On the correlation between phoneme inventory size and elevation: the case of Dagestan

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September 2, 2021

presentation is available here: tinyurl.com/ydv9w364

Overview

Connection of language diversity to physical environment

Prediction of phonological inventory size

East Caucasian languages' data

On the correlation between phoneme inventory size and elevation

Discussion

Connection of language diversity to physical environment

There are a lot of work that connects language diversity to physical environment:

- famous and controversial [Everett 2013] that shows connection between altitude and distribution of ejectives and even propose a hypothesis of the reason of such a correlation
- in [Bentz et al. 2018] shows that phylogenetic signals correlates with different environmental factors (including altitude)
- a lot of works by Johanna Nichols and summary in [Urban 2020]

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Prediction of phonological inventory size

There are several works [Hay and Bauer 2007; Atkinson 2011] that report connection of phoneme inventory sizes and language population sizes. There are several replies on those works [Maddieson et al. 2011; Donohue and Nichols 2011; Wichmann et al. 2011; Moran et al. 2012].

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About East Caucasian phonology

Most East Caucasian (Nakh-Dagestanian) languages are located in the Republic of Dagestan, Chechen Republic and Republic of Ingushetia.

- phonology
  - [Kibrik and Kodzasov 1990]
  - The indigenous languages of the Caucasus: [Job and Smeets 1994], [Smeets 1994]
  - Yaziki mira: [Alekseev et al. 2001] and predecessor projects
  - [Grawunder 2017]
  - The Oxford Handbook of Languages of the Caucasus: [Beguš 2021], [Boris 2021a], [Boris 2021b]
  - Handbook of Caucasian Languages: [Koryakov and Maisak Fort]
  - and phonological parts in more general descriptions of East Caucasian languages
- historical-comparative phonetics
  - S. M. Gasanova, G. Kh. Ibragimov, P. T. Magomedova, U. A. Meylanova, B. B. Talibov, S. M. Khaydakov, A. E. Alekseev, Ju. D. Desheriev, B. K. Gigineishvili, D. S. Imnaishvili, J. Nichols, S. L.

Languages

- Nakh
  - Chechen
  - Ingush
  - Tsova-Tush (Batsbi)
- Tsezic (Didoic)
  - Tsez
  - Hinuq
  - Bezhta
  - Hunzib
  - Khwarshi-Inkhoqwari
- Avar–Andic
  - Avar
  - Andi
  - Botlikh
  - Godoberi
  - Chamalal
  - Karata
  - Tindi
  - Bagvalal
  - Akhvakh
- Dargwa
- Lak
- Lezgic
  - Archi
  - Tabasaran
  - Aghul
  - Lezgian
  - Udi
  - Budukh
  - Kryz
  - Rutul
  - Tsakhur
- Khinalug

Languages not present in [Kibrik and Kodzasov 1990]

- Nakh
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Languages not present in [Kibrik and Kodzasov 1990]

- Andic, Bagvalal [Kibrik et al. 2001]
- Andic, Botlikh [Alexeyev and Verhees Fort]
- Andic, Godoberi [Moroz et al. Fort]
- Andic, Karata [Magomedbekova 1971]
- Dargwa, Mehweb [Moroz 2019]
- Nakh, Chechen [Nichols 1994a]
- Nakh, Ingush [Nichols 1994b]
- Nakh, Tsova-Tush [Holisky and Gagua 1994]

Phonological peculiarities

- East Caucasian consonant systems are more or less typical
  - except uvular and laryngeal consonants
  - except ejective consonants
  - except laterals in Avar-Andic and Tsezic branches
  - except labialization
  - except gemination
- East Caucasian vowel systems are typical

Phonological data

1905 × 9 table with the following columns:

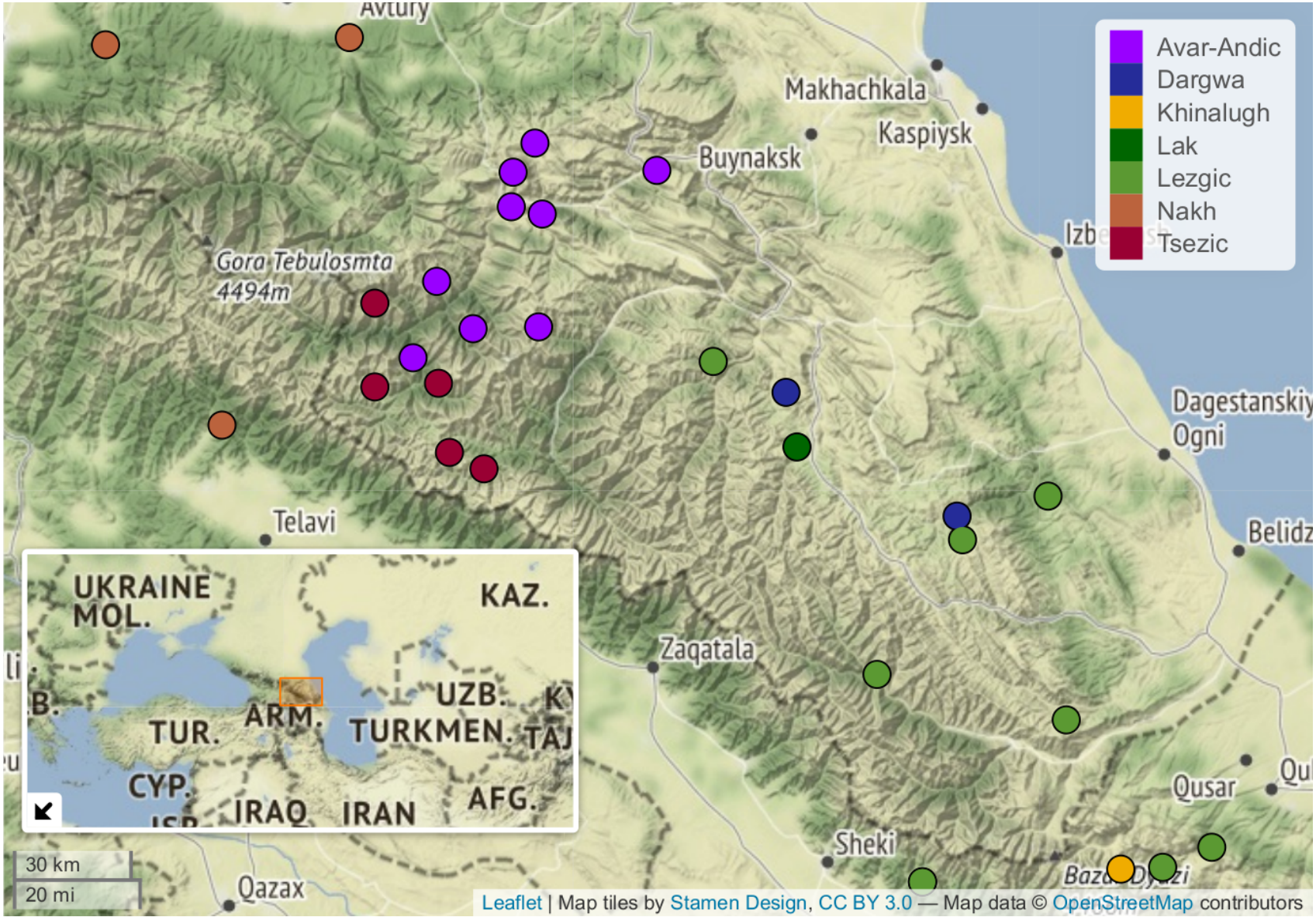
- `id`
- `branch`
- `language`
- `segment IPA`
- `segment sorce`
- `source`
- `sound type`
- `comments`
- `glottocode`

Phonological data

1905 × 9 table with the following columns:

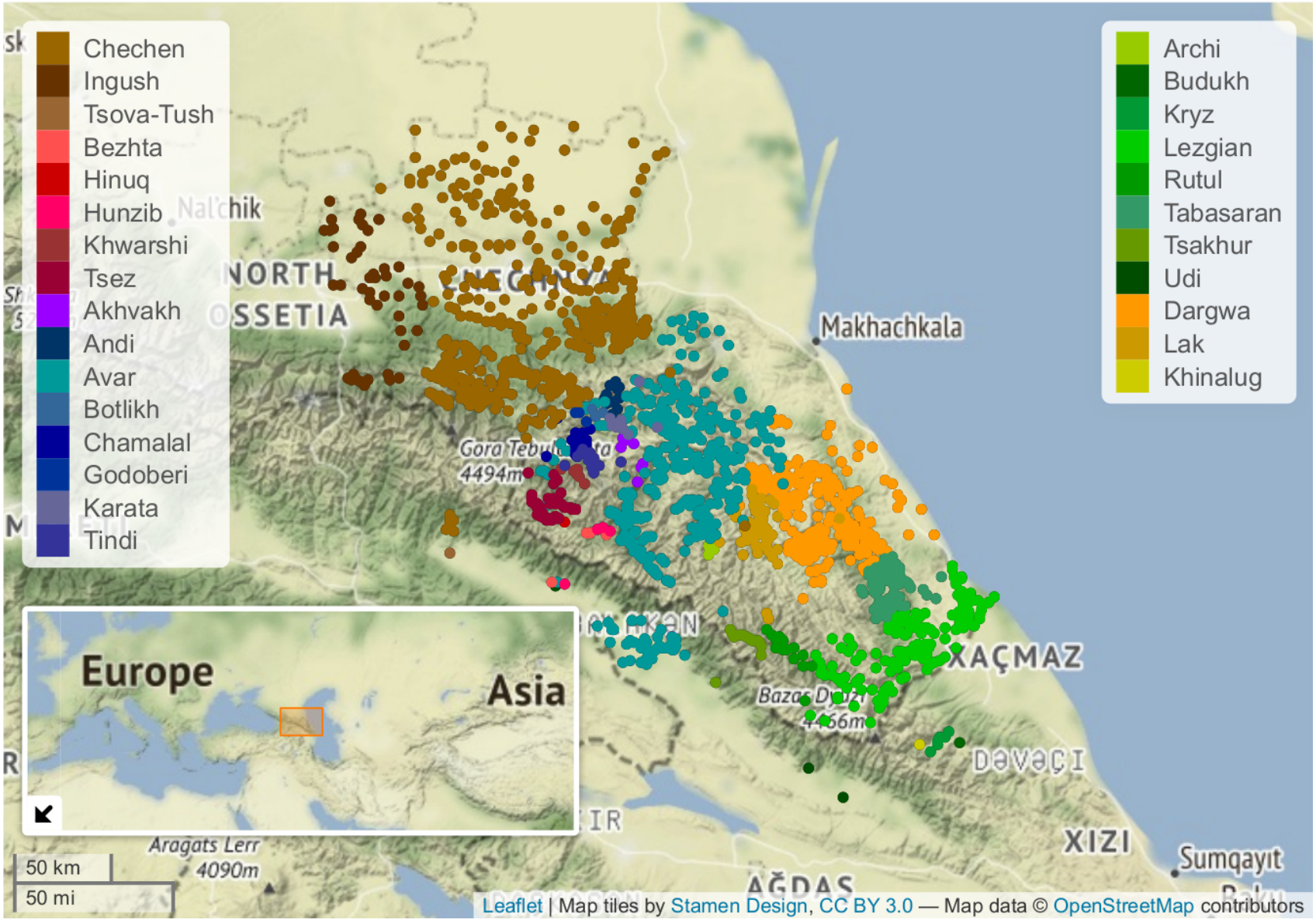
- `id` – 1407
- `branch` – Lezgic (possible values are Avar-Andic, Dargwa, Khinalugh, Lak, Lezgic, Nakh, Tsezic)
- `language` – Tsakhur
- `segment IPA` – tʃː
- `segment sorce` – c̆
- `source` – [Kibrik, Kodzasov 1990: 343-344]
- `sound type` – consonant (possible values are consonant, vowel, diphthong)
- `comments` – rare sound
- `glottocode` – tsak1249

Geographic data [Moroz and Verhees 2020]



created with `lingtypology` [Moroz 2017]

Geographic Data [Moroz and Verhees 2020]



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Elevation Data

Elevation for this data was retrieved using the GLOBE digital elevation model from the National Centers for Environmental Information (after [Urban and Moran 2021]).

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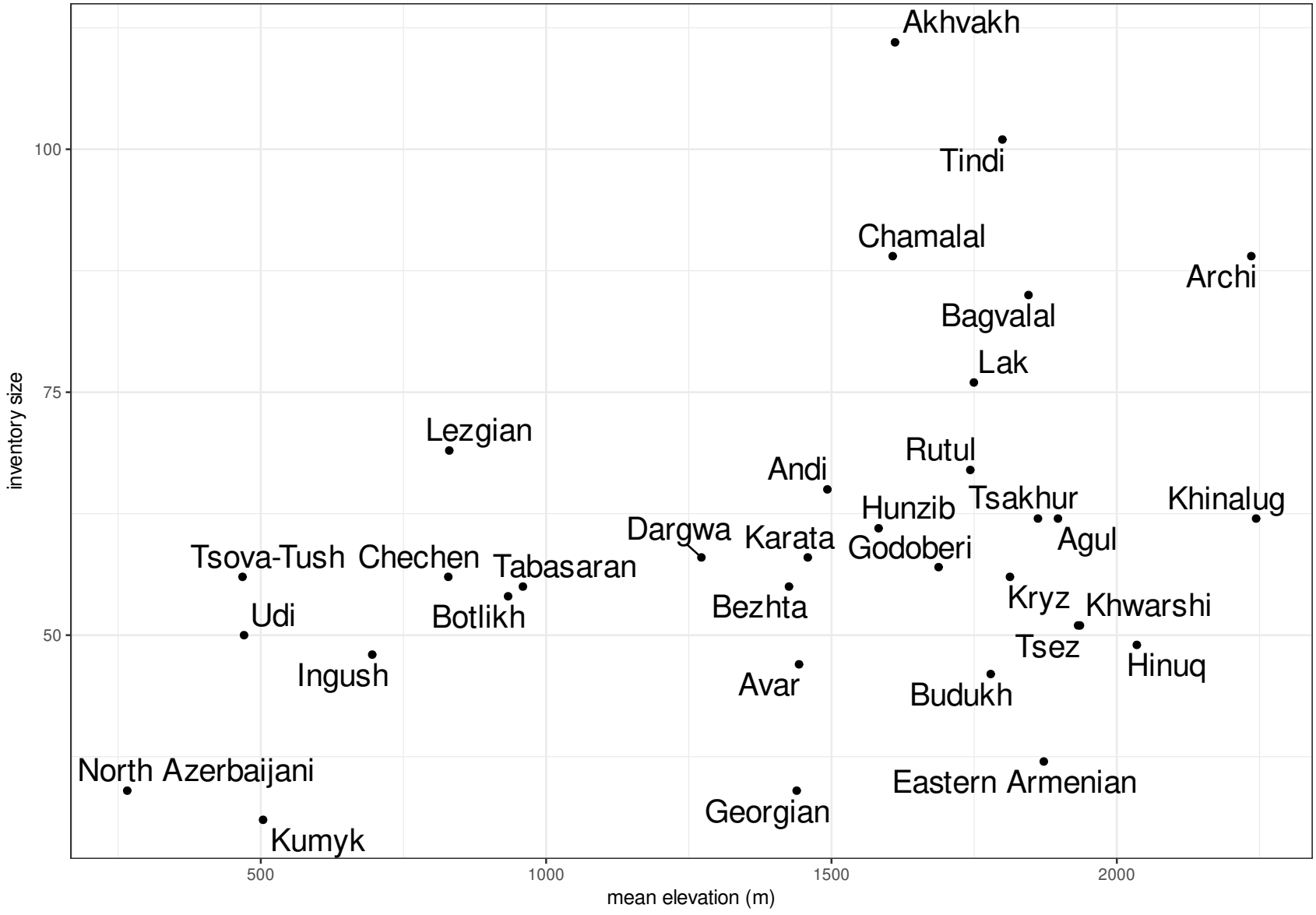
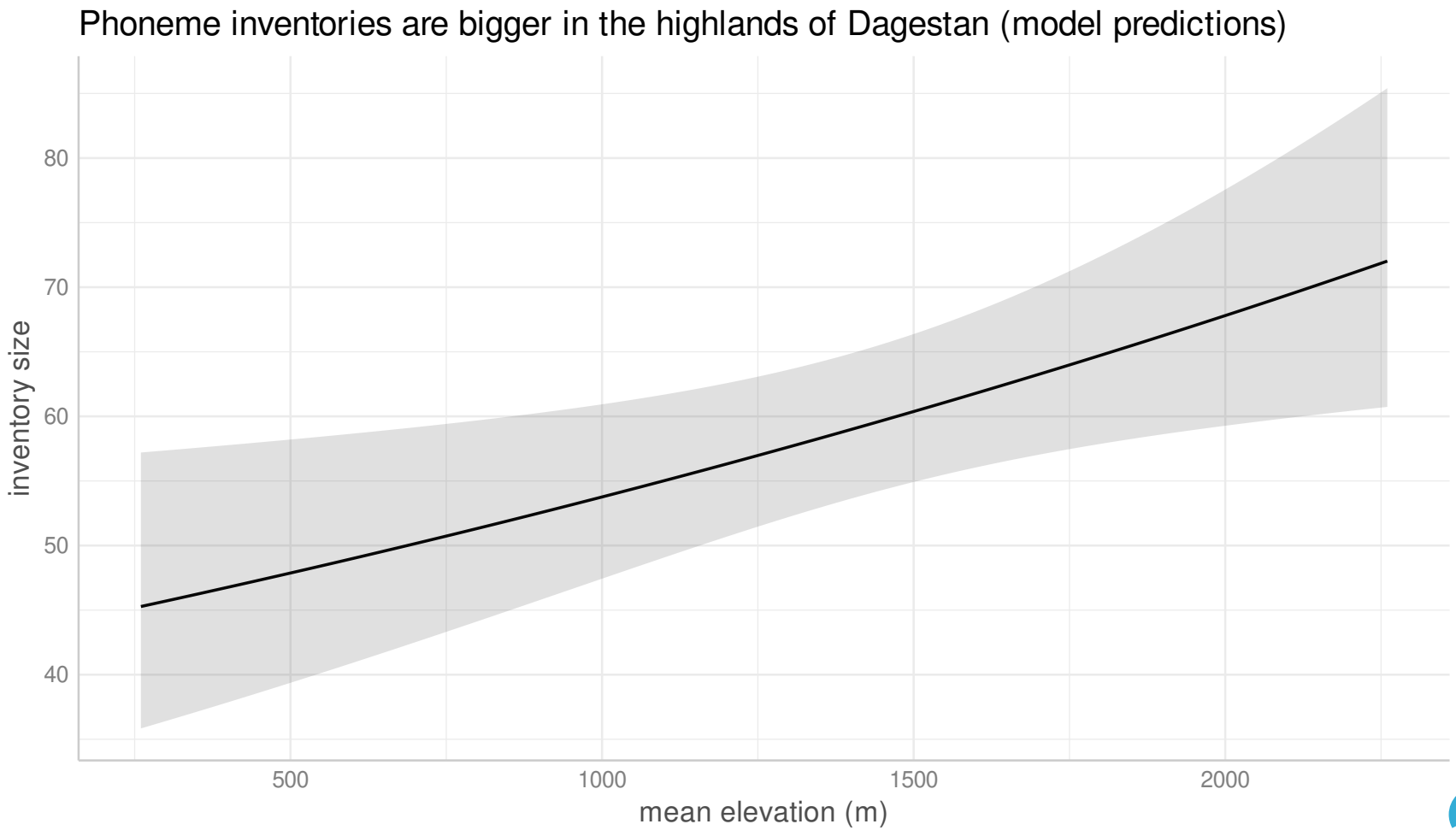


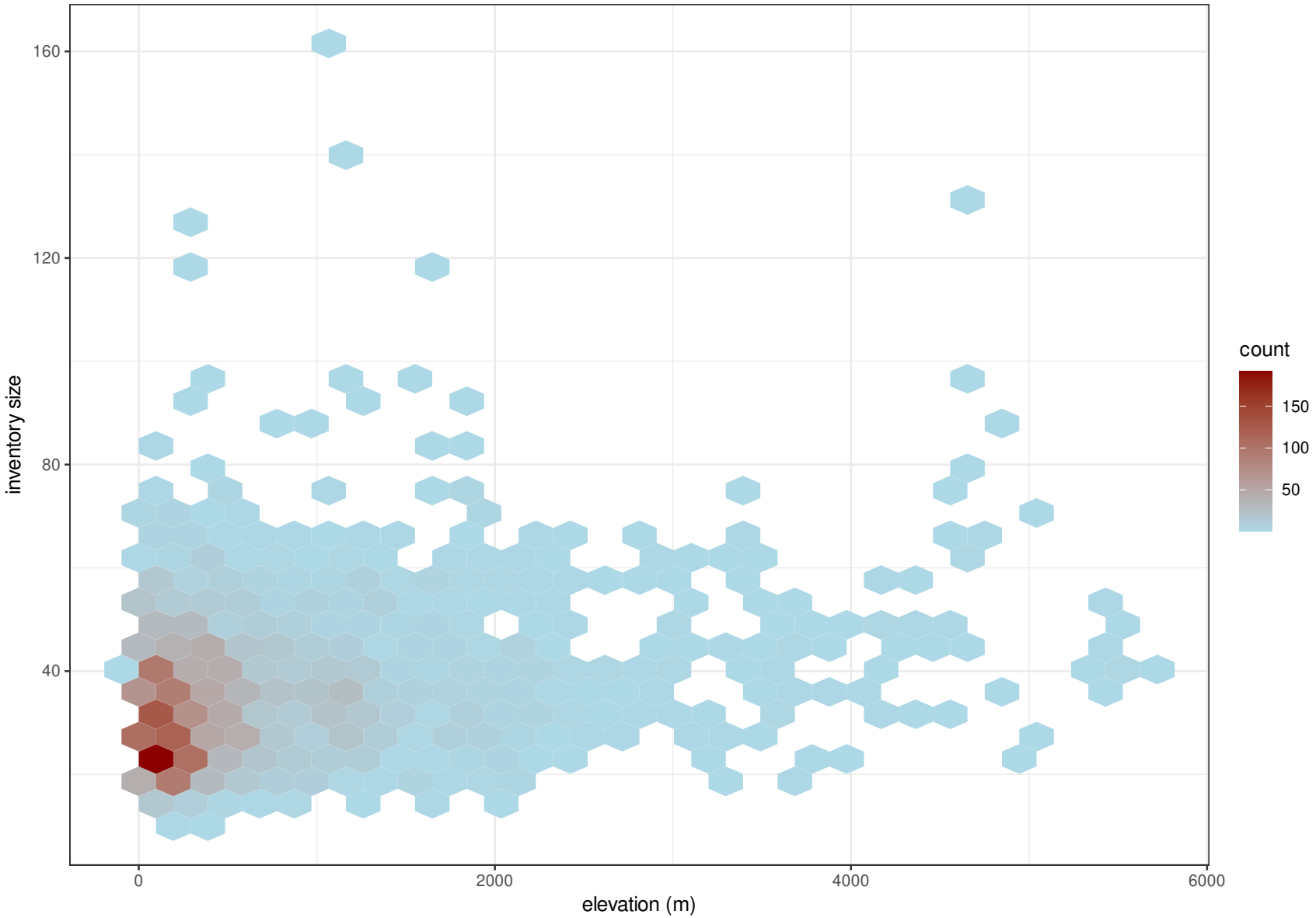
Negative binomial regression model (East Caucasian languages)

$$\text{number of phonemes} = \exp\left[3.7525 + 0.0002 \times \text{elevation}\right]$$



based on the sample of East Caucasian languages

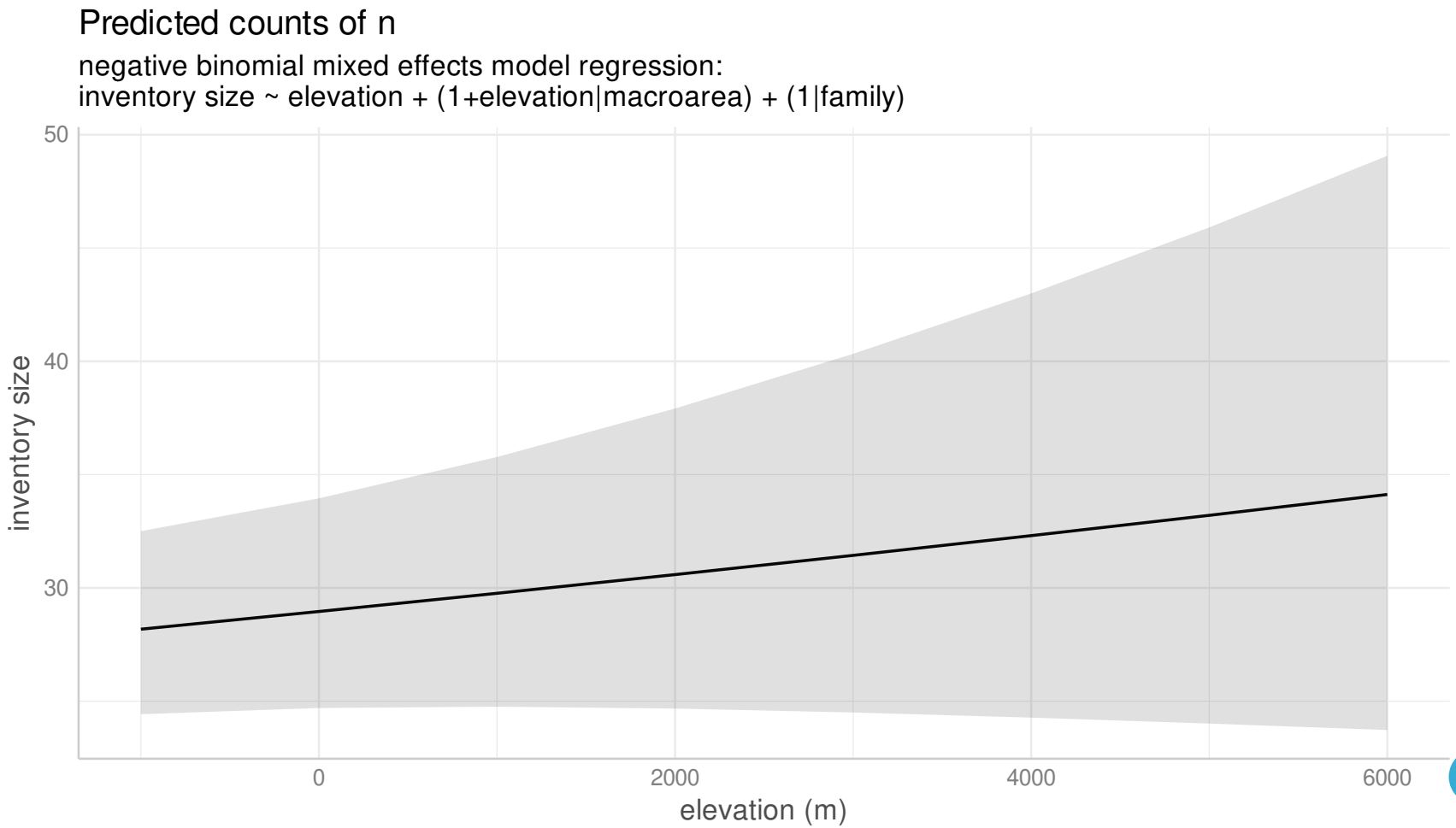
PHOIBLE data [Moran et al. 2014]



Negative binomial regression model (PHOIBLE)

elevation is not statistically significant

$$\text{number of phonemes} = \exp\left[3.3659 + 0.0273 \times \text{elevation}\right]$$



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False? Results:

As a result, I discovered a local effect in Dagestan that should be compared with other mountain areas (see e. g. affricate-rich languages in the Eastern Himalayan and in the Hindukush linguistic areas [Nikolaev and Grossman 2018]). If they show similar results, it would confirm Johanna Nichols' [2013] hypothesis that mountain areas provide isolation and "isolation favors complexity".

False? Results:

- However mountains can be different: see the Altai argument in [Urban 2020];
- It make sense to think more about other obstacles (e. g. rivers and travel costs, see [Allassonnière-Tang, Her this conference], [Koile et al. forthcoming]);
- Ignoring social, cultural and historical changes in language comunities leads to oversimplification: see about multilingualism patterns and their collapse in Dagestan [Dobrushina et al. 2019] and Urban's note during this conference;
- Pure altitude values are useless: we can't take this result and try to predict something in e. g. South America;
- I also wonder, what is the difference between Mountain area patterns and just Isolation patterns. Is it possible to treat Mountains as a complicated isolation situation?

To future researcher

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- Despite the fact that Johanna Nichols has proposed general model for language dynamics in mountain areas, I think we need more prediction oriented theory of Mountain linguistics.
- … and research preregistration!

Thank you for your attention!

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