Supporting Information for "Earthquake hazard and taxonomy under incomplete similarity conditions in northern Chile"

Cristián Siegel[1], Patricio A. Toledo[3], Raúl Madariaga[1,2], Jaime Campos[1,3]

[1]Departamento de Geofísica, Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile, Blanco Encalada 2002, Santiago, Chile

[2]Département de Géologie, Ecole Normale Superieure, PSL University, 75005 Paris, France.

[3]Programa de Riesgo Sísmico PRS, Universidad de Chile, Blanco Encalada 2002, Santiago, Chile

Contents of this file

1. Figures S1 to S3
2. Table S1

Additional Supporting Information (Siegel et al., 2021)

1. Captions for Dataset S1. The zipped file S1.zip contains the data used to make figures 1 and S1. This includes the hypocenter catalog $gfz\_2007\_2018.csv$ (retrieved from Sippl, Schurr, Asch, and Kummerow (2018a)), the coordinates of Northern Chile seismological network $cx.csv$ (retrieved from GFZ German Research Centre For Geosciences and Institut Des Sciences De L'Univers-Centre National De La Recherche CNRS-INSU

(2006)), a topographical profile *lat*21*topo*2, a bathymetric trench dataset *trough.csv* and a volcano location dataset *volcanoes.csv* (retrieved from Sernageomin.cl).

2. Captions for Dataset S2. The zipped file S2.zip contains processed data, including a *csv* data file for each cluster with its corresponding empirical scaling function Φ. The Φ curves are then processed in the spreadsheet *spreadsheet_alpha.xlsx* for power law fitting. Scaling regions, power law α exponent and R^2 associated errors are resumed in *Phi_export.csv*, corresponding to Table S1.

3. Captions for Dataset S3. The zipped file contains the Python scripts needed to make figures and Table (1). *steqca.py* is an auxiliary script. *hypomaps.py* is used to make figures (1) and S1. *betagamma.py* is used to make Table (1). *calc_Phi.py* calculate processed data for dataset S2. *phiPhi_P*1*.py* is used to make Figure S2. *plot_Phi.py* is used to make Figure (1)

Introduction

In this supporting information we present two auxiliary figures and one auxiliary table that reinforce contents shown on figures and tables in the main text. Additionally, we present 3 datasets needed to reproduce our results, published in Siegel et al. (2021).

References

GFZ German Research Centre For Geosciences, & Institut Des Sciences De L'Univers-Centre National De La Recherche CNRS-INSU. (2006). *Ipoc seismic network.* Integrated Plate boundary Observatory Chile - IPOC. Retrieved from `http://geofon.gfz-potsdam.de/doi/network/CX` doi: 10.14470/PK615318

Siegel, C., Toledo, P., Madariaga, R., & Campos, J. (2021, September). *Additional*

supporting information for "earthquake hazard and taxonomy under incomplete similarity conditions in northern chile". Zenodo. Retrieved from https://doi.org/10.5281/zenodo.5519970 doi: 10.5281/zenodo.5519970

Sippl, C., Schurr, B., Asch, G., & Kummerow, J. (2018a). *Catalogue of earthquake hypocenters for northern chile compiled from ipoc (plus auxiliary) seismic stations.* GFZ Data Services. Retrieved from http://doi.org/10.5880/GFZ.4.1.2018.001

Sippl, C., Schurr, B., Asch, G., & Kummerow, J. (2018b). Seismicity structure of the northern chile forearc from¿ 100,000 double-difference relocated hypocenters. *Journal of Geophysical Research: Solid Earth*, *123*(5), 4063–4087.

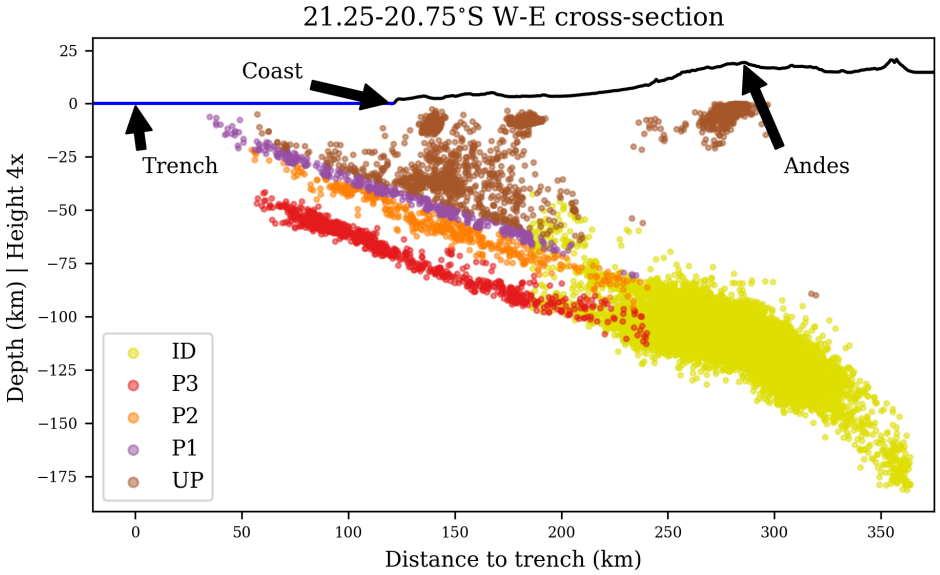

Figure S1. Cross-section at 21° S between 72 and 67° W as shown in Figure (1). On the abscissa is the distance to the trench in km, on the ordinate the depth with respect to sea level in km. The topography is exaggerated 4 times. The topographic features are the coastline and the Andes. As a reference, the seismicity with $1.3 \leq Mw$ is shown for events located between 21.25 and 21.75° S. In colors, according to the legend, are indicated the different seismicity clusters according to Sippl et al. (2018b): ID, Intermediate-Depth Cluster; P3, Lower Plane; P2, Upper Plane; P1, Plate Interface and UP, Upper Plate Cluster.

Table S1. For each cluster P1, P2, P3, UP and ID, the lower and upper regions of the distribution are given in power law form, with their left limit ${\Pi_T}^-$ and right ${\Pi_T}^+$ limits, α exponents and R^2 errors associated with the least squares inversion.

	Lower region		Upper region		Lower region		Upper region	
	${\Pi_T}^-$	${\Pi_T}^+$	${\Pi_T}^-$	${\Pi_T}^+$	α	R^2	α	R^2
P1	5.21×10^{-3}	2.13×10^{0}	1.36×10^{1}	6.85×10^{1}	-1.054	0.999	-3.024	0.996
P2	3.65×10^{-3}	2.32×10^{-1}	4.63×10^{0}	2.93×10^{1}	-0.780	0.994	-3.099	0.998
P3	1.52×10^{-2}	4.92×10^{-1}	4.98×10^{0}	1.59×10^{1}	-0.267	0.903	-4.155	0.998
UP	3.62×10^{-3}	1.83×10^{-1}	2.92×10^{0}	2.33×10^{1}	-0.776	0.975	-2.646	0.989
ID	3.46×10^{-3}	1.12×10^{-1}	1.82×10^{0}	9.39×10^{1}	-0.081	0.805	-2.455	0.999

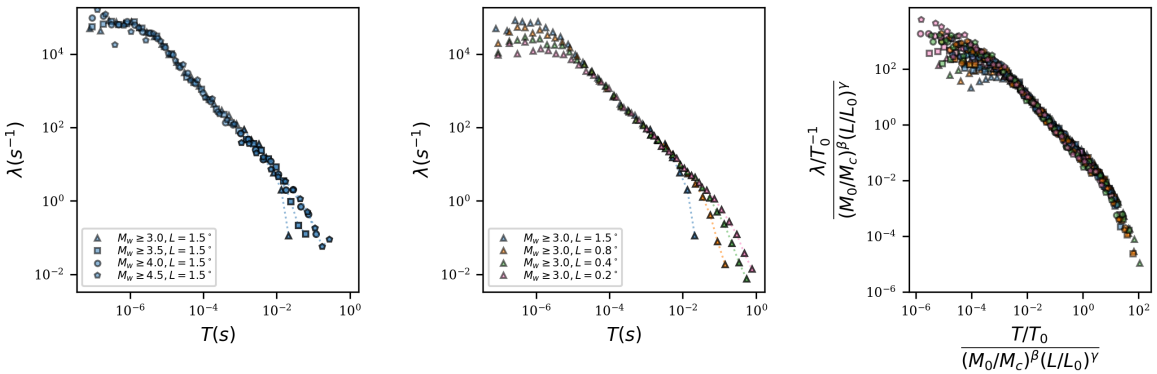

Figure S2. For cluster P1 (Plate interface) the left and middle boxes show the distributions for the expected number of events per unit time T according to the interevent times T. In the left frame the observation length $L = 1.5^\circ$ is fixed and curves for 4 exceedance magnitudes are shown. In the middle box the exceedance magnitude is fixed at $M_w = 3.0$ and curves for 4 observation lengths are shown. The box on the right shows the Φ scaling function for the P1 cluster, the axes show the renormalized variables.

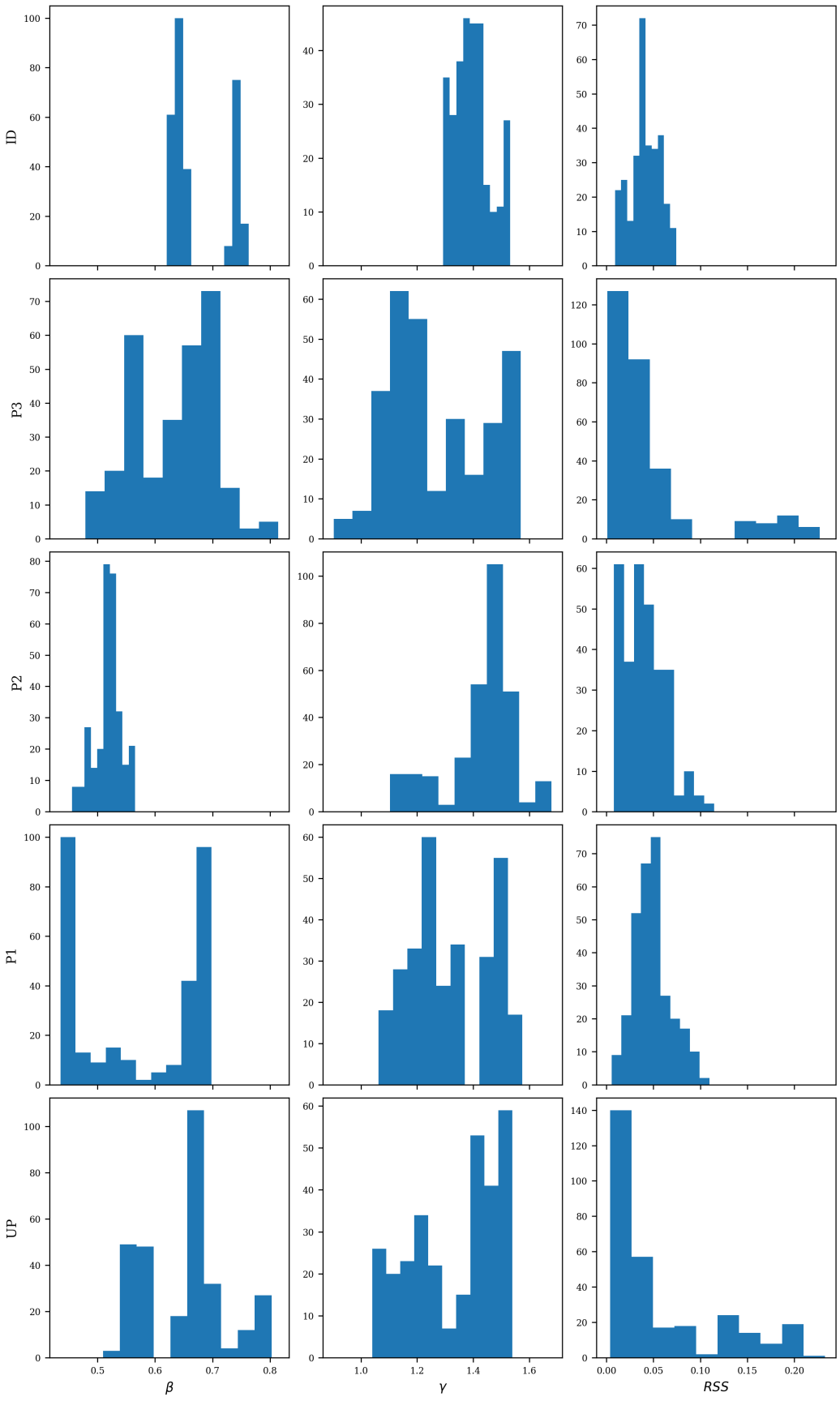

Figure S3. Histograms for β, γ and sum of quadratic residuals (RSS) according to least squares inversion for the assembly of cells, grids and rotations considered, for each cluster ID, P3, P2, P1 and UP.