

Chapter 6

Conclusions

In this dissertation InSAR is used to map crustal deformations associated with the 1992 Landers, California earthquake. The technical approach is described in Chapter 2 and the appendices of Chapter 3. Applications are discussed in Chapters 3,4, and 5. While the Landers earthquake has been widely studied using a variety of geophysical tools, we push the limits of the InSAR method to examine small-scale deformations as well as vertical and postseismic displacements.

6.1. CONCLUSIONS TO CHAPTER 3

The gradient of the interferometric phase can be computed directly from the real and imaginary parts of the complex interferogram and is not subject to phase unwrapping errors. Using the phase gradient method, we were able to map the locations of secondary fractures and triggered slip on major faults due to the Landers earthquake. Some of these observations are new. For instance, other workers had not noticed the fractures we mapped in the Upper Johnson Valley. If the senses of offset on the secondary fractures can be interpreted, they can be used to infer the directions of maximum strain at the Earth's surface induced by the earthquake.

6.2. CONCLUSIONS TO CHAPTER 4

We inferred the distribution of vertical slip on the rupture using a combination of InSAR measurements and finite-fault elastic half-space modeling. It is possible that there was 0.7 meters of dip-slip on the end of the Landers earthquake rupture but the locking depth was approximately 7.5 ± 1 km. There are two east-side up-down pairs of vertical slip associated with the two main earthquake strike-slip events. A map of vertical displacements was used to interpret the fractures mapped in Chapter 3. This map of vertical displacements is difficult to obtain with any method other than InSAR. For example, the error in the vertical component of GPS displacement measurements is often larger than the vertical displacement measurement itself.

6.3. CONCLUSIONS TO CHAPTER 5

A butterfly-shaped long-wavelength displacement pattern in the interferogram spanning 5-215 days after the Landers earthquake may be due to after-slip in the 7.5-10 km depth range. This pattern decays quickly within the first 40 days after the earthquake. The effects of a viscoelastic rebound mechanism may dominate the displacement pattern in the 40-355 day interferogram. A number of deformation mechanisms most likely contribute to the postseismic surface displacement signal including afterslip, pore-fluid re-equilibration, and viscoelastic rebound.