The November 22, 1995 Mw = 7.2 Gulf of Elat Earthquake cycle revisited

Gidon Baer¹, Gareth J. Funning², Tim Wright² and Gadi Shamir¹

¹Geological Survey of Israel, Jerusalem, Israel
²COMET, Department of Earth Sciences, University of Oxford, UK

Introduction

The November 22, 1995, Mw 7.2 Nuweiba earthquake occurred along one of the left-stepping segments of the Dead Sea Transform (DST) in the Gulf of Elat (Aqaba). It was the largest earthquake along the DST in the last few centuries. In this study we reanalyze ERS-1 and ERS-2 data for the period spanning the earthquake and 5 postseismic years. Coseismic interferograms were made for the intervals spanning the earthquake + 1 week, + 4 months, + 6 months, and + 5 years. Postseismic interferograms span the period from 1 week to 5 years after the earthquake. Non-linear inversions were carried out for fault geometry and linear inversions were made for slip distribution using an ascending-descending 2-frame dataset.

Location and Data

Two alternative models for the 6-m coseismic rupture. Both yield relatively high residuals and suggest slip at depth greater than 20 km. The 2-track non-linear inversion yields an unrealistic fault location.

Coseismic Modeling

Linear inversion for variable slip

Coseismic residuals

Triggered Slip

Geological map of the coastal area and hill of the main rupture (Bar-Sahav et al., 2002)

Postseismic and Modeling

Summary

Coseismic deformation:
1. The present model improves previous InSAR models of the Nuweiba earthquake, but differs significantly from recent teleseismic waveform inversion results.
2. The calculated moment of our best-fit model is in agreement with the seismological moment. Error analysis shows tradesoff among several fault parameters.
3. Future joint InSAR-seismology inversion will reduce these discrepancies and tradesoffs.

Postseismic deformation:
1. The magnitude of postseismic deformation in the first 2 years after the Nuweiba earthquake is about 15% of the coseismic deformation.
2. Our models suggest that slip occurs along the lower part of the coseismic rupture.
3. Localized deformation along the Gulf shows NW of the main rupture in the first 6 months after the earthquake is correlated with shallow M>4.5 3 km aftershocks and surface displacements along active Gulf-parallel normal faults. This deformation is an order of magnitude higher than expected for single M~4.3 aftershocks, but could be a result of several aftershocks and/or coseismic slip events.
4. Major aftershocks and slip along Gulf-parallel faults NW and SE of the main rupture are shown to be a possible result of positive Coulomb stress changes induced by the earthquake.