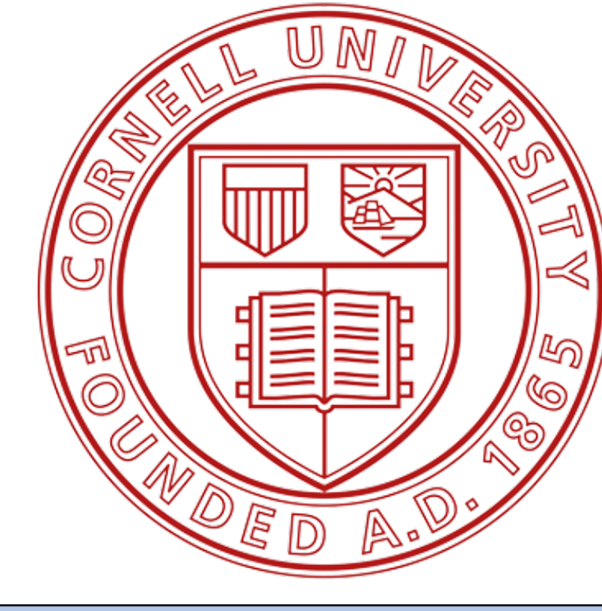


Relocating the 2021 and 1938 Chignik Alaska Aftershock Sequences with Station Corrections from AACSE

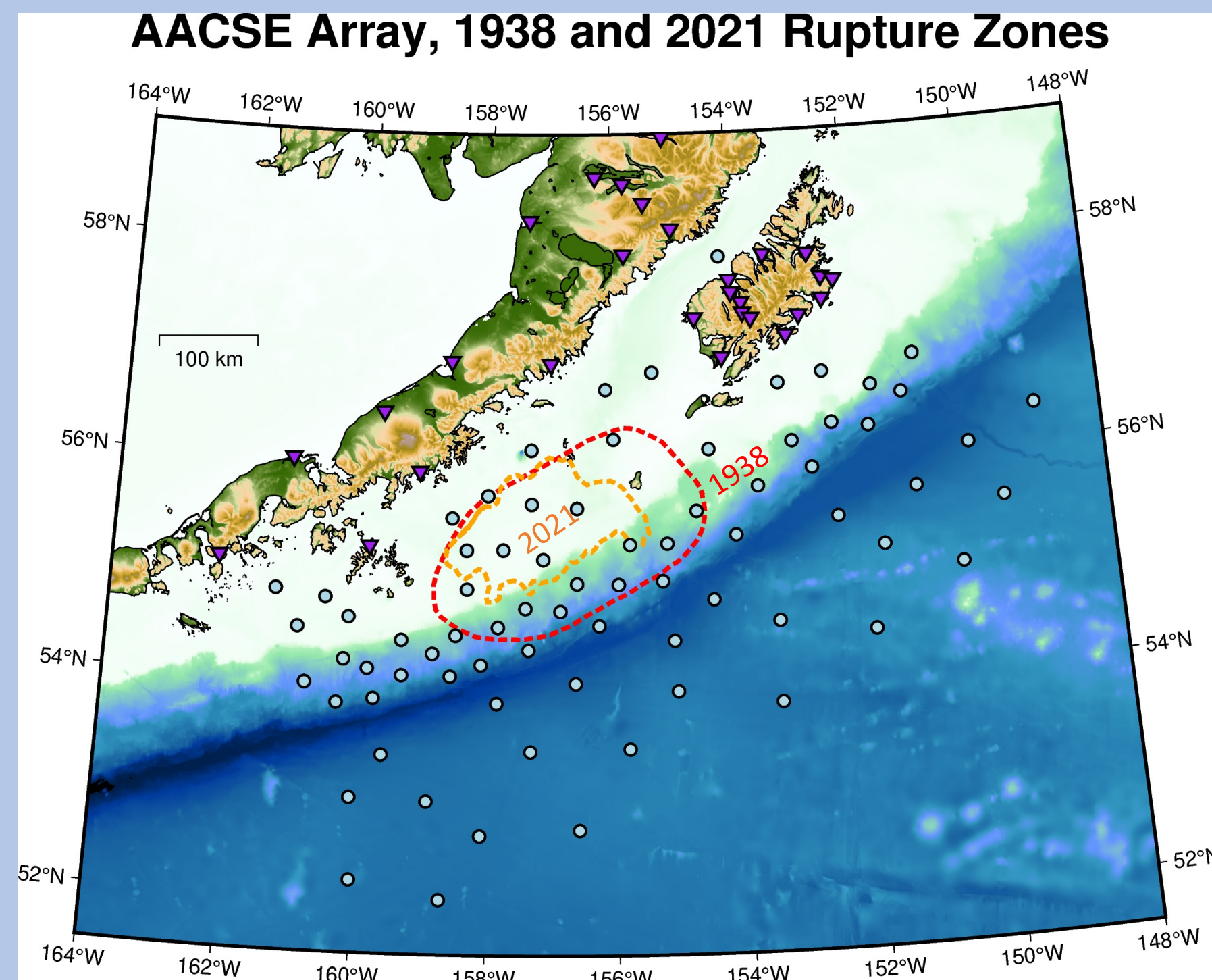


Array to Improve Rupture Area Estimates

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Introduction

To what extent did the 1938 and 2021 sequences rupture? How do the two rupture areas compare?



Need **accurate** aftershock locations

- Use Time Residuals from AACSE Array as Station Corrections for 1938/2021 arrivals to correct for local structure

Fig. 1: Map showing AACSE Array, 1938 Rupture Zone (Davies et al. 1981), and Estimated 2021 Rupture Zone (Liu et al. 2022)

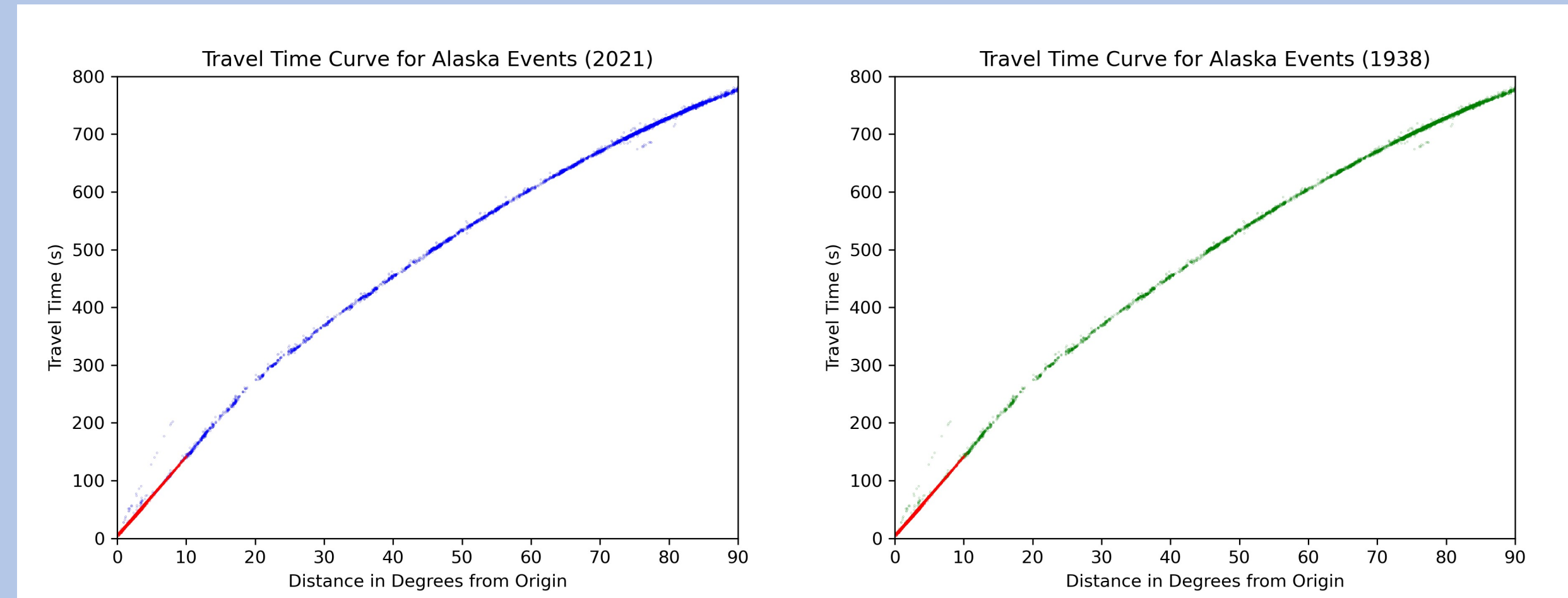


Fig. 2: Travel time curves showing coverage of USGS (blue) and ISC (green) arrivals compared to AACSE (red)

2021 Aftershock Relocations

- 266 events from AEC catalog relocated with LOCSAT
- 227 depth locations within 10 km uncertainty
- Western relocations appear more systematic, Eastern smaller motion

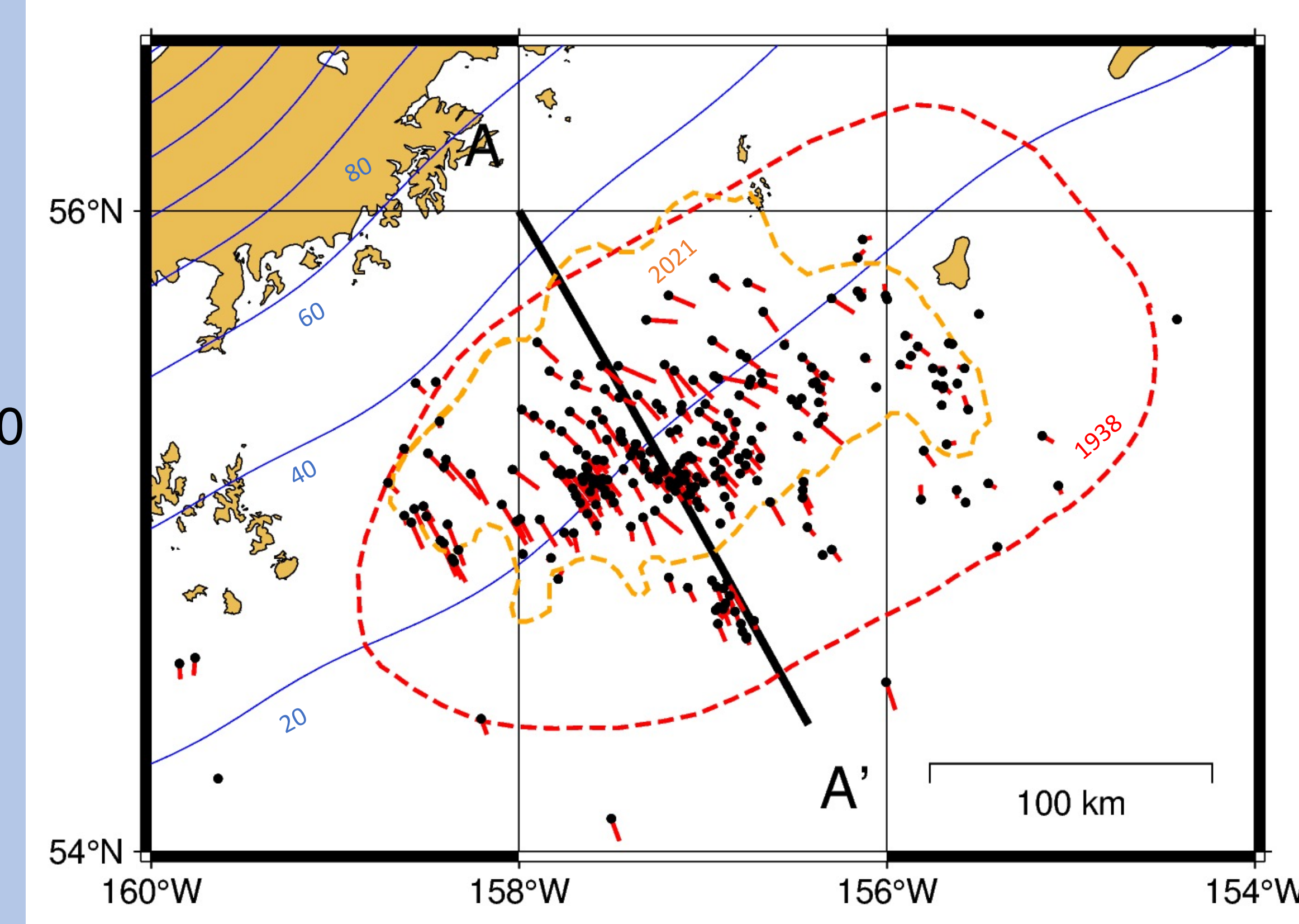


Fig. 6: Relocated 2021 Chignik Aftershocks with AACSE corrections. New locations shown in black with red tail to their original locations. Arrival data retrieved from AEC catalog.

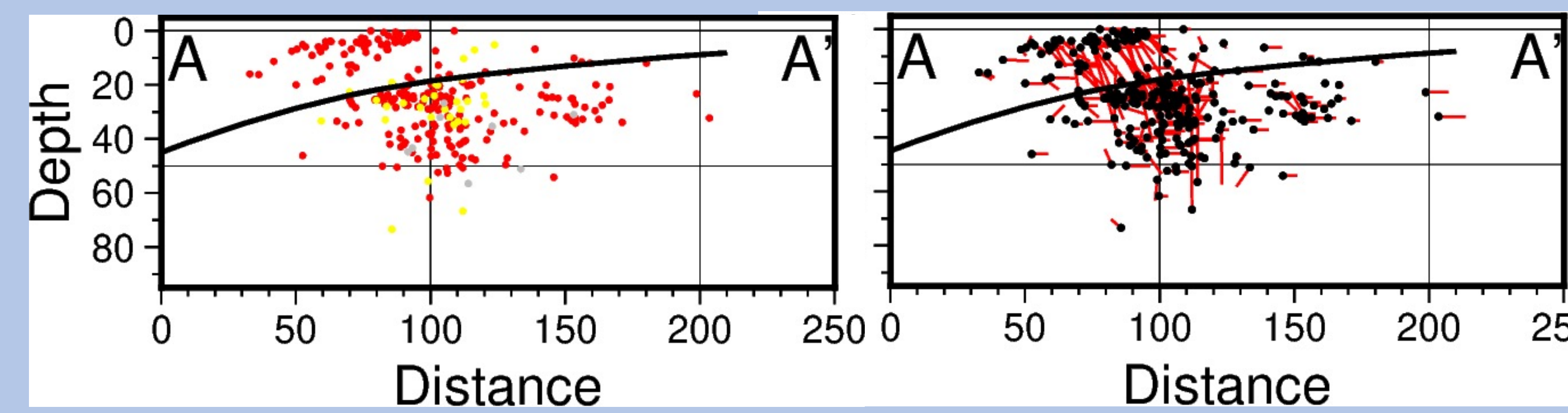


Fig. 7: Cross sections of relocated events with azimuth=150. **Left:** Events marked by depth uncertainty (Red: Sdepth < 10 km, Yellow: 10 < Sdepth < 20 km, Grey: Sdepth > 20 km, or was fixed during relocation). **Right:** Motion cross section showing new location (black) from original location (end of red tail).

1938 Aftershock Relocations

- 3 events contained arrival information from ISC to be relocated with LOCSAT
- 8 unique events appear to have occurred in the 1938 region in the year following the mainshock
- All depths fixed during relocation
- Events without arrival data contained no magnitude or depth data

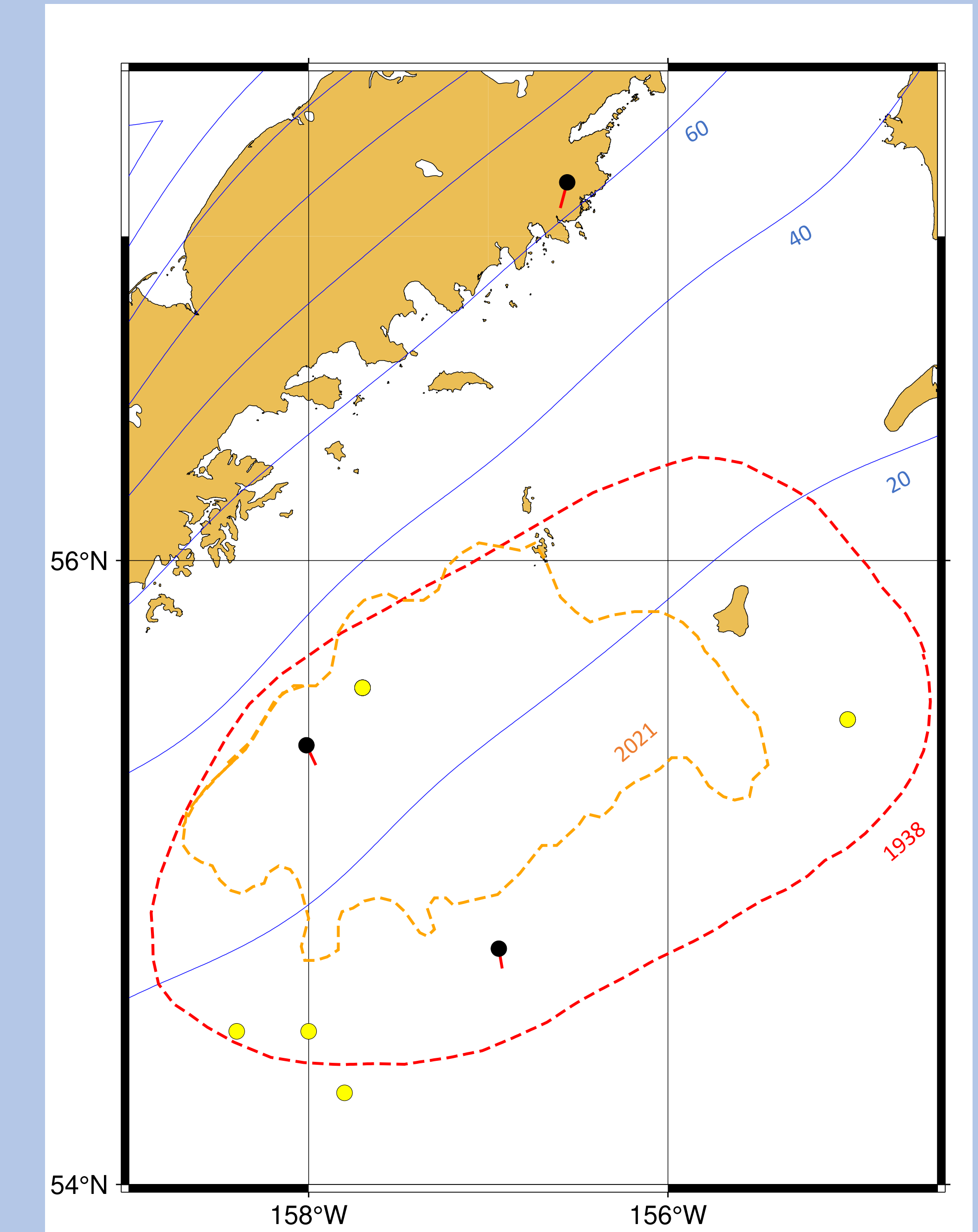


Fig. 10: Relocated 1938 Aftershocks with teleseismic corrections from new 2021 locations. Stations without arrival data are shown in yellow. Arrival data is retrieved from ISC Catalog.

Regional Corrections

Relocate AACSE events with global relocation method LOCSAT and iasp91

Generate Station Corrections for Alaska stations

$$SC = \frac{\sum_{i=1}^n t_i w_i}{\sum_{i=1}^n w_i}$$

where t_i = time residual, w_i = station weight (based on linear dist-wgt model), and n = # arrivals at station

Fig. 5: Map of P (top) and S (bottom) station corrections for Alaska stations. OBS stations see early arrivals, where stations on land and behind arc see late arrivals

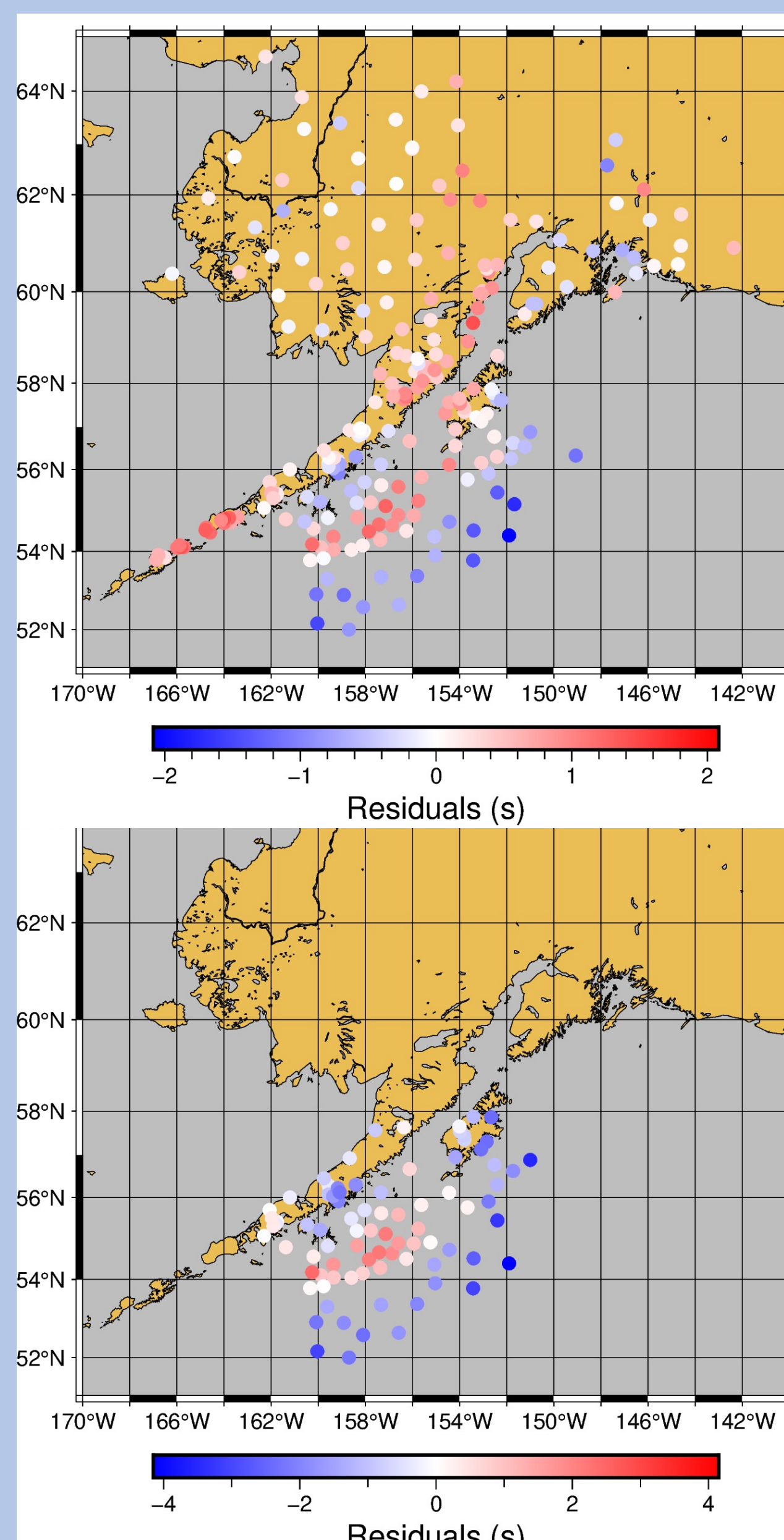
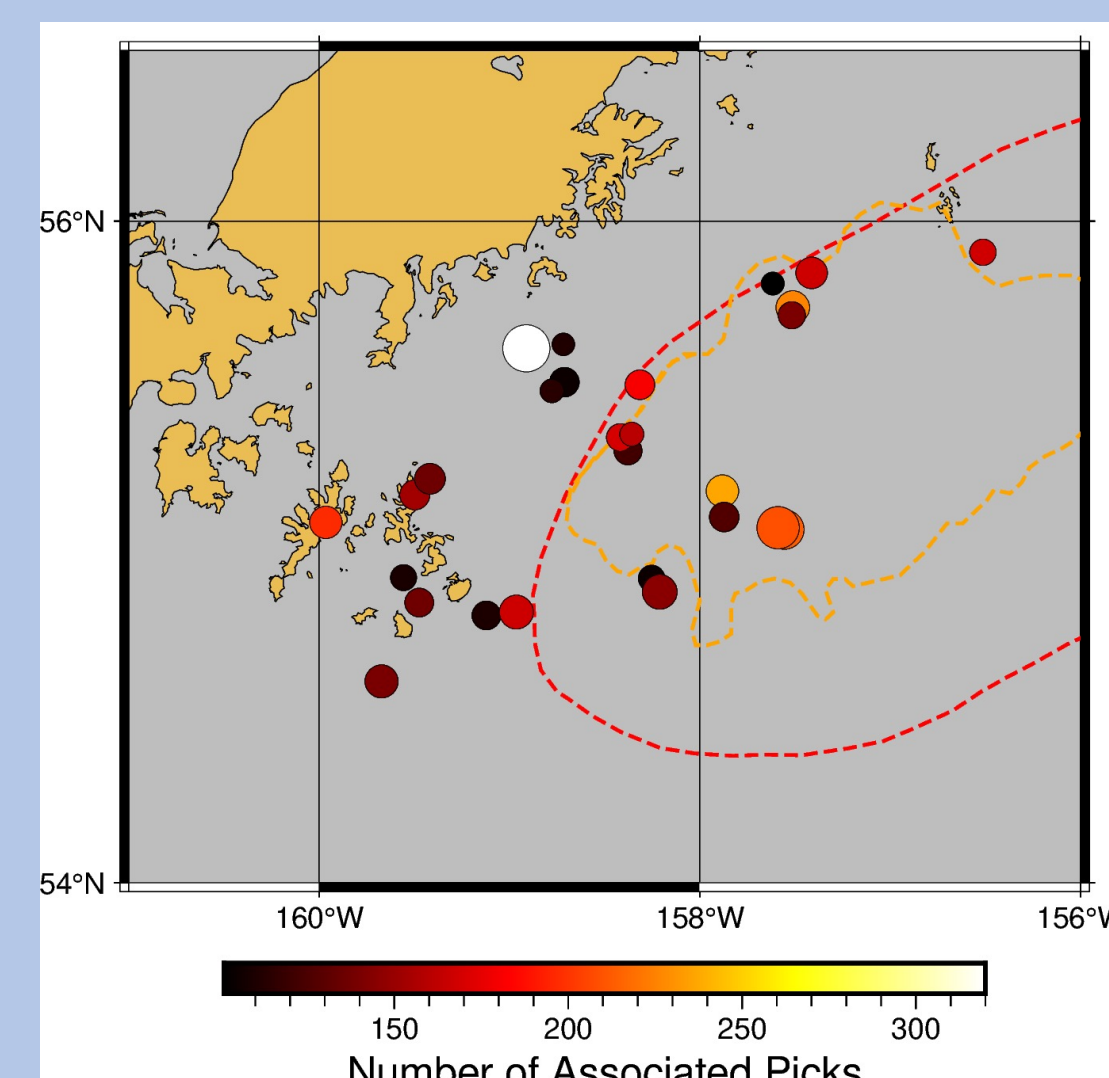


Fig. 4: 27 events during AACSE near 38 zone used for calibration



Teleseismic Corrections

Fig. 8: Teleseismic P arrival corrections for 1938 stations (ISC), calculated from averages of nearest 2021 residuals. Stations without corrections marked in yellow.

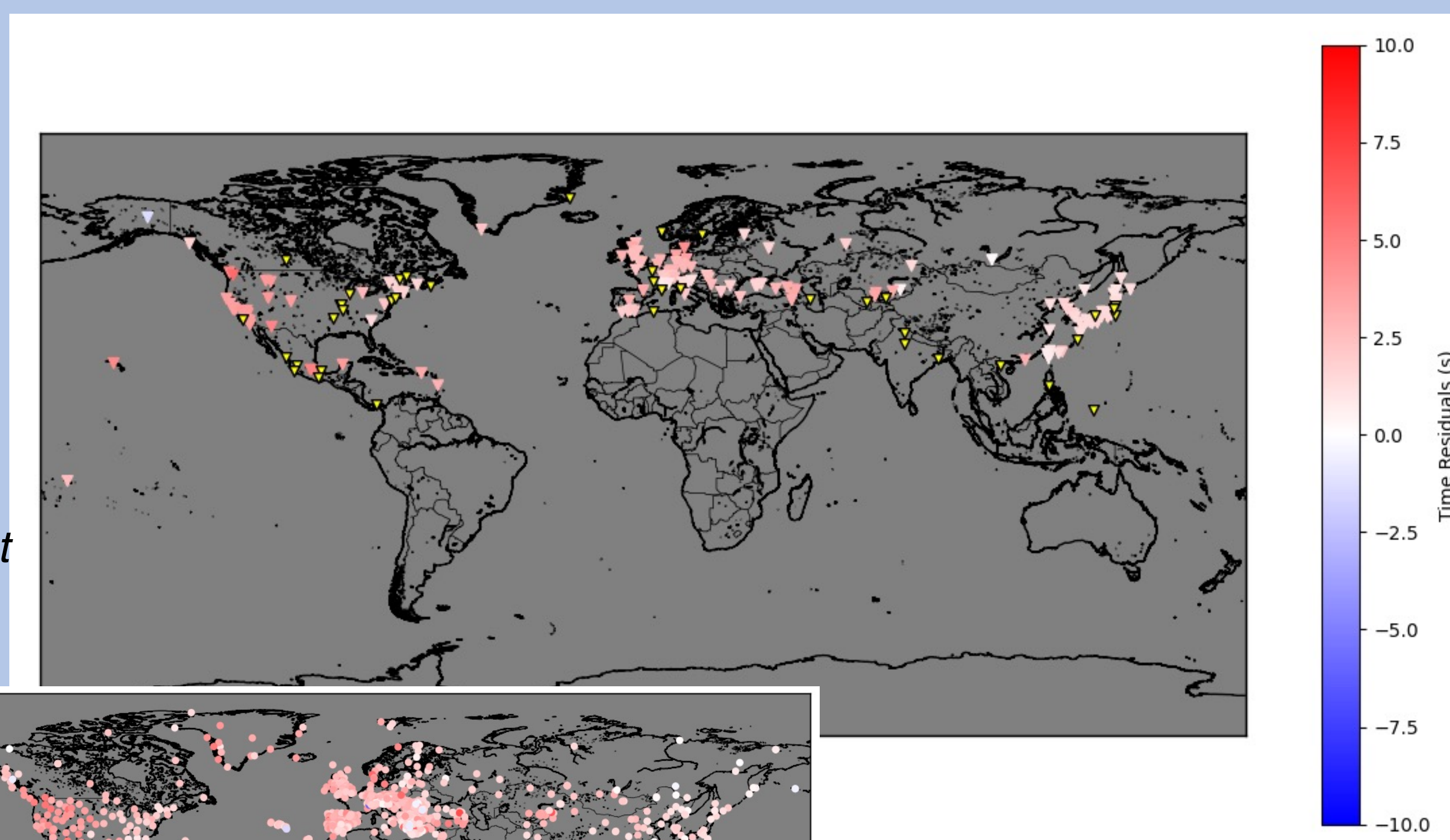
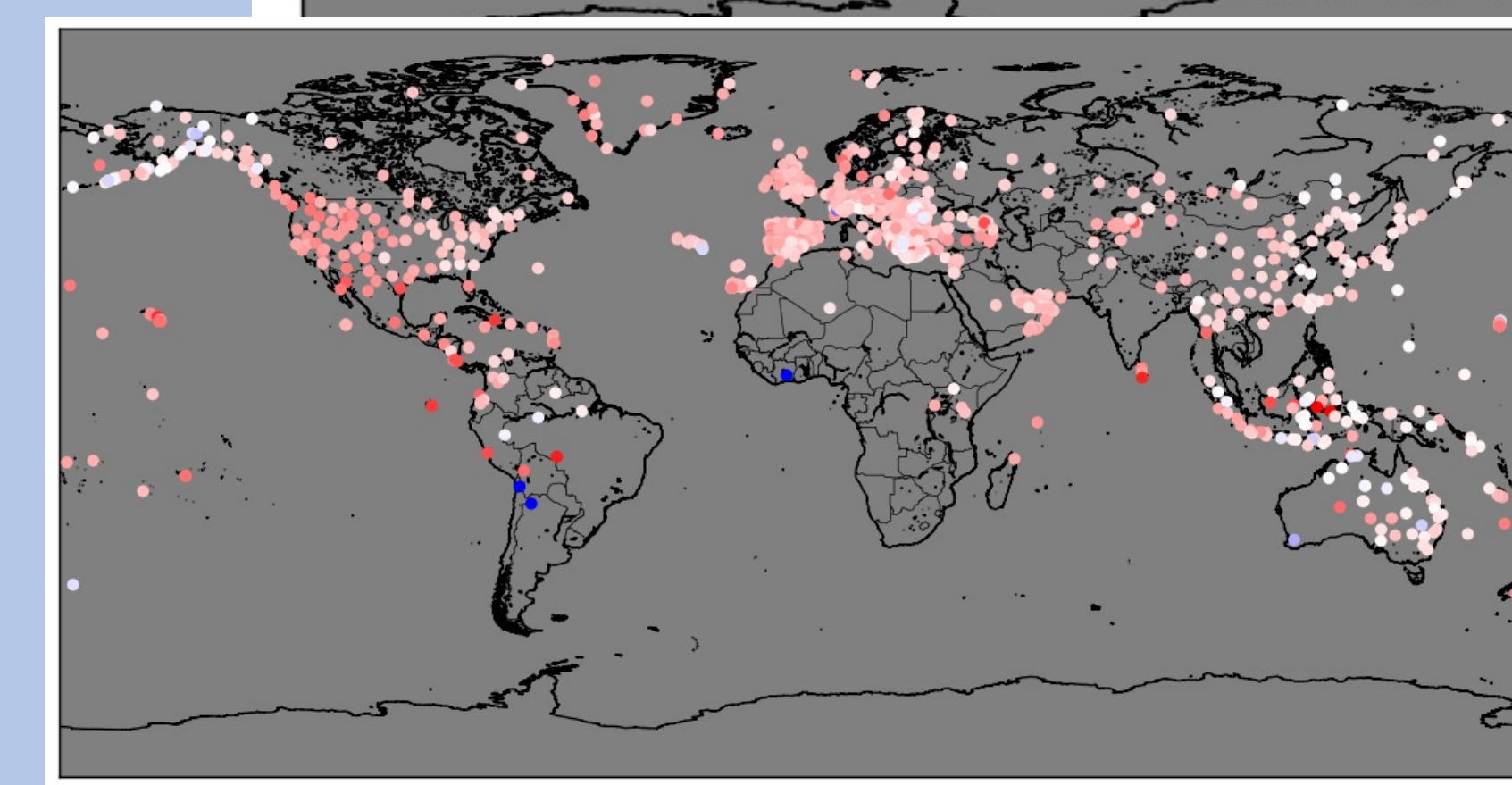


Fig. 9: Teleseismic P arrival corrections for 2021 stations, calculated from USGS picks and station corrected locations.



Conclusion

- Local and Teleseismic residuals have large scale spatial coherency
- 2021 Chignik Sequence shifted away from the trench after corrections by 5 km (8 km for western events)
- 2021 Aftershocks appear to separate into upper plate and lower plate zones
- Too little data to unambiguously constrain 1938 rupture, but relocations shift events in same direction as 2021 Aftershocks

Next Steps:

- 1) Recover data from other 1938 events
- 2) Re-gather 1938 teleseismic corrections with more technically rigorous method.