Supplement to
A repeating earthquake catalog for the Atacama Segment in North Chile (24°S-31°S)

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Description

This supplement file contains a description of the associated text files:
nca_repeater_list.txt,
nca_mining_cluster.txt,
nca_event_pairs.txt
as well as **additional figures** with examples and descriptions to support the main article.

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Catalog Files

nca_repeater_list.txt

This file contains the repeating earthquake table, where events are grouped into repeater families already. Below the header, there occur two different types of lines. The type, starting with #, contains information on the properties of the repeater family. The other line-type holds information on the single events.
Header entries are:

time	:	event origin time
cID	:	cluster ID
lat	:	event latitude or median of the sequence
lon	:	event longitude or median of the sequence
dep	:	event depth in km or median of the sequence
mag	:	magnitude or average magnitude for the sequence
stdmag	:	standard deviation of magnitudes in the sequence
numel	:	number of events in the sequence
td	:	total duration between first and last event in days
tr	:	average inter-event time
cvr	:	coefficient of variation
slip	:	slip in cm or cumulative slip in cm for the whole series, where each first event is neglected
sr	:	average slip rate in cm/yr, note that sr may be artificially high if td or tr are very small.
tccls	:	tectonic location identifier similar to Münchmeyer et. al, 2025
type	:	recurrence pattern type for sequences with n>3

nca_mining_cluster.txt

This file contains a list of earthquakes that fulfill the repeater criteria but bear the tectonic label $mining$, which stands for mining events. They were removed from the repeater lists as they do not reflect natural seismicity. The events are grouped into clusters similar to the repeaters. Below the header, there occur two different types of lines. The type, starting with #, contains information on the properties of the repeater family. The other line-type holds information on the single events.
Header entries are:

time	:	event origin time
cID	:	cluster ID
lat	:	event latitude or median of the sequence
lon	:	event longitude or median of the sequence
dep	:	event depth in km or median of the sequence
mag	:	magnitude or average magnitude for the sequence
numel	:	number of events in the sequence
tccls	:	tectonic location identifier similar to Münchmeyer et. al, 2025

nca_event_pairs.txt

This file contains the pairs of matches and templates from which the repeater families were constructed.
Header entries are:

time	:	event origin time of the match
time_t	:	event origin time of the template
cc	:	list of cross correlation values at the closest available stations - sorting refers to stat column
lat	:	latitude of template event
lon	:	longitude of template event
dep	:	depth of template event in km
stat	:	stations on which the cc was computed - sorting refers to the cc column
cID	:	cluster ID
mag	:	magnitude of match
mag_t	:	magnitude of template

Additional Figures

Figure S 1 Waveform availability of the utilized seismic station network. Stations stem from networks CX, C, C1 and IU. Locations are shown on the map in Figure 1 and in Figure S2. Station sorting is from north to south. In the bottom panel, waveform availability for station IU.LCO is displayed, additionally, over its complete availability range.
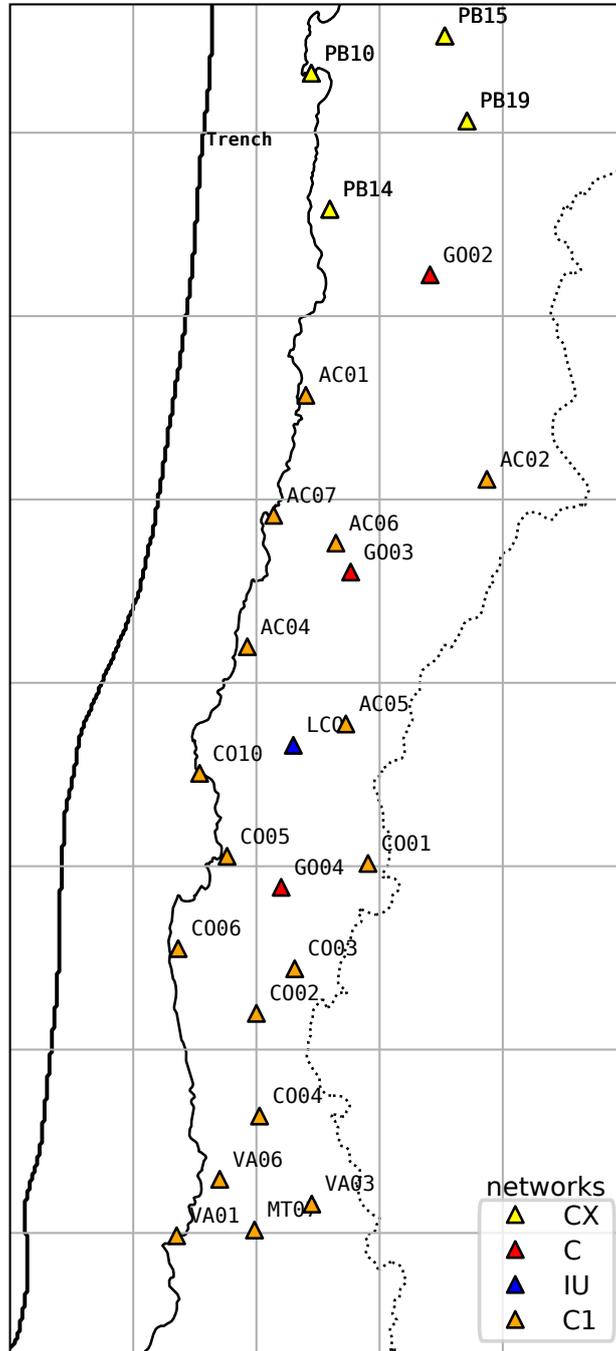
Figure S 2 Station network with seismic stations in orange. Black lines from left to right are: the trench, the coastline and the Chilean border.
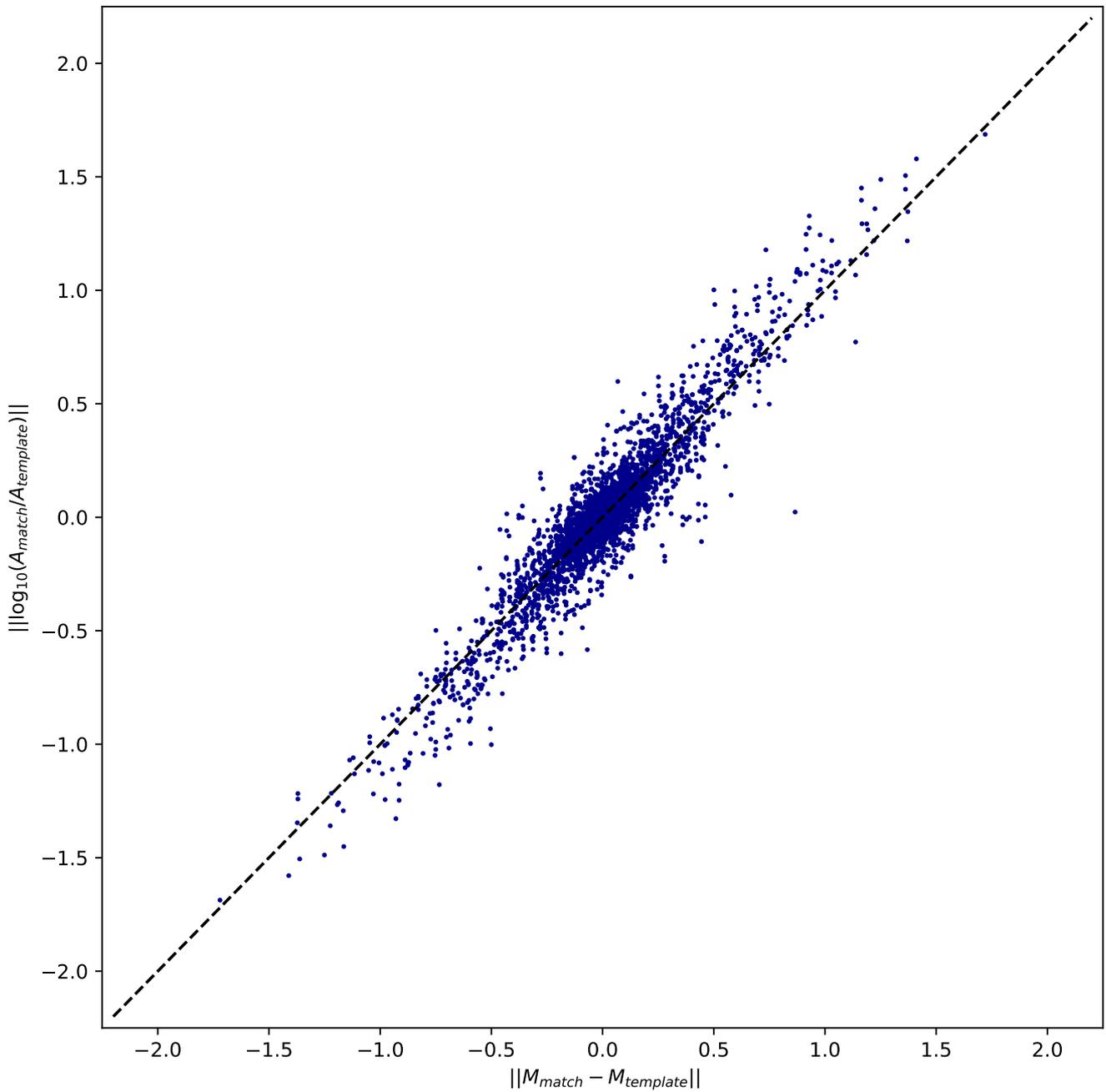
Figure S 3   Logarithmic amplitude ratio versus magnitude difference for all 3328 event pairs, where both events are contained in the Atacama catalog. Black dashed line is the bisecting (1:1) line. Here, both $M_{template}$ and M_{match} are the catalog magnitudes, while the amplitude ratio is independently measured (averaged over 2-3 stations, 1-4Hz filtered velocity waveforms). The great majority of points lie close to the 1:1 line, meaning that the relative magnitude measurements obtained by the template matching provide consistent values with the catalog magnitudes. We can therefore apply it to compute the magnitudes of the newly detected events which were not in the original catalog. Note that this relative simple approach works especially well here, because it is applied to pairs of highly similar seismic waveforms.
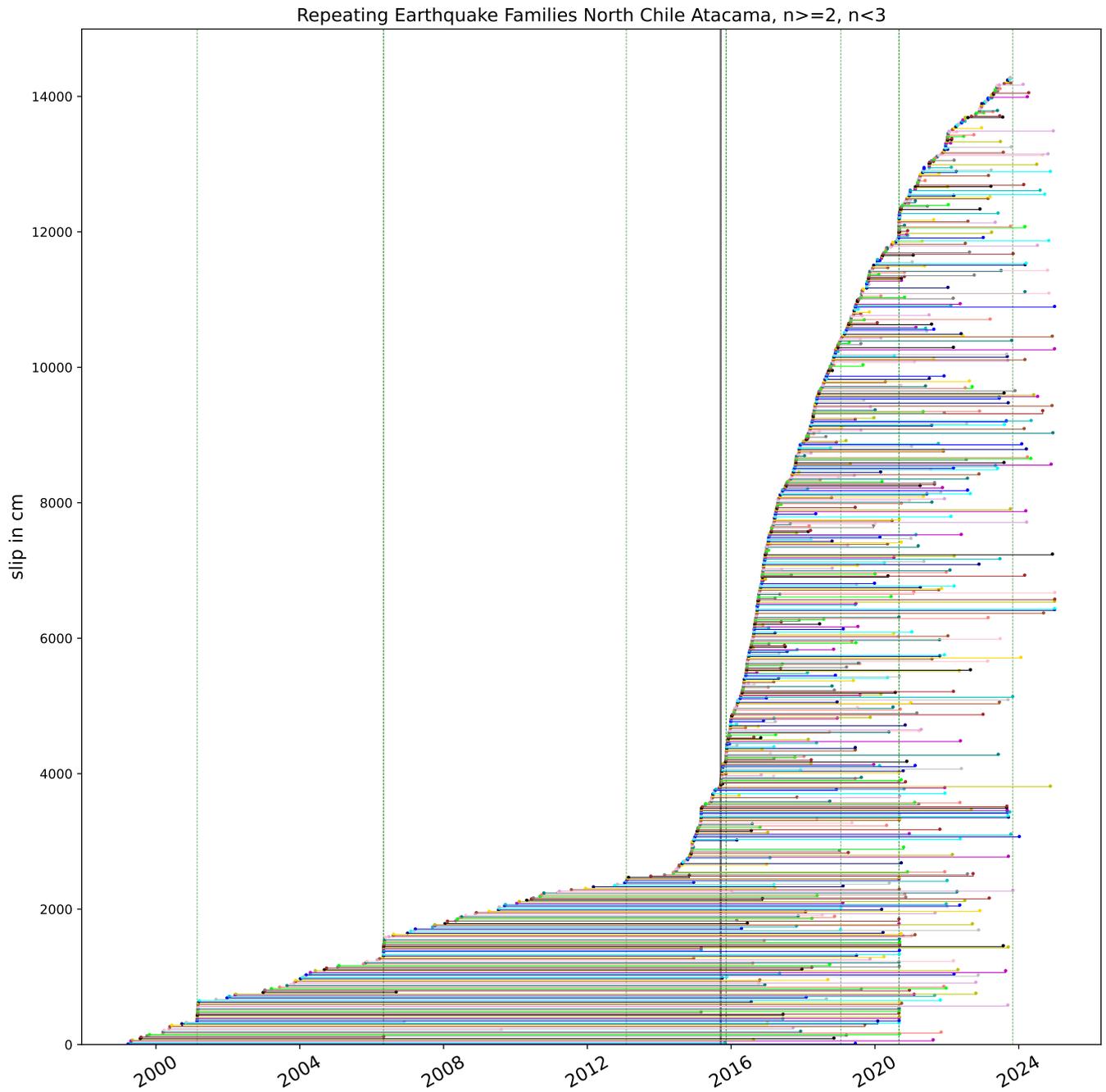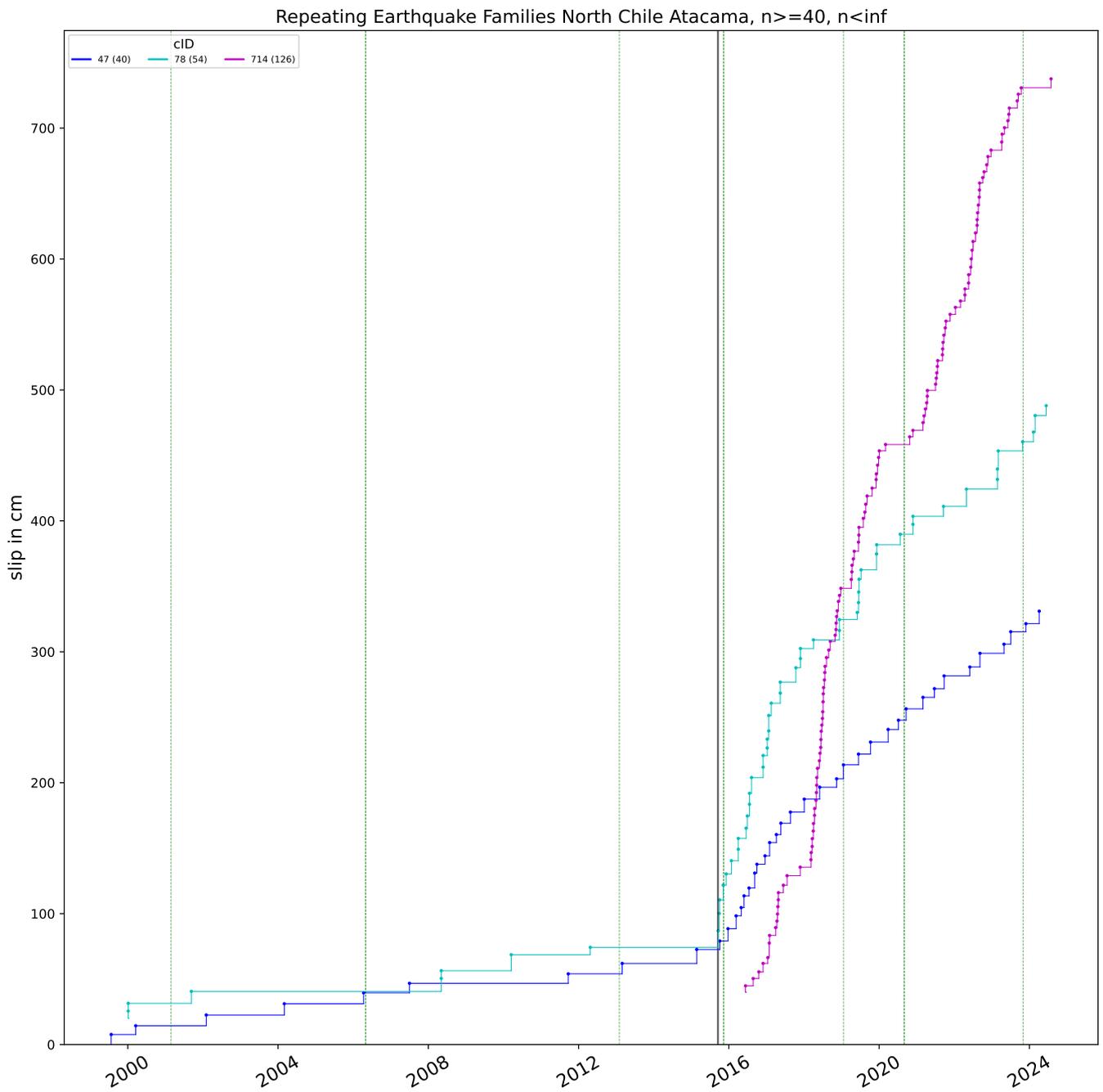
**Figure S 4** Slip vs. time for repeater families that only have 2 members (doublets). The vertical line denotes the occurrence time of the 2015 Illapel earthquake. Dashed lines depict occurrence times of other, selected large magnitude events. Note their big influence on repeater occurrence rates. Also, be aware of the increase of station coverage starting from may 2014.
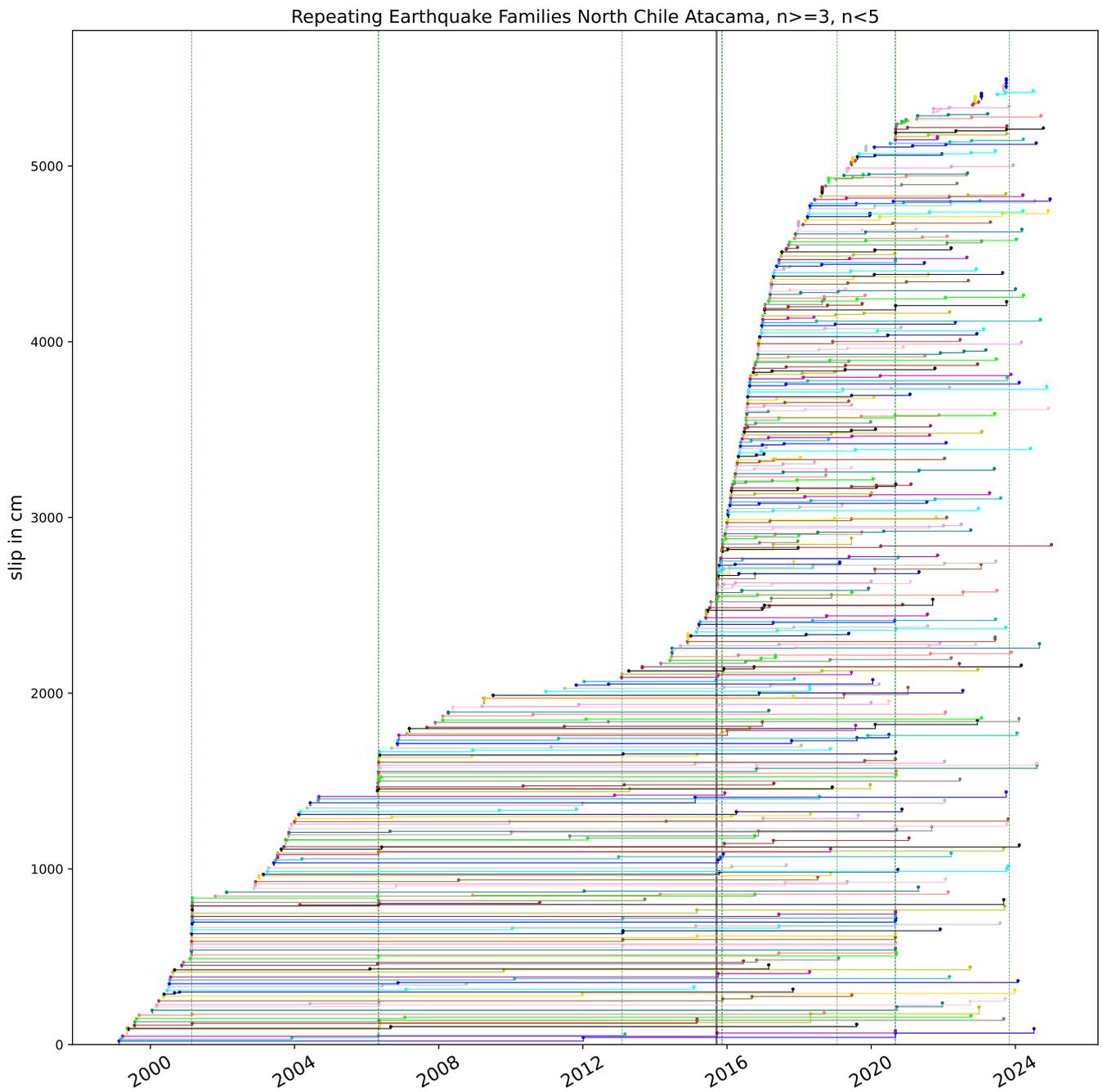
Figure S 5 Slip vs. time for repeater families that have 3–4 members. The vertical line denotes the occurrence time of the 2015 Illapel earthquake.
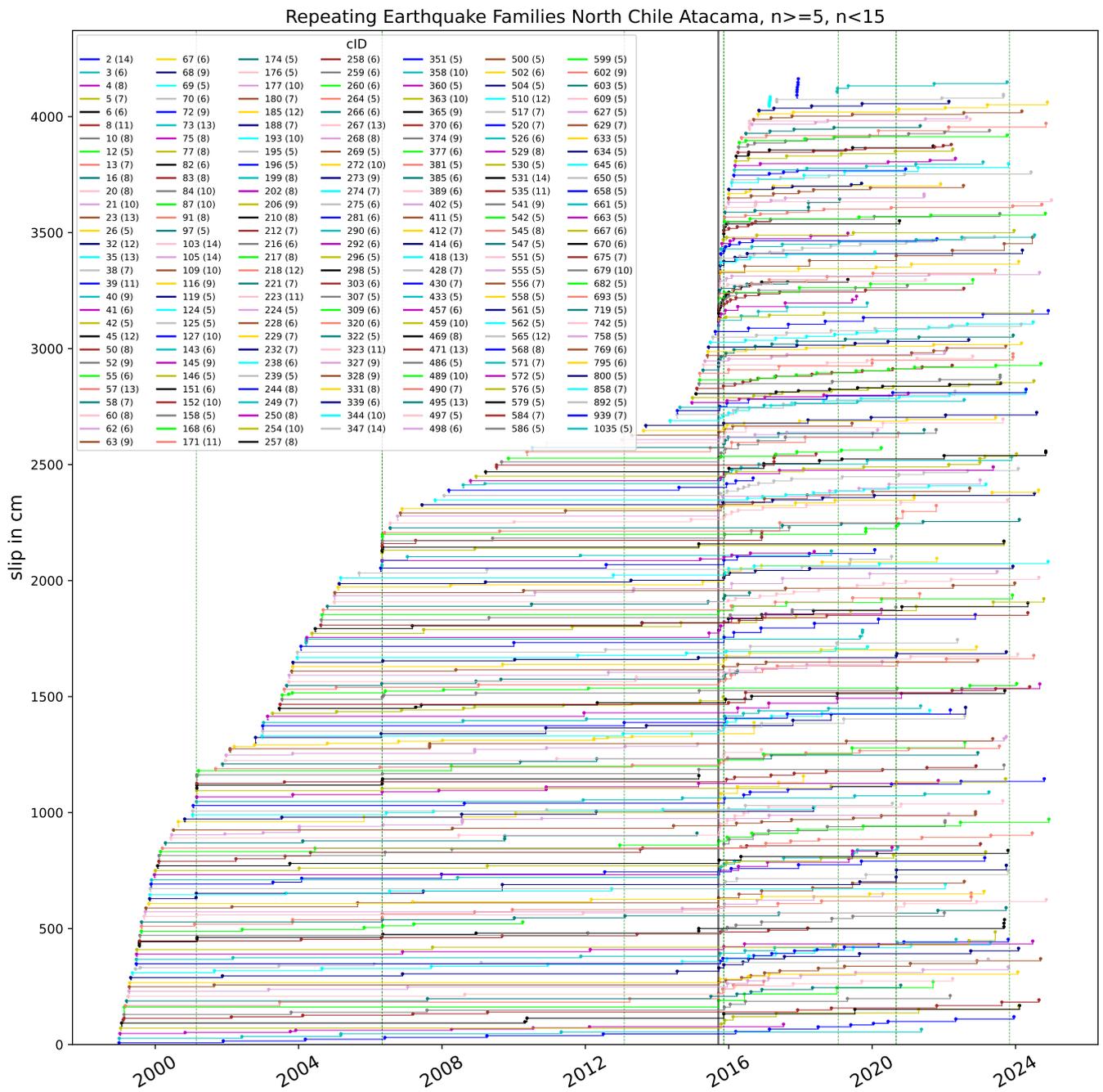
Figure S 6   Slip vs. time for repeater families that have 5–14 members. The vertical line denotes the occurrence time of the 2015 Illapel earthquake.
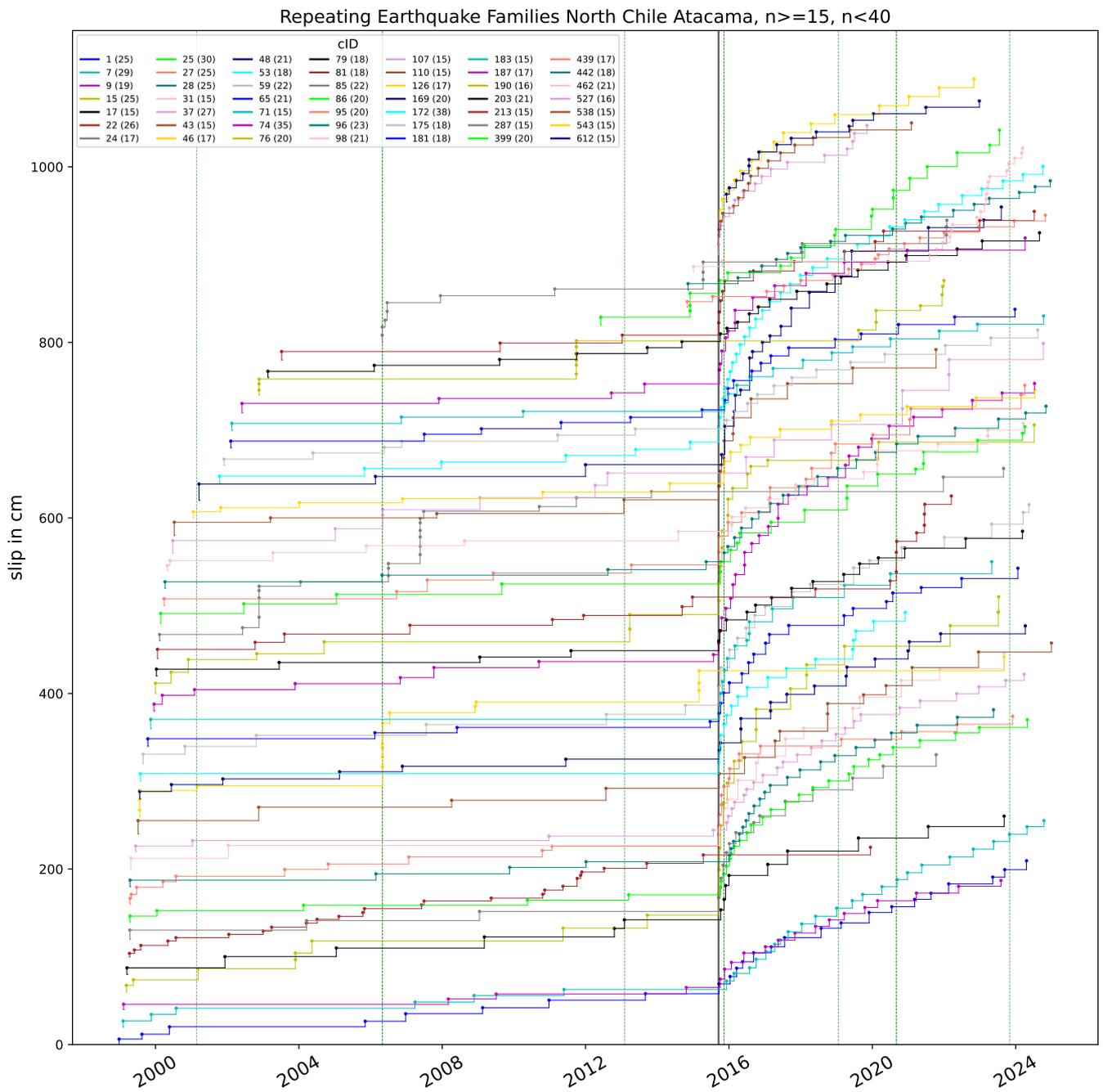
Figure S 7 Slip vs. time for repeater families that have 14–39 members. The vertical line denotes the occurrence time of the 2015 Illapel earthquake. Note its strong impact on repeater recurrence behavior.

Figure S 8 Slip vs. time for repeater families that have 40 or more members. The vertical line denotes the occurrence time of the 2015 Illapel earthquake.
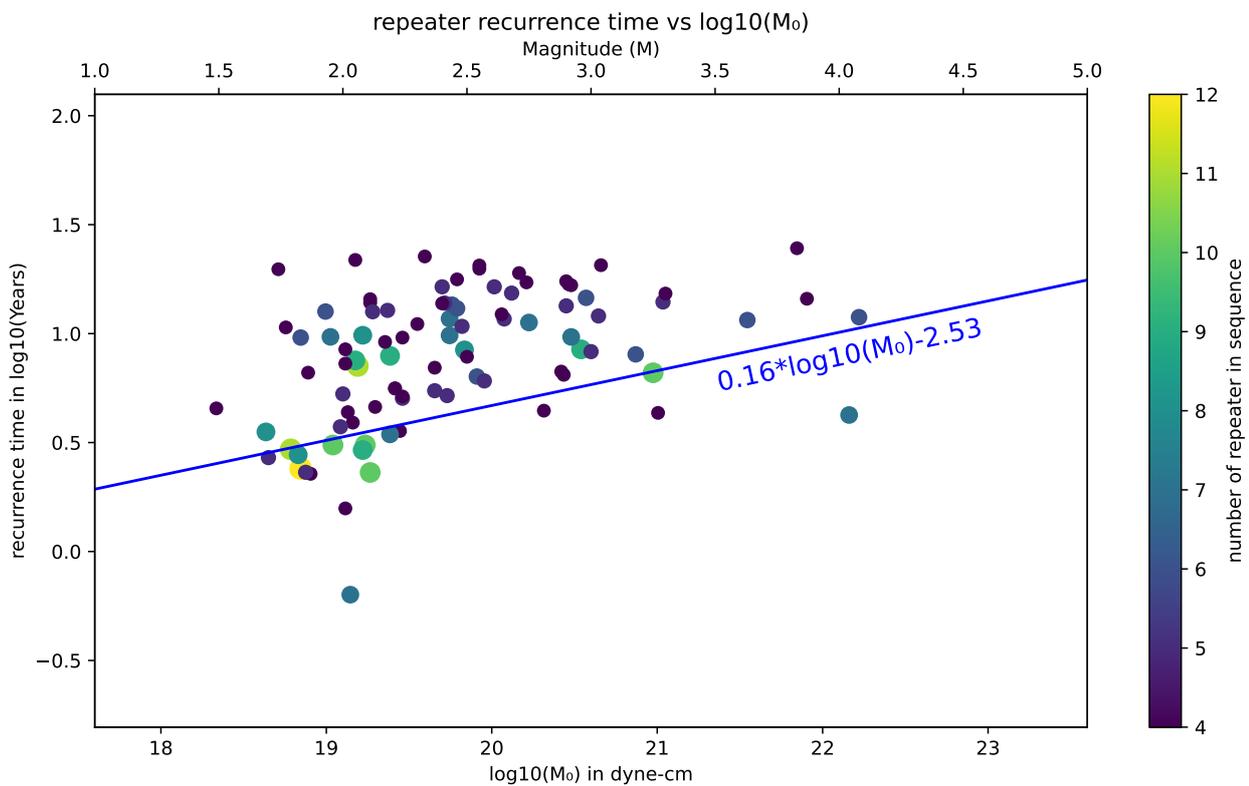
Figure S 9   Recurrence time vs. magnitude. Only RES with the quasi periodic label (qp) are included. The blue line shows the relation obtained by Nadeau & Johnson (1998) and Chen (2007) which has been shown to be valid in many regions of the world (Uchida(2019)). The recurrence times have been normalized by the regional plate convergence velocity (6.7cm/yr). The coloring shows the number of REs in each group. Note, that those groups with more members better align with the blue line.
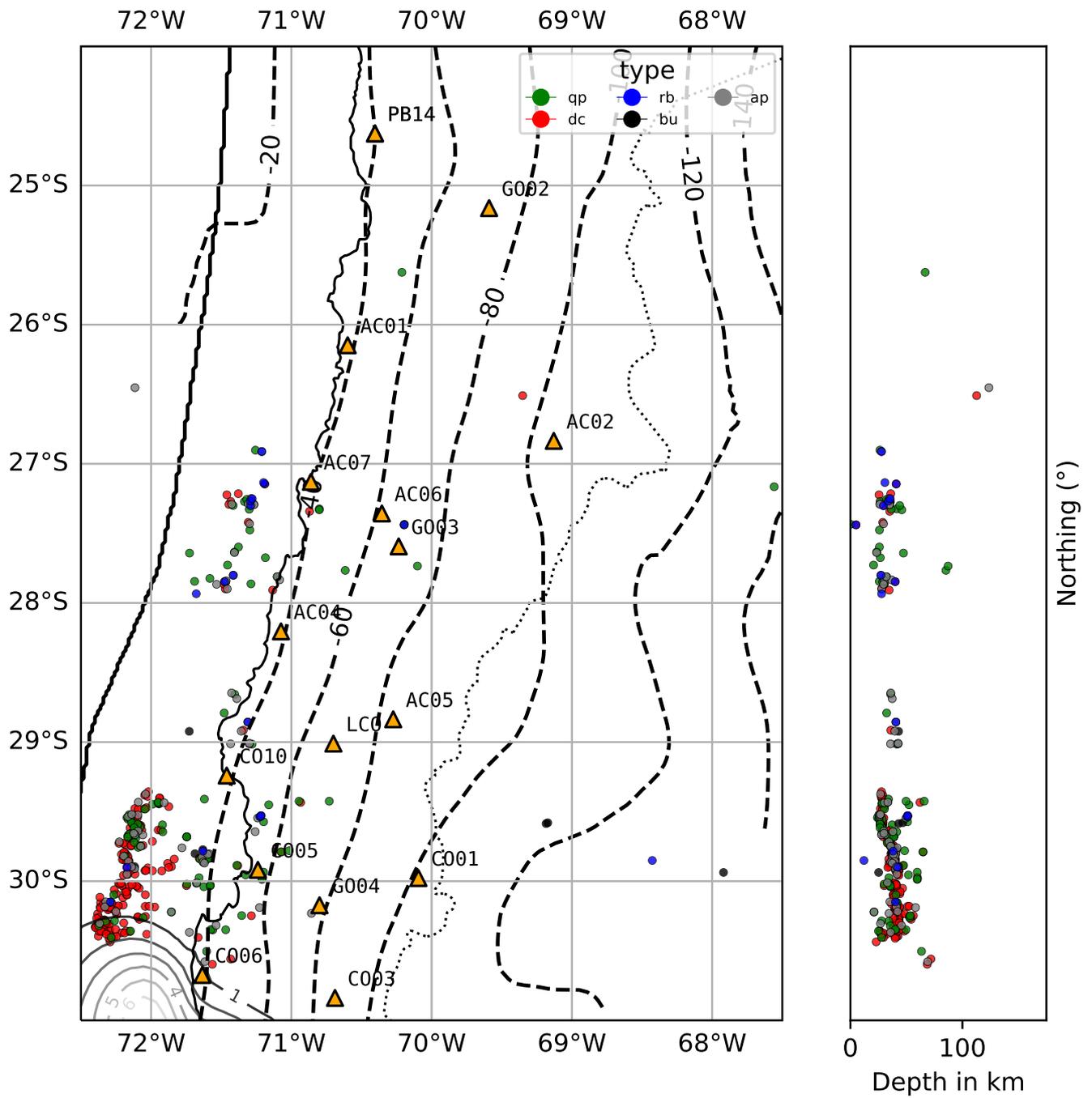
Figure S 10 Recurrence type map: qp - quasi periodic, rb: repeated burst, ap: aperiodic, dc: decay, bu: burst.
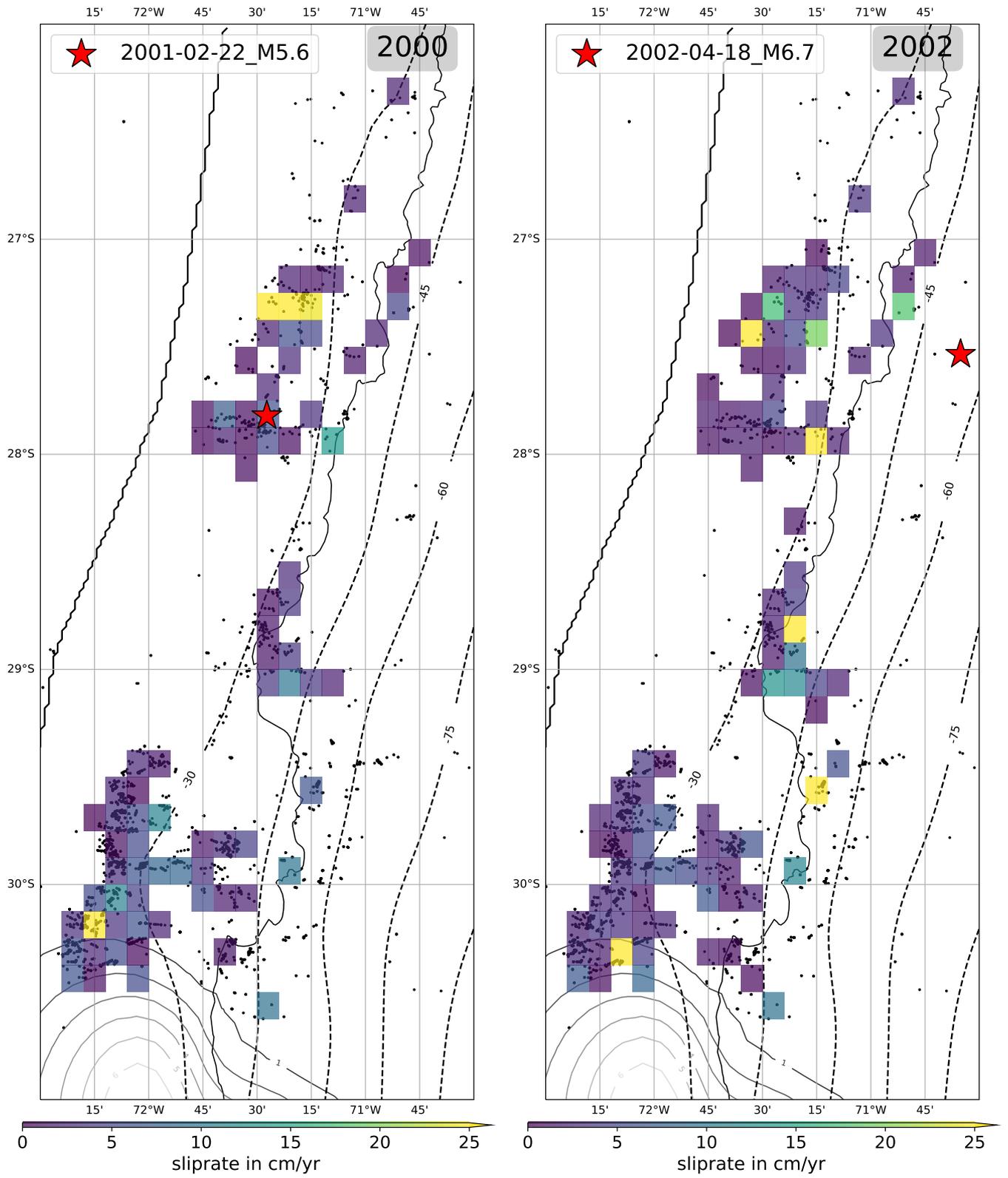
Figure S 11   Biyearly slip maps of the years 2000/2001 and 2002/2003.
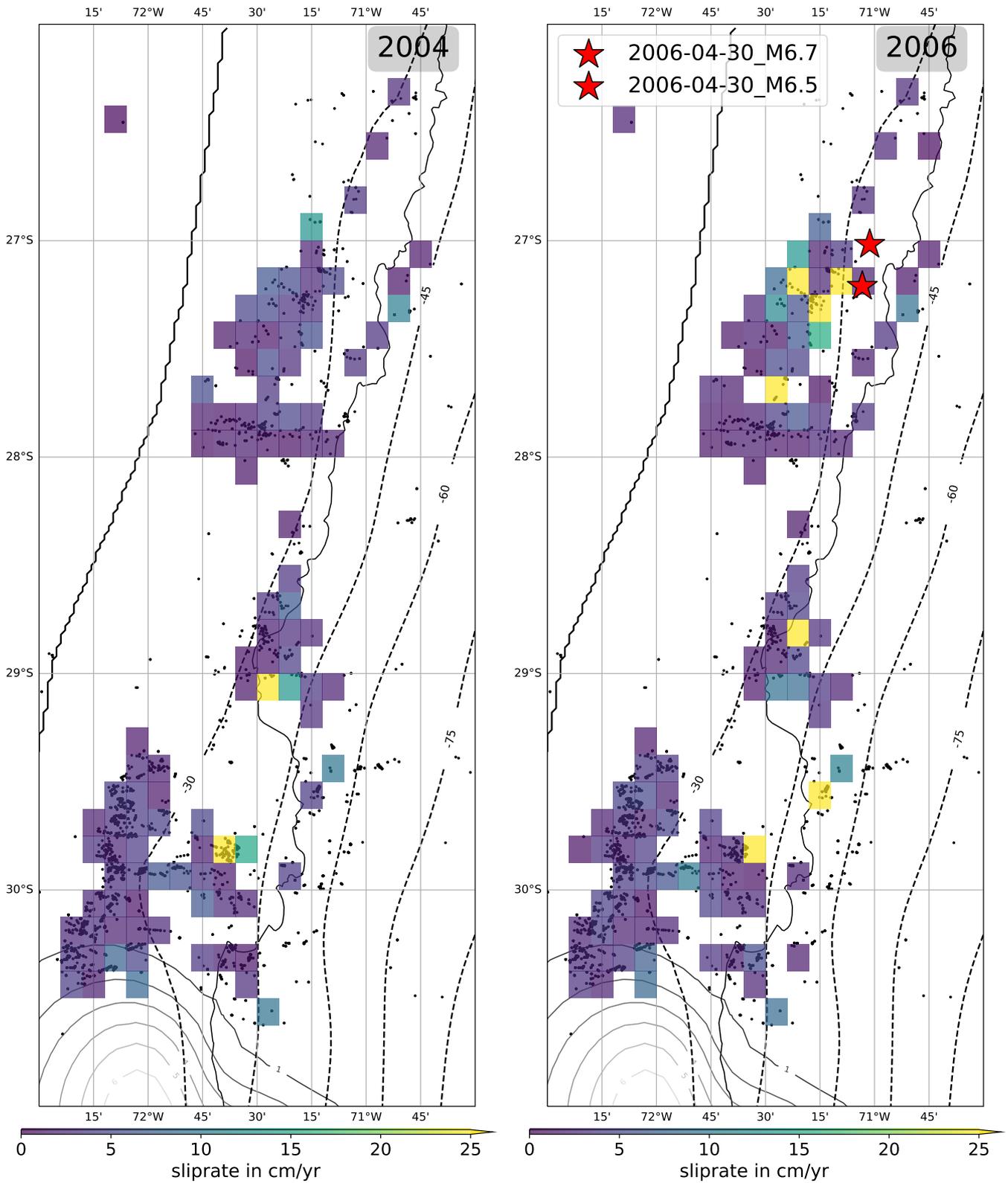
Figure S 12   Biyearly slip maps of the years 2004/2005 and 2006/2007.
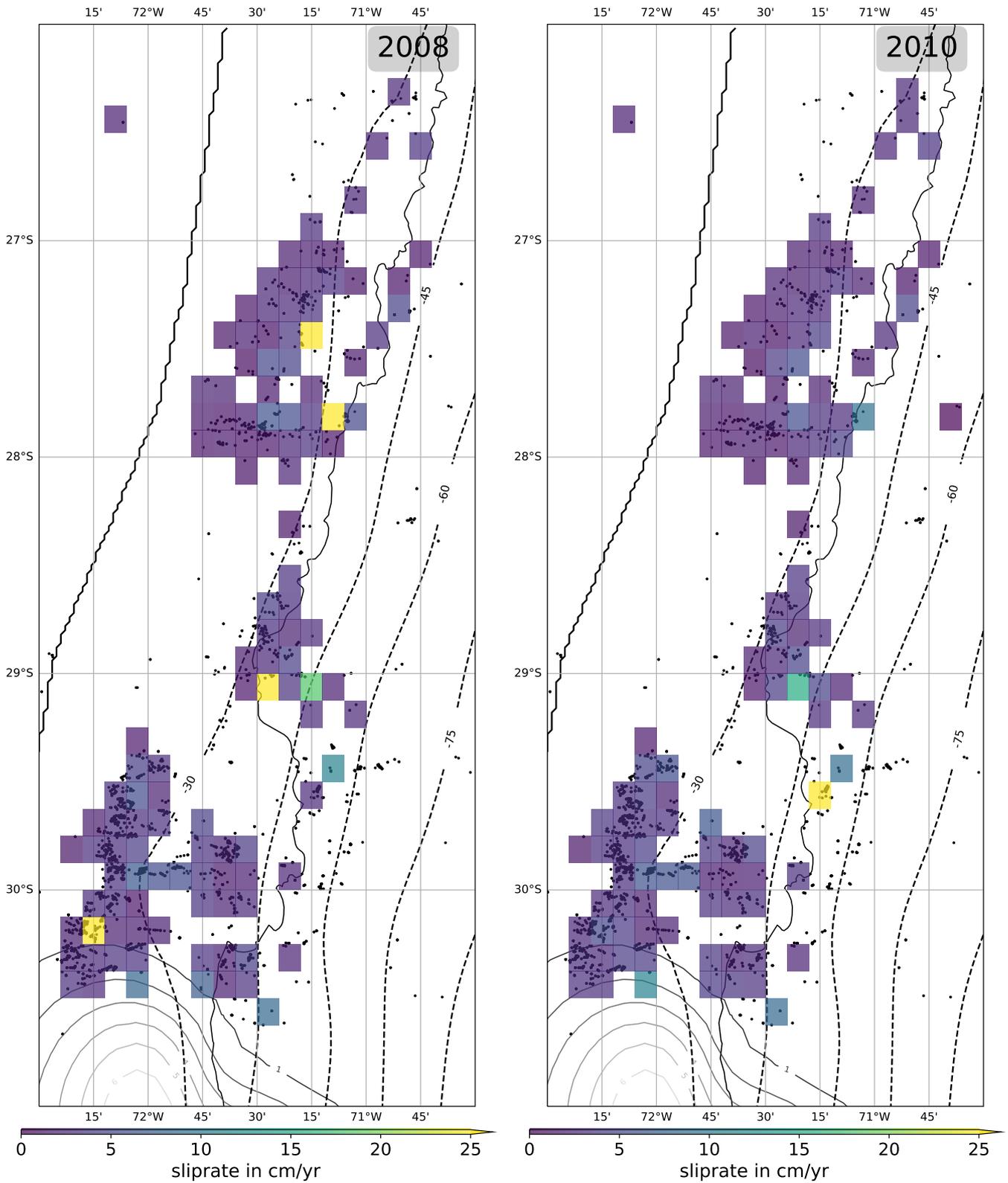
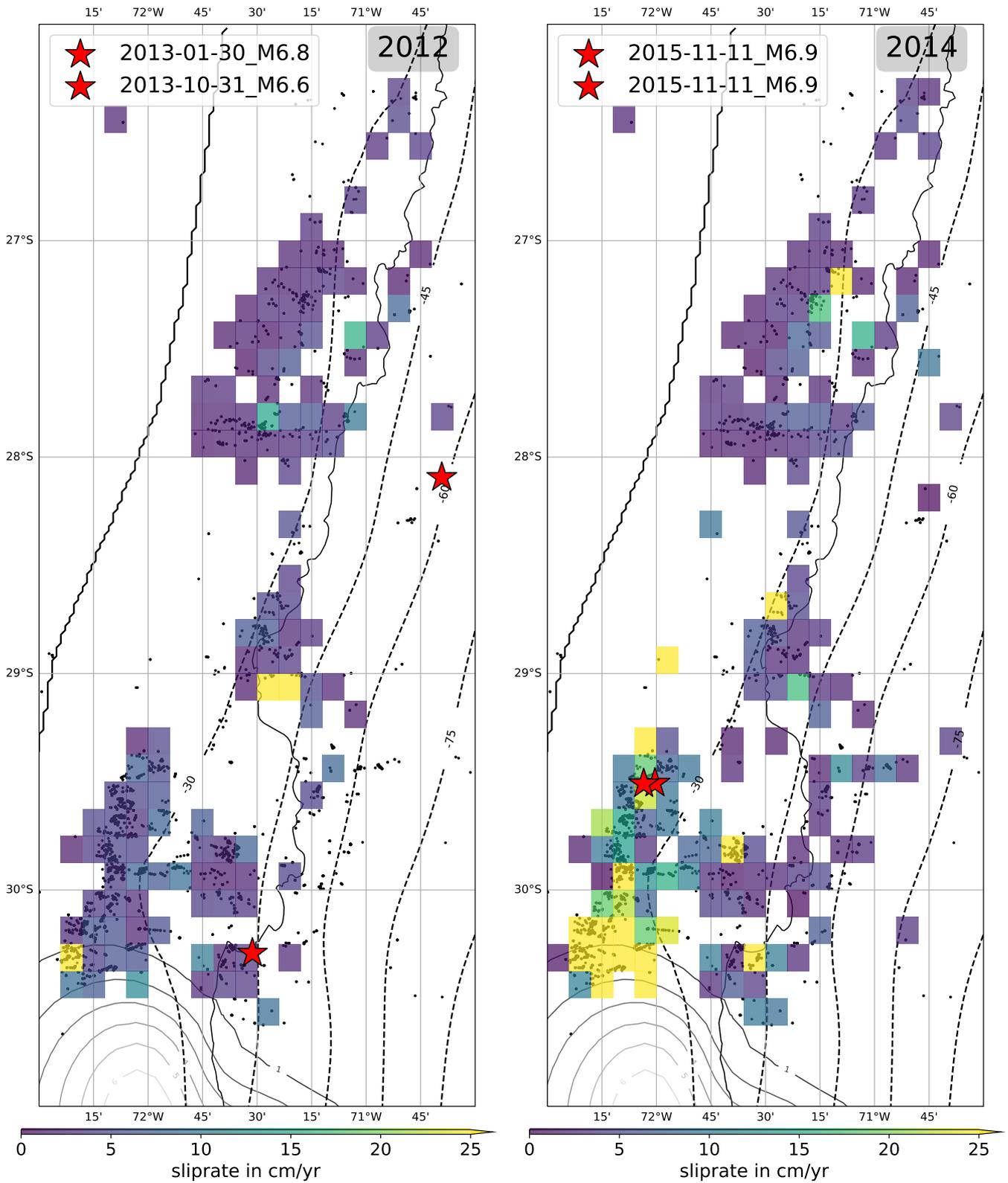**Figure S 13**   Biyearly slip maps of the years 2008/2009 and 2010/2011.

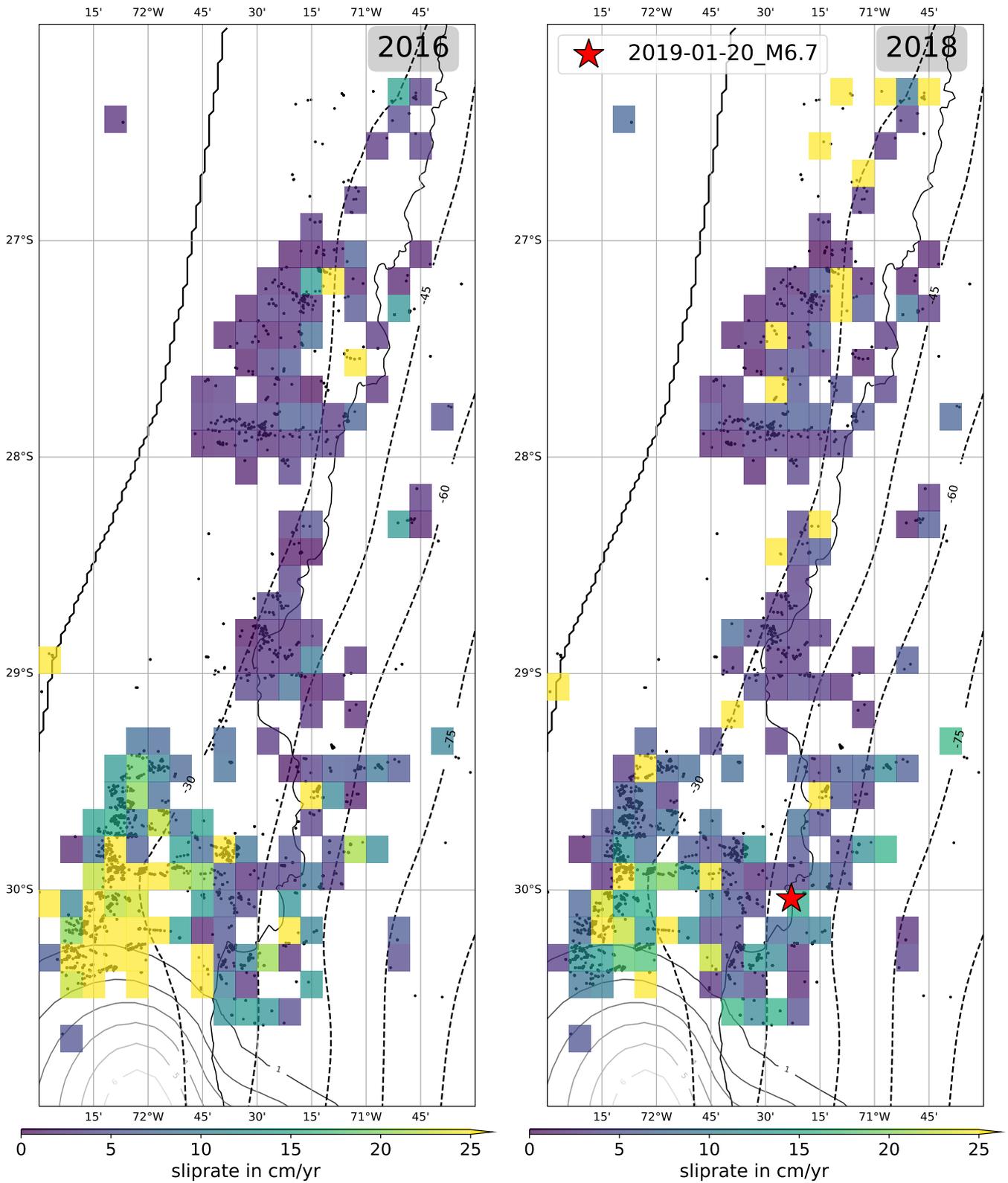**Figure S 14**   Biyearly slip maps of the years 2012/2013 and 2014/2015.

Figure S 15   Biyearly slip maps of the years 2016/2017 and 2018/2019.
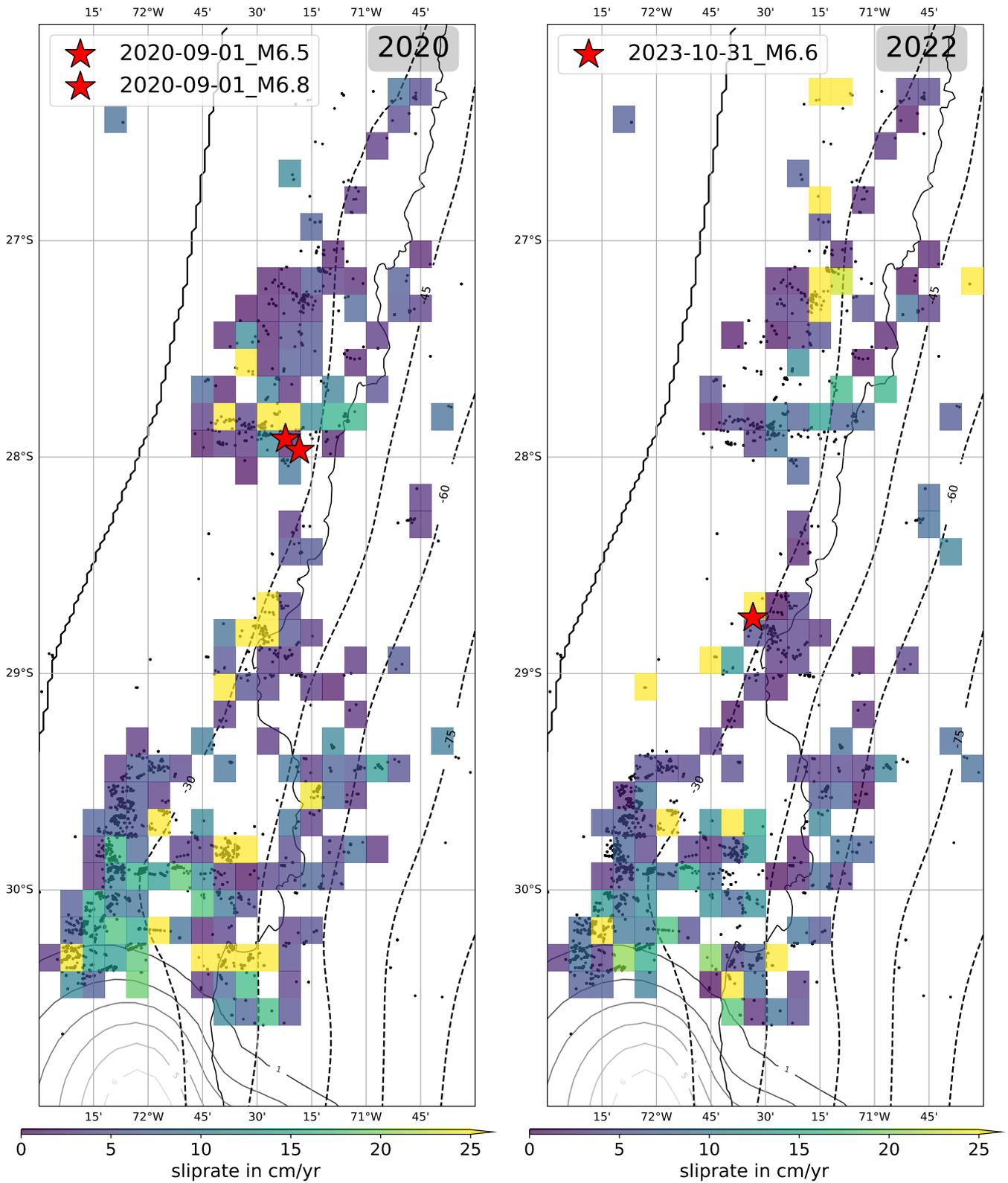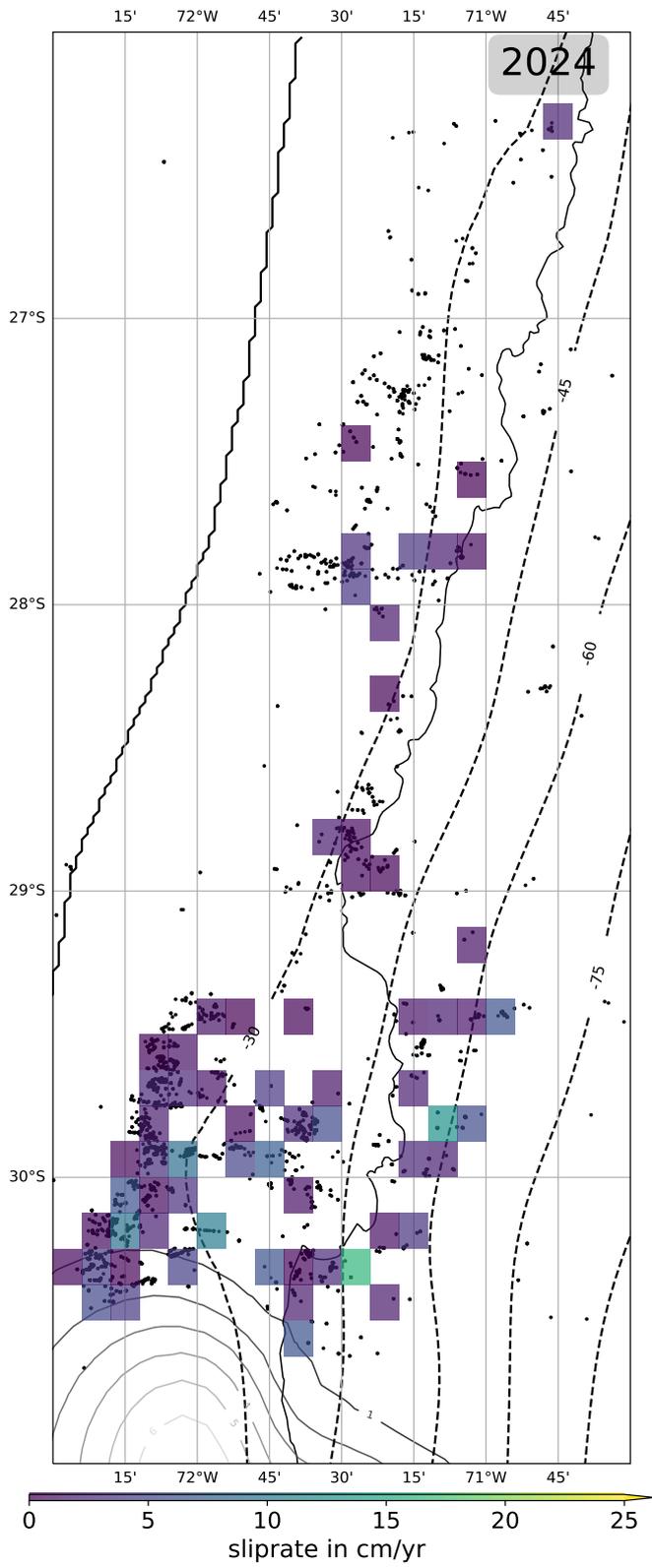
Figure S 16 Biyearly slip maps of the years 2020/2021 and 2022/2023.

Figure S 17   Yearly slip maps of the year 2024.