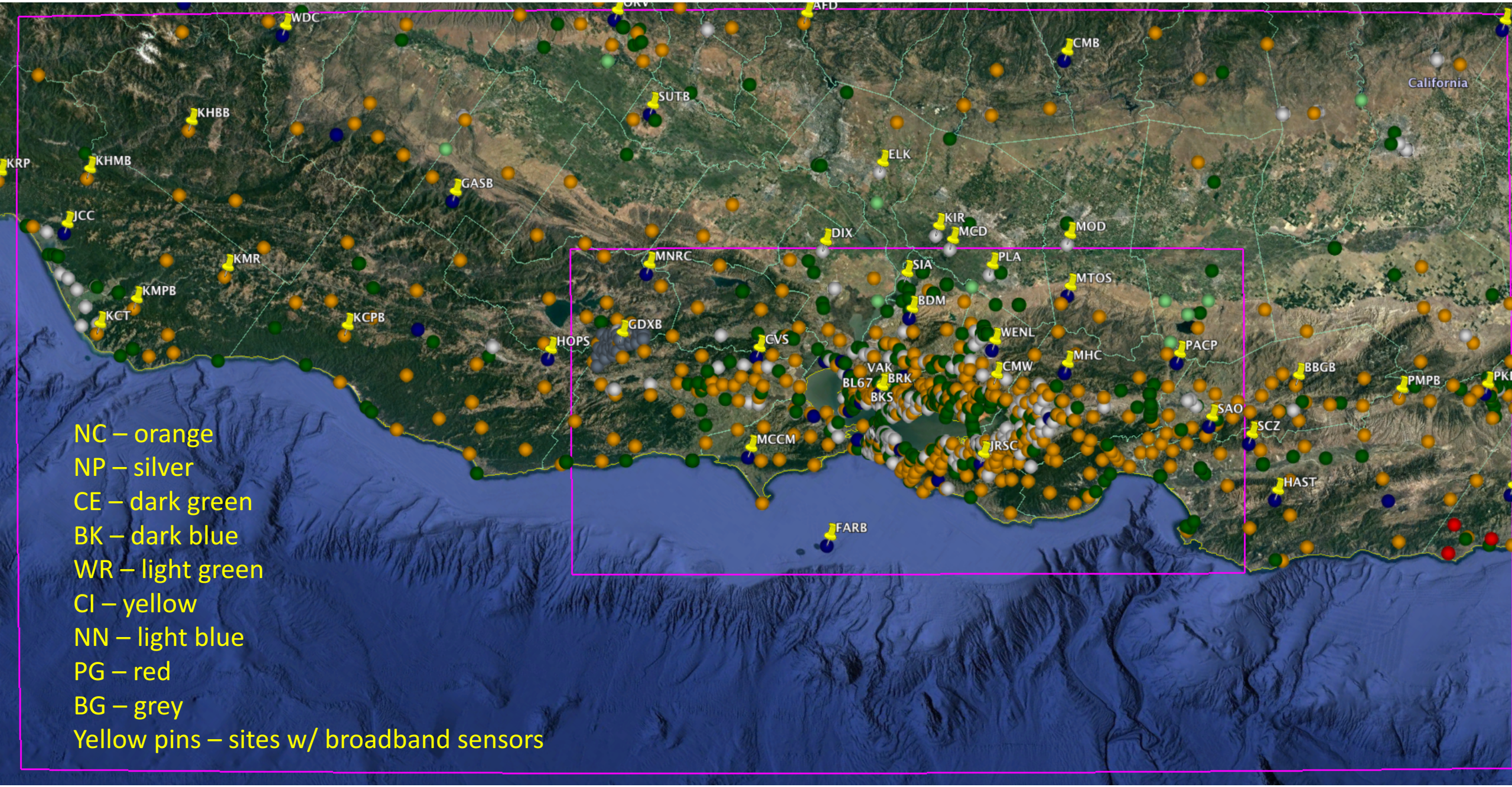
Northern California Seismic Networks

- Part of California Integrated Seismic Network
- Regional Seismic Networks
  - Northern California Seismic Network – USGS
  - Berkeley Digital Seismic Network – UC Berkeley
  - Bounding networks
    - Southern California Seismic Network – Caltech & USGS
    - Pacific Northwest Seismic Network – UW, UO, & USGS
    - Northern Nevada Seismic Network – UNR
- Strong motion networks
  - Strong Motion Instrumentation Program - California Geological Survey
  - National Strong Motion Network - USGS
- Specialized or focused networks
  - Central Coast Seismic Network – PG&E
  - CA Department of Water Resources – DWR
  - Parkfield High Resolution Seismic Network – UC Berkeley
  - Geysers Network – LBNL/Calpine
  - Engineering Seismology Network – UC Santa Barbara
  - PBO sites with seismic sensors - UNAVCO

It's a group effort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NC – orange
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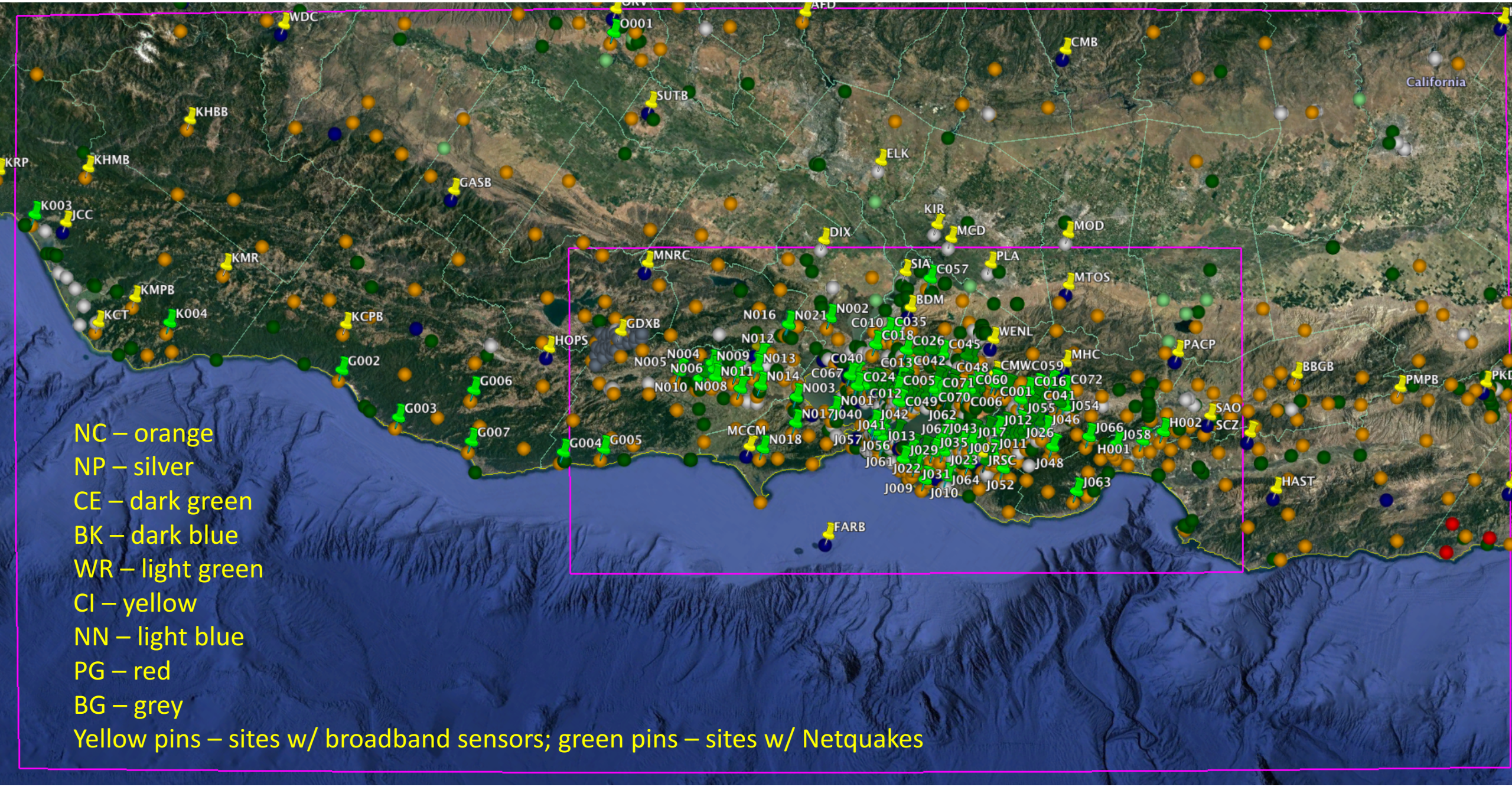
Yellow pins – sites w/ broadband sensors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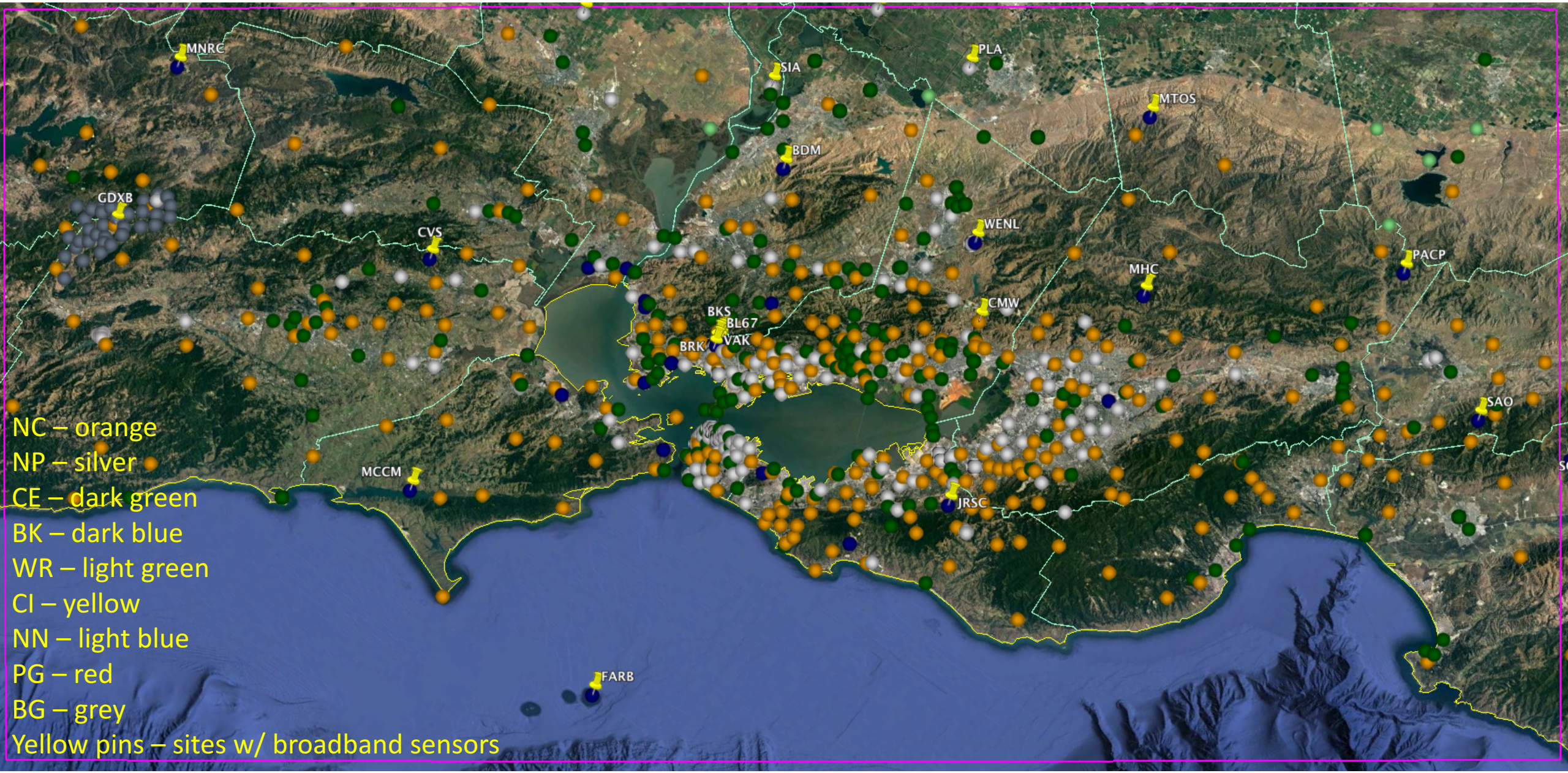
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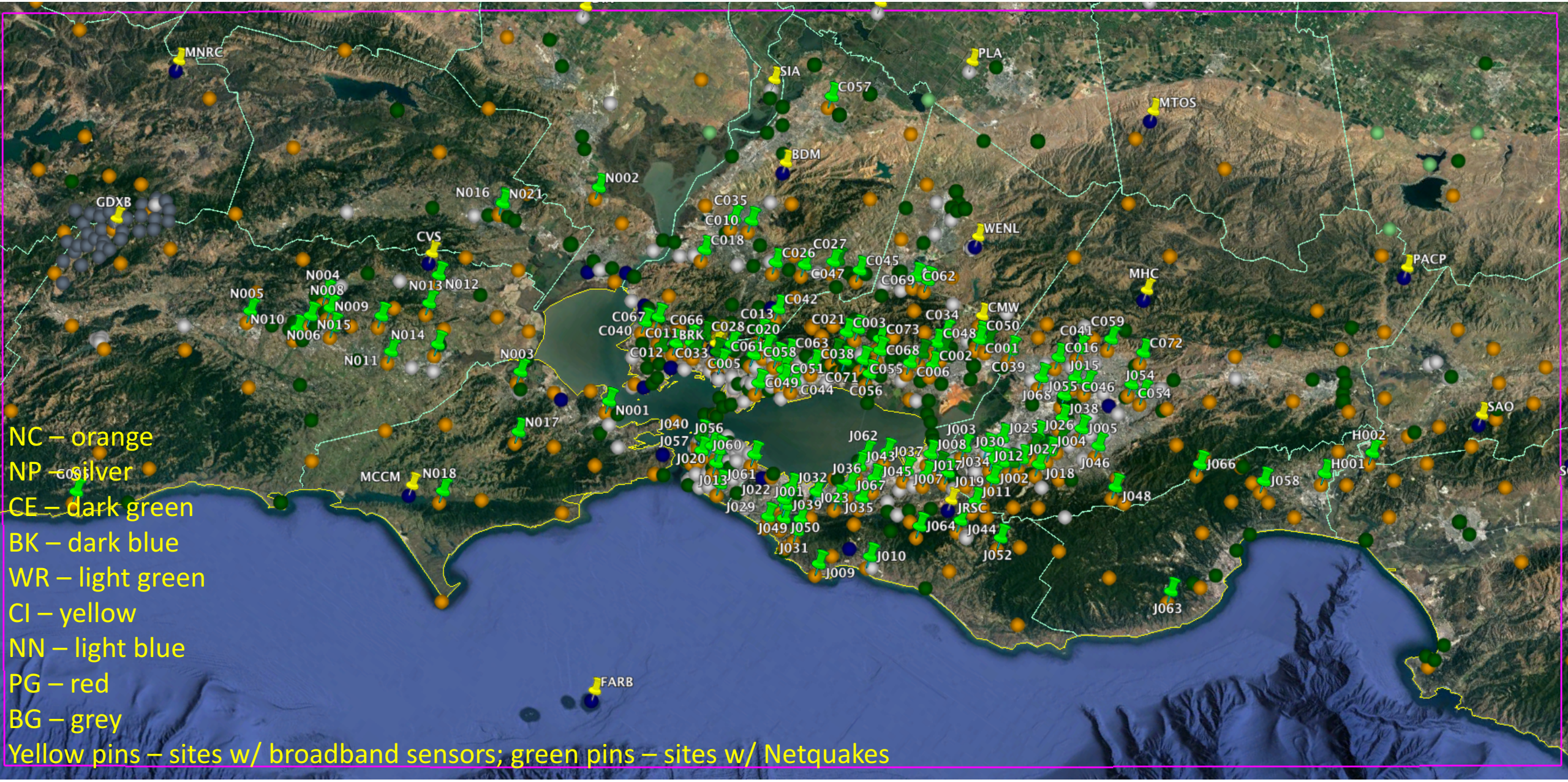
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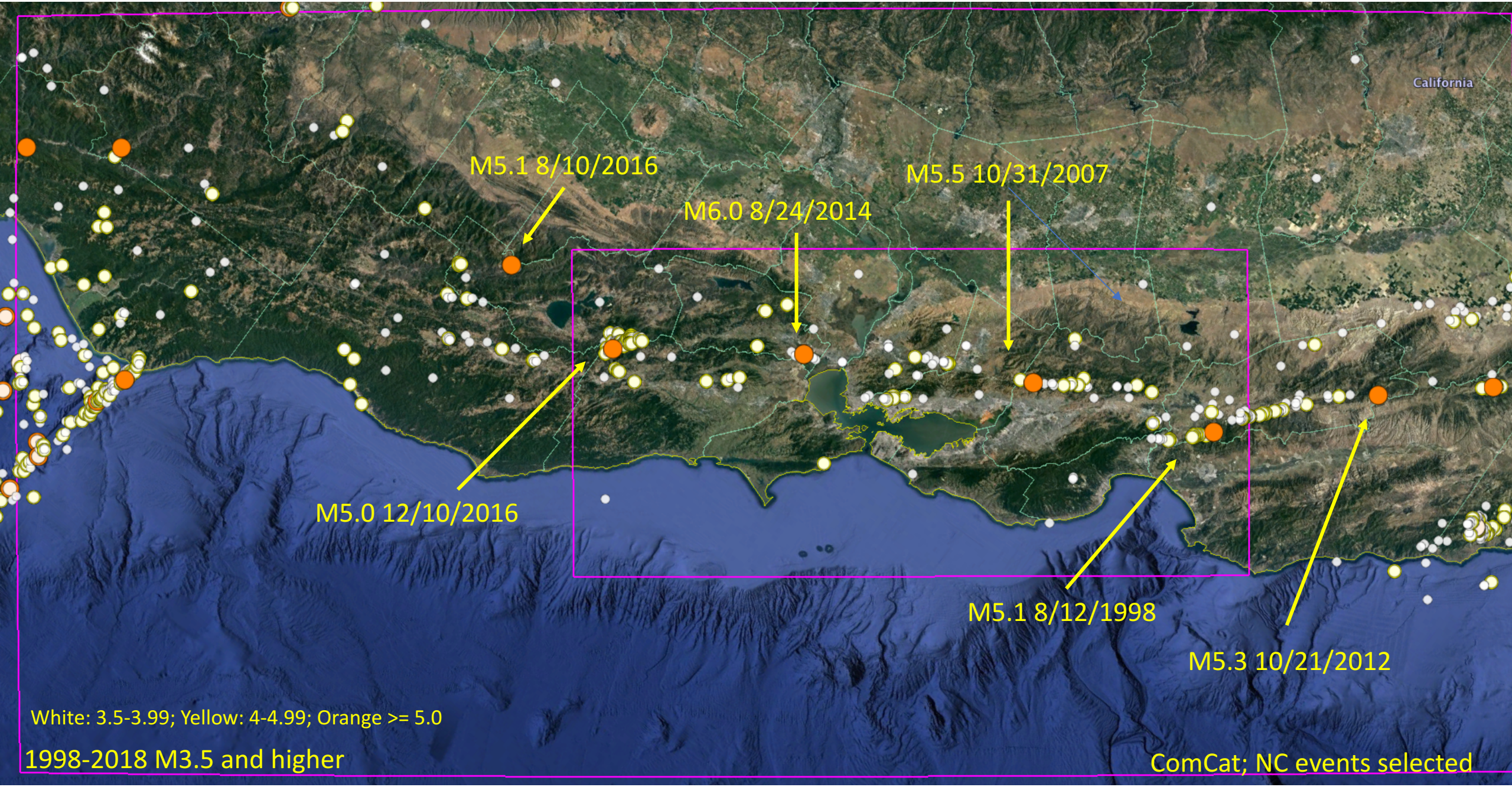
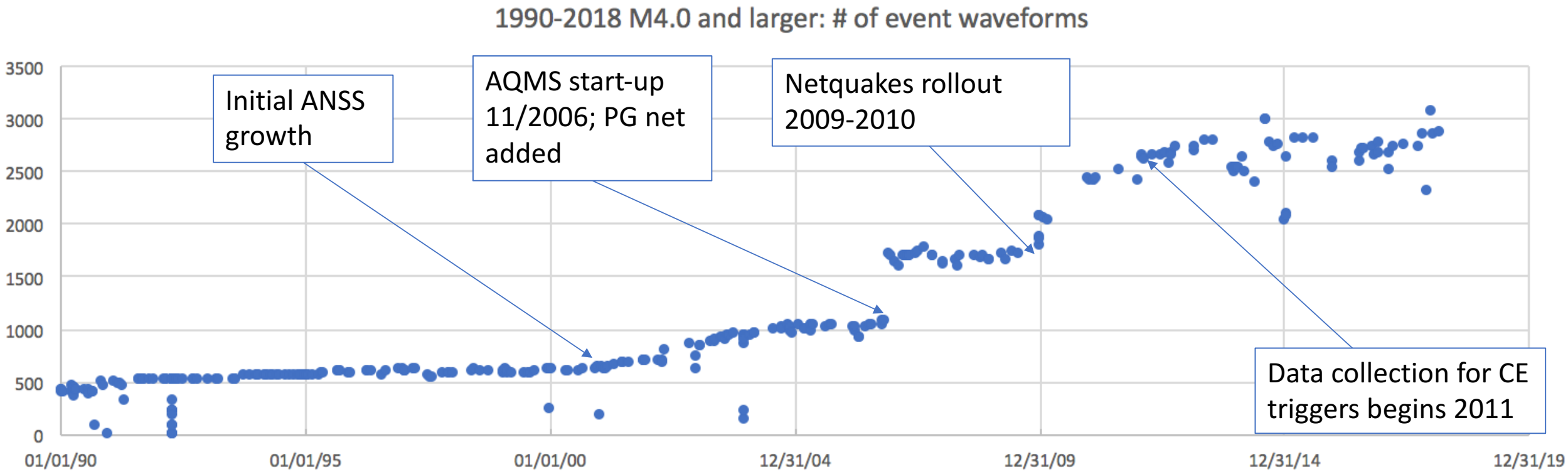

California
M5.1 8/10/2016
M6.0 8/24/2014
M5.5 10/31/2007
M5.0 12/10/2016
M5.1 8/12/1998
M5.3 10/21/2012
White: 3.5-3.99; Yellow: 4-4.99; Orange >= 5.0
1998-2018 M3.5 and higher
ComCat; NC events selected

Northern California Seismic System

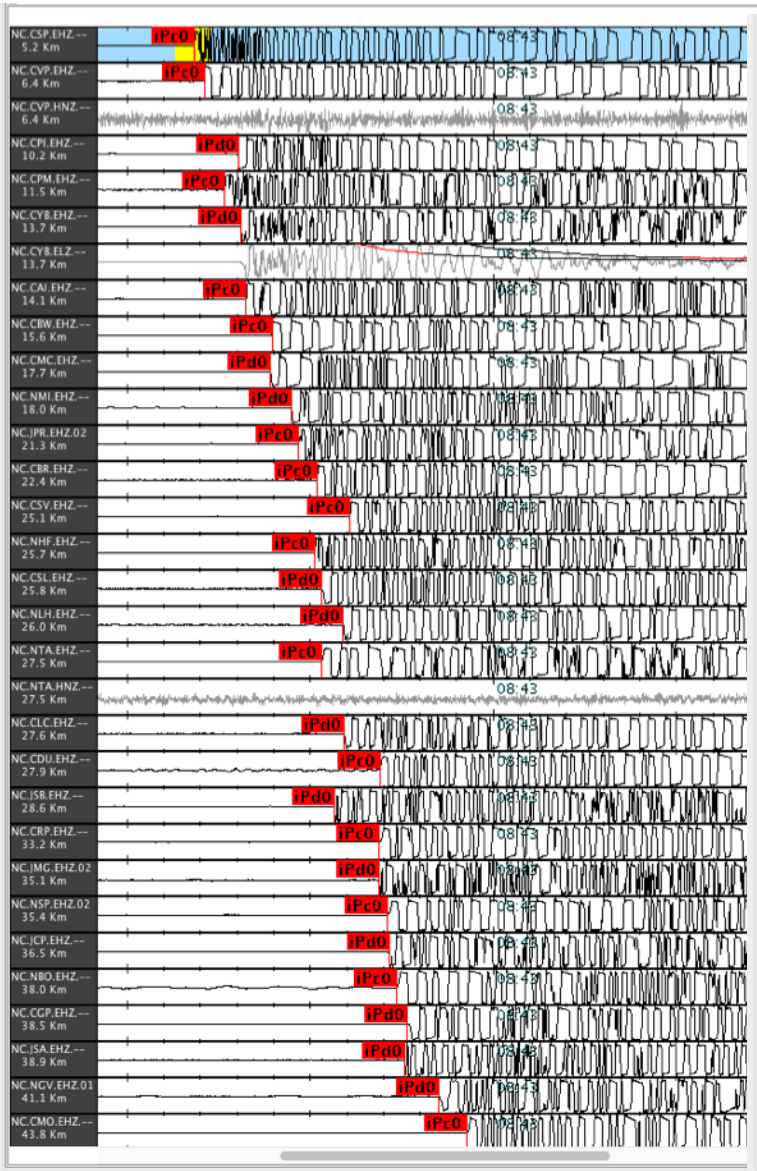
USGS & UC Berkeley collaboration

- Fully merged operations under AQMS initiated in late 2006
- Catalog contents:
  - 1D & Waldhauser double difference locations with phase & amplitude information
  - First motion mechanisms & moment tensor solutions (M3.5 and higher)



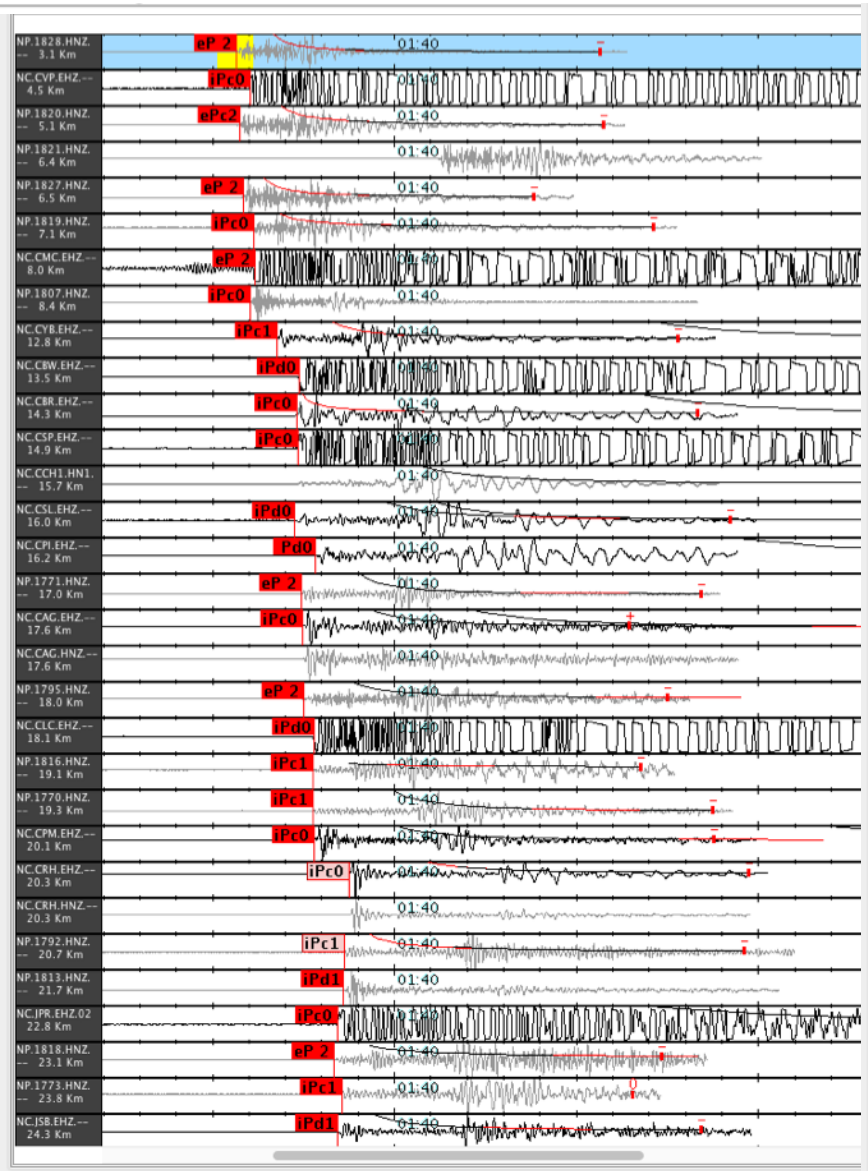
6/26/1994 M4.0

250 picks, 560 waveforms



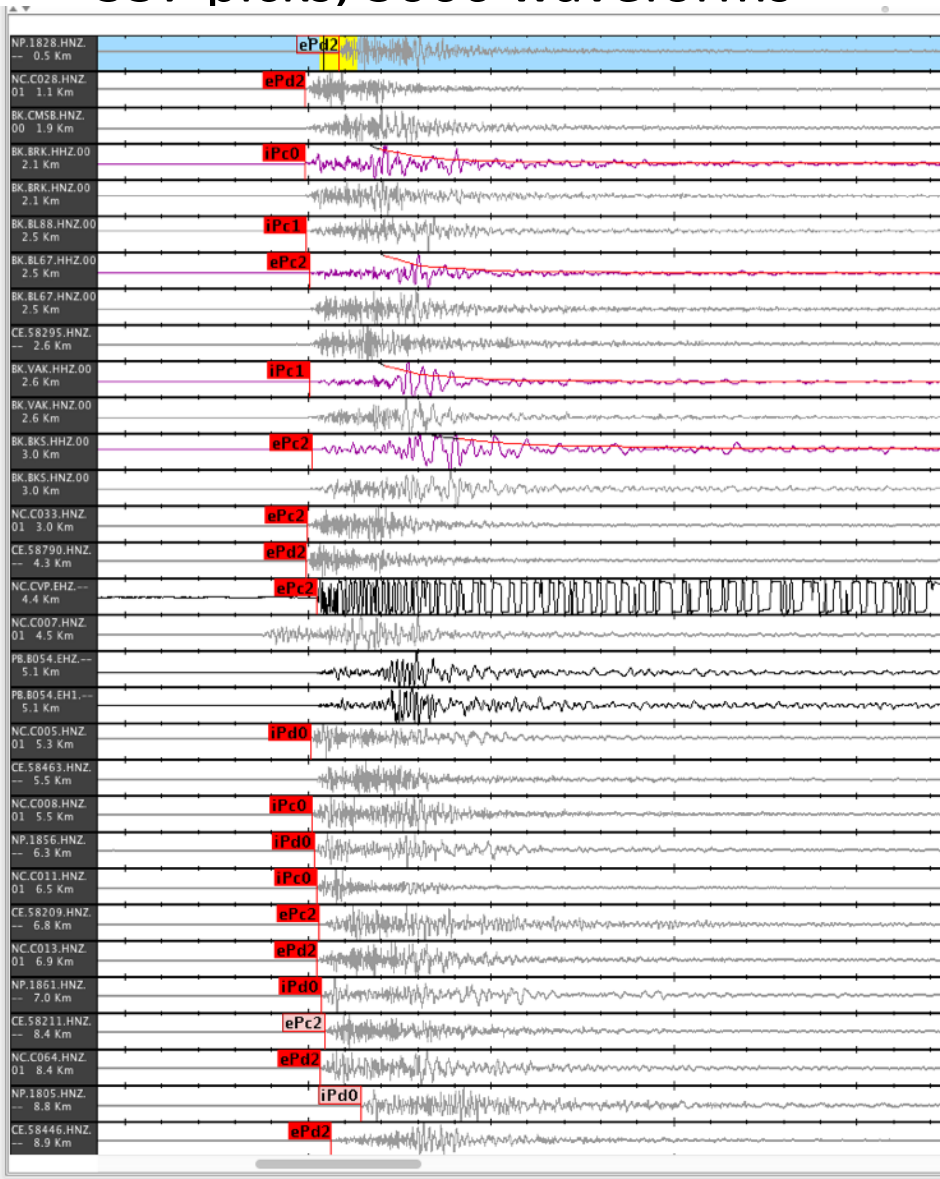
9/5/2003 M4.0

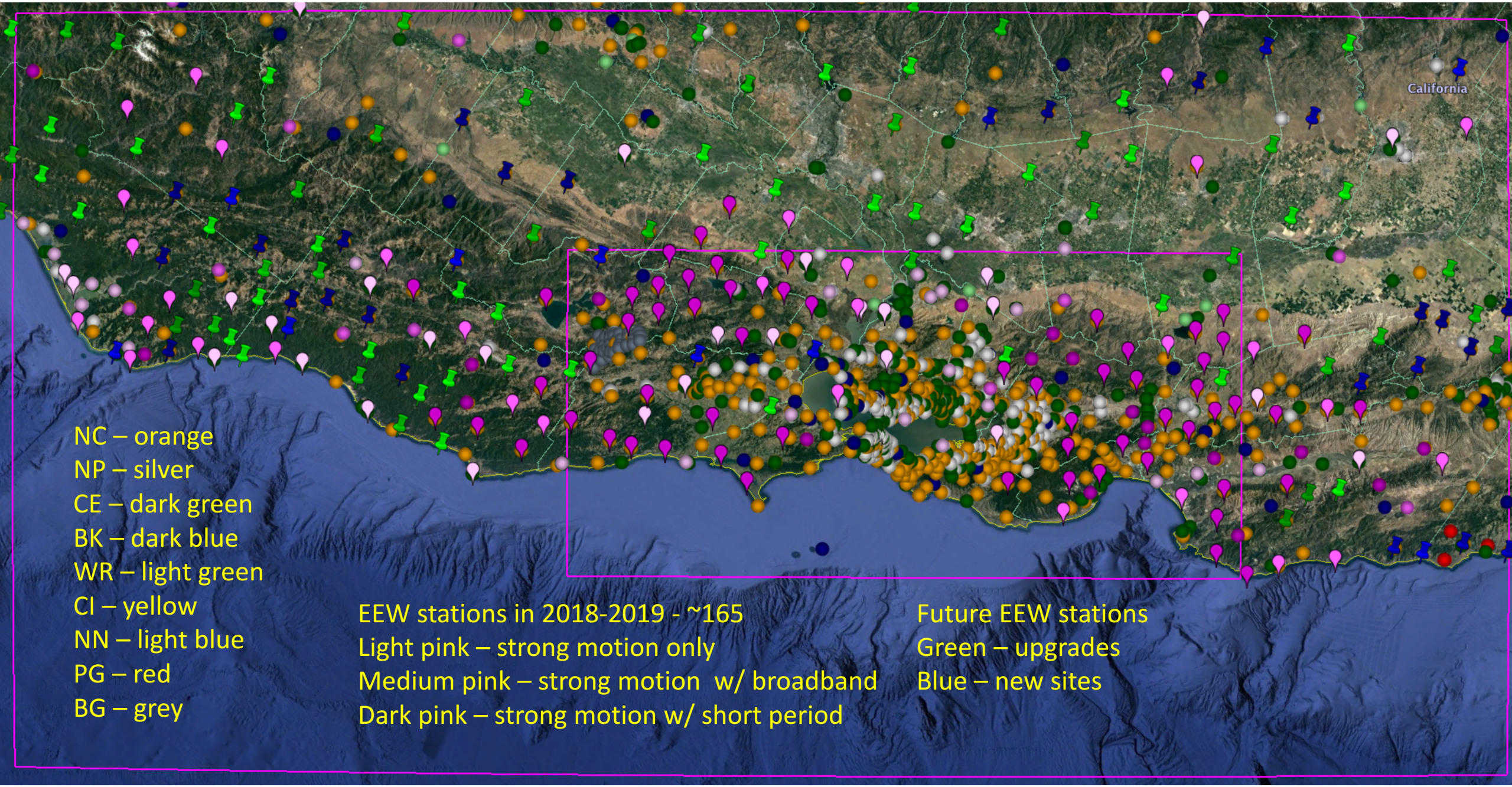
329 picks, 924 waveforms



1/4/2018 M4.4

357 picks, 3066 waveforms




California
NC – orange
NP – silver
CE – dark green
BK – dark blue
WR – light green
CI – yellow
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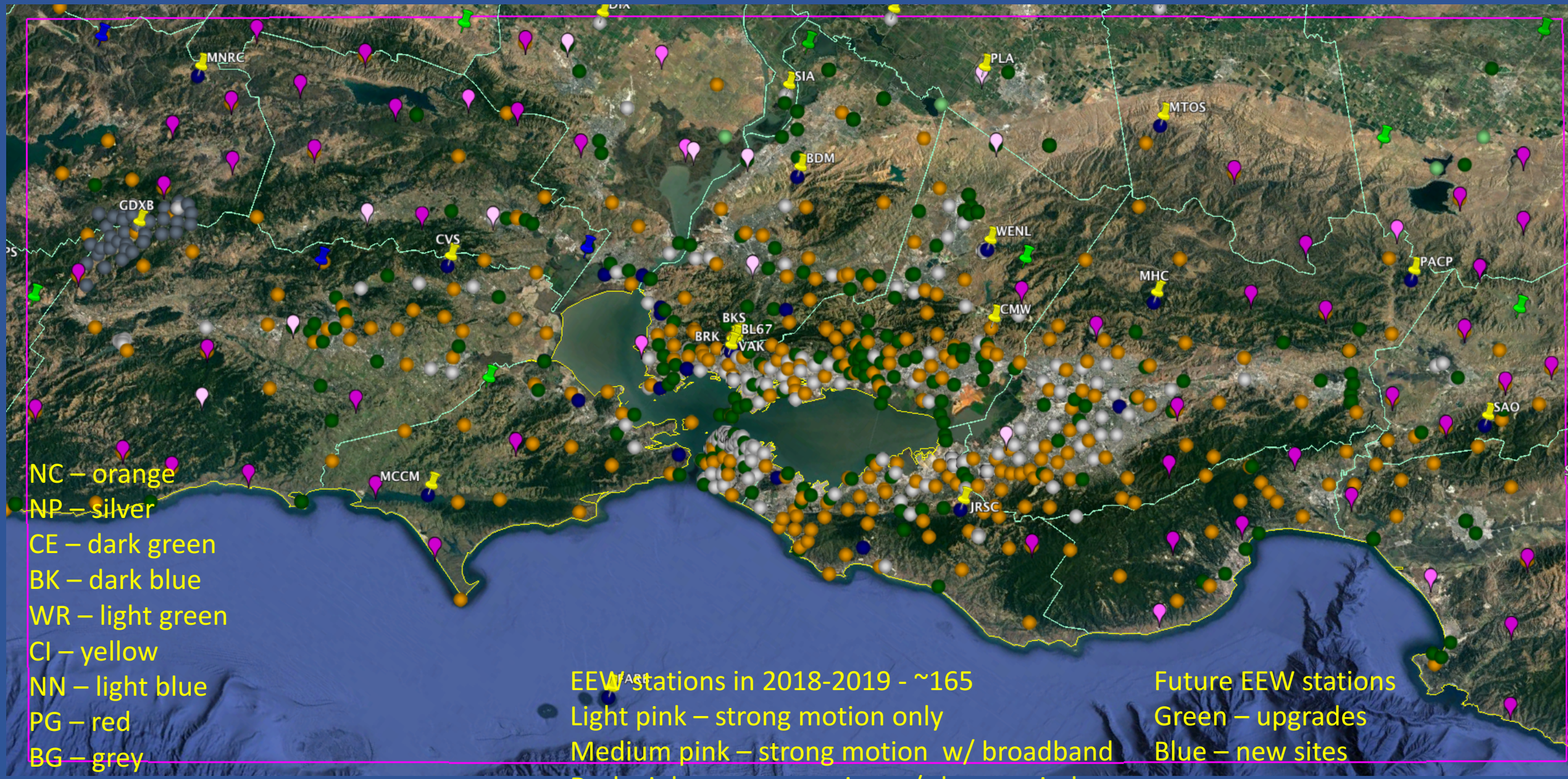
PG – red
BG – grey
EEW stations in 2018-2019 - ~165
Light pink – strong motion only
Medium pink – strong motion w/ broadband
Dark pink – strong motion w/ short period
Future EEW stations
Green – upgrades
Blue – new sites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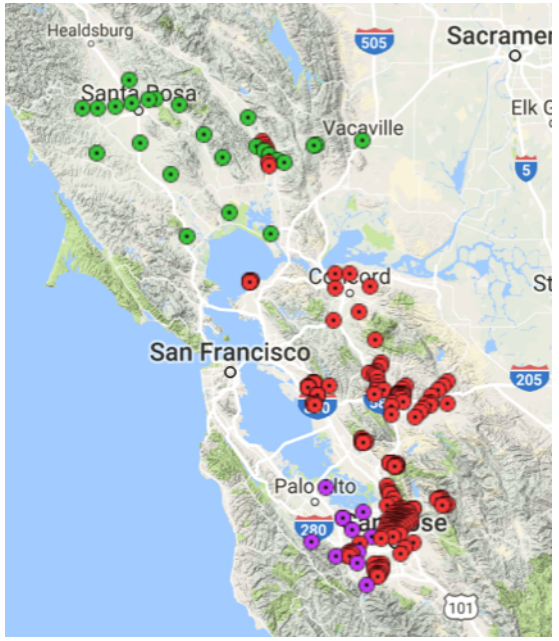
Where to find data

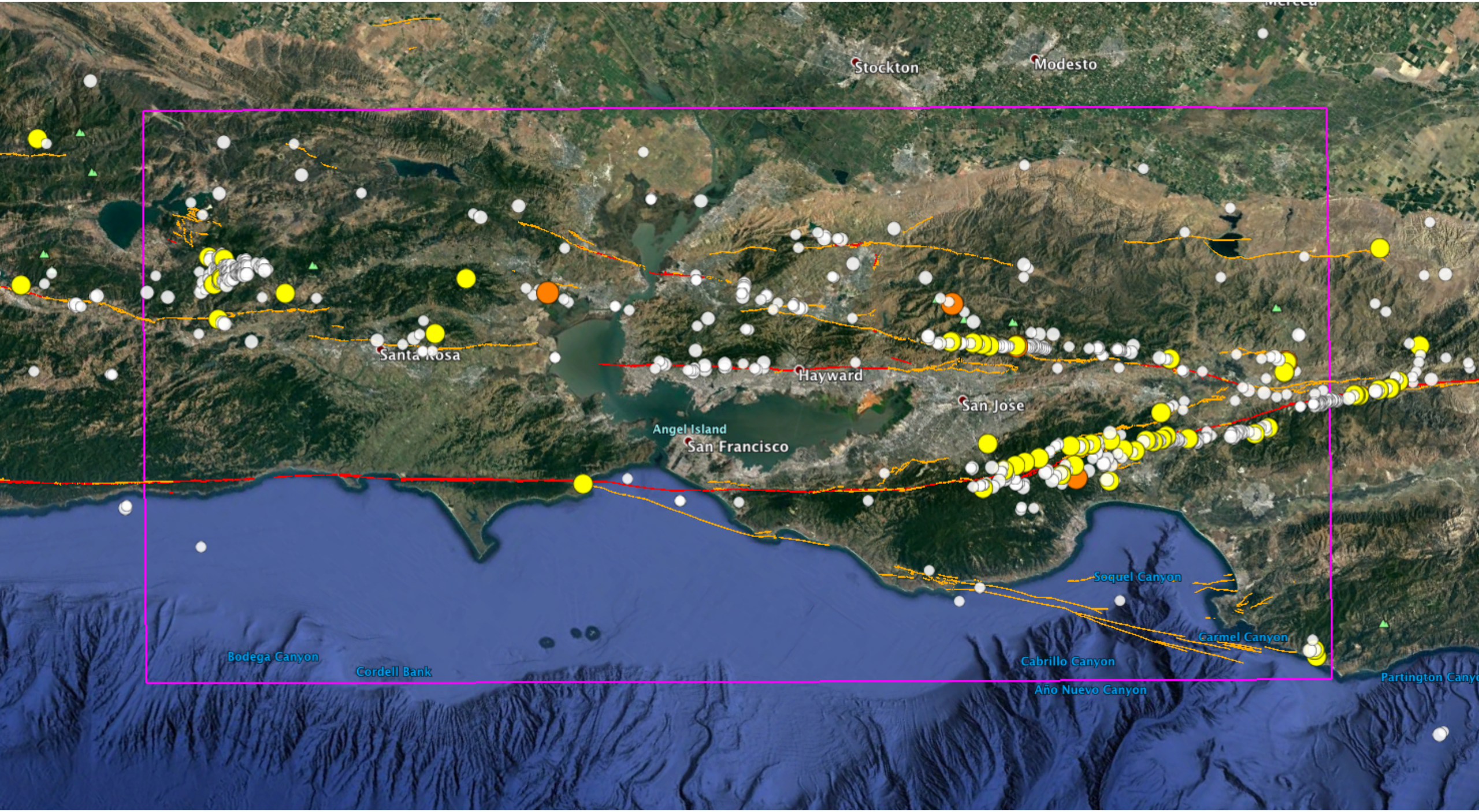
- USGS Comprehensive Catalog (ComCat) – authoritative earthquake catalog
  - https://earthquake.usgs.gov/earthquakes/map/
  - Can select NC events (recommended to avoid “contributed” solutions)
- NCEDC – Northern California Earthquake Data Center
  - http://ncedc.org/
  - Home to continuous & event data for most (but not all) CISN stations in Northern California
  - Hosts the Waldhauser double difference catalog in addition to ”standard” NCSS catalog
- CESMD – Center for Engineering Strong Motion Data
  - http://cesmd.org/
  - Home to strong motion data for California and more broadly
  - M3.5-4 and higher in California
- IRIS – Incorporated Research Institutions for Seismology
  - http://www.iris.edu/
  - Home to data from temporary experiments
    - YG – South Bay - 1999-2004
    - YK – North Bay – 2003 – present (in time variable configurations)
    - GS – Various experiments



Final Thoughts – Catalog changes

New catalog efforts under way

- Merge NCSN & BDSN phase observations 1966-2006 (pre AQMS)
- Include the older UC Berkeley catalog 1910-1965
- Correct problems in Mds from 1969-1977
- Correct problems with coda termination values in the PG network 2006-2011
- Calculate new station corrections
- Relocate the catalog with the new corrections
  - Recalculate Md, ML, and first motion mechanisms
  - Recalculate Mw as needed (in general, the events will not move much)


Stockton
Modesto
Santa Rosa
Hayward
San Jose
Angel Island
San Francisco
Soquel Canyon
Carmel Canyon
Cabrillo Canyon
Año Nuevo Canyon
Bodega Canyon
Cordell Bank
Partington Canyo

Changes in NCSN/NCSN systems

- 1995-1997 Installation of digital sites in the North Coast
- 1997-04-29 Catalog update – GPS station locations & new station traveltime corrections
- 2001-2002 Early ANSS growth. Bay Area NP sites moved to continuous telemetry and acquired by the NCSS
- 2004-09-25 Archive of continuous BK HL? And HH? Waveforms initiated
- 2006-09-05 Incorporation of PG waveform data in near-real time
- 2006-11-29 AQMS replaces CUSP. NC & BK networks combined in earthquake processing
- 2007-07-23 Incorporation of BG waveform data in near-real time
- 2009-2010 Rollout of the Netquake instruments
- 2011-11 Incorporation of CE event triggers
- 2013-05-27 Geysers reporting threshold changed
- 2015-10-07 Change in depth reference
- 2017-06-06 Catalog snapshots initiated on github

NCSS General protocols for picking

P arrivals

- For M3 and higher, the max cutoff for any event is 300 km
- For events less than M3.0, pick out until no more good onsets. Usually that works out to being 100km or less for anything under 2.0 and 200km for the 2.0 to 3.0M range.

S arrivals

- Pick out to 60 - 100km (max), usually 0-25km. The only exception would be a little playing with these rules for far offshore Mendocino events.

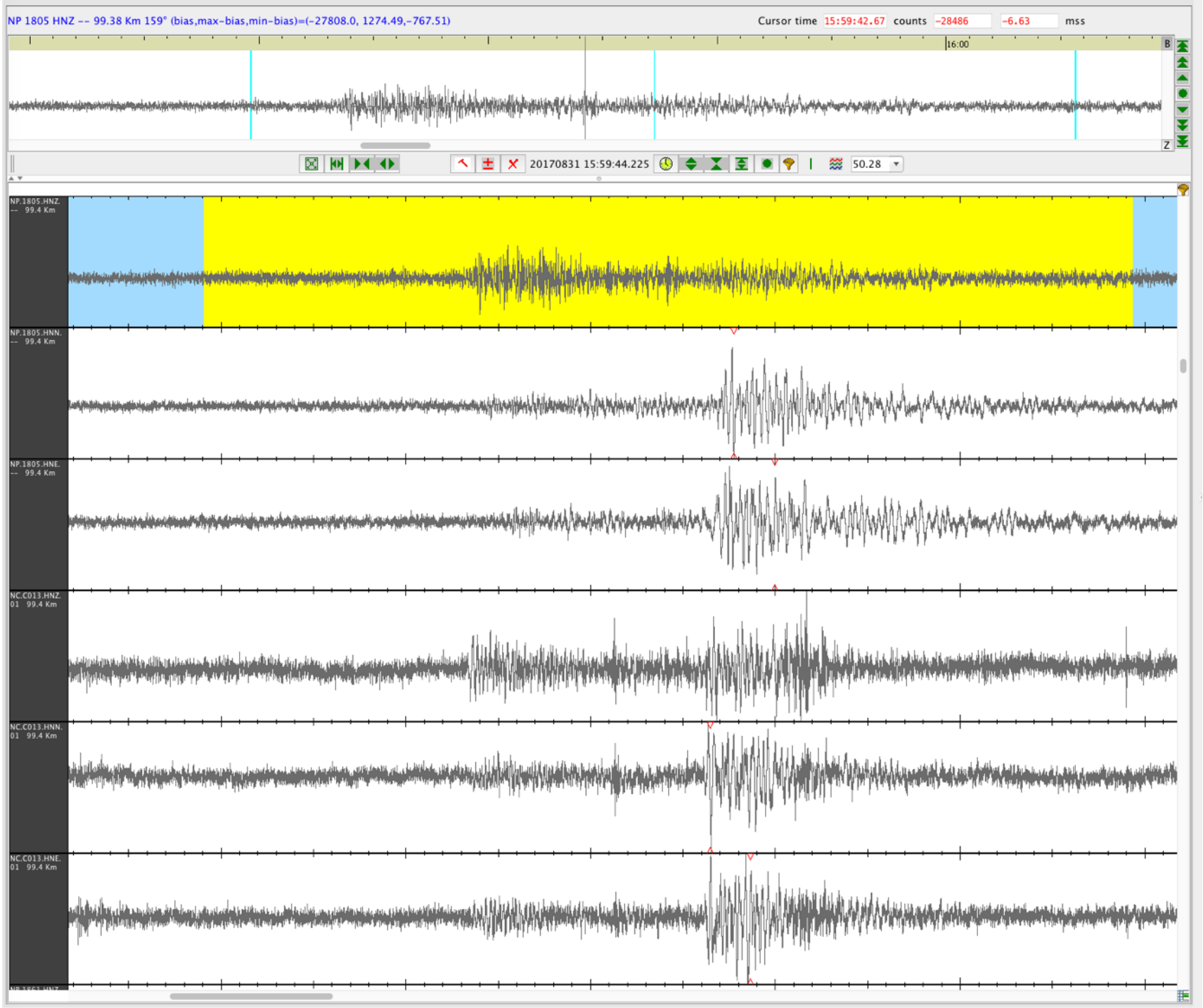
M3.5 Calistoga

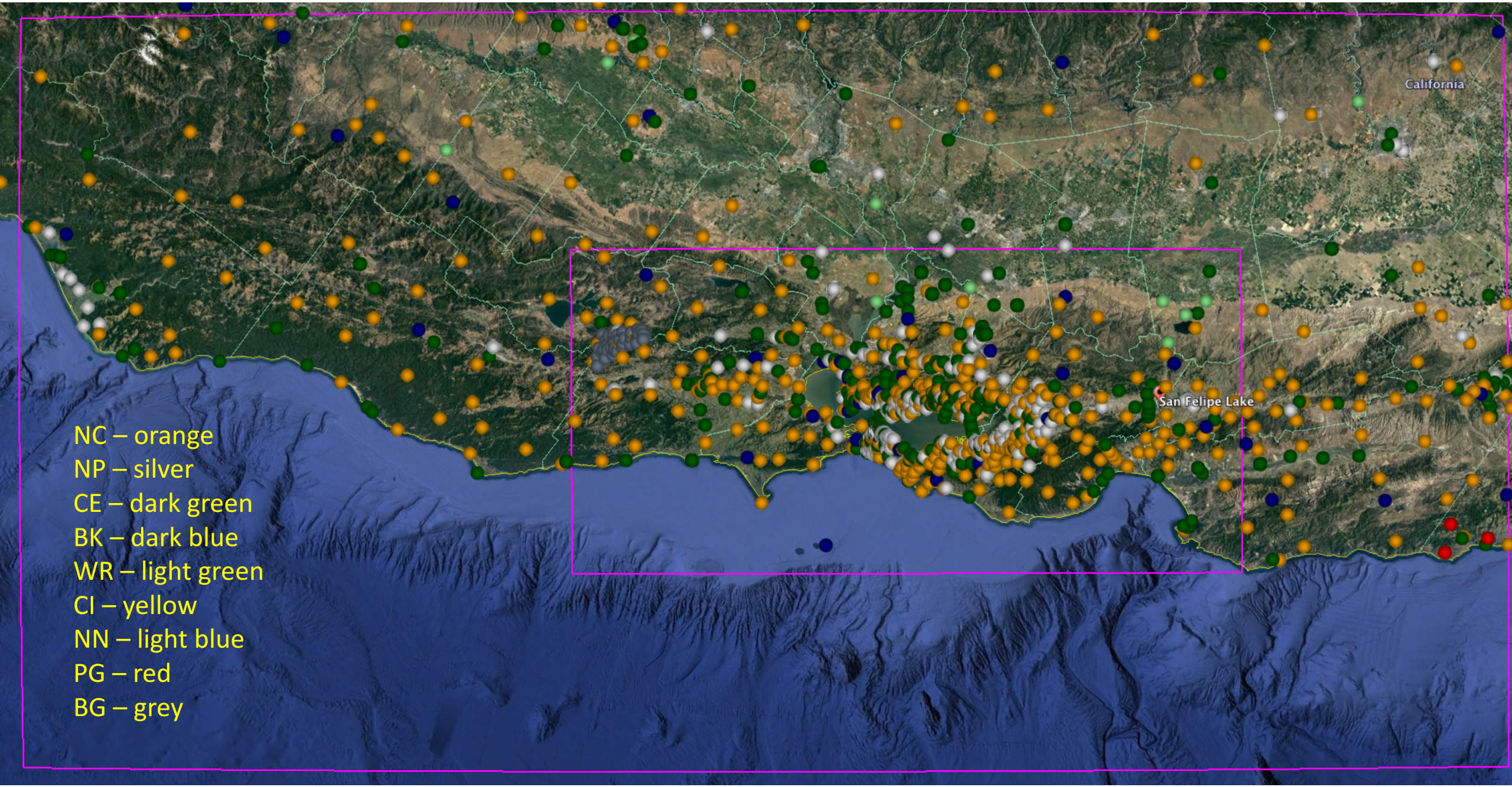
- Top 3 traces:

  NP site with Episensor

- Bottom 3 traces:

  NC site with Netquakes




California
San Felipe Lake
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