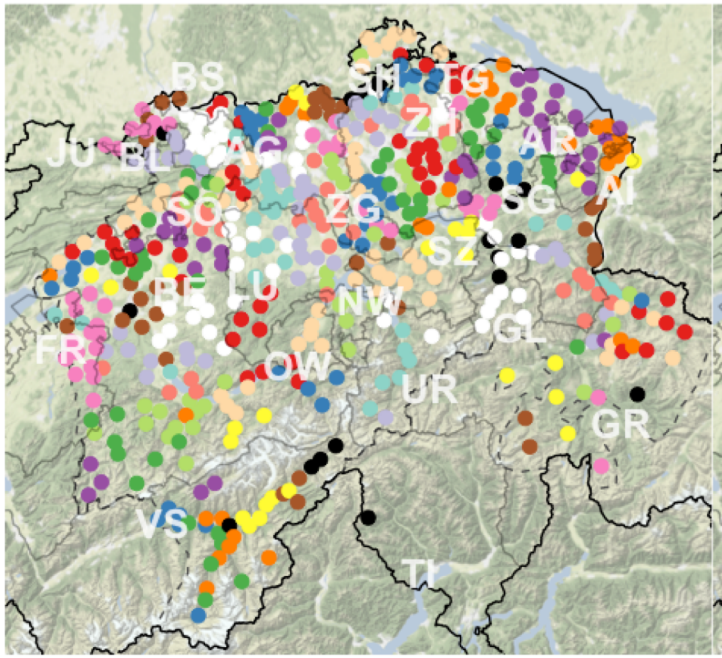
S20, Seed:119



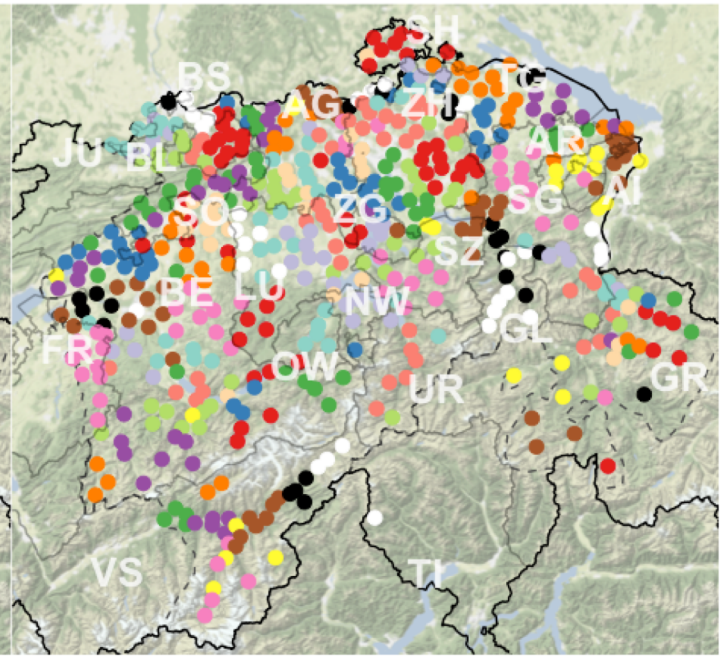
S64, Seed:3



S64, Seed:128

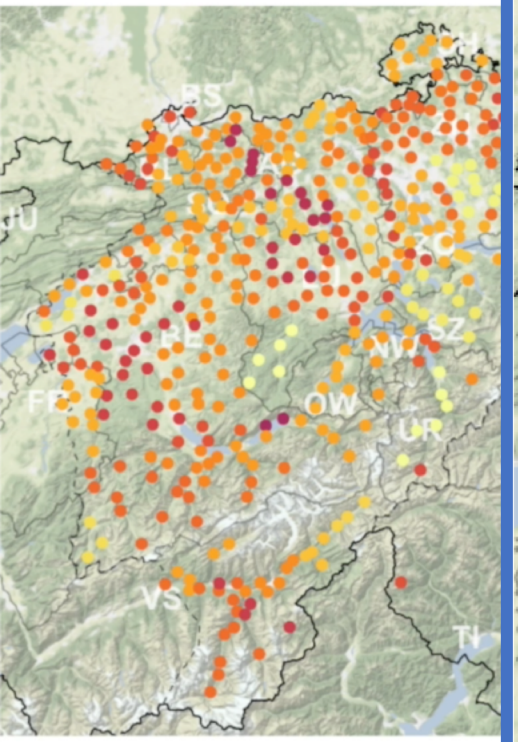


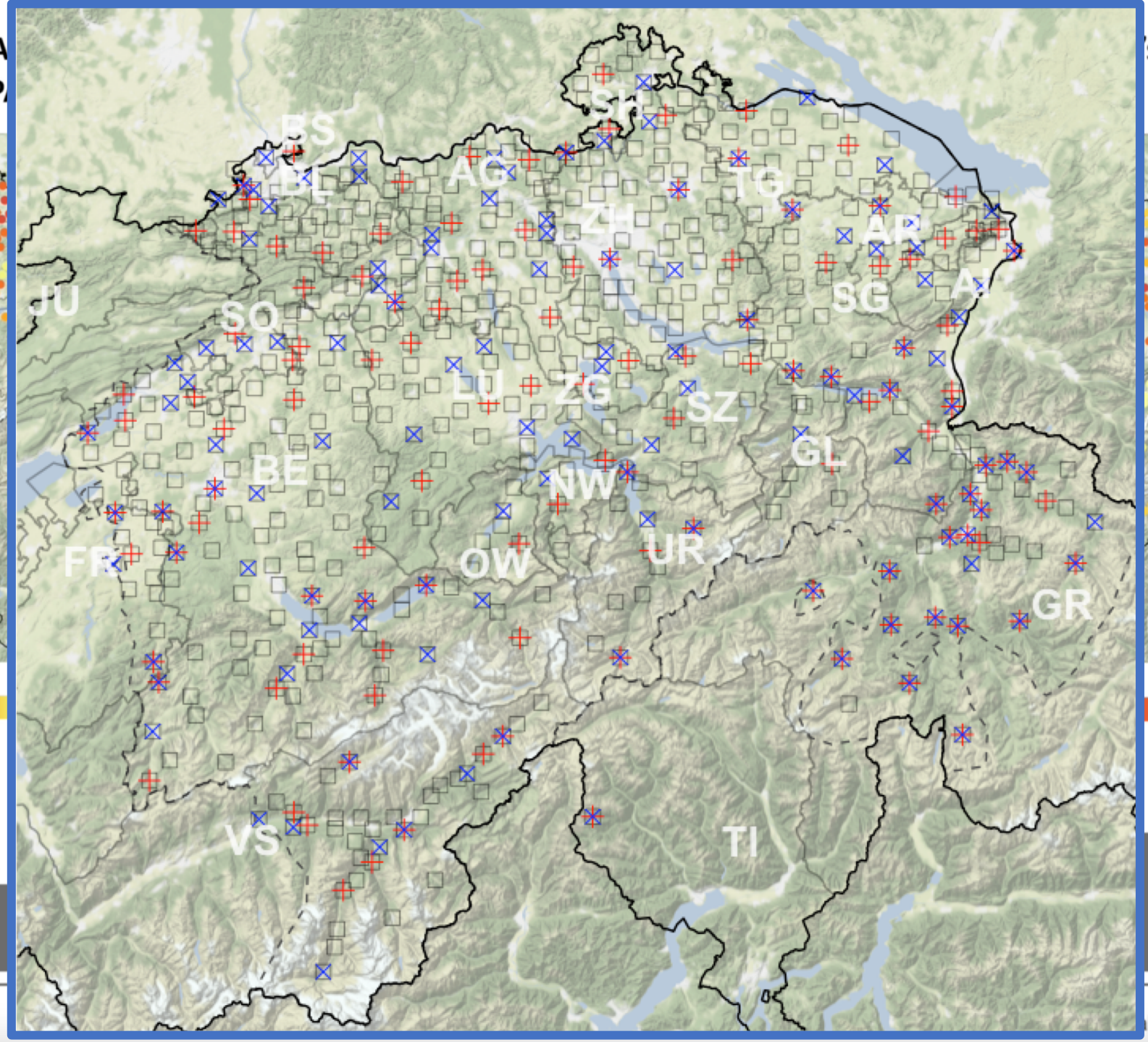
S64, Seed:207

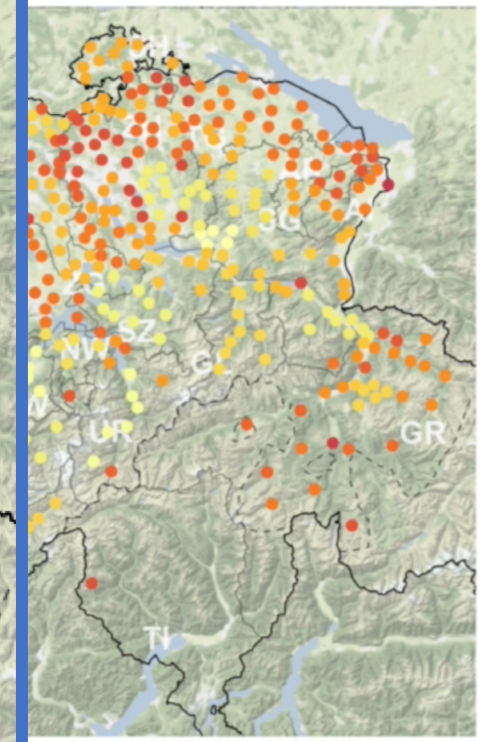


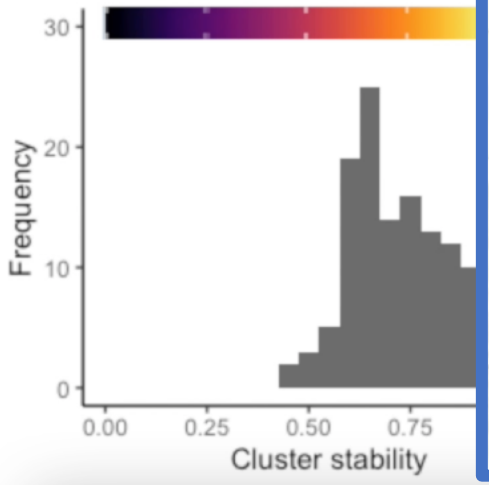
Partitioning A
Medoids (PA

's method





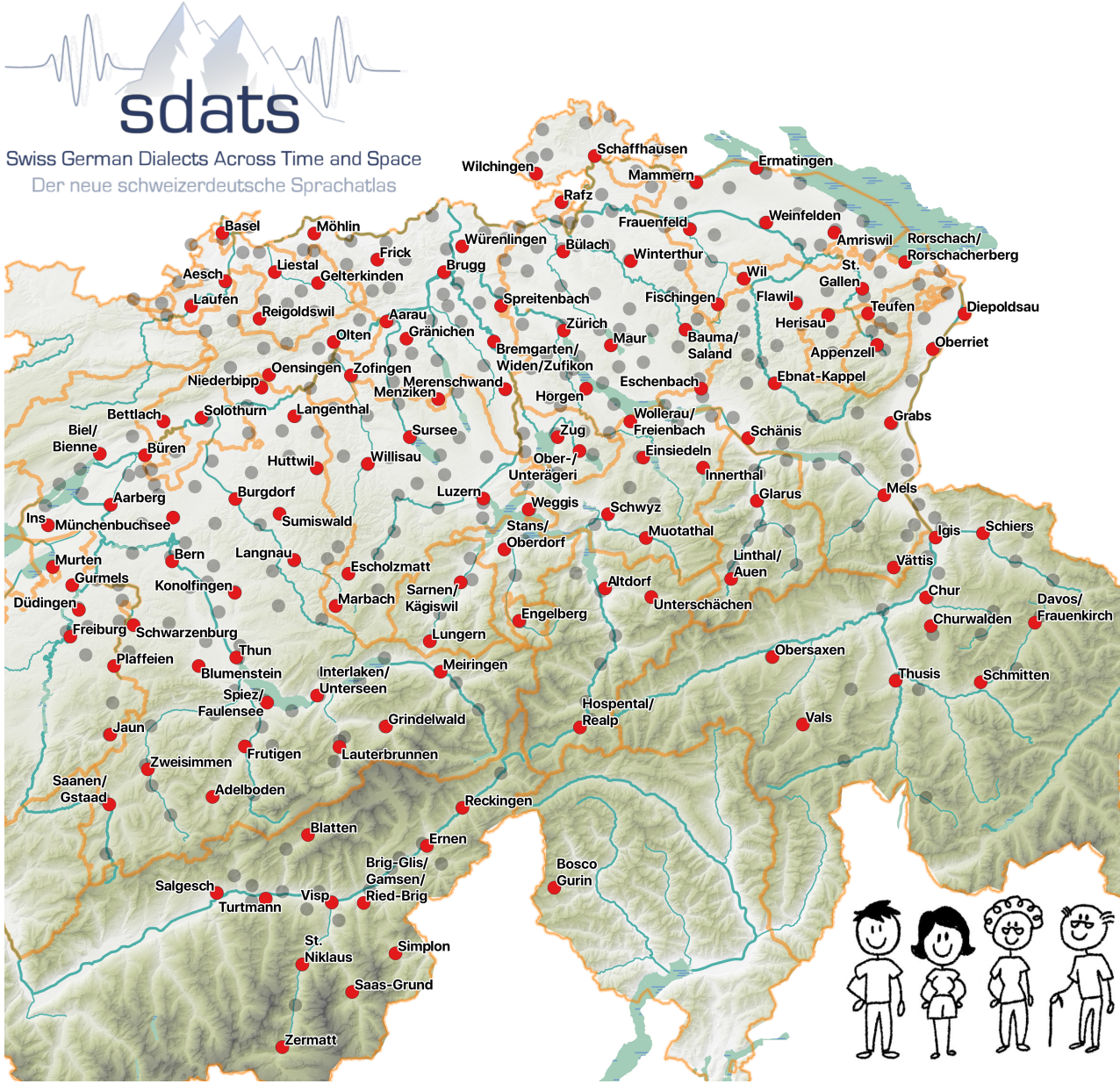




Final revision

- **Socio-demographic filtering:**
  Check for important changes at candidate sites
  → change in population →
  → change/mixture of dialects
- **Linguistic filtering:**
  Known, remarkable dialects;
  Interesting/representative local dialects;
  Documented change;
  Equidistant survey sites possible?

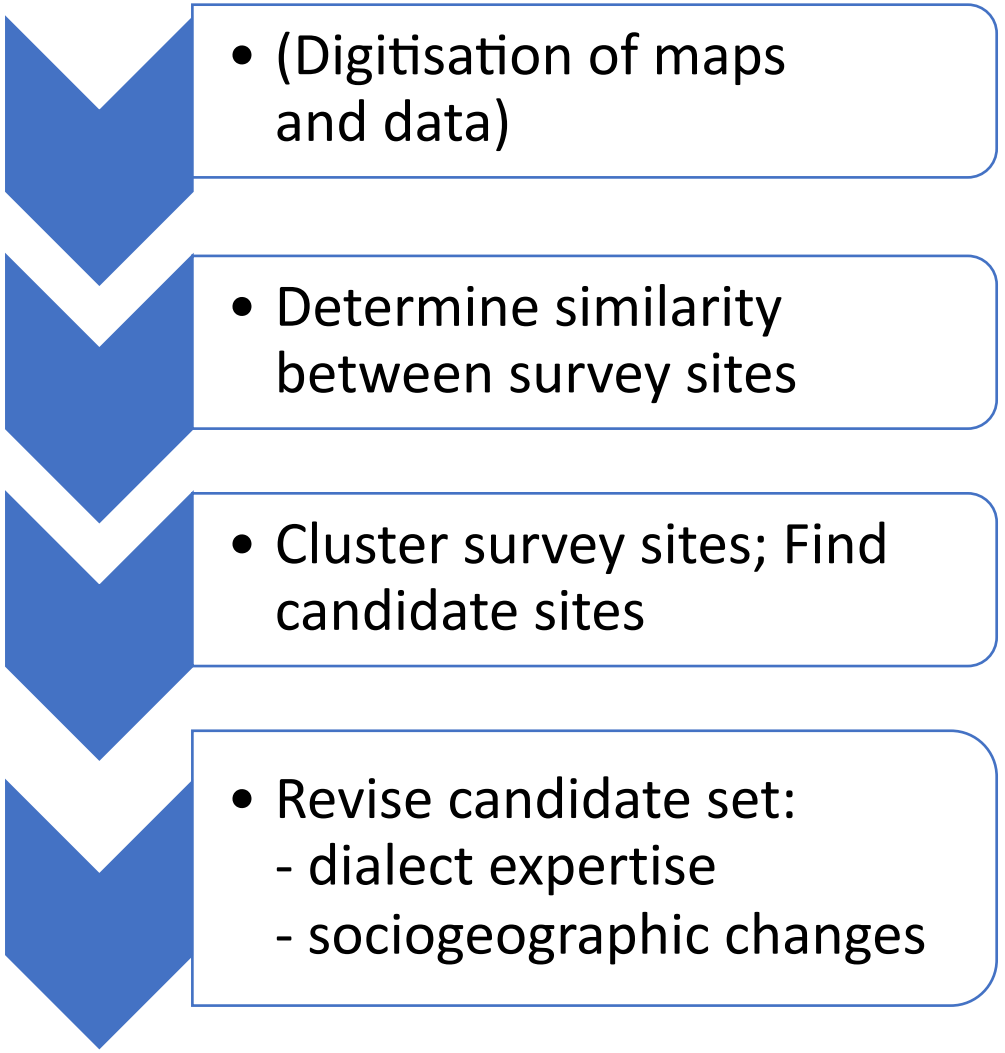
→ **Overwrite quantitative decisions**



Key findings

- **Main benefit: offer *n* candidate survey sites in a quantitative framework**
- Arbitrary number of representative sites can be appointed
- Overlap of the original and intended studies with regards to their objectives and variables
- Locally representative site depends on the purpose of the intended study
- Dialect change to be considered as we want to represent the contemporary dialectal variation → qualitative revision needed

STEPS OF THE GENERAL METHODOLOGY



Thank you very much!

sdats

Swiss German Dialects Across Time and Space

Der neue schweizerdeutsche Sprachatlas

@sdatsbern

Check out our preprint:
https://bit.ly/3sBiM20

frontiers

Reduction of survey sites in dialectology: a new methodology based on clustering

Péter Jeszenszky [1,*], **Carina Steiner** [1] **and Adrian Leemann** [1]

[1] *Center for the Study of Language and Society, Faculty of Humanities, University of Bern, Bern, Switzerland*

Correspondence*:
Péter Jeszenszky
peter.jeszenszky@csls.unibe.ch

ABSTRACT

Many language change studies aim for a partial revisitation, i.e., selecting survey sites from previous dialect studies. The central issue of survey site reduction, however, has often been addressed only qualitatively. Cluster analysis offers an innovative means of identifying the most representative survey sites among a set of original survey sites. In this paper we present a general methodology for finding representative sites for an intended study, potentially applicable to any collection of data about dialects or linguistic variation. We elaborate the quantitative steps

@ Swiss German speakers:
Participate in a study of ours!

Is it possible to estimate age, weight, height, origin etc. based on voice only? https://bit.ly/3gazzqb

Our homepage: www.sdats.ch

Funded by: FNSNF Swiss National Science Foundation

References (selection based on preprint and presentation)

- Cheshire, J. A., Mateos, P., and Longley, P. A. (2011). Delineating Europe's Cultural Regions: Population Structure and Surname Clustering. *Human Biology* 83, 573–598
- Christen, H., Glaser, E., Friedli, M., & Renn, M. (2010). *Kleiner Sprachatlas der deutschen Schweiz*. Frauenfeld: Verlag Huber.
- Goebl, H. (1982). *Dialektometrie: Prinzipien und Methoden des Einsatzes der Numerischen Taxonomie im Bereich der Dialektgeographie* (Wien: Verlag der Osterreichischen Akademie der Wissenschaften)
- Grieve, J., Speelman, D., and Geeraerts, D. (2011). A statistical method for the identification and aggregation of regional linguistic variation. *Language Variation and Change* 23, 1–29. https://doi.org/10.1017/S095439451100007X
- Heeringa, W. (2004). *Measuring dialect pronunciation differences using Levenshtein distance*. Ph.D. thesis, University of Groningen
- Hennig, C. (2020). *Package "fpc": Flexible Procedures for Clustering v. 2.2-8* (pp. 1–164). pp. 1–164. Retrieved from https://cran.r-project.org/web/packages/fpc/fpc.pdf
- Hotzenköcherle, R., Schläpfer, R., Trüb, R., and Zinsli, P. (eds.) (1962-2003). *Sprachatlas der deutschen Schweiz* (Bern (I–VI)/ Basel (VII–VIII): Francke), 8 vols edn.
- **Jeszenszky, P., Hikosaka, Y., Imamura, S., & Yano, K. (2019). Japanese Lexical Variation Explained by Spatial Contact Patterns. *ISPRS International Journal of Geo-Information*, *8*(400), 1–30. https://doi.org/10.3390/ijgi8090400**

- **Jeszenszky, P., Steiner, C., Leemann, A. (in print). Reduction of survey sites in dialectology: a new methodology based on clustering. *Frontiers of Artificial Intelligence* (tba), doi: 10.13140/RG.2.2.31230.20807**
- Kaufman, L. and Rousseeuw, P. J. (1987). Clustering by means of medoids. In *Statistical Data Analysis Based on the L 1 –Norm and Related Methods*, ed. Y. Dodge (Amsterdam: North-Holland, Elseviert). 405–416
- **Leemann, A., Jeszenszky, P., Steiner, C., Studerus, M., Messerli, J. (2020). Linguistic fieldwork in a pandemic: Supervised data collection combining smartphone recordings and videoconferencing. *Linguistics Vanguard*, 6.3. doi: 10.1515/lingvan-2020-0061**
- [Dataset] **Leemann, A., Jeszenszky, P., Steiner, C., Studerus, M., Messerli, J. (2020, May 7). SDATS Corpus – Swiss German Dialects Across Time and Space. Retrieved from osf.io/s9z4q**
- Maechler, M., Rousseeuw, P., Struyf, A., Hubert, M., Hornik, K., Studer, M., … Murphy, K. (2019). Package "cluster" for R - Finding Groups in Data: Cluster Analysis Extended. *R Package Version 2.1.0*. Retrieved from https://svn.r-project.org/R-packages/trunk/cluster
- Montgomery, C. (2018). The Perceptual Dialectology of England. In N. Braber & S. Jansen (Eds.), *Sociolinguistics in England* (pp. 127–164). https://doi.org/10.1057/978-1-137-56288-3_6
- Nerbonne, J., Kleiweg, P., Heeringa, W., and Manni, F. (2008). Projecting dialect distances to geography: Bootstrap clustering vs. noisy clustering. In *Data Analysis, Machine Learning and Applications*, eds. C. Preisach, H. Burkhardt, L. Schmidt-Thieme, and R. Decker (Berlin, Heidelberg: Springer). 647–654. https://doi.org/10.1007/978-3-540-78246-976
- Park, H. S. and Jun, C. H. (2009). A simple and fast algorithm for K-medoids clustering. *Expert Systems with Applications* 36, 3336–3341. https://doi.org/10.1016/j.eswa.2008.01.039
- Prokić, J. and Nerbonne, J. (2008). Recognising groups among dialects. *International Journal of Humanities and Arts Computing* 1, 153–172. https://doi.org/10.3366/e1753854809000366

- [Dataset] Scherrer, Y. (2019). dialektkarten.ch – Interactive dialect maps for German-speaking Switzerland and other European dialect areas
- Scherrer, Y. and Stoeckle, P. (2016). A quantitative approach to Swiss German – Dialectometric analyses and comparisons of linguistic levels. *Dialectologia et Geolinguistica* 24, 92–125. https://doi.org/10.1515/dialect-2016-0006
- Sicoli, M. A., & Holton, G. (2014). Linguistic phylogenies support back-migration from Beringia to Asia. *PLoS ONE*, *9*(3). https://doi.org/10.1371/journal.pone.0091722
- Syrjänen, K. J. J., Honkola, T., Lehtinen, J., Leino, A., and Vesakoski, O. (2016). Applying Population Genetic Approaches within Languages. *Language Dynamics and Change* 6, 235–283. https://doi.org/10.1163/22105832-00602002
- Ward, J. H. (1963). Hierarchical Grouping to Optimize an Objective Function. *Journal of the American Statistical Association* 58, 236–244
- Wilks, D. (1995). *Statistical Methods in the Atmospheric Sciences, International Geophysics - Volume 59* (Academic Press), 1st edn.
- Willis, D. (2020). Using social-media data to investigate morphosyntactic variation and dialect syntax in a lesser-used language: Two case studies from Welsh. *Glossa: a journal of general linguistics* 5, 103. https://doi.org/10.5334/gjgl.1073
- Zheng, Y., Xu, S., Liu, J., Zhao, Y., & Liu, J. (2017). Genetic diversity and population structure of Chinese natural bermudagrass [Cynodon dactylon (L.) Pers.] germplasm based on SRAP markers. *PLoS ONE*, *12*(5), 1–15. https://doi.org/10.1371/journal.pone.0177508