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Distribution of postseismic slip on the Calaveras fault, California, following the 1984 M6.2 Morgan Hill earthquake

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ABSTRACT

Repeating earthquakes (REs) are sequences of events that have virtually identical waveforms and are interpreted to represent fault asperities driven to failure by loading from aseismic creep on the surrounding fault surface at depth. To investigate the postseismic deformation after the 1984 M6.2 Morgan Hill earthquake, we identify RE sequences occurring on the central Calaveras fault between 1984 and 2005 using a combination of cross-correlation and spectral coherence techniques. Both the accelerated slip transients due to the earthquake as well as the return to interseismic background creep rates can be imaged from our dataset. A comparison between the regions of the fault that ruptured coseismically and the locations of the REs show that REs preferentially occur in areas adjacent to the coseismic rupture. Using calculated RE-derived subsurface slip distributions at 6 months and 18 months after the mainshock, we predict surface electronic distance meter (EDM) line length changes between stations near the Morgan Hill rupture area. The RE-derived slip model underpredicts a subset of the observed line-length changes. Inclusion of transient aseismic slip below the seismogenic zone is needed to better match the measured surface deformation.

1. Introduction

The ability to accurately determine the magnitude and location of postseismic slip after a large earthquake is essential when identifying regions that are releasing elastic strain through aseismic slip and locked areas that this slip may be further loading. This information is especially important for use in hazard assessment studies on faults that are known to have locked and creeping sections, such as the Calaveras, Hayward and San Andreas faults in California.

Although not necessarily typical, studies modeling afterslip following moderate earthquakes on both the central Calaveras and creeping section of the San Andreas fault suggested that postseismic slip can be on the same order as, or even exceed, the coseismic slip (Langbein et al., 2006; Johanson et al., 2006; Prescott et al., 1984). The extent to which these creeping patches can influence the timing of rupture of nearby locked patches is currently under question. For example, on the Calaveras fault, an investigation of a sequence of three northward progressing earthquakes, the 1979 M5.9 Coyote Lake earthquake, the 1984 M6.2 Morgan Hill earthquake, and the 1988 M5.1 Alum Rock earthquake, deduced that coseismic shear stress increases alone could not be wholly responsible for the sequence occurrence (Du and Aydin, 1993).

An analysis of microseismicity with respect to probable rupture areas of earthquakes greater than M5 along the central Calaveras fault illustrates that larger events tend to rupture in deep, relatively aseismic areas, suggesting that these aseismic holes are seismogenic but currently locked (Oppenheimer et al., 1990). An independent assessment using surface geodetic data to identify regions with interseismic subsurface slip deficits also supports the conclusion that the deeper aseismic patches are locked (Manaker et al., 2003). Similar behavior has been observed on the Parkfield segment of the San Andreas fault, where a previously identified deep section of the fault lacking REs (Nadeau and McEvilly, 1999) later ruptured as the northwest slip patch of the 2004 M_w6.0 Parkfield earthquake (e.g., Kim and Dreger, 2008).

The Morgan Hill earthquake was located within a deep portion of the fault that is largely aseismic and probably locked (Schaff et al., 2002). Due to a lack of near-fault surface displacement measurements prior to the Morgan Hill earthquake, it is not well known if the surface trace of the fault up-dip from the rupture area was locked or creeping (Manaker et al., 2003). After the earthquake, a small-aperture alignment array installed four kilometers southeast of the epicenter and above the rupture zone did not reveal significant amounts of slip for at least two months after the mainshock (Brown, 1984). However, electronic distance meter (EDM) modeling by Prescott et al. (1984) showed a large 335 mm subsurface creep signal in the 4 months following the earthquake, at least a portion of which must have occurred shallower than ~4 km.

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To better resolve the complex spatio-temporal distribution of postseismic slip after the 1984 Morgan Hill earthquake, we identify repeating earthquakes (REs) occurring between March 1984 to December 2005 to image both the accelerated slip transients due to the earthquake as well as the return to interseismic background rates. The RE data are used to develop two dislocation models covering the first 6 and 18 month time periods directly after the mainshock, which we compare with a compilation of available surface EDM line-length changes of stations near the Morgan Hill earthquake. Our results indicate that RE data alone underpredict some of the observed line-length changes and that additional transient slip below the seismogenic zone is needed to better match the measured surface deformation.

2. Repeating earthquake identification

REs are sequences of events that are thought to rupture the same asperity on the fault surface and thus produce nearly identical earthquake records (Nadeau and McEvilly, 1999). In this study, we identify RE sequences on the Calaveras fault using a combination of cross-correlation techniques and phase and amplitude spectral coherence measures, which we will summarize below. A detailed description of this method can be found in Nadeau and McEvilly (2004, Appendix A) and Templeton et al. (2008).

We identify REs on the Calaveras fault by first cross-correlating all pairs of events with epicentral separations of up to 10 km within our study area (Fig. 1). Vertical component, short-period Northern California Seismic Network (NCSN) waveforms, sampled at 100 samples/sec, from stations up to 50 km away from the fault are used in this analysis. A pair of events is selected for further consideration if their average cross-correlation coefficient across all stations is greater then 0.98 as determined by using a 5-second time window beginning with the P-phase arrival. We then calculate the phase and amplitude coherence for this master-pair of events between 8–20 Hz. If the average of the phase and amplitude coherence assessments is greater than 0.85, the master-pair is identified as a RE. To identify additional members of the RE sequence, phase and amplitude coherence assessments are then performed on all events that have an average cross-correlation coefficient greater then 0.85 with at least one of the master-pair events.

Using this methodology, we identify 95 RE sequences on the central Calaveras fault (Table S1 of Appendix A). This is less than the number of RE sequences that other authors have identified in this region. However Peng et al. (2005) and Schaff et al. (2002) use a selection criteria based on magnitude, relocated hypocenter similarities, and circular rupture dimensions based on an assumed stress drop to identify REs. This study follows a more conservative method that relies on waveform similarities between events with good signal-to-noise.

3. Subsurface slip

RE seismological data can be extremely useful when investigating postseismic deformation at depth following large earthquakes. It has the ability to gain subsurface slip information over the entire postseismic period with pre-existing instruments. The limitation of this method is that data can only be obtained at points on the fault that can produce REs, i.e., seismically active areas of the fault plane. On

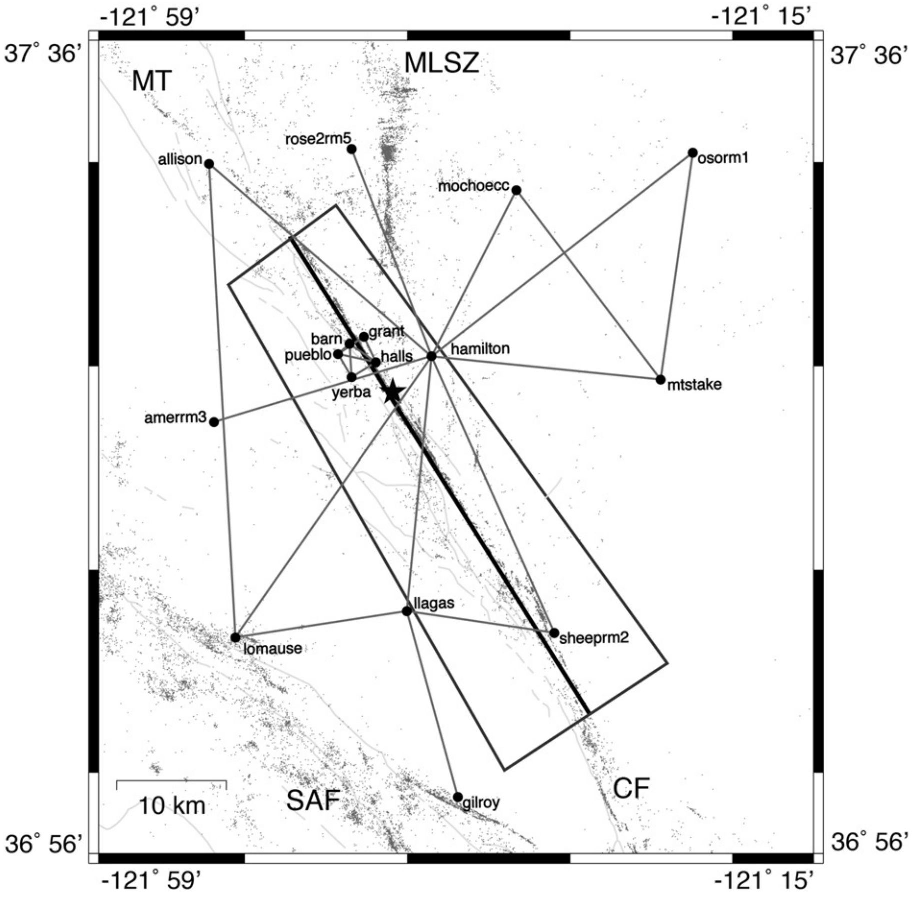

Fig. 1. Location map with EDM stations as black circles, surface fault traces as thin grey lines, and relocated background seismicity (Ellsworth et al., 2000) as small grey dots. Location of modeled fault trace indicated by thick black line, study area by black box, Morgan Hill epicenter by black star and modeled EDM line length change measurements as thin grey lines. SAF = San Andreas fault; CF = Calaveras fault; MLSZ = Mt. Lewis seismic zone; MT = Mission seismic trend.

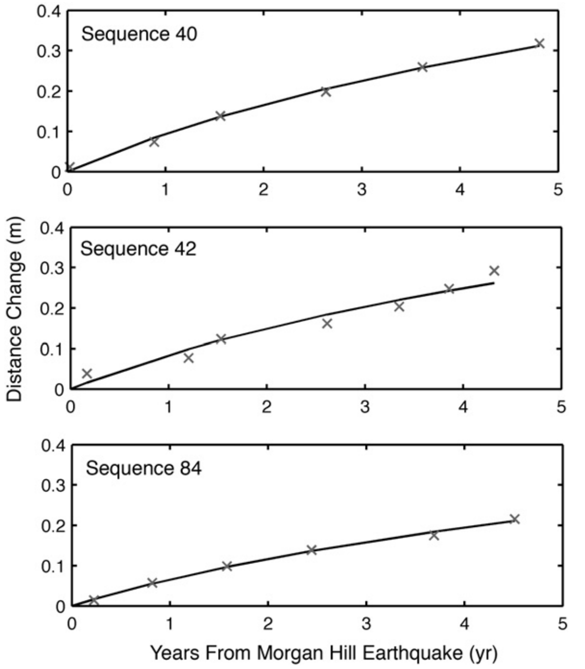

Fig. 2. RE cumulative slip data points as dark gray x-marks and functional logarithmic form used in models as black line. Constant τ of 3.035 years over all sequences.

this section of the Calaveras fault, seismicity generally occurs between 2–10 km. Additionally, RE information alone cannot reveal with certainty if aseismic fault patches away from the immediate vicinity of a RE are creeping or are locked and accumulating elastic strain.

3.1. Determination of RE slip

To estimate the amount of slip around a RE location, we start with the empirical method of Nadeau and McEvilly (1999), which takes into account the median moment and the number of repeats in the sequence. This method implies that between the times of two events within a RE sequence, the surrounding fault is aseismically creeping and loading the asperity, which causes the RE slip patch to rupture. Although the empirical relationship was calibrated on the Parkfield segment of the San Andreas fault, it has proven to be consistent with geodetically determined values of creep on other transform, subduction and oblique thrust faults (Bürgmann et al., 2000; Chen et al., 2007; Igarashi et al., 2003). Slip rates can be determined by dividing the total amount of slip over the time interval in question.

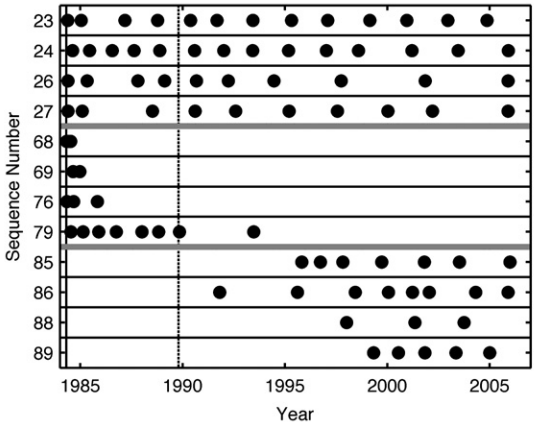

Fig. 4. Examples of timing of REs. Each circle within a sequence represents a RE occurrence. Solid vertical line indicates time of the 1984 M6.2 Morgan Hill earthquake while the dashed vertical line indicates time of the nearby 1989 M6.9 Loma Prieta earthquake. Figs. S2–S5 of Appendix A show timing of all RE sequences.

Due to the lack of NCSN digital waveform data before the Morgan Hill earthquake, RE data alone cannot constrain the amount of slip between the mainshock and the first event within each RE sequence. However, if we assume that afterslip decays logarithmically, which rate and state variable friction laws suggest (Marone et al., 1991), we can take into account the amount of slip that occurs before the first event in a sequence by modeling RE slip as

$$S = a*\log\left(1+\frac{T}{\tau}\right)+b \tag{1}$$

where S is slip as determined by using the Nadeau and McEvilly (1999) method at time T for a particular RE, τ is the relaxation time in years, and a and b are the regression constants. Examples comparing the modeled slip with the discrete RE slip estimates can be seen in Fig. 2. We find an average τ value of 3.04 years over the fault using the first 5 years of RE data. To ensure a robust determination of slip, we only apply this model to sequences that have at least 3 events within the 5-year time period, one of which must have occurred within the first 6 months after the mainshock. Of the 95 REs originally identified using the cross-correlation and spectral coherence measures, 43 sequences have a sufficient number of early events to be included in the postseismic study.

3.2. RE slip results

In general, the locations of these 43 REs occur in the region adjacent to the fault patches inferred to have ruptured in the Beroza and Spudich (1988) coseismic slip model (Fig. 3). Additionally, the REs with the most postseismic slip are seen to be near the mainshock hypocenter and above the deep coseismic slip patch located approximately 15 km southeast of the hypocenter. According to Beroza and Spudich (1988), this patch slipped coseismically in excess of 200 cm, while slip on the deep rupture area directly adjacent to the hypocenter did not exceed 110 cm. For comparison, the average

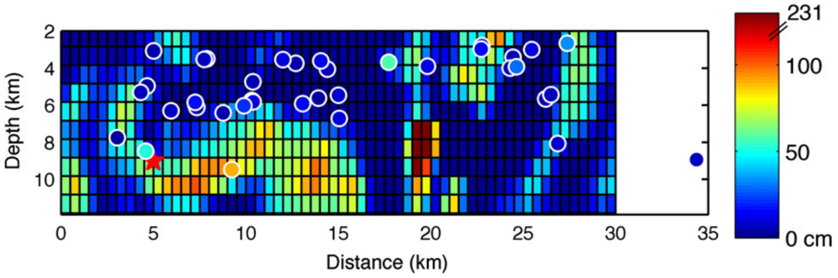

Fig. 3. All 43 REs included in the 18-month model indicated by circles that are color coded to indicate total slip over the observation period. Star indicates the location of the Morgan Hill hypocenter. Beroza and Spudich (1988) coseismic rupture model shown in the background. We realign the relocated RE slip patches to match the depth of the Morgan Hill hypocenter of the rupture model. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

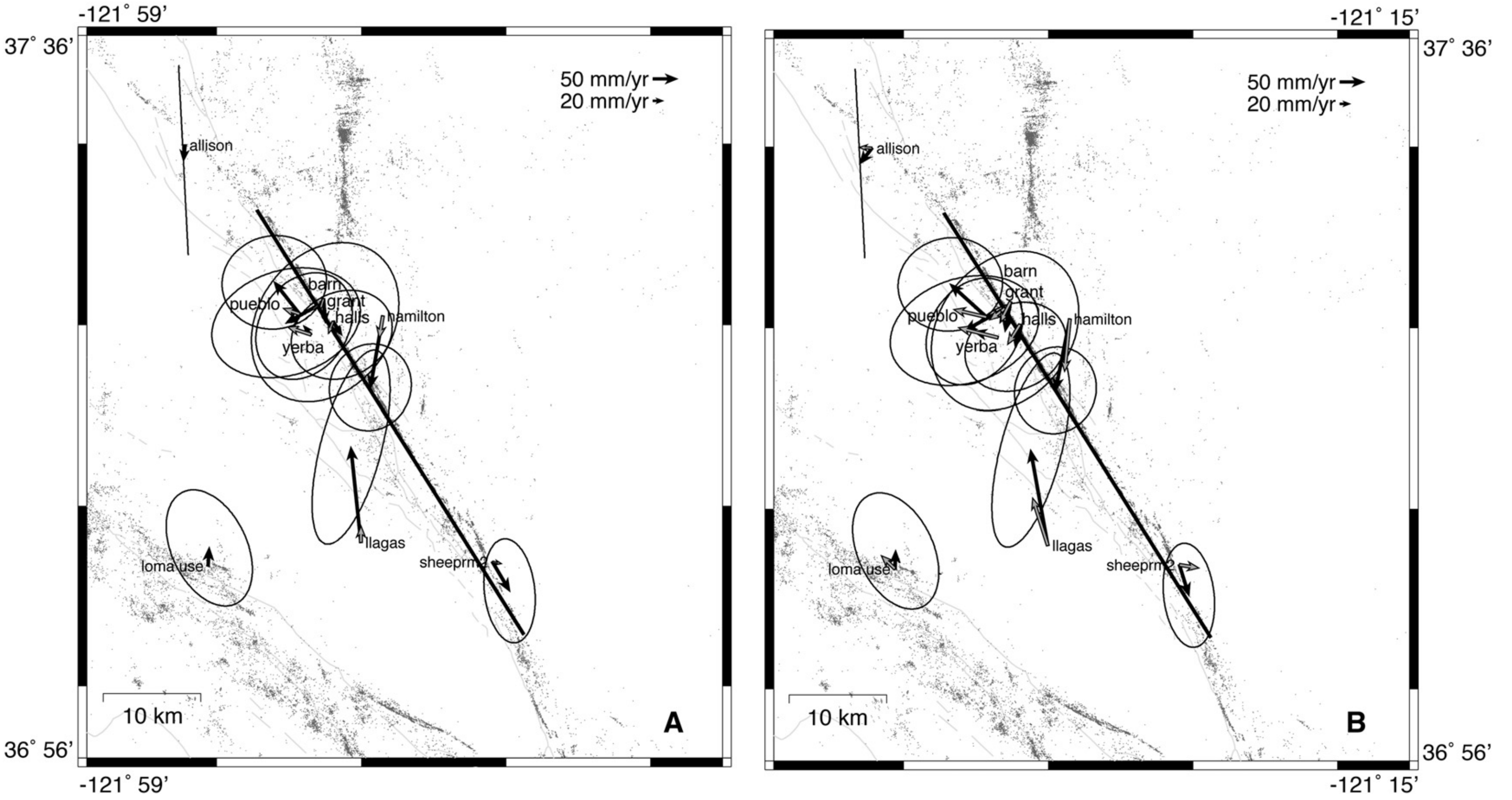

Fig. 5. Map view of 6-month model predicted total displacement field. Black arrows determined from observed EDM data. Gray arrows determined from calculated subsurface slip model. A) Subsurface slip model with RE data only B) Subsurface slip model with RE data and 31 cm of deep slip below 12 km. Stations show a 1σ confidence line instead of an ellipse if only one baseline pair is used to constrain the solution.

amount of slip determined at individual RE locations for the first ~18 months after the mainshock, with the RE-derived interseismic rate of 1.01 cm/year removed, was 13.2 cm with a range of 1.5–89.4 cm. The corresponding average slip rate for this time period was 8.7 cm/year with a range of 1.0–59.0 cm/year. The RE-derived interseismic slip rate was determined by calculating the rate at RE locations throughout the observation period on an ~15 km section of the fault that did not appear to be influenced by the Morgan Hill earthquake. We assume the interseismic rate to be uniform across the study area. Thus, the RE data indicate that the amount of postseismic slip in the first ~18 months after the mainshock was much less than the amount of slip which occurred coseismically.

Taking all 95 REs into consideration (Fig. S1 of Appendix A), it is observed that a handful of REs, which had high slip rates or were steadily slipping directly after the Morgan Hill earthquake, stopped their repeating pattern after a few years, e.g., Sequences 68, 69, 76, and 79 (Fig. 4). From the RE data alone, it is unclear if these asperities became locked or were destroyed due to the accelerated creep. Conversely, a few REs also exhibited relatively steady slip, but did not start their repetitions until the 1990s, e.g., Sequences 85, 86, 88, and 89 (Fig. 4). Most sequences near the rupture zone however are seen to be either steadily slipping or have slightly longer time intervals between repeats as time from the mainshock increases, for example Sequences 23, 24, 26, and 27 (Fig. 4). The sequence furthest from the Morgan Hill epicenter whose repeat intervals clearly indicate that it was influenced by the earthquake is Sequence 83, located approximately 25 km southeast of the epicenter. This maximum observed distance of influence does not appear to be symmetrical along strike away from the epicenter. None of the 10 REs located 5–20 km away from the hypocenter to the northwest appear to be influenced by the Morgan Hill earthquake. These sequences exhibit predominantly steady slip over the entire study period and have an average slip of 10.1 mm/year over the observation window. For comparison, the average cumulative slip rate of all 95 REs identified between 1984 and 2005 calculated using the Nadeau and McEvilly (1999) method is 15.2 mm/year. Thus, it appears that the Morgan Hill rupture predominantly accelerated creep along strike to the southeast of the hypocenter, and directly above the rupture zone, and that little afterslip due to the mainshock occurred more than approximately 5 km to the northwest along strike. We note, however, that only approximately one month of pre-Morgan Hill seismicity is available, so that the behavior of the REs to the northwest of the Morgan Hill epicenter before the mainshock is unknown.

4. Postseismic fault slip modeling

4.1. Repeating earthquake data

Using Eq. (1), we determine the amount of total slip at RE locations for the approximately 6 month period, between 24 April 1984 and 14 November 1984, and 18 month period, between 24 April 1984 and 28 October 1985, directly following the 1984 Morgan Hill earthquake. The end dates of the two periods reflect conclusion dates for the majority of the campaign-style EDM surveys used in this investigation. 43 RE data points are included in the models. In the 6-month model, the average slip rate over this time interval was 9.8 cm/year with a range of 1.1–66.7 cm/year. In the 18-month model, the average slip rate was 8.7 cm/year with a range of 1.0–59.0 cm/year at individual sequence locations.

4.2. EDM data

In our modeling of post-Morgan Hill subsurface slip, we use EDM data collected by the United States Geological Survey (USGS, http://quake.wr.usgs.gov/research/deformation/gps/geodolite/index.html) to study the postseismic surface deformation following the mainshock. 23 baselines near the Morgan Hill earthquake are included (Fig. 1). The majority of these baselines have measurements within the first 3 days following the mainshock. Two far-field baselines, which do not cross the fault, have measurements within the first week following the mainshock.

4.3. Model parameterization

To relate RE-derived afterslip estimates to the EDM data, we develop elastic half-space slip models that forward predict surface deformation between the EDM stations.

Relocated seismicity indicates that the majority of this portion of the central Calaveras fault is steeply dipping between 85° to 90° and that the up-dip extension of the seismically illuminated fault plane does not always connect with the more complicated surface trace (Simpson et al., 2004). In addition, the fault dip begins to shallow and the fault plane begins to curve slightly to the west in the southernmost extent of the area studied (Simpson et al., 2004). In spite of these minor deviations from planar geometry, and considering the sparcity of our data, we orient our model fault plane to 327°, the azimuth on which the majority of the 43 relocated RE sequences fall on, and fix its dip to 90°.

We discretize the fault into 2×2 km subfaults and average RE-derived total slip values across subfaults. Although REs can only give definitive estimates of slip on the fault at asperity locations, the Nadeau and McEvilly (1999) method assumes that aseismic creep around asperity locations loads REs to failure. In this study, we account for this aseismic creep by setting our subfault grid to be 2×2 km and setting the average value of creep across the subfault to be equal to the RE slip. Consequently, our results can be sensitive to the assumed element size. Larger subfaults will increase the area of slip, and thus the moment, while smaller subfaults may decrease it.

We isolate the transient afterslip component by subtracting the RE-derived interseismic creep rate of 10.1 mm/year. EDM baseline changes are also corrected for their average rates established in the ~10-year interval prior to the Morgan Hill earthquake (Manaker et al., 2003).

Our models predict EDM line-length changes due to slip on the subfaults at depth assuming a homogenous, isotropic, elastic half-space.

5. Model results and implications

As previously mentioned, Figs. 5 and 6 compare surface displacements inverted from the observed EDM line-length change measurements using a model-coordinate solution (Segall and Mathews, 1988) with calculated displacements determined from RE-derived afterslip models for the first 6 and 18 months after the Morgan Hill earthquake. These graphical representations provide an effective method to quickly identify how well our models fit the data but are for convenience only. The mapping of measured 1D surface displacements along various EDM baseline azimuths to a fixed 2D X–Y reference frame is non-unique (Segall and Mathews, 1988). This is why EDM data vectors can be slightly different when using different fault slip models, even when the same EDM displacement dataset is provided as input. In this study, however, the final determination of quality of fit depends on comparisons to the actual line-length changes (Tables S2, S3, S4, and S5 of Appendix A) and the χ^2 value. Although the errors in our data are large, due to the scarcity of EDM measurements along most baselines during this time period, it can be seen that slip models using only RE data compare reasonably well to the data at most stations (Figs. 5A and 6A). Hamilton, llagas, and sheeprm2 are the exceptions as our results tend to underpredict the amount of deformation that is observed at these stations. Correctly predicting the line-length changes between hamilton and llagas is especially important however since this station pair obliquely crosses the fault over the Morgan Hill coseismic rupture.

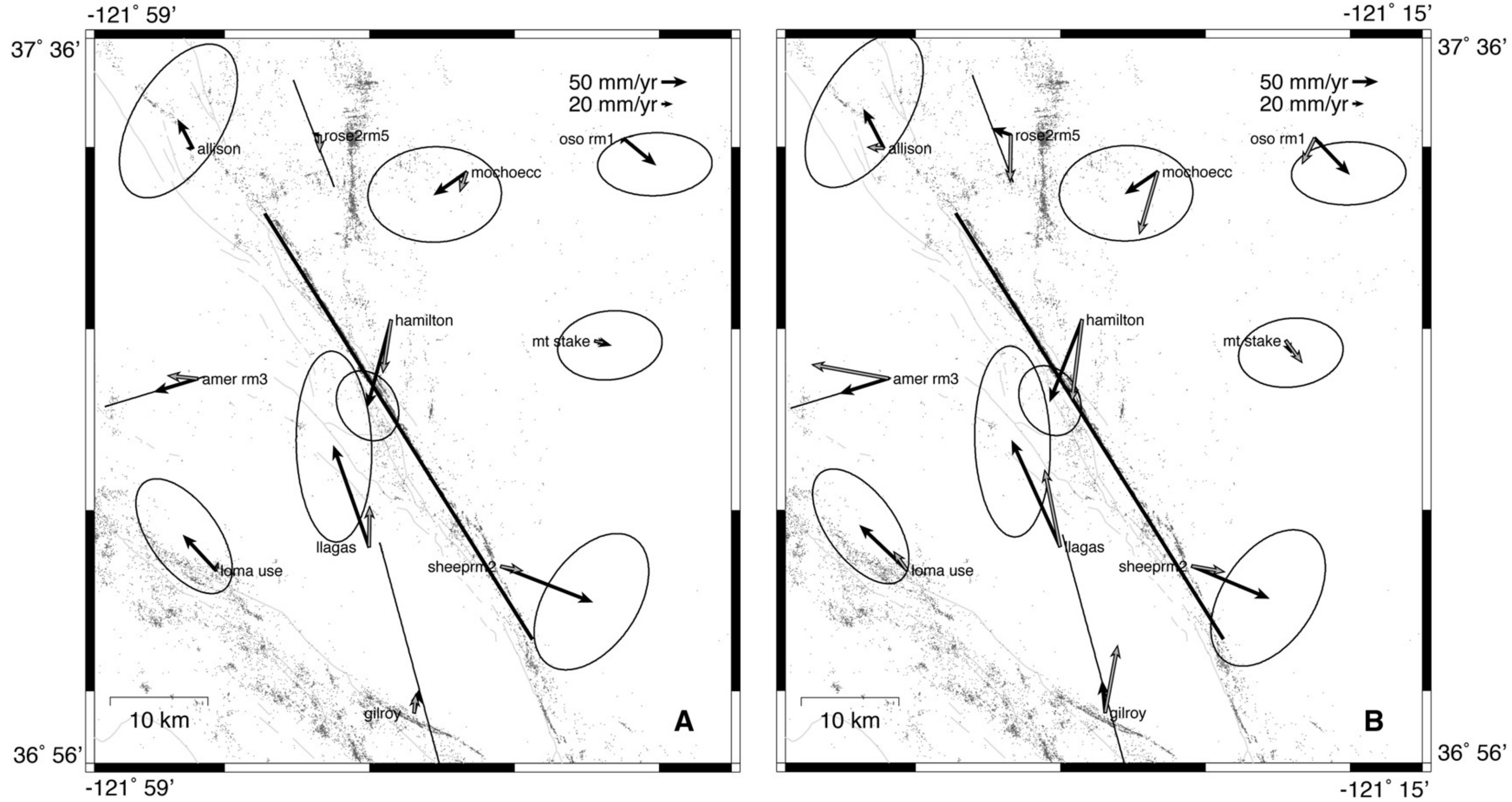

Fig. 6. Map view of 18-month model predicted cumulative displacement field. Black arrows determined from observed EDM data. Gray arrows determined from calculated subsurface slip model. A) Subsurface slip model with RE data only B) Subsurface slip model with RE data and 32 cm of deep slip below 12 km. Stations show a 1σ confidence line instead of an ellipse if only one baseline pair is used to constrain the solution.

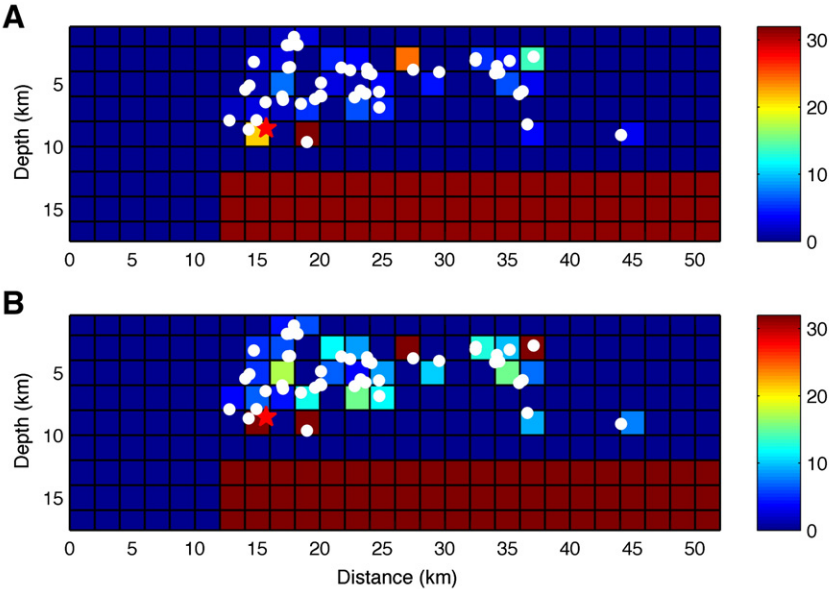

Fig. 7. RE-derived subsurface slip models with deep slip used in forward modeling. White dots indicate locations of the 43 REs included in the models. Star indicates location of Morgan Hill hypocenter. A) 6-month model. B) 18-month model.

A number of factors may lead to this underprediction of motions at more distant sites. One possible reason is that the actual fault geometry may be significantly different from the modeled fault geometry. Mapping across the Calaveras fault in this area determined that the fault zone includes several shorter sub-parallel fault strands at the surface (Page, 1984), however precisely-relocated microseismicity reveals a much simpler and continuous fault surface (Schaff et al., 2002). It may also be possible that a lack of good waveform data may have caused the elimination of RE sequences from consideration. Failure to identify any REs along a portion of the fault zone, would imply that the fault area in question is not slipping when in reality it may be experiencing afterslip. Thirdly, RE-derived slip estimates may systematically underpredict true slip. Although our 10.1 mm/year RE-derived interseismic creep rate estimate along the Calaveras fault agrees to first order with those inferred geodetically (Manaker et al., 2003), a recent rate and state friction model investigation proposed that RE-rates may systematically underestimate true slip during times of accelerated postseismic slip as some slip is accommodated by slow slip events (Ariyoshi et al., 2007). Another reason for the underprediction, which we believe to be the most likely explanation, is that unmodeled afterslip may be occurring on sections of the fault lacking seismicity, such as below the seismogenic zone where REs cannot nucleate. Previous studies have shown that small REs and aseismic slip are also possible within the coseismic rupture area of other REs (Uchida et al., 2007). Although we cannot rule out small and unmodeled amounts of slip at intermediate depths, including the coseismic rupture area, we model afterslip within the seismogenic zone only on fault patches that also produce REs. In this way, we have a direct link between the seismological evidence and inferred creep within the seismogenic zone. Although most of the REs identified in this study occur around the rupture area, a few occur slightly within the inferred rupture zone (Fig. 2). Thus, the RE data suggest that small portions of the coseismic rupture area also experience postseismic slip.

To determine if additional slip below the seismogenic zone is indeed the cause of the underprediction, we add deep slip between 12 and 18 km. In the 6-month model we add 31 cm of deep slip and to the 18-month model we add 32 cm (Fig. 7). These values are determined by choosing the least amount of slip that best fits the data and by constraining the 18-month model to have a greater amount of slip than the 6-month model. These deep slip values are less than the inferred amount of coseismic and RE-derived slip determined over the modeled time intervals. The inclusion of additional deep afterslip leads to an improved fit to the data. In the 6-month model, the χ^2 sum is reduced from 23.0 to 8.4 and in the 18-month model, the χ^2 sum is reduced from 62.8 to 46.4. Interestingly, our models suggest that most deep slip between 12 and 18 km occurred within the first 6 months of the mainshock. If deep slip continued to decay and added only a negligible amount of slip after 18 months, the deep slip rate over the observation period would be 17.7 mm/year, which is comparable with the long-term slip rate of 15+/−3 mm/year (WG99, 1999). This would suggest that deep aseismic slip on this portion of the Calaveras fault may actually occur in spurts after larger events instead of steadily slipping through time independent of larger events.

6. Discussion and conclusions

A comparison between the regions of the fault that ruptured coseismically during the 1984 Morgan Hill earthquake and locations of REs show that REs tend to occur in areas adjacent to the coseismic rupture although a few REs did occur slightly within the rupture area (Fig. 2). In addition, it is observed that transient afterslip preferentially occurred to the southeast of the hypocenter in the direction of earthquake rupture. RE sequences that were obviously influenced by the mainshock were located up to ~25 km away to the southeast as compared to only ~5 km away to the northwest along strike. The average amount of RE slip due to the Morgan Hill event after 18 months was 13.2 cm. This is significantly less than the inferred coseismic slip which had slip patches with up to ~230 cm of slip.

When all 95 RE sequences are taken into account, it is seen that the average cumulative slip between 1984–2005 calculated using the Nadeau and McEvilly (1999) method is 33.1 cm. This average slip amount includes both the accelerated postseismic creep transient after the Morgan Hill earthquake and the interseismic creep. Although 33.1 cm is still lower than the coseismic slip, it corresponds to an average slip rate of 15.2 mm/year, which is consistent with the long-term slip rate of 15+/−3 mm/year (WG99, 1999). We infer that the areas of the fault that produce REs are on average freely slipping and loading the deeper asperities that rupture as infrequent larger earthquakes.

The slow decrease of slip rates through time of some REs within the study area shows that the 1984 Morgan Hill earthquake influenced recurrence times of these REs (e.g., Sequences 17, 37, 52, and 83 in Figs. S2, S3, S4, and S5 of Appendix A) for up to two decades. Although it cannot be ruled out completely, this extraordinarily long apparent decay of slip does not appear to be obviously due to the 1989 Loma Prieta earthquake (Bürgmann et al., 1997).

When comparing the observed and predicted EDM data, the models that include only RE-derived afterslip underpredict some of the observed long baseline data. However, the inclusion of 31 cm of deep afterslip below the seismogenic zone within the first 6 months and 32 cm of deep slip within the first 18 months provides a better fit to the data. Similarly, on the creeping section of the San Andreas fault, coseismic stress changes have been shown to be able to drive accelerated slip on deeper velocity strengthening portions of the fault zone (Johnson et al., 2006). The inferred deeper relaxation beneath the Morgan Hill rupture area may also have had an added contribution from the nearby 1979 M5.9 Coyote Lake earthquake, which occurred on the Calaveras fault directly southeast of the Morgan Hill mainshock rupture area.

These results show that when investigating fault interactions and the slip budget on an incompletely locked fault, it is important to consider the contribution of afterslip on creeping shallow fault patches as well as time-dependent slip beneath the seismogenic zone.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.epsl.2008.09.024.

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Tables

Table S1. RE sequences identified in this study. First line within each sequence indicates the sequence label number, average sequence latitude, average sequence longitude, average sequence depth, and average sequence magnitude from the NCSN. The following lines indicate earthquake time, latitude, longitude, depth, and magnitude for each individual event within a RE sequence.

1	37.39283	-121.78467	0.82	2.48	
	1987.150.073321	37.39383	-121.78400	01.62	2.46
	2003.082.214509	37.39183	-121.78533	00.02	2.50
2	37.39983	-121.76600	3.46	2.17	
	1986.038.171527	37.39983	-121.76600	03.46	2.40
	1992.117.191709	37.39883	-121.76550	03.34	2.13
	1998.159.001759	37.39917	-121.76400	03.67	2.17
	2004.114.050348	37.39900	-121.76550	03.87	2.17
3	37.37492	-121.74833	2.54	1.48	
	1991.139.155455	37.37417	-121.74833	02.35	1.52
	2003.119.162907	37.37567	-121.74833	02.74	1.43
4	37.36089	-121.73694	2.04	1.49	
	1987.112.150227	37.36117	-121.73667	01.86	1.49
	1992.313.213727	37.36083	-121.73583	02.04	1.49
	2000.192.052232	37.36067	-121.73833	02.22	1.47
5	37.42211	-121.76900	7.32	1.59	
	1990.008.222628	37.42367	-121.76867	07.25	1.53
	1991.213.135922	37.42100	-121.76950	07.32	1.59
	2005.245.174336	37.42167	-121.76883	07.38	1.66

6	37.41058	-121.76046	6.94	1.98	
	1988.203.215839	37.40983	-121.76017	07.06	1.98
	1993.164.143724	37.41167	-121.76067	06.81	1.98
	1998.048.110053	37.41067	-121.76067	06.98	1.86
	2004.191.163731	37.41017	-121.76033	06.91	1.99
7	37.38737	-121.74312	6.17	2.00	
	1987.313.123958	37.38883	-121.74383	05.44	1.92
	1991.008.113318	37.38650	-121.74300	06.43	1.98
	1995.068.035619	37.38700	-121.74233	06.42	2.05
	1999.215.154412	37.38717	-121.74333	06.39	2.01
8	37.38159	-121.73800	7.16	1.96	
	1984.344.135151	37.38100	-121.73767	07.13	1.96
	1987.200.221540	37.38150	-121.73750	07.07	1.91
	1989.240.152602	37.38133	-121.73800	07.20	1.82
	1992.146.034047	37.38233	-121.73883	07.21	1.97
	1995.352.054200	37.38150	-121.73750	07.18	2.08
	1999.170.053014	37.38233	-121.73833	07.08	1.87
	2003.109.100943	37.38117	-121.73817	07.24	2.07
9	37.37364	-121.73321	6.64	1.45	
	1985.020.221713	37.37317	-121.73383	06.61	1.45
	1988.122.140753	37.37533	-121.73583	06.54	1.36
	1989.266.230235	37.37367	-121.73250	06.66	1.41
	1993.029.155824	37.37250	-121.73217	06.57	1.39
	1998.272.053016	37.37317	-121.73183	06.23	1.56
	2002.181.055808	37.37433	-121.73300	07.11	1.49
	2004.323.193616	37.37333	-121.73333	06.78	1.55
10	37.35279	-121.72004	5.83	1.64	
	1986.282.231459	37.35233	-121.72017	05.70	1.49
	1988.135.205134	37.35200	-121.71983	05.93	1.74
	1990.018.032441	37.35200	-121.71967	05.95	1.71
	1991.341.111502	37.35267	-121.72050	05.81	1.79
	1993.314.205204	37.35233	-121.72017	05.70	1.41
	1996.247.041356	37.35333	-121.72100	06.07	1.57
	1998.224.055803	37.35367	-121.71917	05.98	1.63
	2002.320.085155	37.35417	-121.72017	05.89	1.64
	2005.204.112204	37.35217	-121.71983	05.32	1.64
11	37.3320	-121.6995	7.56	1.52	
	1984.169.151248	37.3317	-121.6988	7.46	1.51
	1987.322.054535	37.3318	-121.7000	7.38	1.45
	1988.134.072908	37.3318	-121.6997	7.50	1.37
	1990.134.160910	37.3320	-121.6988	7.21	1.43

	1990.310.173912	37.3323	-121.7002	7.79	1.57
	1997.157.035026	37.3323	-121.6992	7.77	1.63
	2001.057.060653	37.3330	-121.7008	8.12	1.47
	2003.059.151613	37.3317	-121.6983	7.25	1.51
	2005.334.002059	37.3310	-121.6993	7.60	1.63
12	37.32263	-121.69200	7.95	1.77	
	1985.240.175026	37.32267	-121.69233	08.04	2.13
	1986.336.071659	37.32283	-121.69217	07.89	1.98
	1987.279.025716	37.32283	-121.69233	07.58	1.71
	1988.247.103356	37.32283	-121.69183	08.32	1.73
	1989.198.061715	37.32200	-121.69133	07.94	1.77
13	37.32045	-121.69000	7.50	1.38	
	1984.161.125705	37.32100	-121.69067	7.89	1.38
	1984.219.210703	37.31967	-121.68783	6.39	1.42
	1984.249.160104	37.32067	-121.69150	8.23	1.18
14	37.31621	-121.68629	7.31	1.70	
	1984.247.183245	37.31600	-121.68617	07.59	1.67
	1988.178.164227	37.31633	-121.68733	07.37	1.93
	1989.078.135805	37.31633	-121.68667	07.47	1.70
	1990.314.111532	37.31617	-121.68450	07.45	1.76
	1992.068.163701	37.31683	-121.68717	06.38	1.48
	1996.320.025030	37.31600	-121.68567	07.30	1.72
	1999.095.054430	37.31583	-121.68650	07.64	1.56
15	37.31239	-121.68261	7.58	1.90	
	1991.258.153314	37.31117	-121.68217	07.37	1.76
	1996.086.161104	37.31183	-121.68283	07.50	1.92
	2001.190.200530	37.31417	-121.68283	07.87	1.90
16	37.31025	-121.68025	8.31	2.26	
	1990.055.232455	37.30983	-121.68067	07.96	2.23
	2001.206.130654	37.31067	-121.67983	08.66	2.29
17	37.3099	-121.6820	6.48	1.48	
	1984.127.143748	37.3098	-121.6810	6.35	1.58
	1984.157.040122	37.3102	-121.6837	6.40	1.43
	1984.327.145022	37.3093	-121.6818	6.14	1.46
	1985.158.140942	37.3100	-121.6832	6.20	1.48
	1986.049.030330	37.3103	-121.6830	5.97	1.55
	1987.014.222731	37.3098	-121.6830	6.45	1.49
	1988.036.180459	37.3102	-121.6818	6.20	1.36

	1989.159.185749	37.3102	-121.6832	6.35	1.33
	1993.174.054010	37.3098	-121.6825	6.20	1.53
	1998.190.093415	37.3107	-121.6828	6.79	1.47
	2001.214.120020	37.3090	-121.6758	8.23	1.53
18	37.3221	-121.6936	5.19	1.56	
	1984.260.060614	37.3213	-121.6930	4.74	1.59
	1986.137.234321	37.3210	-121.6937	5.17	1.42
	1987.148.005948	37.3218	-121.6943	5.11	1.51
	1988.267.153608	37.3218	-121.6933	4.85	1.57
	1990.045.013657	37.3222	-121.6942	5.13	1.62
	1991.316.161115	37.3218	-121.6943	5.32	1.55
	1994.015.055354	37.3223	-121.6935	5.26	1.49
	1996.030.001520	37.3218	-121.6942	5.41	1.51
	1998.007.202308	37.3225	-121.6938	5.13	1.51
	2002.232.065848	37.3242	-121.6923	5.15	1.69
	2005.098.054640	37.3218	-121.6925	5.78	1.58
19	37.31902	-121.69177	4.61	1.31	
	1984.256.230202	37.31783	-121.69117	04.57	1.20
	1985.024.183515	37.31833	-121.69250	04.56	1.06
	1988.011.132401	37.31950	-121.68950	04.32	1.33
	1990.193.024923	37.31900	-121.69150	04.17	1.33
	1991.167.055513	37.31867	-121.69250	04.47	1.29
	1992.151.084335	37.31867	-121.69117	04.45	1.10
	1994.109.145625	37.31950	-121.69217	04.30	1.25
	1995.204.082812	37.31883	-121.69250	05.10	1.43
	1997.364.110254	37.32167	-121.69267	05.58	1.35
	2002.045.063701	37.31817	-121.69200	04.61	1.42
20	37.31459	-121.69212	2.50	1.45	
	1984.265.234633	37.31483	-121.69250	02.49	1.45
	1986.002.072123	37.31450	-121.69183	02.67	1.46
	1987.243.094447	37.31400	-121.69417	02.25	1.45
	1989.073.033306	37.31467	-121.69317	02.27	1.45
	1990.251.224828	37.31533	-121.69250	02.64	1.41
	1992.194.184257	37.31483	-121.69317	02.56	1.43
	1994.254.003747	37.31467	-121.69200	02.36	1.39
	1997.330.102125	37.31600	-121.69133	02.61	1.48
	2001.090.164259	37.31383	-121.69100	02.29	1.47
	2003.168.164420	37.31450	-121.69217	02.13	1.49
	2005.183.083754	37.31333	-121.68950	03.23	1.44
21	37.2898	-121.6744	0.66	1.43	

	1984.116.033945	37.2902	-121.6710	0.03	1.47
	1984.302.092104	37.2902	-121.6775	0.03	1.27
	1986.082.022915	37.2897	-121.6762	0.04	1.33
	1989.144.193734	37.2893	-121.6745	0.26	1.36
	1993.229.150743	37.2900	-121.6755	0.24	1.48
	1997.277.051310	37.2890	-121.6743	1.11	1.43
	2005.143.115232	37.2902	-121.6720	2.90	1.57

22	37.29670	-121.67900	1.97	1.79	
	1985.156.154421	37.29667	-121.67950	01.57	1.84
	1986.285.054158	37.29700	-121.67800	02.27	1.74
	1988.224.170835	37.29650	-121.67917	01.78	1.79
	1991.306.001700	37.29717	-121.67900	02.07	1.40
	1995.167.000742	37.29617	-121.67933	02.17	1.79

23	37.29668	-121.67788	2.17	1.41	
	1984.138.165150	37.29483	-121.67683	02.02	1.27
	1985.012.152304	37.29483	-121.67700	01.96	1.38
	1987.063.040039	37.29400	-121.67783	01.29	1.29
	1988.283.062005	37.29550	-121.67483	01.83	1.51
	1990.138.101739	37.29450	-121.67550	02.12	1.43
	1991.247.073947	37.29467	-121.67767	01.89	1.31
	1993.155.220915	37.29467	-121.67350	01.67	1.42
	1995.118.032932	37.29700	-121.67767	01.71	1.43
	1997.032.082516	37.29633	-121.67633	01.98	1.45
	1999.055.023045	37.31633	-121.69233	06.12	1.44
	2000.347.043644	37.29467	-121.67750	01.79	1.35
	2002.350.085712	37.29483	-121.67783	01.73	1.41
	2004.320.140412	37.29467	-121.67767	02.09	1.13

24	37.29320	-121.67550	1.94	1.41	
	1984.225.012051	37.29283	-121.67500	01.97	1.27
	1985.161.215752	37.29333	-121.67750	01.66	1.43
	1986.201.021848	37.29350	-121.67500	01.84	1.40
	1987.225.220702	37.29333	-121.67750	01.66	1.31
	1988.319.135912	37.29300	-121.67583	01.97	1.41
	1990.212.104647	37.29267	-121.67517	02.27	1.41
	1991.364.201618	37.29567	-121.67850	01.57	1.19
	1993.153.103257	37.29417	-121.67350	01.79	1.43
	1995.062.141822	37.29267	-121.67500	02.02	1.26
	1997.005.061042	37.29267	-121.67617	02.08	1.35
	1998.214.095058	37.29267	-121.67550	01.93	1.49
	2001.074.122020	37.29267	-121.67317	02.62	1.49
	2003.165.135828	37.29333	-121.67450	01.74	1.36
	2005.334.095356	37.29233	-121.67467	02.00	1.48

25	37.29056	-121.67250	1.78	1.31	
	1985.112.203709	37.29033	-121.67400	01.84	1.27
	1986.012.013343	37.29317	-121.67133	03.15	1.20
	1986.334.181950	37.29000	-121.67317	01.73	1.34
	1988.015.152317	37.29317	-121.66733	00.06	1.33
	1989.040.234327	37.28983	-121.67000	01.66	1.31
	1990.232.104757	37.29050	-121.67283	01.92	1.40
	1992.085.125515	37.28967	-121.67283	01.98	1.26
	1993.343.014441	37.29067	-121.67467	01.48	1.25
	1995.179.091357	37.28983	-121.67150	01.90	1.45
	1998.258.054806	37.29050	-121.67433	01.75	1.32
	2001.023.171236	37.28900	-121.67283	01.81	1.31
	2002.234.153718	37.29050	-121.67433	01.89	1.21
	2004.309.081609	37.29017	-121.67333	01.92	1.37
26	37.2894	-121.6722	1.86	1.60	
	1984.145.072840	37.2893	-121.6722	1.66	1.53
	1985.118.125532	37.2887	-121.6727	2.08	1.69
	1987.296.052821	37.2895	-121.6728	1.95	1.56
	1989.043.224212	37.2897	-121.6745	1.88	1.60
	1990.246.000917	37.2898	-121.6735	1.81	1.57
	1992.085.180019	37.2890	-121.6718	1.68	1.46
	1994.166.193253	37.2892	-121.6722	1.70	1.59
	1997.271.020915	37.2893	-121.6718	2.00	1.64
	2001.309.121551	37.2903	-121.6695	1.82	1.64
	2005.329.221521	37.2893	-121.6708	2.06	1.64
27	37.2886	-121.6723	1.94	1.92	
	1984.144.183558	37.2882	-121.6757	0.70	1.96
	1985.031.074614	37.2882	-121.6723	1.90	1.93
	1988.189.102418	37.2883	-121.6732	1.76	1.95
	1990.221.085352	37.2883	-121.6723	2.15	1.94
	1992.213.005340	37.2883	-121.6717	1.84	1.91
	1995.072.140831	37.2885	-121.6727	1.83	2.00
	1997.206.054908	37.2882	-121.6722	2.24	1.84
	2000.008.044431	37.2893	-121.6717	2.95	1.82
	2002.075.221338	37.2913	-121.6703	1.79	1.84
	2005.329.230015	37.2875	-121.6705	2.25	1.92
28	37.26865	-121.65519	2.35	1.93	
	1984.315.124731	37.26800	-121.65500	02.38	2.04
	1985.161.020515	37.26917	-121.65517	02.15	1.82
	1986.074.184759	37.26900	-121.65583	02.04	2.00
	1987.026.171826	37.26867	-121.65517	02.23	1.76

	1988.212.004234	37.26817	-121.65633	02.39	1.94
	1990.067.004652	37.26833	-121.65483	02.19	1.89
	1991.251.192939	37.26900	-121.65583	02.09	1.83
	1993.350.184235	37.26867	-121.65500	02.20	1.93
	1995.260.011626	37.26800	-121.65500	02.29	1.78
	1998.120.103758	37.26833	-121.65483	03.42	1.97
	2001.223.121049	37.27033	-121.65450	02.68	1.96
	2004.285.080816	37.26817	-121.65483	02.20	1.93
29	37.29583	-121.67578	3.56	1.85	
	1985.316.205336	37.29550	-121.67567	03.34	1.86
	1991.184.000838	37.29583	-121.67600	03.82	1.85
	2003.242.180026	37.29617	-121.67567	03.53	1.85
30	37.29465	-121.67502	3.98	2.19	
	1984.148.202345	37.29500	-121.67550	03.26	2.00
	1985.236.130957	37.29400	-121.67533	03.96	2.29
	1987.119.031505	37.29417	-121.67600	03.88	2.19
	1989.130.101906	37.29433	-121.67533	03.79	2.07
	1991.183.230010	37.29433	-121.67517	04.18	2.20
	1994.244.230210	37.29417	-121.67433	03.83	2.21
	1996.251.064134	37.29500	-121.67317	04.06	1.95
	2000.160.055327	37.29567	-121.67517	05.02	2.20
	2004.168.181909	37.29517	-121.67517	03.82	2.17
31	37.29433	-121.67327	3.43	1.38	
	1984.224.072702	37.29383	-121.67483	03.55	1.44
	1985.292.163320	37.29483	-121.67300	03.33	1.38
	1989.272.071636	37.29433	-121.67350	03.53	1.36
	1994.216.171908	37.29400	-121.67417	03.54	1.37
	2003.156.163823	37.29467	-121.67083	03.18	1.44
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	2004.175.233928	37.20083	-121.59983	03.18	1.38
72	37.18092	-121.58269	3.35	2.51	
	1984.200.130402	37.18100	-121.58283	03.41	2.55
	1985.327.122810	37.18117	-121.58300	02.59	2.43

	1987.199.025705	37.18067	-121.58217	03.48	2.53
	1991.132.122231	37.18083	-121.58250	03.60	2.51
	1996.294.193402	37.18100	-121.58333	03.48	2.41
	2002.021.095302	37.18083	-121.58233	03.56	2.51
73	37.18050	-121.58220	3.38	1.85	
	1984.165.234601	37.18000	-121.58250	03.73	1.87
	1988.337.104902	37.18017	-121.58183	03.66	1.83
	1992.123.052402	37.18117	-121.58200	03.25	1.85
	1995.131.121124	37.18033	-121.58250	03.10	1.81
	2002.164.084404	37.18083	-121.58217	03.18	1.87
74	37.17912	-121.58069	3.31	1.76	
	1984.118.195508	37.17867	-121.58217	03.43	1.89
	1984.323.020645	37.17900	-121.58067	03.40	1.76
	1986.030.080516	37.17900	-121.58050	03.35	1.81
	1987.199.083600	37.17900	-121.58017	03.57	1.71
	1988.330.150441	37.17933	-121.58100	02.49	1.55
	1991.093.093259	37.17933	-121.58033	03.04	1.76
	1996.001.125800	37.17933	-121.58033	03.46	1.76
	2002.022.014304	37.17933	-121.58033	03.75	1.80
75	37.17238	-121.56992	4.11	2.32	
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	1984.175.110413	37.17317	-121.56900	04.11	2.41
	1984.335.142058	37.17233	-121.56983	04.39	2.23
	1985.159.003740	37.17150	-121.57017	03.96	2.17
76	37.16922	-121.56772	4.26	1.40	
	1984.126.124015	37.16917	-121.56817	04.19	1.38
	1984.243.190336	37.16950	-121.56700	04.49	1.45
	1985.302.131004	37.16900	-121.56800	04.09	1.40
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	1985.158.135800	37.16983	-121.57050	03.85	1.61
	1986.063.125318	37.16967	-121.57100	03.85	1.54
	1986.342.140319	37.17050	-121.57033	03.65	1.39
	1987.290.225557	37.17017	-121.57083	03.88	1.44
	1988.317.051453	37.16967	-121.57000	04.02	1.39
	1990.047.040038	37.17000	-121.56983	03.84	1.52
	1991.362.121204	37.16967	-121.57067	03.55	1.54
	1996.304.045104	37.16933	-121.57100	03.61	1.60
	2000.019.040142	37.16933	-121.56967	03.89	1.60
	2002.234.231221	37.16967	-121.57000	03.93	1.63
	2005.082.023302	37.17000	-121.57083	03.58	1.59

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	1984.185.072415	37.16400	-121.56617	02.86	1.91
	1985.089.062821	37.16300	-121.56367	03.53	1.86
	1986.091.202746	37.16333	-121.56400	03.34	1.84
	1988.238.200156	37.16200	-121.56450	01.89	1.58
	1989.202.001736	37.16367	-121.56533	03.65	1.70
	1991.043.034804	37.16367	-121.56433	03.50	1.86
	1993.205.094443	37.16333	-121.56167	03.75	1.77
	1994.357.194242	37.16283	-121.56300	03.59	1.62
	1998.196.113519	37.16417	-121.56517	03.12	1.80
	2003.014.145149	37.16350	-121.56150	03.41	1.93

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	1985.049.062221	37.14733	-121.55400	03.24	1.41
	1985.326.205606	37.14750	-121.55183	02.77	1.40
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	1993.173.134130	37.14583	-121.55500	03.00	1.42

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	1996.051.150523	37.16067	-121.55233	06.43	2.75
	2005.083.070209	37.16133	-121.55217	06.34	2.50

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	1986.166.183016	37.15733	-121.55083	05.68	1.61
	1987.019.082820	37.15750	-121.55033	05.77	1.61

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	1999.290.053326	37.15750	-121.55067	05.85	1.72
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	2005.122.131035	37.15600	-121.54900	05.42	1.60
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	1997.301.113030	37.14933	-121.53833	08.15	1.52
	1999.263.151336	37.14883	-121.53850	08.64	1.51
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	1998.158.194607	37.14233	-121.53550	08.47	1.35
	2000.020.091232	37.14217	-121.53750	08.07	1.39
	2001.081.115303	37.14450	-121.53583	08.25	1.25
	2002.019.102645	37.14300	-121.53733	08.04	1.71
	2004.117.134710	37.14217	-121.53633	08.34	1.43
	2005.328.073019	37.14250	-121.53450	08.48	1.41
87	37.13067	-121.52910	8.34	2.18	

	1985.125.011842	37.13017	-121.52950	08.33	2.11
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	1992.121.005427	37.13067	-121.52817	08.38	2.19
	1996.120.000019	37.13100	-121.52917	08.41	2.18
	2001.044.205841	37.13100	-121.52867	08.42	2.20
88	37.12350	-121.52600	7.90	1.84	
	1998.001.115752	37.12350	-121.52500	08.03	1.94
	2001.126.023233	37.12350	-121.52633	07.69	1.84
	2003.272.030244	37.12350	-121.52667	07.97	1.82
89	37.12230	-121.52537	7.82	1.56	
	1999.122.082452	37.12233	-121.52467	07.92	1.67
	2000.197.141509	37.12283	-121.52750	07.84	1.48
	2001.304.220046	37.12233	-121.52500	07.71	1.57
	2003.129.084031	37.12150	-121.52483	07.83	1.45
	2005.001.192940	37.12250	-121.52483	07.81	1.56
90	37.12317	-121.52328	8.56	1.44	
	1984.302.094205	37.12500	-121.52333	08.48	1.44
	1986.331.164627	37.12350	-121.52317	08.55	1.41
	1989.349.091802	37.12100	-121.52333	08.65	1.59
91	37.11900	-121.52397	7.31	1.55	
	1986.183.124949	37.11883	-121.52400	07.44	1.75
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	2002.114.212406	37.11950	-121.52467	07.06	1.73
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	1991.113.032129	37.09450	-121.50700	09.04	1.34
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	2005.005.074706	37.09633	-121.50617	08.99	1.49
93	37.05827	-121.49400	4.51	2.55	
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	1991.137.225635	37.05833	-121.49300	04.62	2.68
	1994.264.113536	37.05850	-121.49367	04.67	2.53
	1998.203.185308	37.05867	-121.49350	04.49	2.55
	2002.094.143408	37.05883	-121.49583	04.46	2.49
94	37.05122	-121.48761	6.58	2.52	
	1986.039.124526	37.05200	-121.48667	06.68	2.49

	1992.025.092231	37.04983	-121.48883	06.25	2.52
	2000.359.044047	37.05183	-121.48733	06.81	2.57
95	37.04639	-121.48500	5.37	1.46	
	1985.049.173007	37.04650	-121.48433	05.47	1.46
	1990.223.085022	37.04600	-121.48633	05.19	1.45
	1994.312.160108	37.04667	-121.48433	05.46	1.47

Table S2. Observed and predicted EDM line length changes between stations for the 6-month model assuming no deep slip.

Station1	Station2	Observed (m)	Calculated (m)
barn	halls	0.6600E-02	0.1300E-02
barn	pueblo	0.5000E-03	0.9543E-03
barn	yerba	-0.8200E-02	-0.1705E-02
grant	halls	-0.1300E-02	0.1890E-03
grant	pueblo	-0.1500E-02	0.4606E-03
halls	pueblo	0.5000E-02	0.3155E-02
halls	yerba	0.2700E-02	0.1252E-02
pueblo	yerba	0.7900E-02	-0.1070E-02
allison	loma use	-0.6900E-02	-0.5841E-03
hamilton	loma use	-0.1710E-01	-0.4866E-02
hamilton	llagas	-0.3460E-01	-0.8180E-02
hamilton	sheeprm2	-0.5700E-02	-0.2828E-02
llagas	sheeprm2	0.9400E-02	0.2368E-02

Table S3. Observed and predicted EDM line length changes between stations for the 6-month model assuming 31 cm of deep slip.

Station1	Station2	Observed (m)	Calculated (m)
barn	halls	0.6600E-02	0.1782E-02
barn	pueblo	0.5000E-03	0.1507E-02
barn	yerba	-0.8200E-02	-0.3253E-02
grant	halls	-0.1300E-02	-0.2700E-03
grant	pueblo	-0.1500E-02	0.6610E-03
halls	pueblo	0.5000E-02	0.5402E-02
halls	yerba	0.2700E-02	0.1600E-02
pueblo	yerba	0.7900E-02	-0.1129E-02
allison	loma use	-0.6900E-02	-0.2670E-02
hamilton	loma use	-0.1710E-01	-0.1004E-01
hamilton	llagas	-0.3460E-01	-0.2074E-01
hamilton	sheeprm2	-0.5700E-02	-0.6993E-02
llagas	sheeprm2	0.9400E-02	0.8867E-02

Table S4. Observed and predicted EDM line length changes between stations for the 18-month model assuming no deep slip.

Station1	Station2	Observed (m)	Calculated (m)
allison	hamilton	0.1420E-01	0.6936E-02
amer rm3	hamilton	-0.6000E-03	0.8447E-03
gilroy	llagas	0.1770E-01	0.4511E-02
hamilton	sheeprm2	0.1000E-03	-0.6880E-02
llagas	loma use	0.1400E-02	0.7591E-03
llagas	sheeprm2	0.3060E-01	0.5661E-02
allison	loma use	-0.1600E-02	-0.1419E-02
hamilton	rose2rm5	0.1600E-01	0.6554E-02
hamilton	oso rm1	0.1680E-01	0.7268E-02

hamilton	mochoecc	0.1110E-01	0.6479E-02
hamilton	mt stake	0.6300E-02	0.2756E-02
hamilton	llagas	-0.3850E-01	-0.1981E-01
hamilton	loma use	-0.1970E-01	-0.1171E-01
mochoecc	mt stake	0.3000E-02	-0.7585E-03
mt stake	oso rm1	-0.4000E-02	-0.8644E-03

Table S5. Observed and predicted EDM line length changes between stations for the 18-month model assuming 32 cm of deep slip.

Station1	Station 2	Observed (m)	Calculated (m)
allison	hamilton	0.1420E-01	0.1252E-01
amer rm3	hamilton	-0.6000E-03	0.7569E-02
gilroy	llagas	0.1770E-01	0.3319E-02
hamilton	sheeprm2	0.1000E-03	-0.1118E-01
llagas	loma use	0.1400E-02	0.1285E-02
llagas	sheeprm2	0.3060E-01	0.1237E-01
allison	loma use	-0.1600E-02	-0.3572E-02
hamilton	rose2rm5	0.1600E-01	0.6473E-02
hamilton	oso rm1	0.1680E-01	0.7121E-02
hamilton	mochoecc	0.1110E-01	0.2997E-02
hamilton	mt stake	0.6300E-02	0.4164E-02
hamilton	llagas	-0.3850E-01	-0.3278E-01
hamilton	loma use	-0.1970E-01	-0.1705E-01
mochoecc	mt stake	0.3000E-02	-0.2532E-02
mt stake	oso rm1	-0.4000E-02	-0.1525E-02

Figure S1.

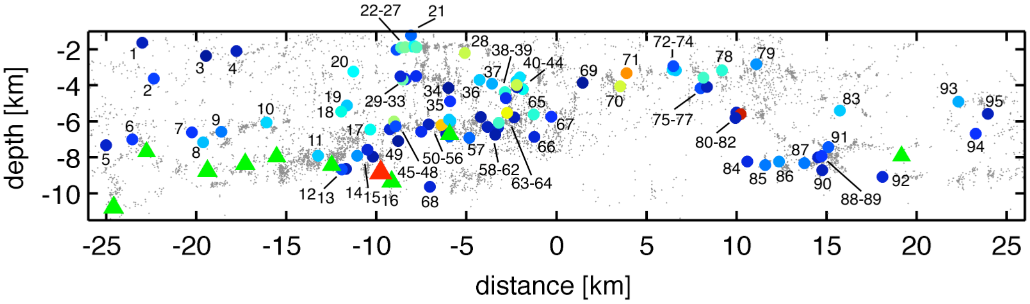

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Figure S2.

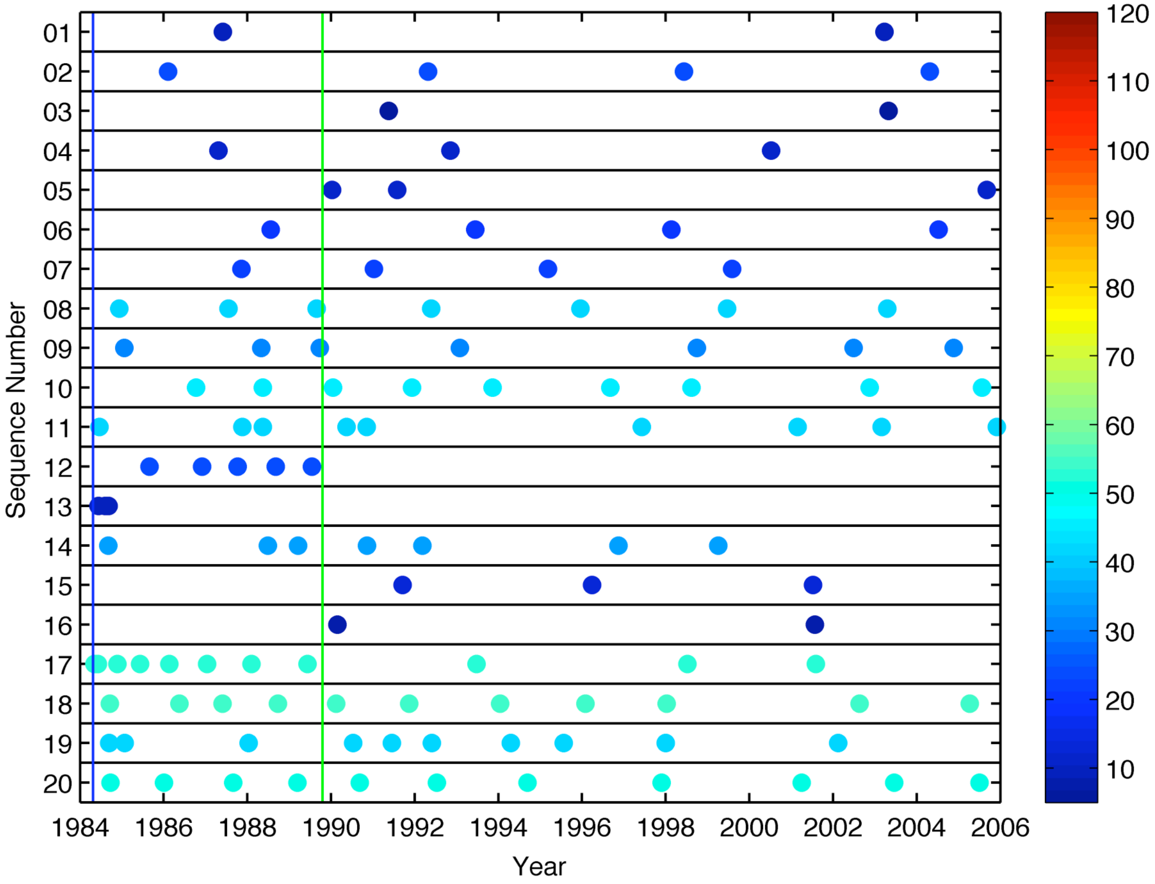
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Figure S3.

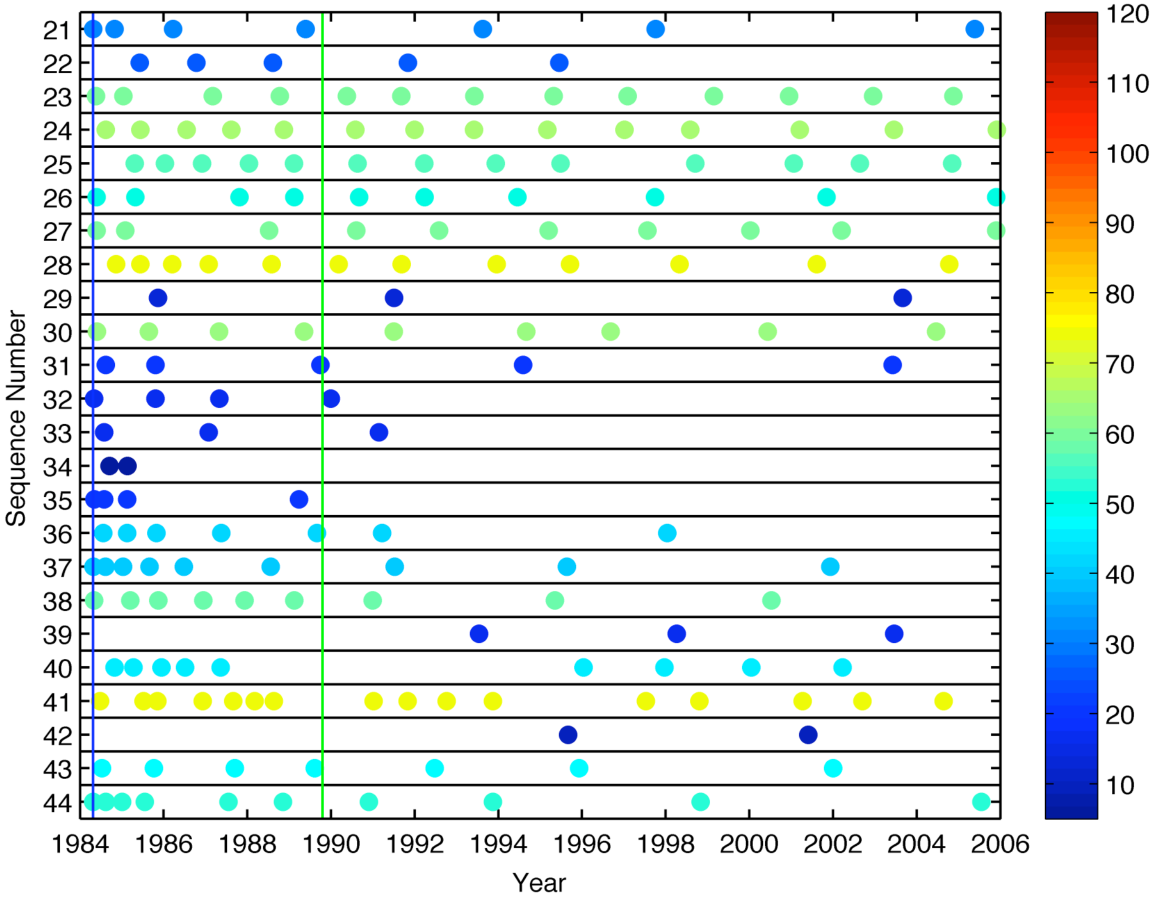
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Figure S4.

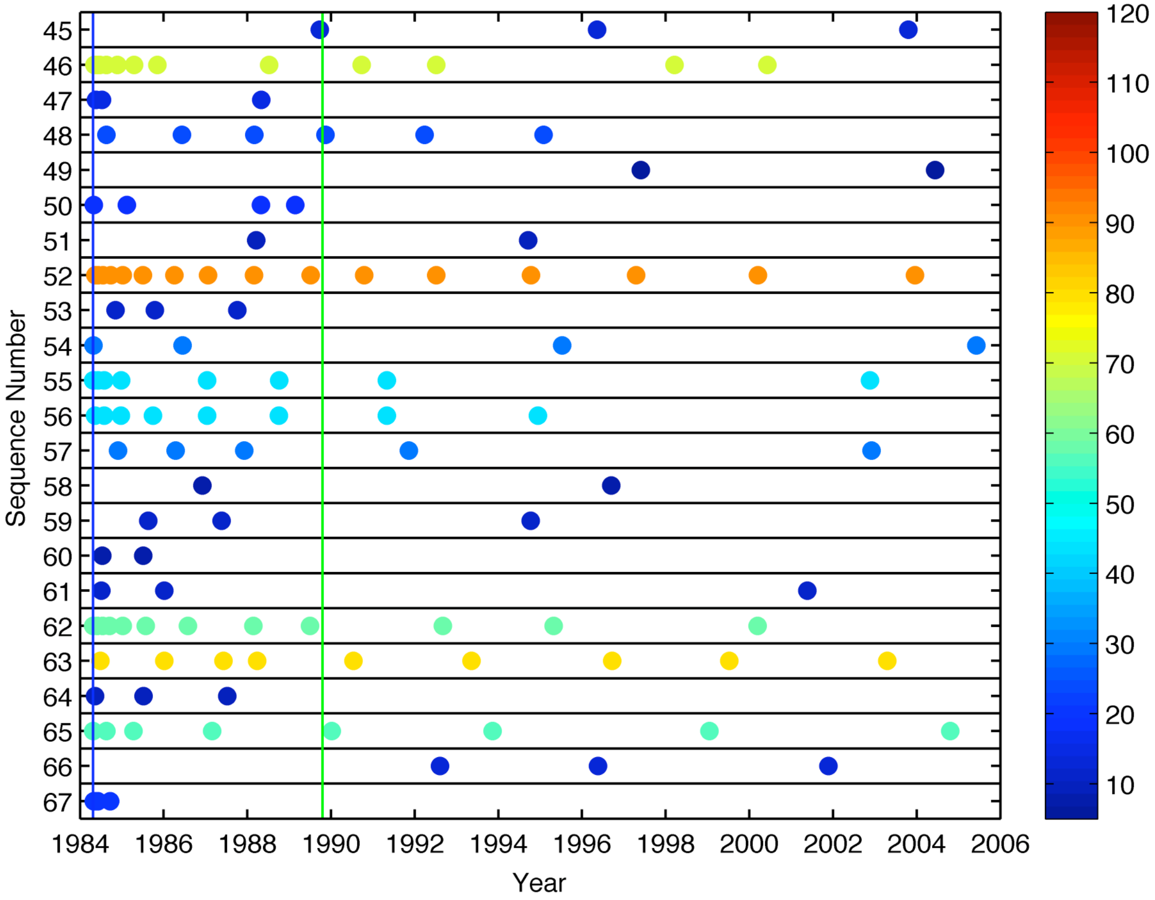
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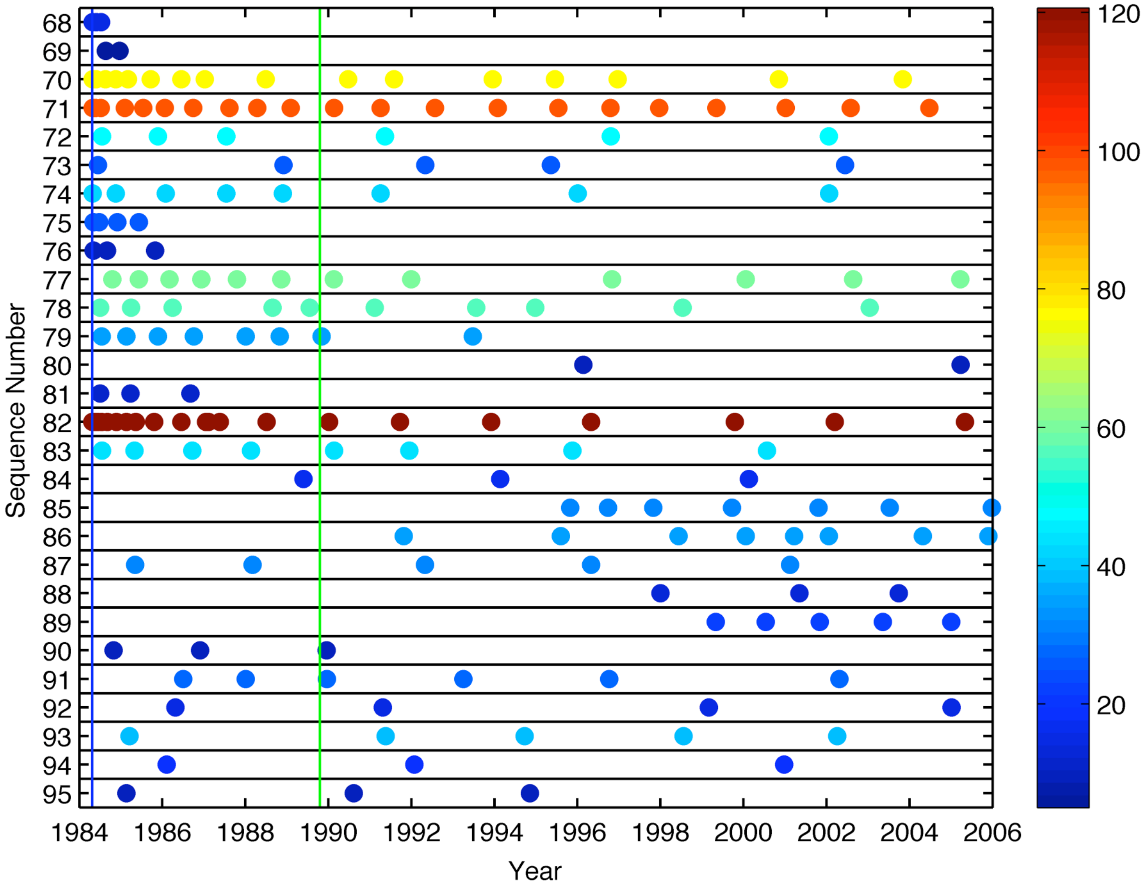
Figure S5.



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