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InSAR constraints on interseismic slip-rate of the Esfarayen fault, northeastern Iran

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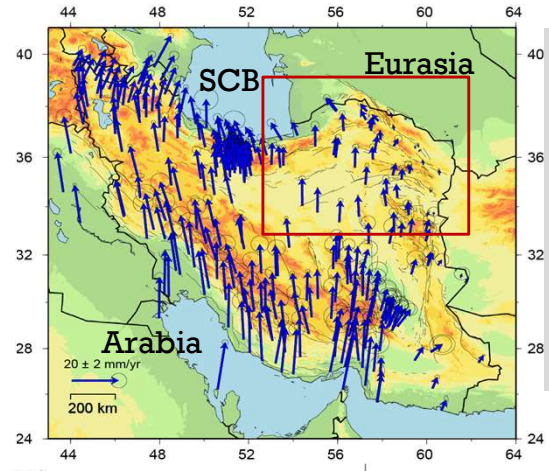
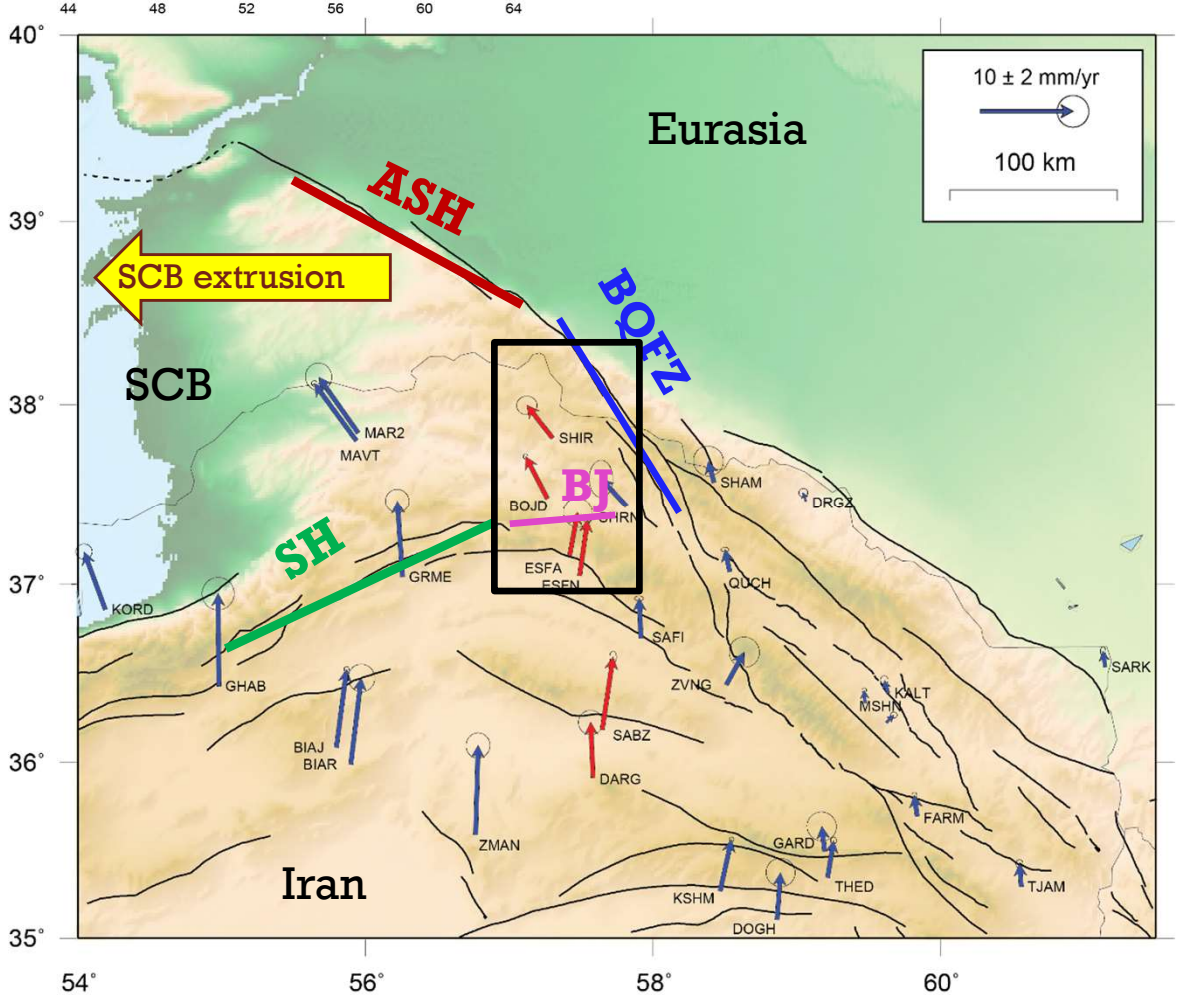
Motivation: Study area



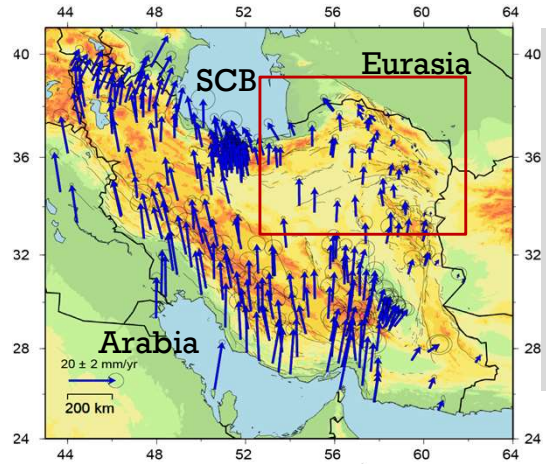
- Active faulting in Iran results from the continental collision between Arabia and Eurasia.
- Relative motion between the Caspian basin and Eurasia accommodate across the major fault zones; including Ashkabad (ASH), Baghan-Quchan fault zone (BQFZ), Shahrud (SH).



GPS (Mousavi et al., 2013)

- **ASH: 6.7± 0.5 mm/yr Right lateral**
- **BQFZ: 6-7 mm/yr Righ-lateral**
- **SH: 4-6 mm mm/yr Left-lateral**
- **Bojnord fault: 5 mm/yr Left-lateral**

Motivation: Study area



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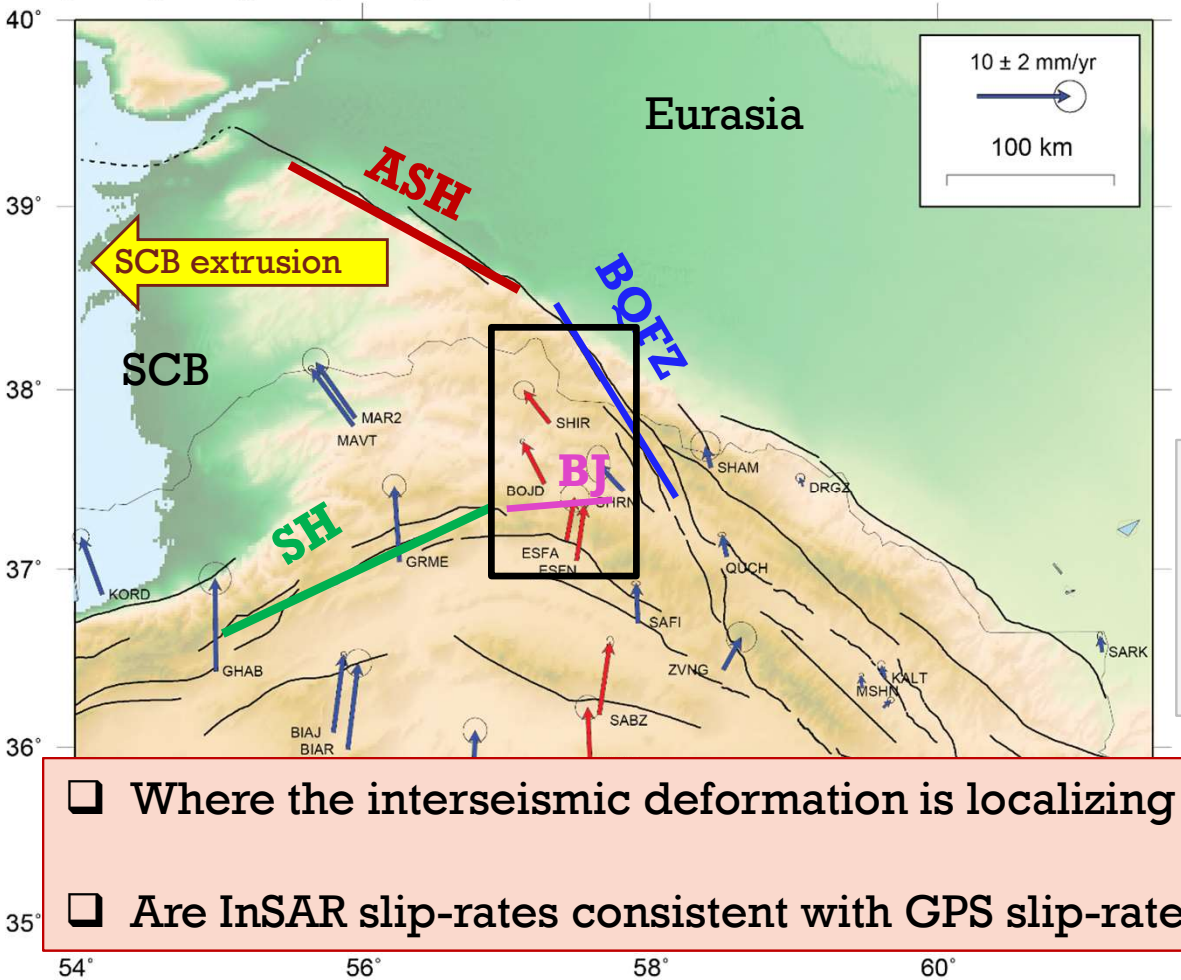

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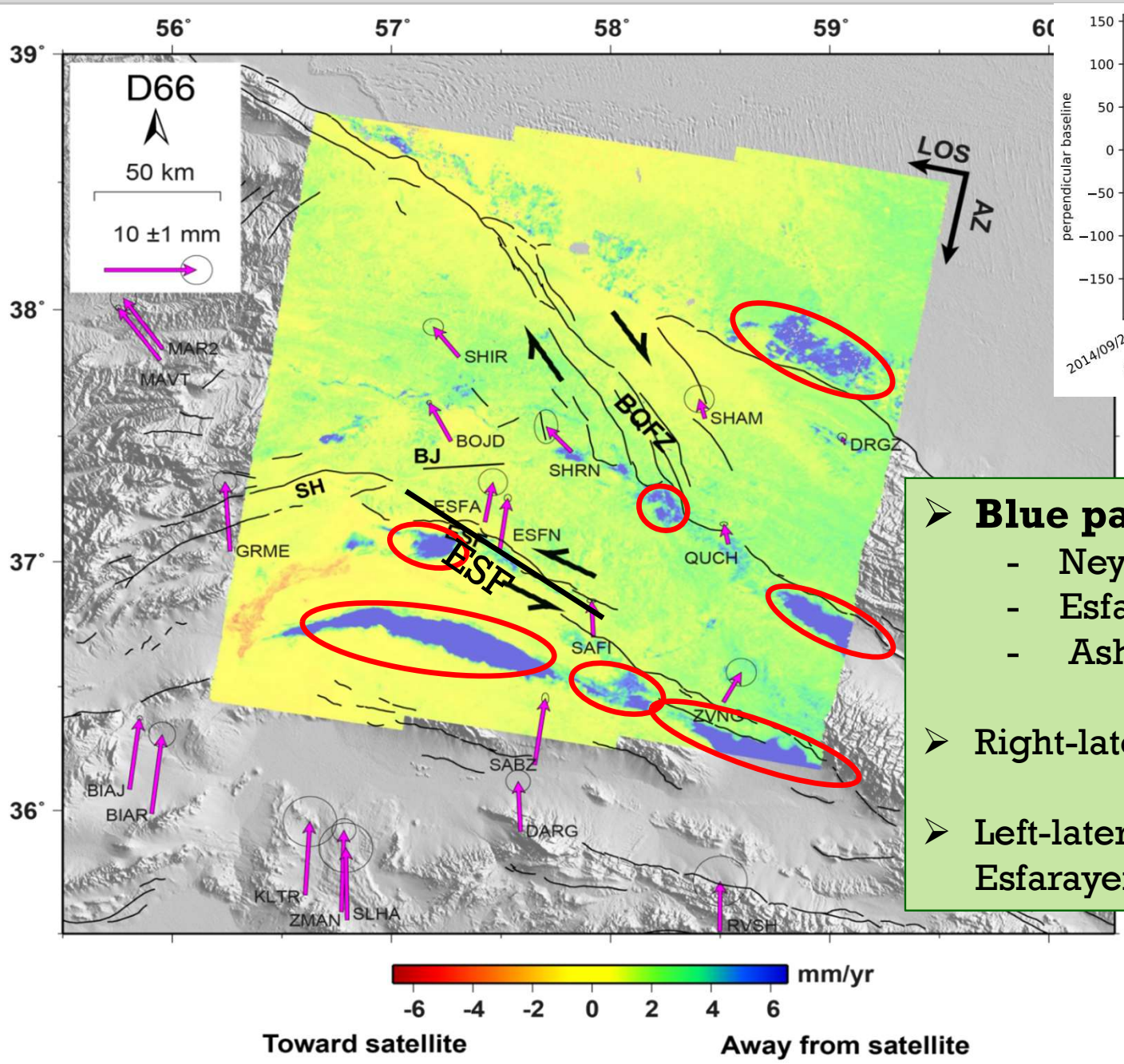
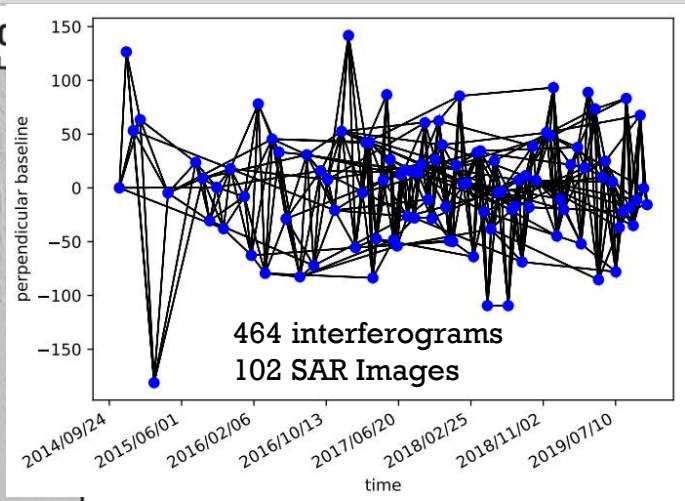
InSAR

- ASH: 5-12 mm/yr RL (Walters et al. 2013)
- SH: 4.75 ± 0.8 mm/yr LL (Mousavi et al. 2015)

- Where the interseismic deformation is localizing along the eastern border of the basin?
- Are InSAR slip-rates consistent with GPS slip-rates for these faults?

InSAR mean velocity map

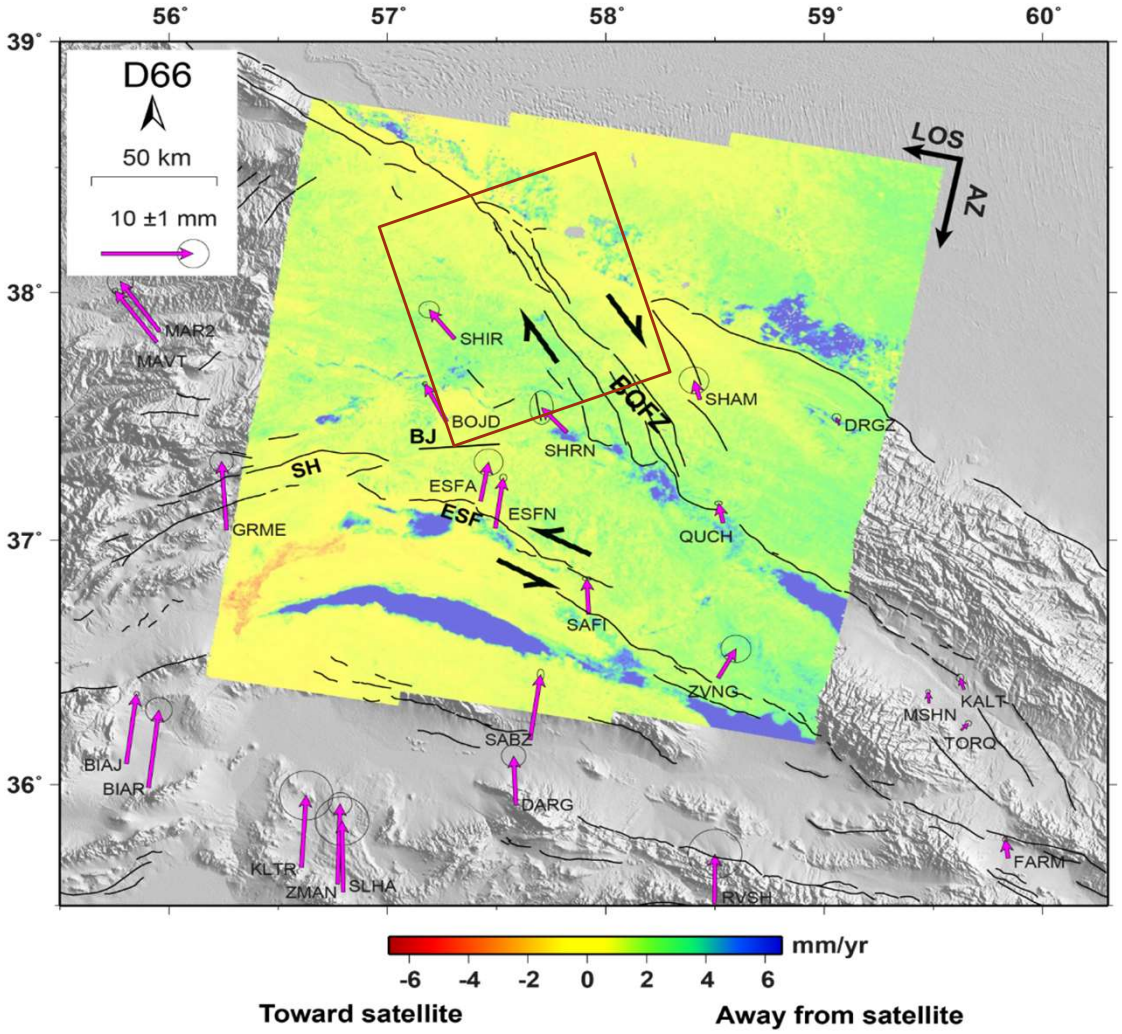


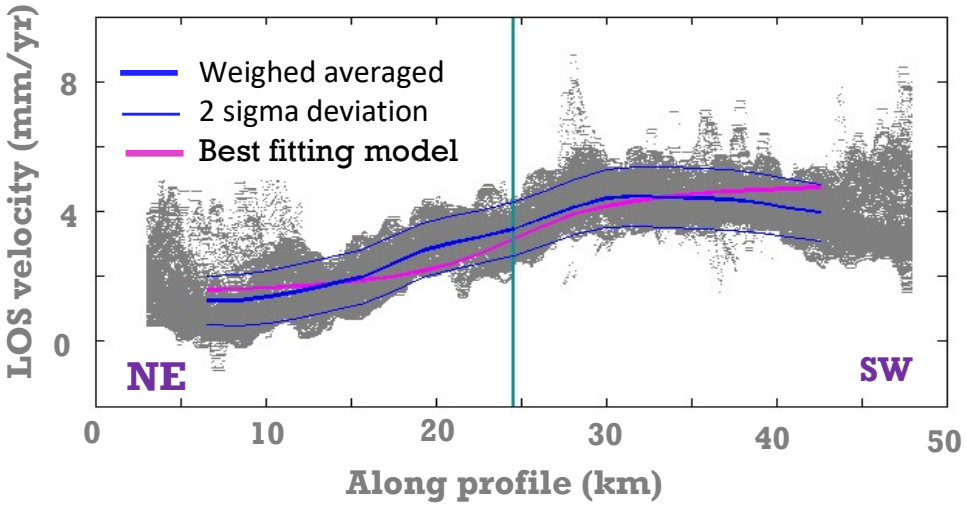


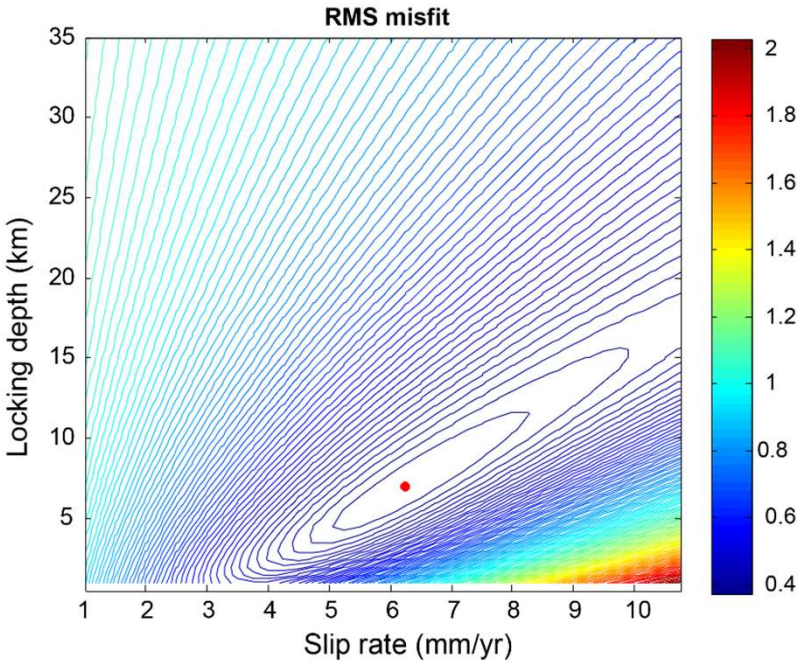
- **Blue patches are subsidence.**
  - Neyshabour (25 mm/yr)
  - Esfarayen (20 mm/yr)
  - Ashkbaad (10 mm/yr)
- Right-lateral movement across BQFZ
- Left-lateral movement across Esfarayen fault not on Bojnord fault.

We process data using NSBAS package (Doin et al., 2011).

BQFZ slip-rate



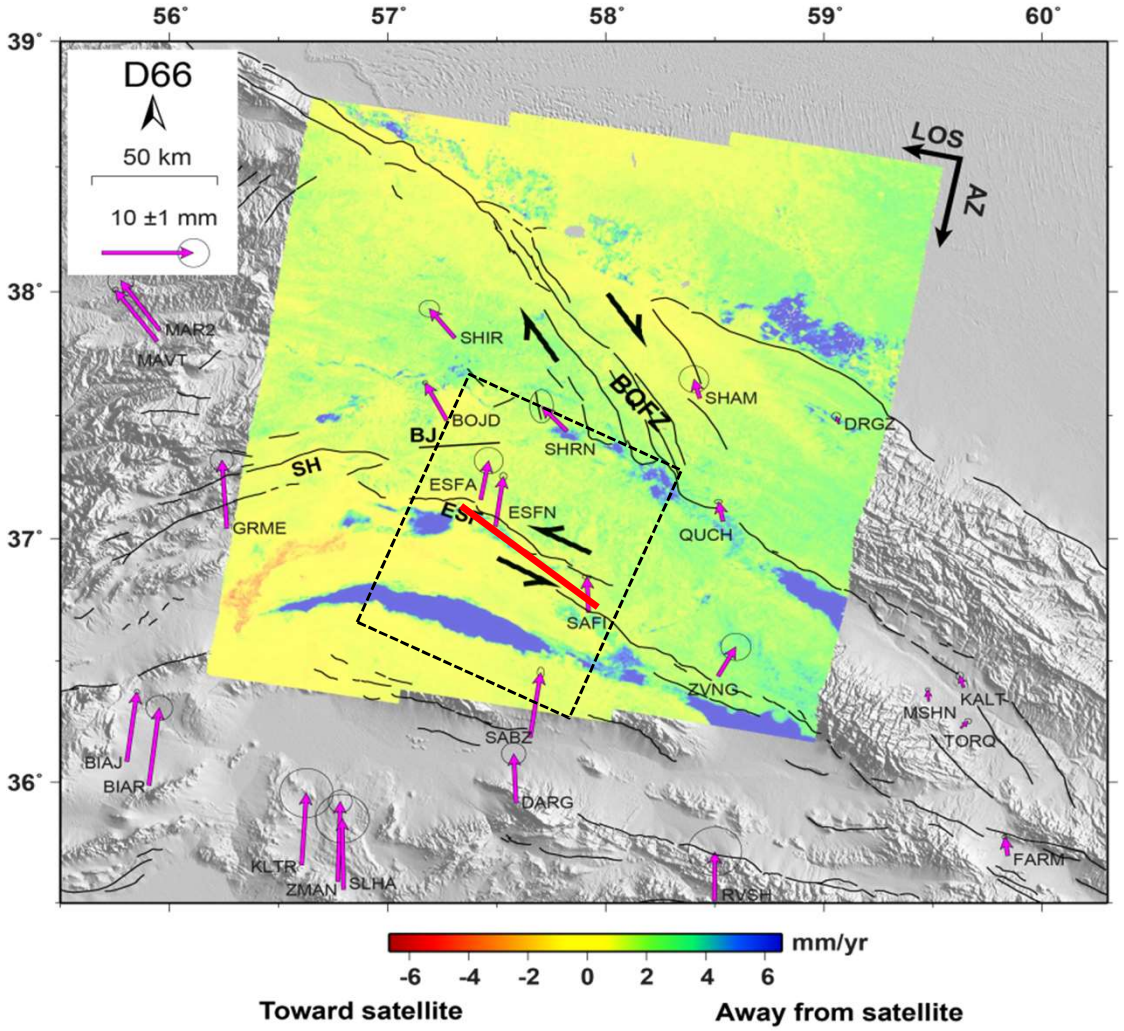




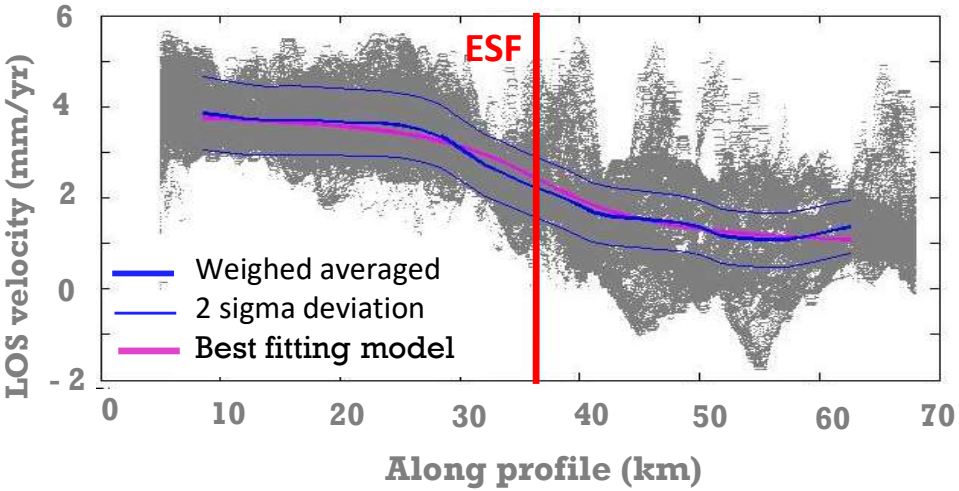
BQFZ

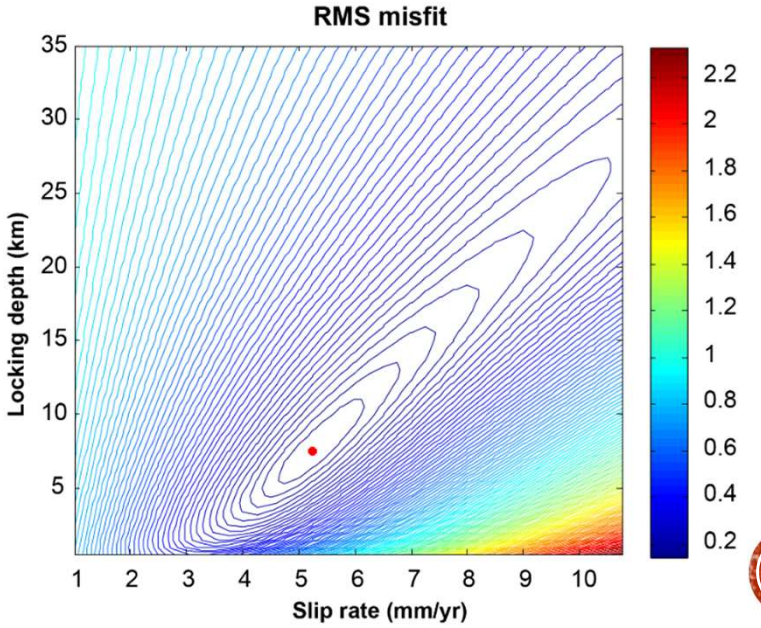
- ✓ Slip rate: 6.25 mm/yr right-lateral
- ✓ Locking depth: 7 km

Esfarayen fault slip-rate



ESFA: located on the fault trace
ESFN: located inside the subsidence area

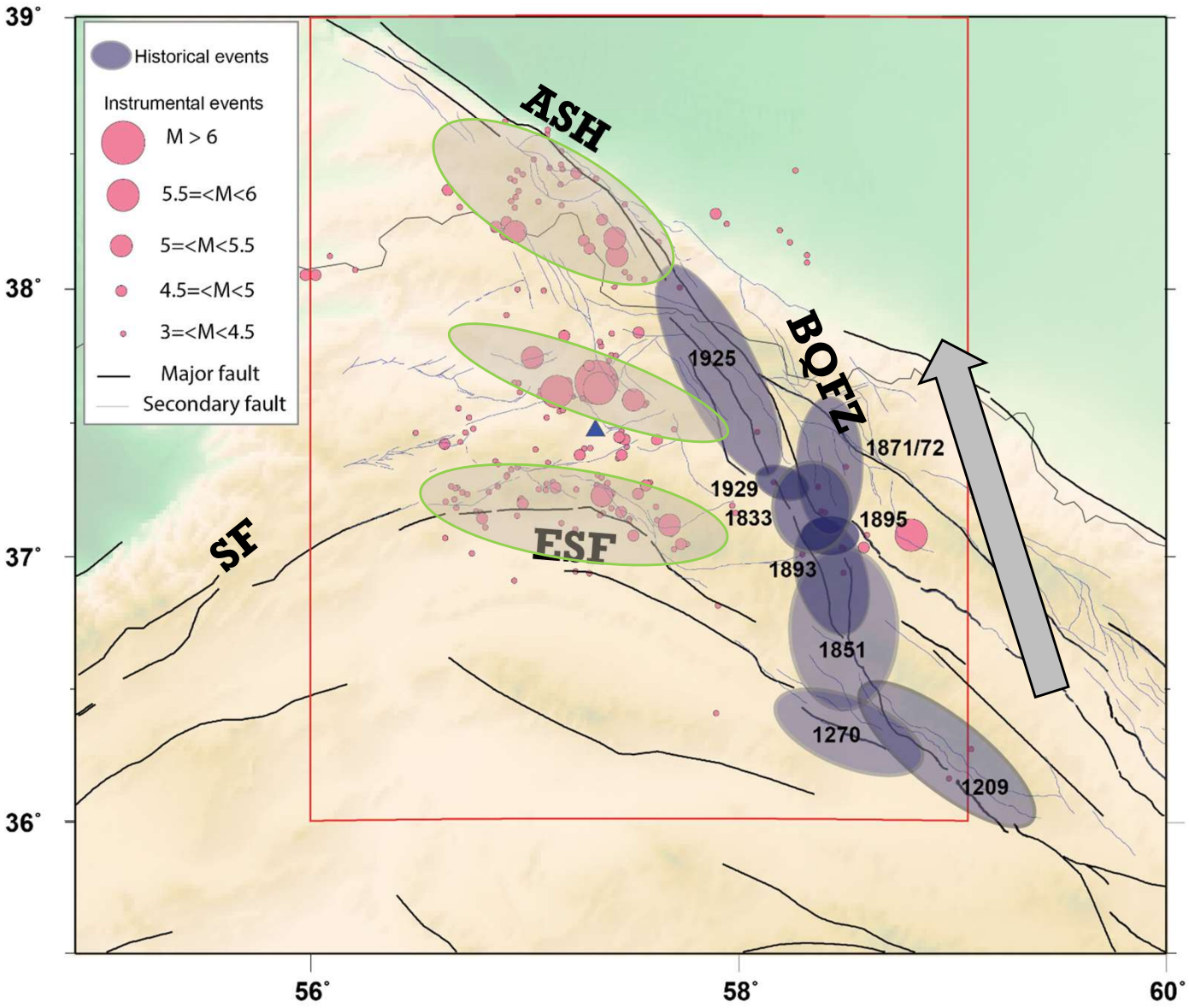




Esfarayen fault

- ✓ Slip rate: 5.25 mm/yr
- ✓ Locking depth: 7.5 km

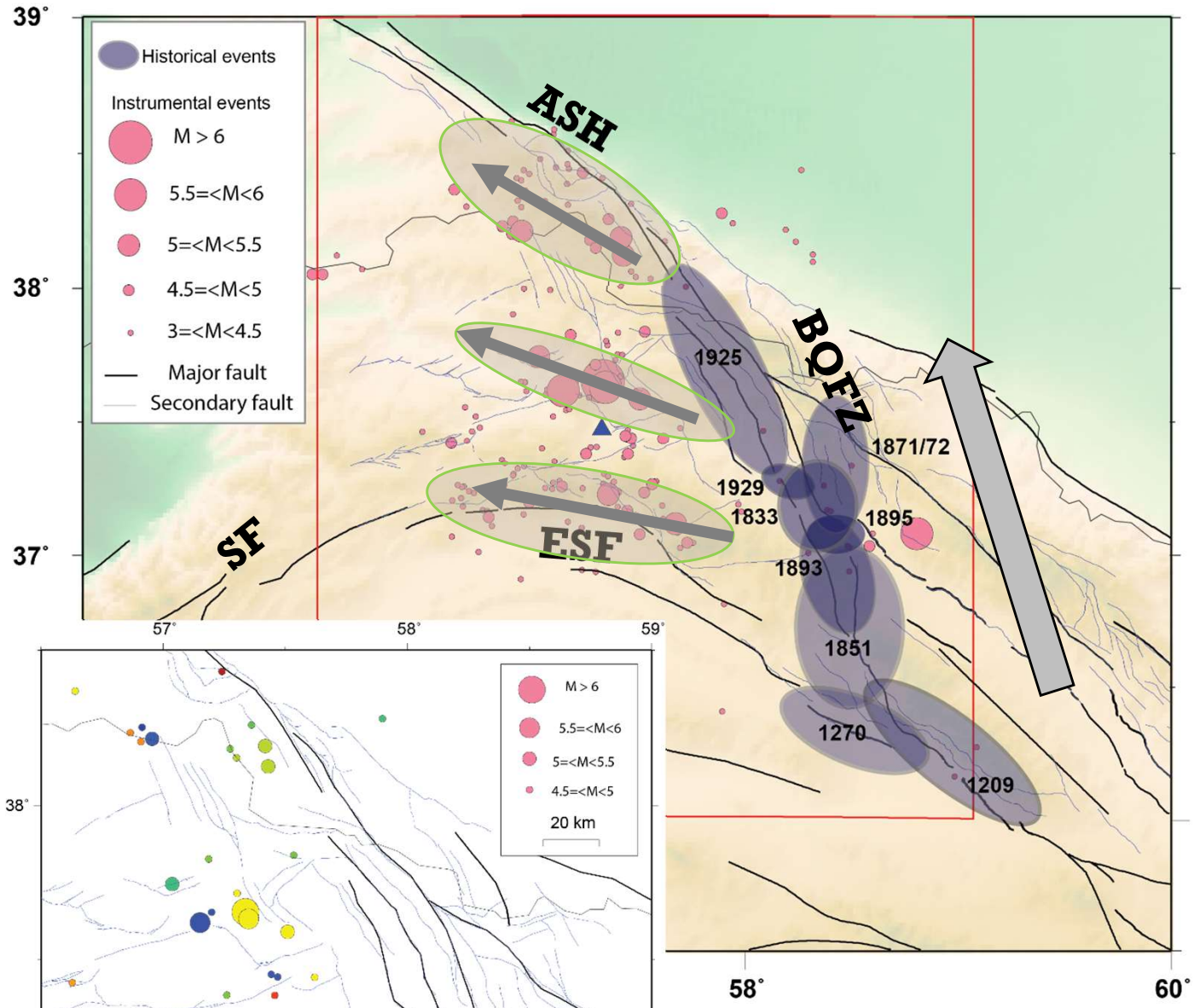
Discussion and conclusion



- **Slip rates:**
  - ✓ **ESF:5.25 mm/yr LL**
  - ✓ **BQFZ: 6.25 mm/yr RL**
- **Esfarayen fault acts as the active southeastern limit of the South Caspian basin.**
- **Historical large earthquakes propagate in time from south to north along the BQFZ.**
- **Instrumental events (3.5< M < 5.5) are mostly distributed west of the BQFZ, propagating from east to west.**

- Historical earthquakes are from Aflaki et al. (2019).
- The instrumental events are from Shabani et al. (in preparation).
- Red rectangle presents the location the seismicity cluster.

Discussion and conclusion



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Large magnitude events occur along the major fault zone (BQFZ) while the microseismicity happens along shorter faults to the west.

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Thanks