Studying the creep across the Central San Andreas using INSAR

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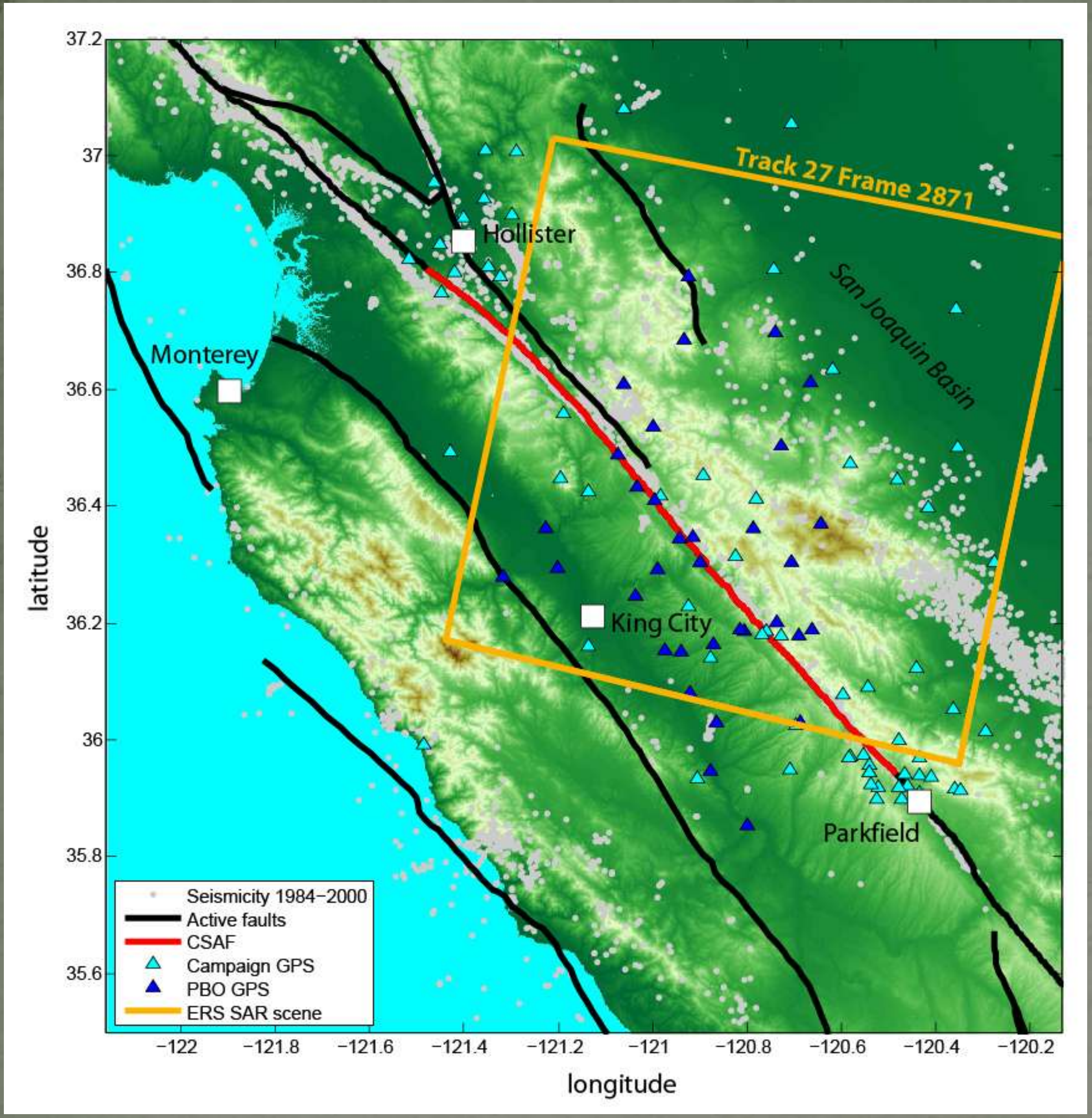
Effect of Wavelength

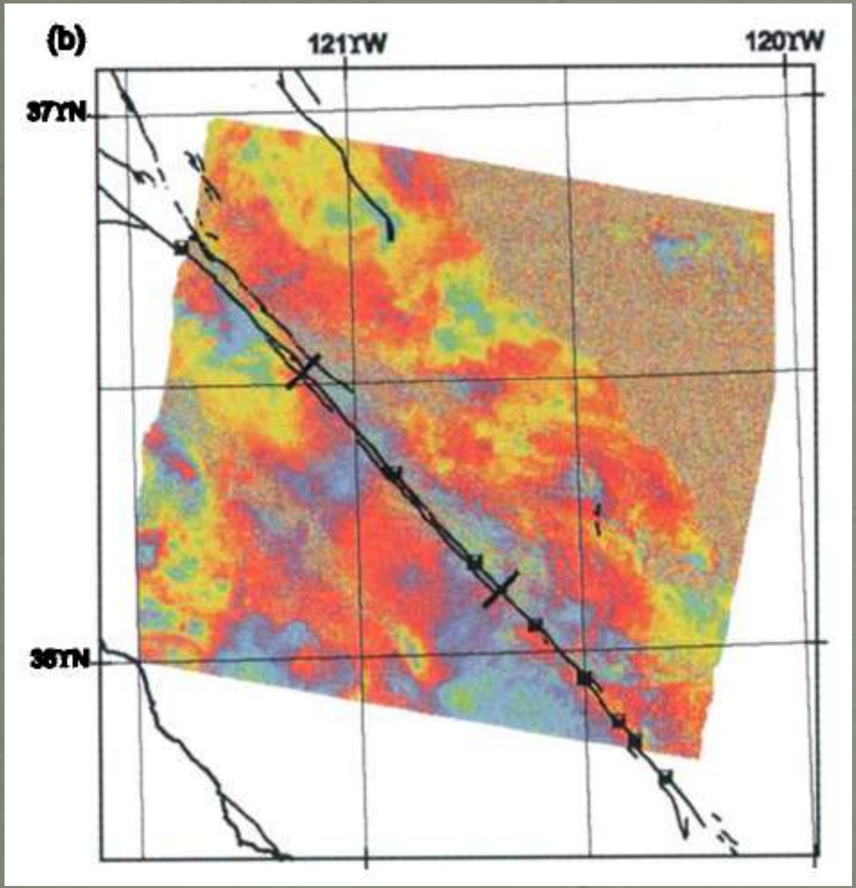
- C-band (6 cm)– ERS and Envisat satellites from ESA.
- L-band (24 cm)– ALOS PALSAR from JAXA.
- Comparison of
  - Conventional InSAR (C-band and L-band)
  - InSAR stacking (C-band)
  - Persistent Scatterer InSAR (C-band)
- Implications for DESDynI and future missions.

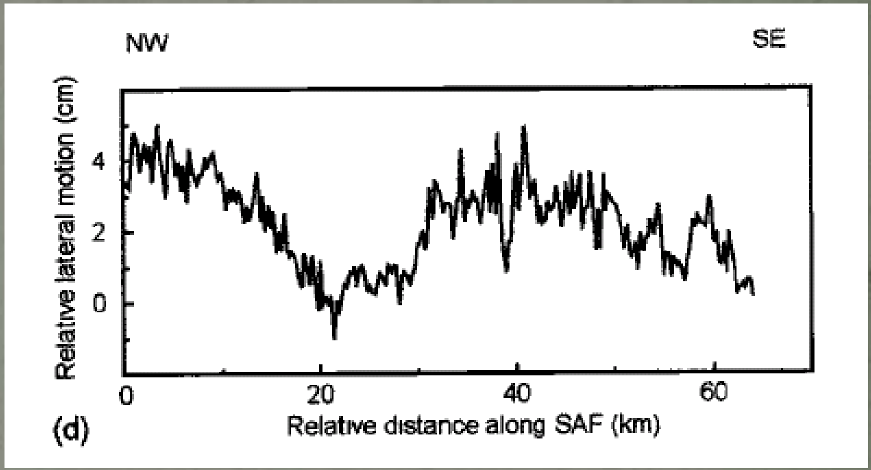


Ryder and Burgmann (2008)

- Does the amount of fault creep vary as a function of location along the fault?
- Does the fault creep at the same rate over time?

Conventional InSAR (C-band)

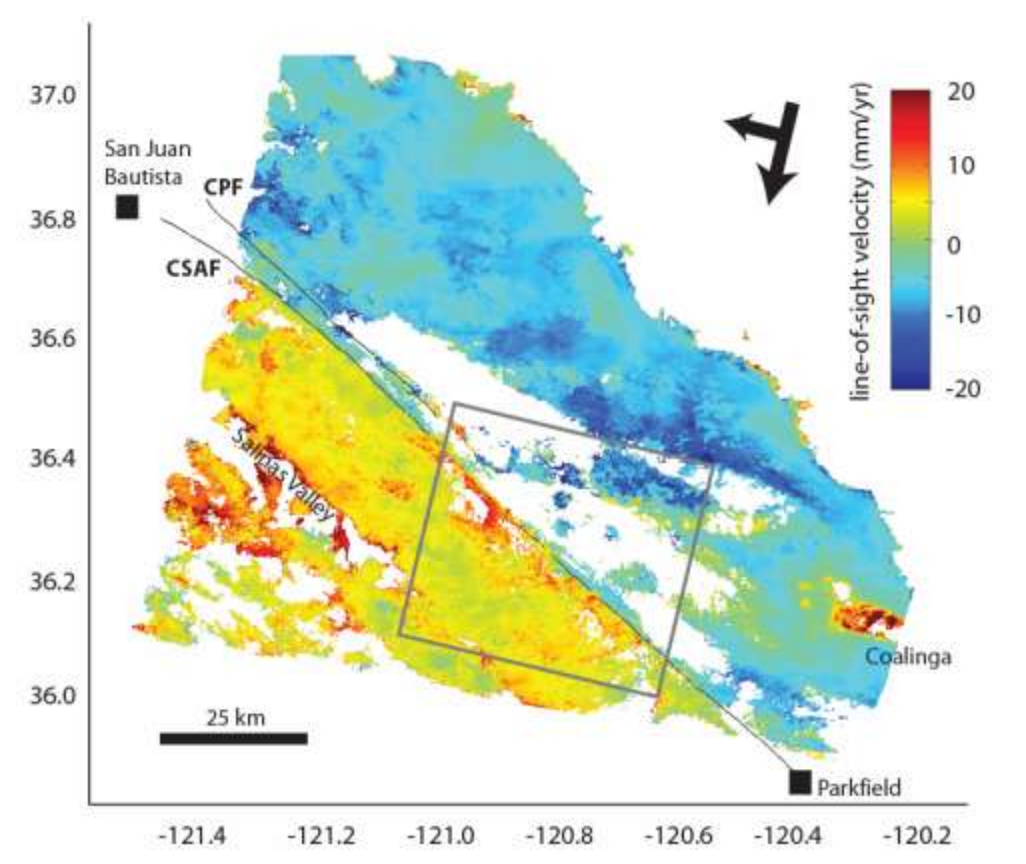




- Baseline of 3 meters.
- Time separation of 420 days.
- First aseismic creep observation using InSAR.

Rosen et al (1998)

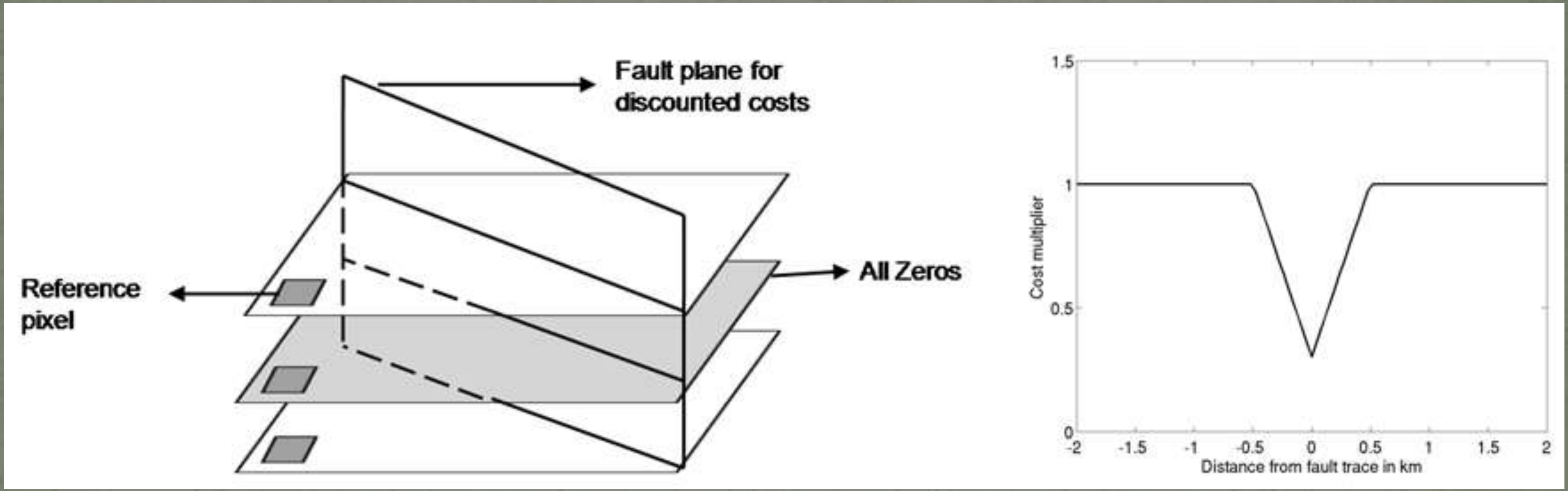
InSAR stacking (C-band)



- 13 C-band ERS interferograms.
- The fault is locked at the surface near Parkfield.
- The estimated shallow creep rate is 30-35 mm/yr.
- 20-25 mm/yr around Monarch peak.

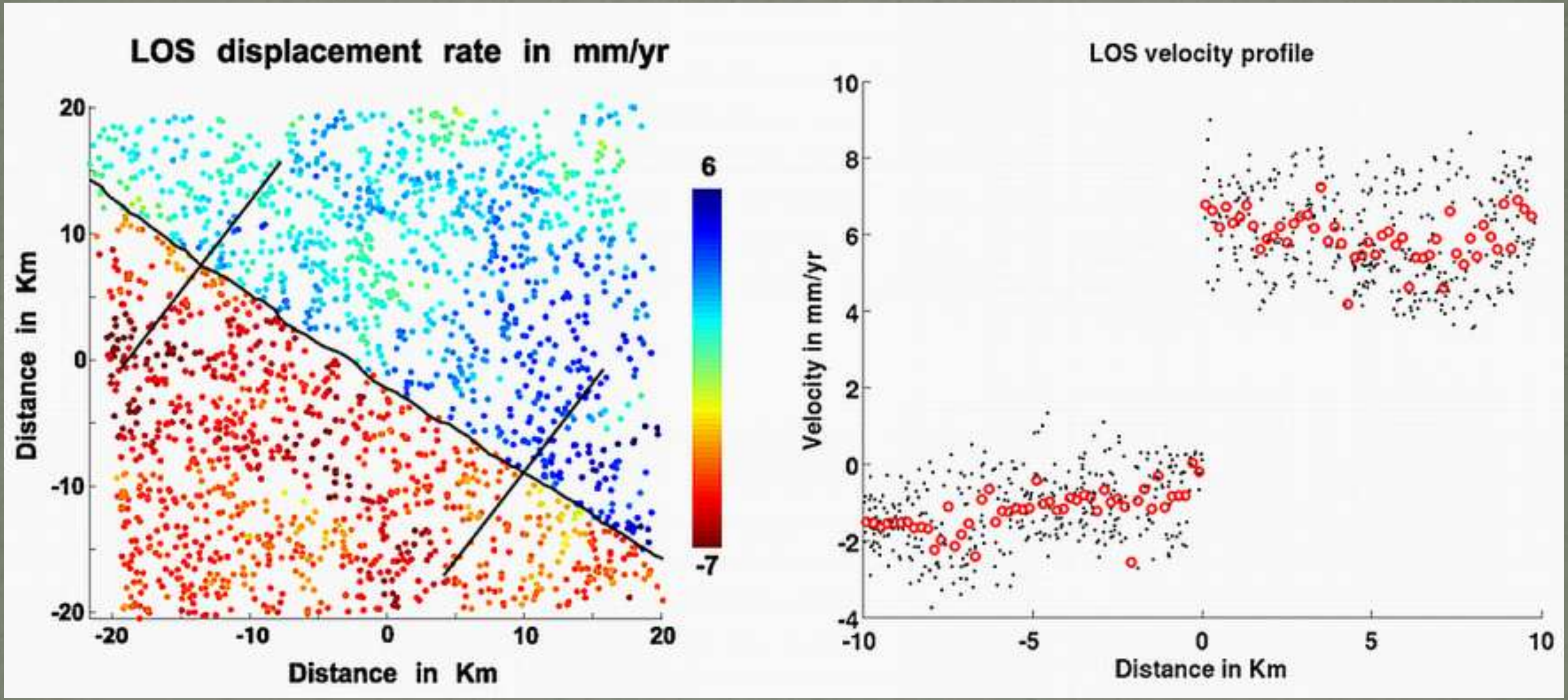
Ryder and Burgmann (2008)

PS-InSAR Unwrapping model



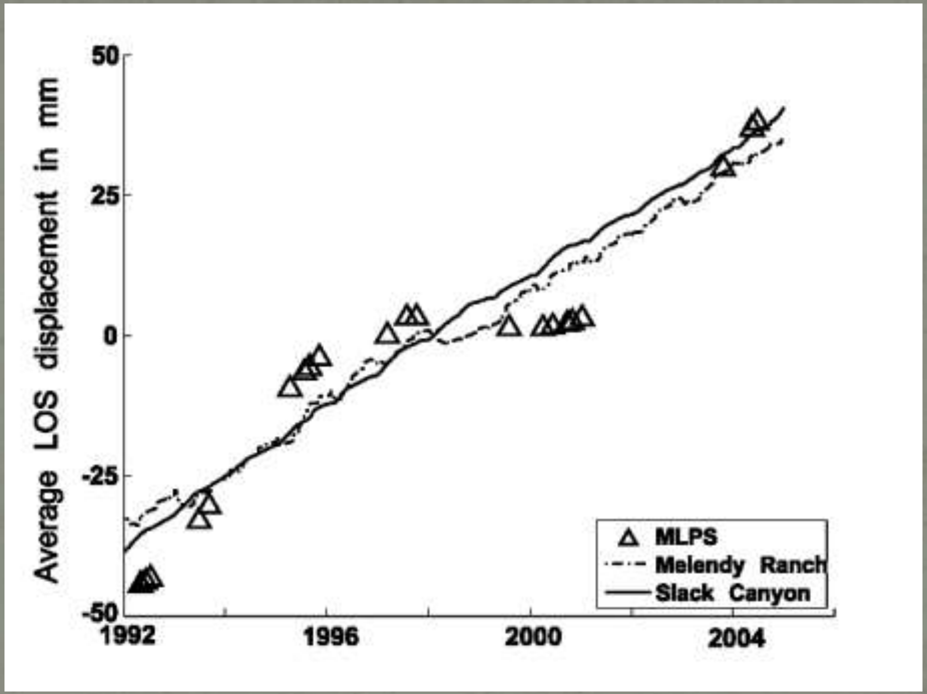
- Use a priori information to constrain the unwrapped solution.
- Fault plane of discounted costs.
- Reference pixel and reference plane forced to zero.
- Blocks connected by loose strings.

CSAF PS Velocity



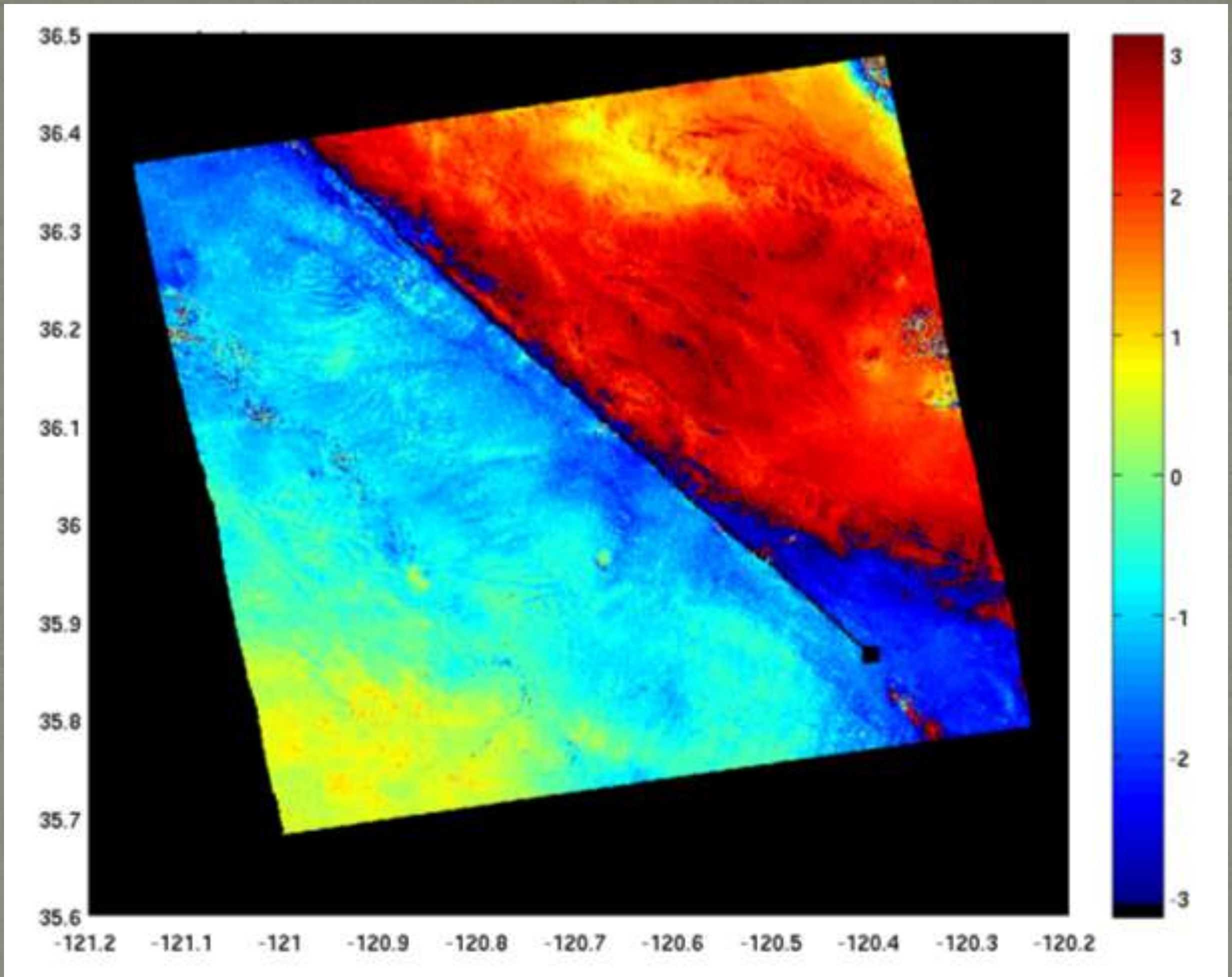
- The velocity plot clearly shows block like motion.
- The average creep is 22 mm/yr.

CSAF PS Time-series



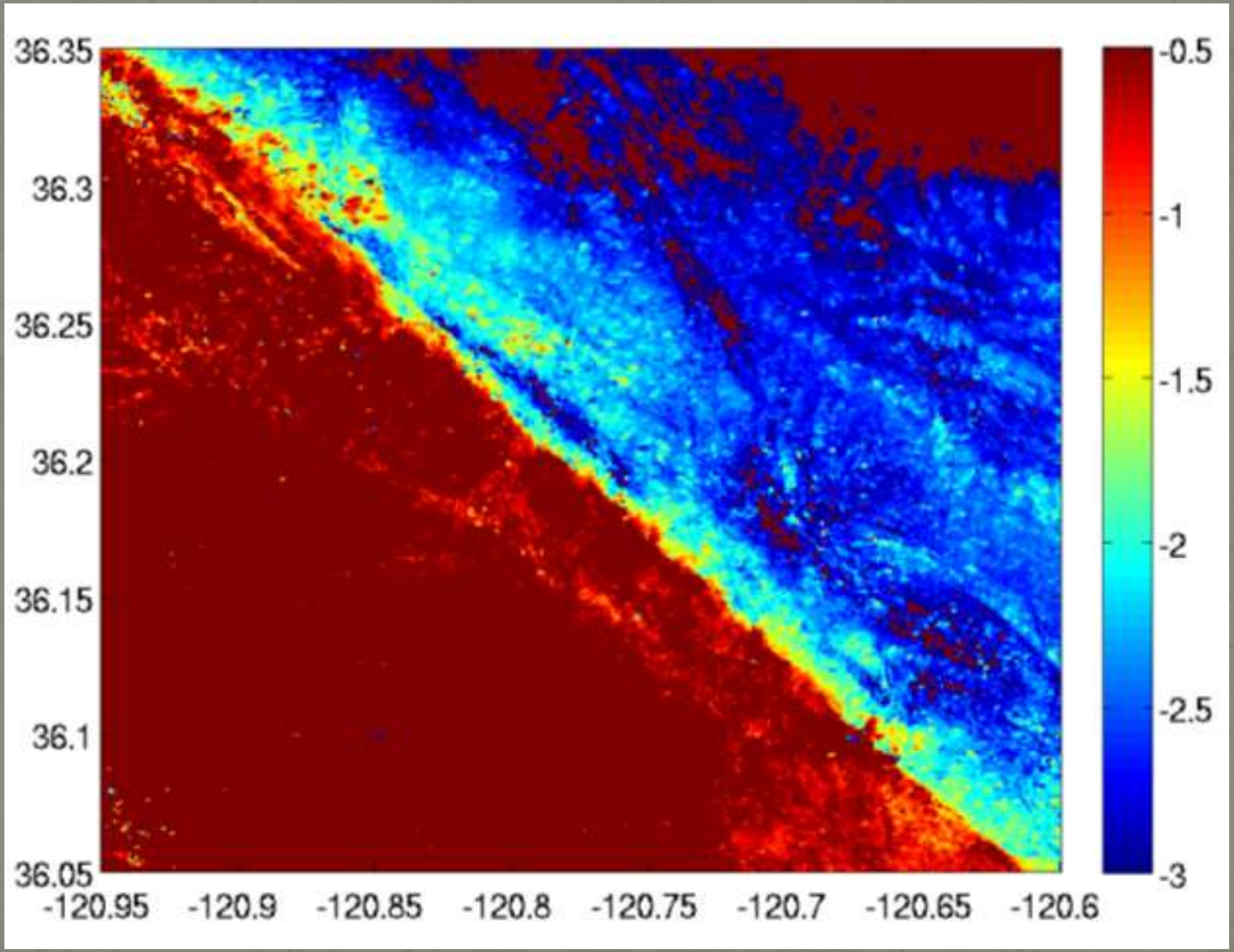
- Solution agrees well with creep meters.
- GPS stations after 2005.
- Microseismicity is a suggested proxy for fault creep.
- Non-uniform creep rate?

ALOS PALSAR (L-Band)

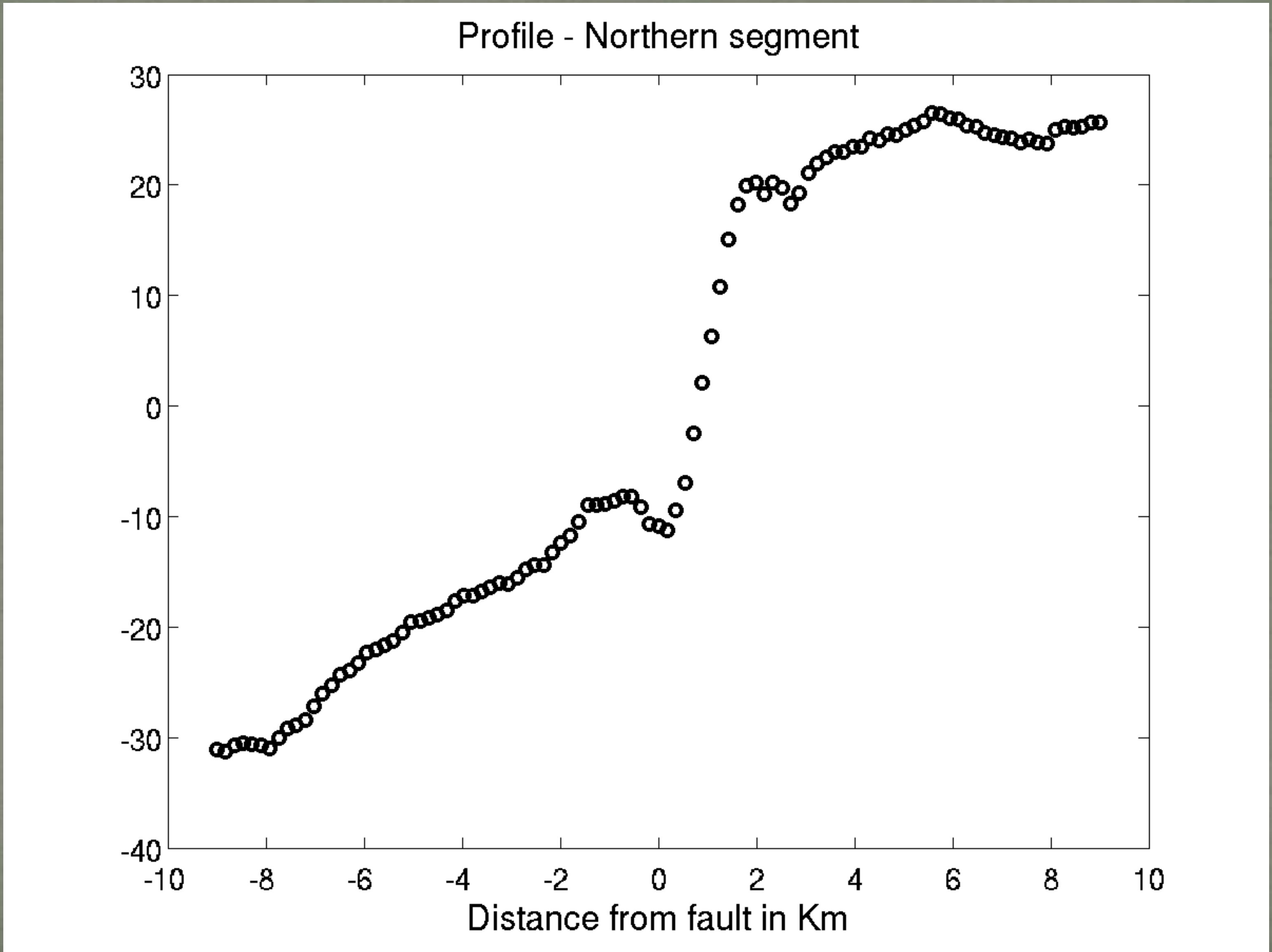


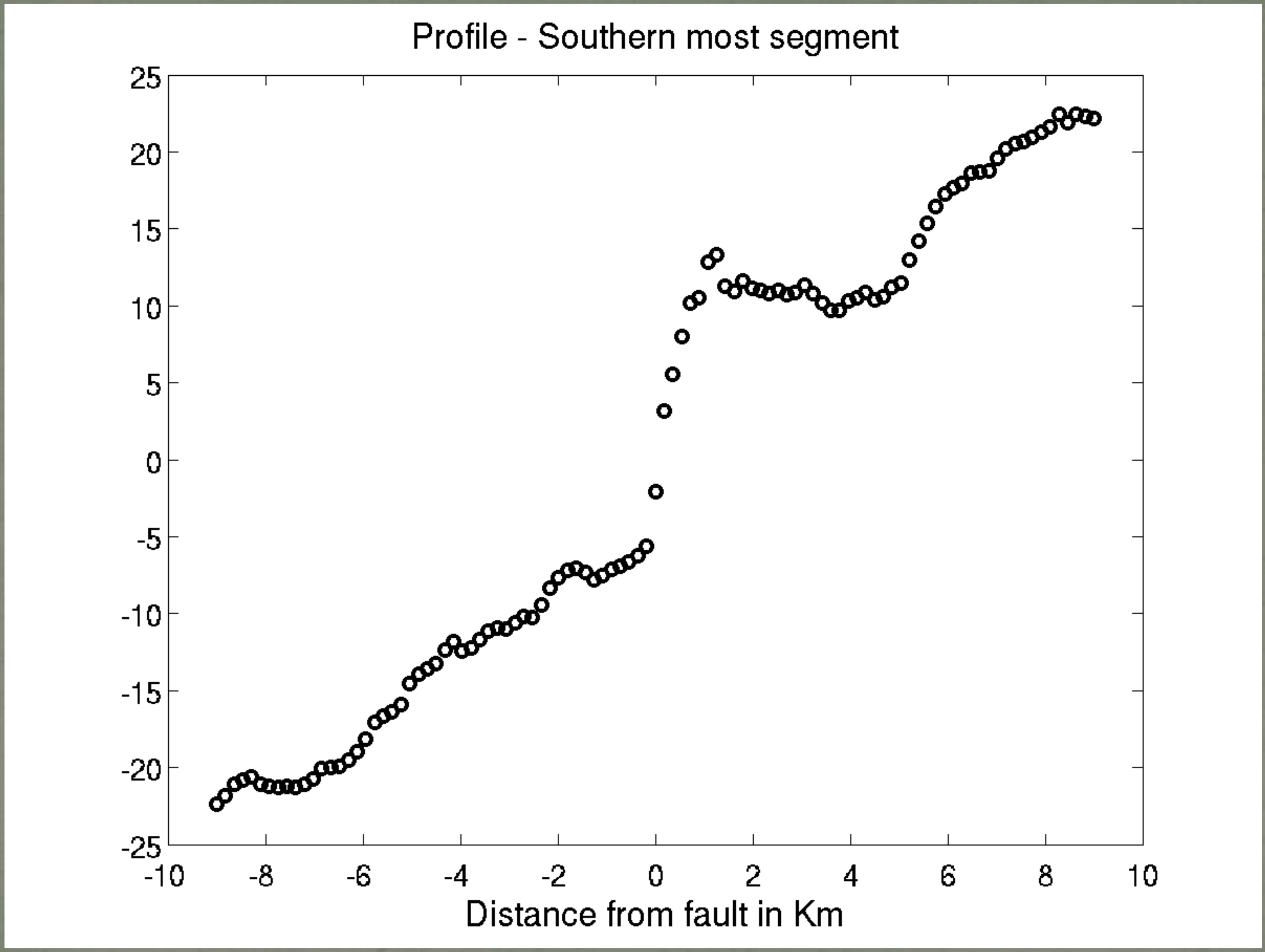
March 2007 - Dec 2009. 31 m baseline.

Detailed Fault Structure around the Monarch Peak Area

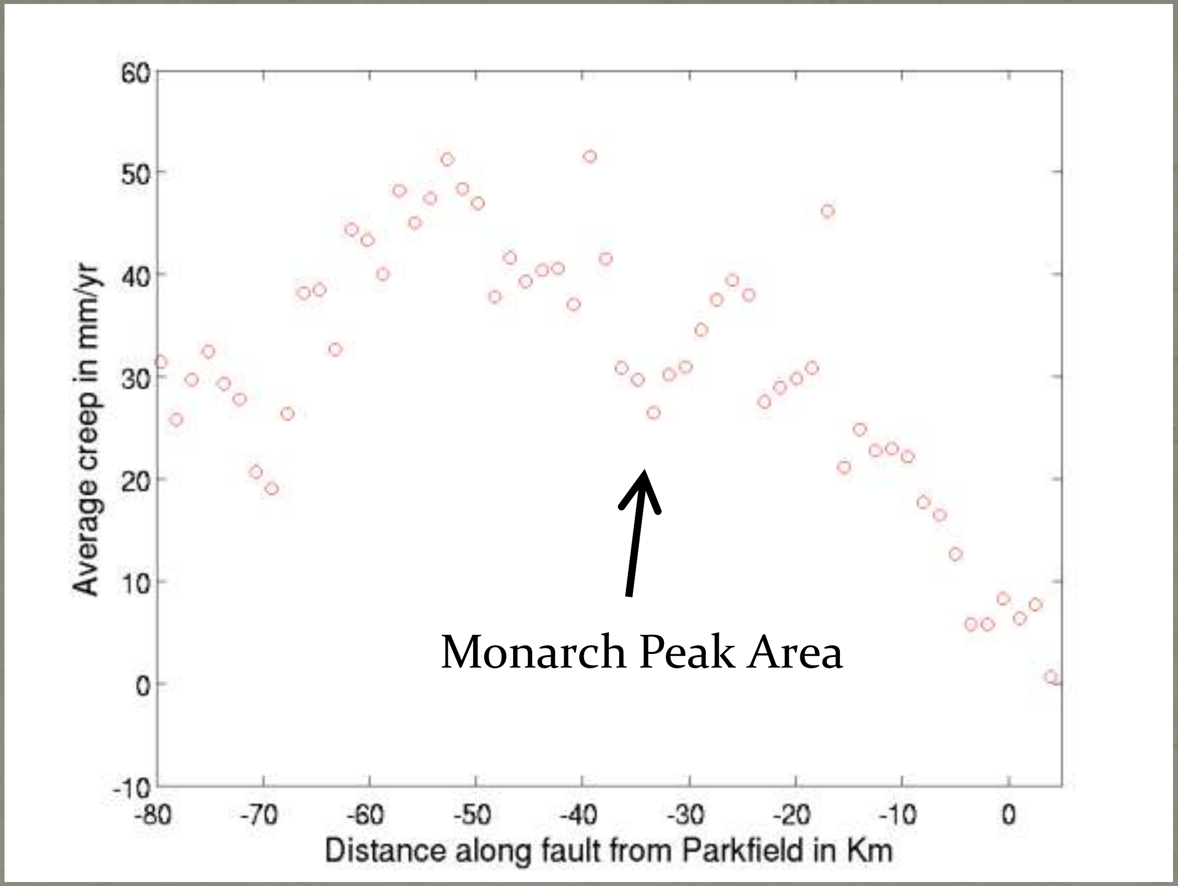


Profiles across the Fault



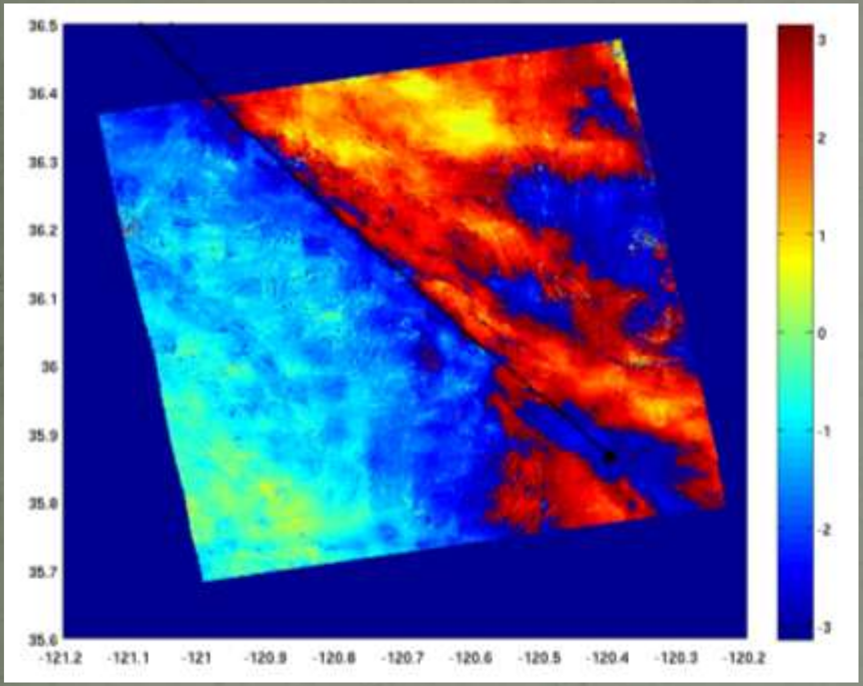

Profile - Southern most segment
25
20
15
10
5
0
-5
-10
-15
-20
-25
-10
-8
-6
-4
-2
0
2
4
6
8
10
Distance from fault in Km

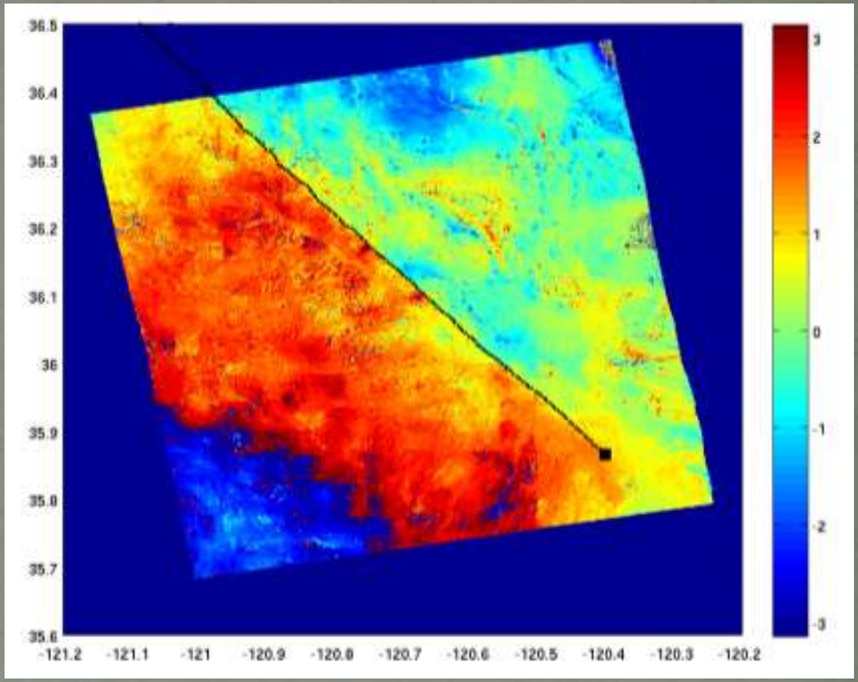
Variation in observed creep along the CSAF



Local vertical deformation gets amplified by a factor of 4 and can affect the estimates shown above.

Effect of Baseline





Oct 2007 – Mar 2007
Baseline: 1000 m

Sep 2009 – Mar 2007
Baseline: 500 m

Implications for DESDynI

- L-band system. Expected to outperform existing C-band ESA systems.
- Greater coherence and possibly higher resolution.
- Multiple imaging geometries will help separate out local vertical deformation.
- The deformation at the “lock” location can be better characterized.
- Systematic baseline drift of ALOS PALSAR does not allow us to estimate DEM error.
- Better baseline control on DESDynI will also enable us account for DEM and sub-pixel position error.

Work to do

- 12 ALOS scenes each for the Parkfield and San Juan Batista areas.
- 15-20 viable interferograms with "ubiquitous" coherence.
- Invert for time-series of creep across the fault.
- Invert the time-series using Elastic half-space models.
- Comparison with X-band InSAR.