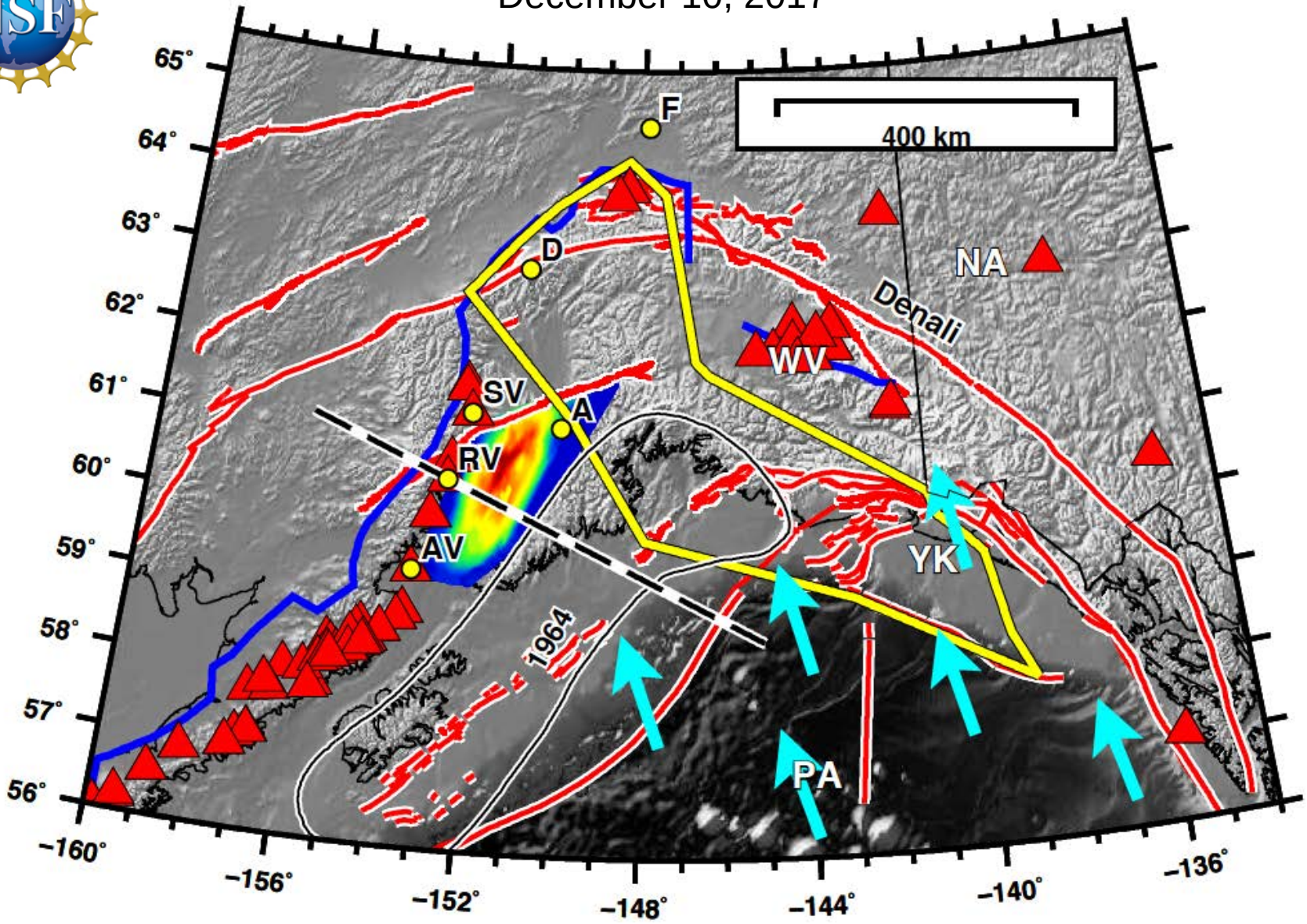
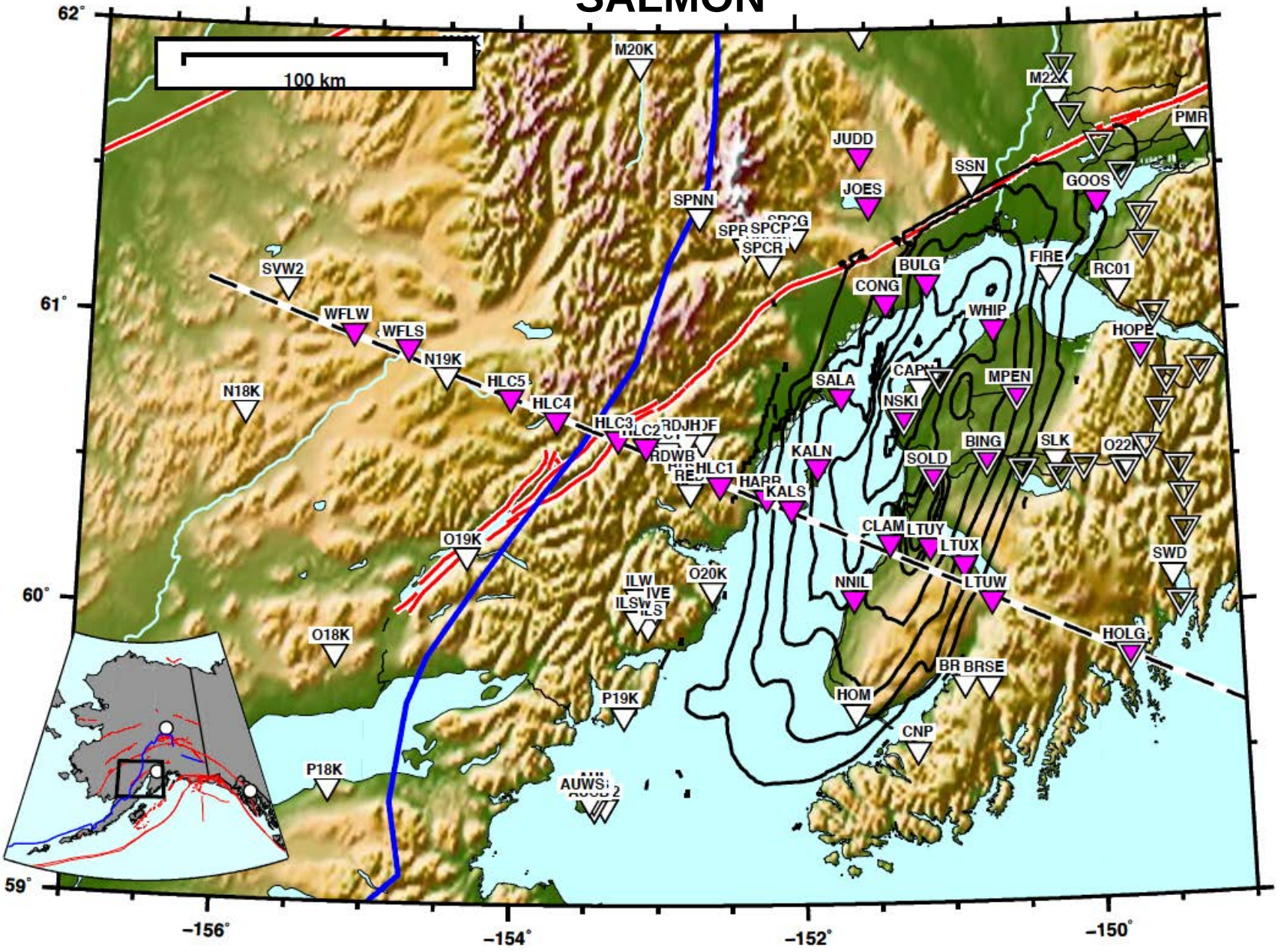
SALMON project (2015–2017): data quality and ongoing science

Carl Tape, Doug Christensen, Melissa Driskell

December 10, 2017



Southern Alaska Lithosphere and Mantle Observation Network
SALMON



Southern Alaska Lithosphere and Mantle Observation Network (SALMON): A Seismic Experiment Covering the Active Arc by Road, Boat, Plane, and Helicopter

by Carl Tape, Douglas Christensen, Melissa M. Moore-Driskell, Justin Sweet, and Kyle Smith

Seismological Research Letters, 2017


ELLEN J

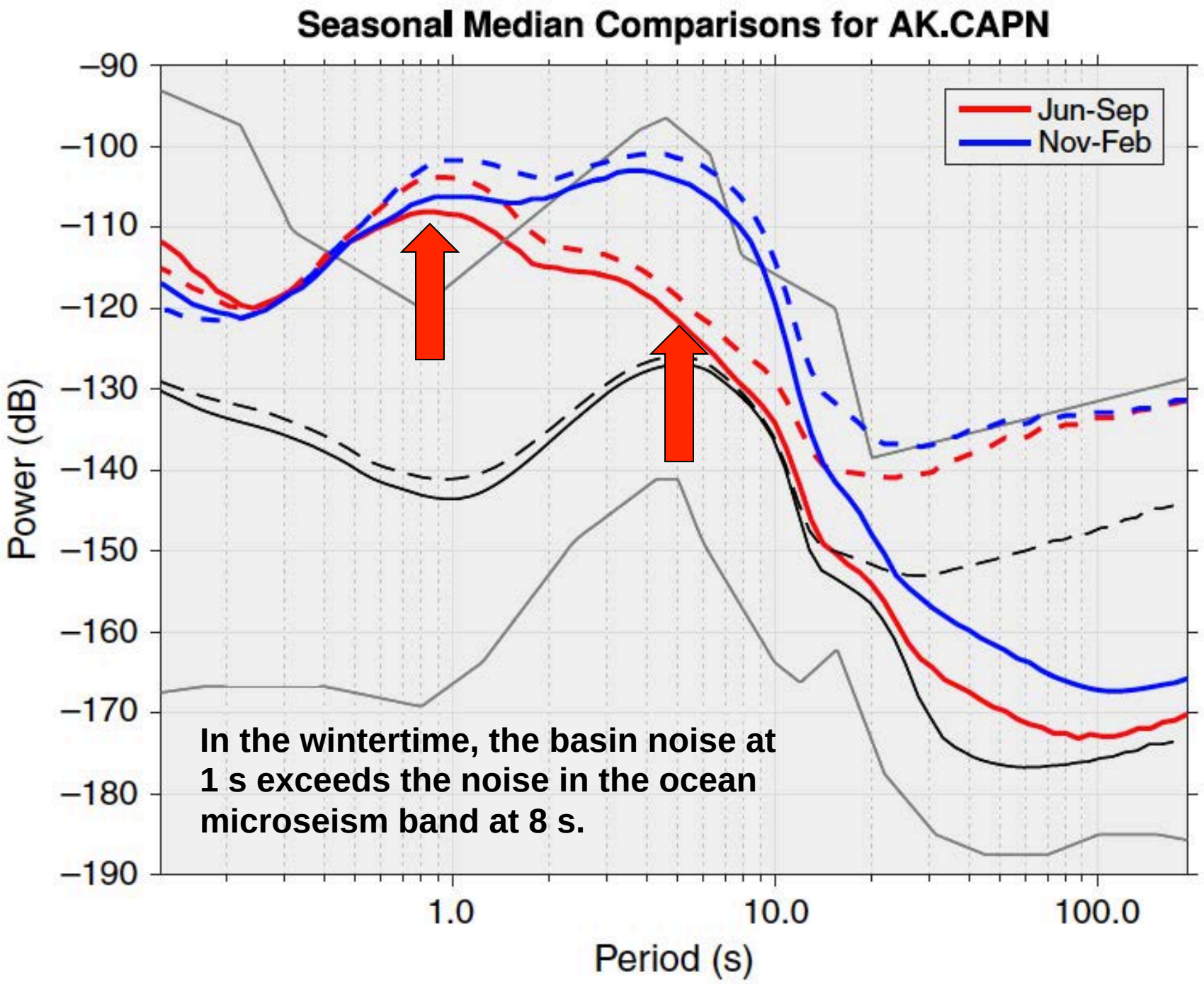
Summary of SALMON data quality

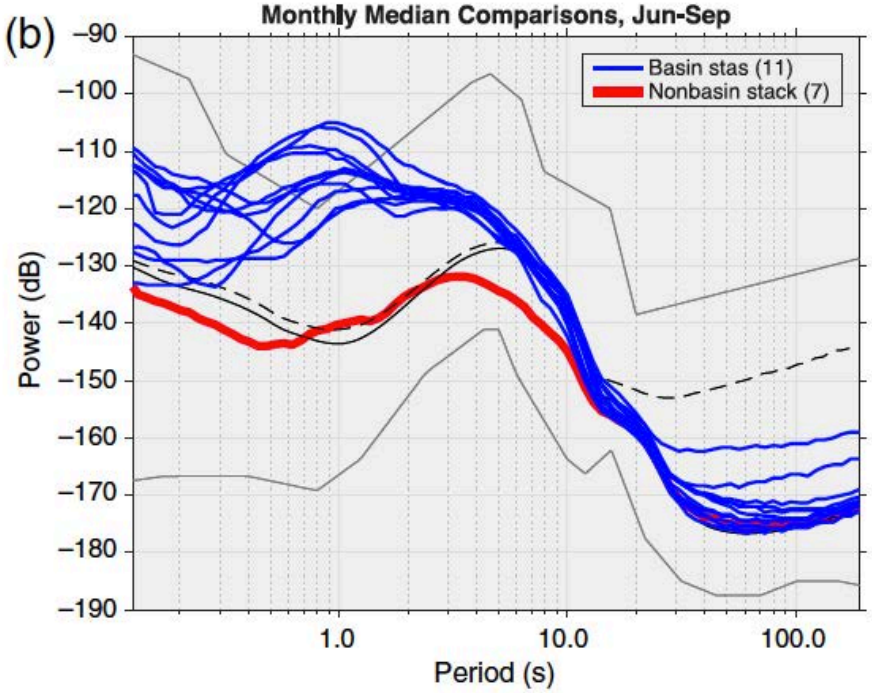
- Three sensors damaged in shipping
  - One did not pass huddle test
  - Two did pass huddle test and were installed (MPEN, KALS)
- 100% of data losses due to bears
  - 13 out of 54 station-years were lost (all from remote sites)
- Detailed analysis of ambient noise reveals
  - Strong seasonal variations
  - Strong basin effect (0.5 – 2 Hz)
  - Long-period H/V ratio at all stations, including GSN borehole (II.KDAK)

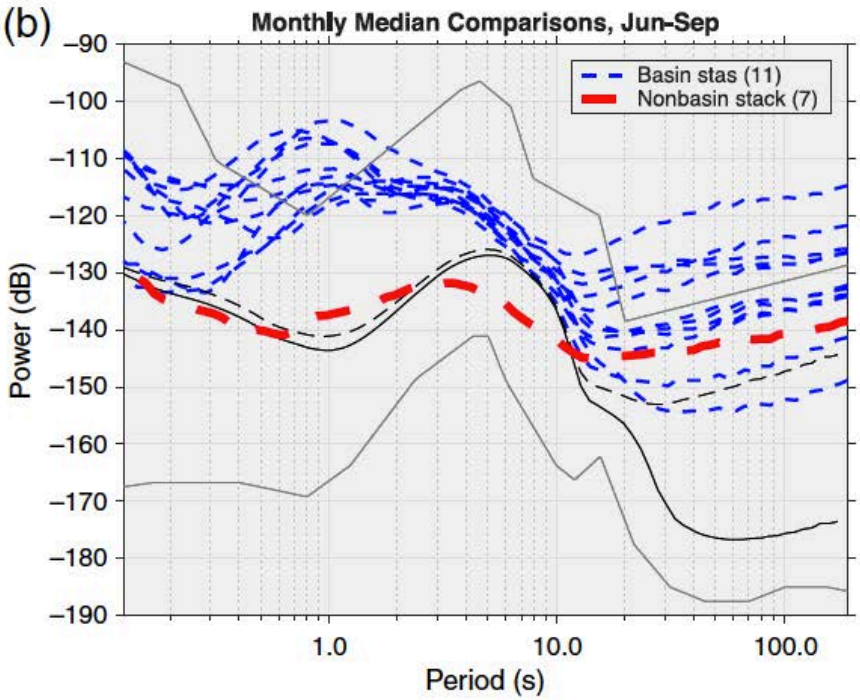

LTUW install 2015-07-02

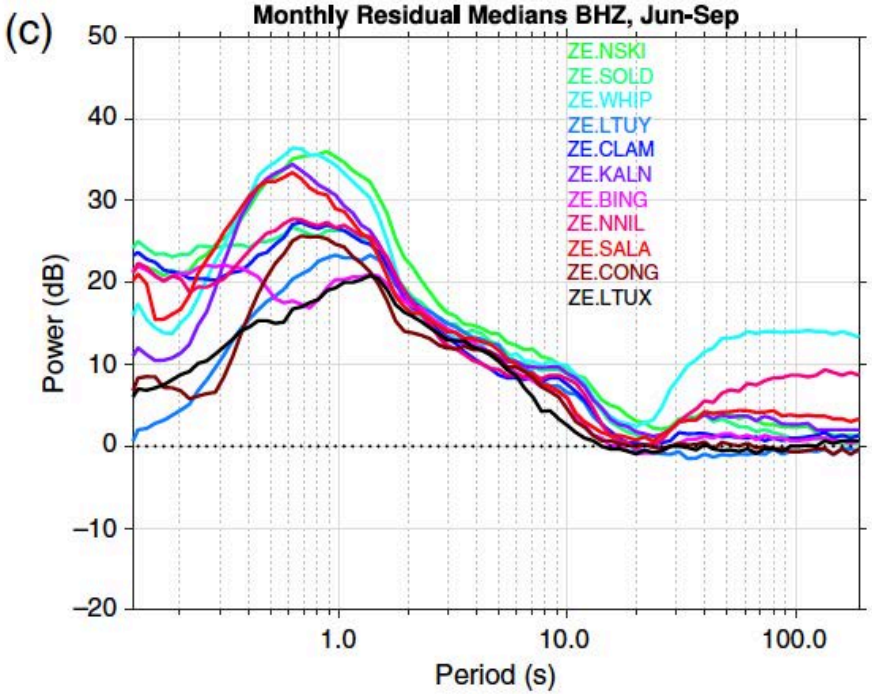
12 days later

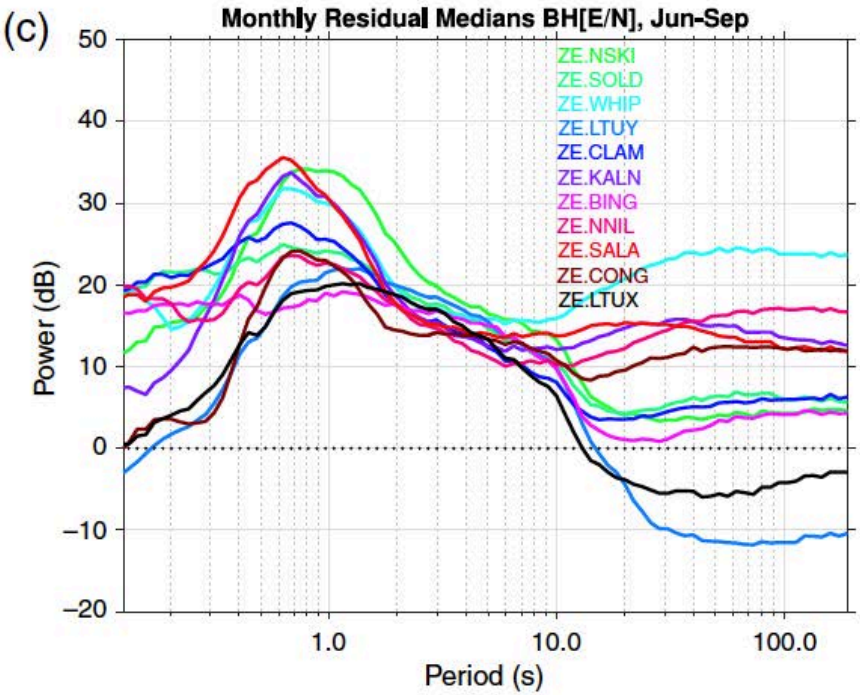
(photo taken during servicing on 2016-05-22)


Seasonal Median Comparisons for AK.CAPN
Jun-Sep
Nov-Feb
Power (dB)
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
1.0
10.0
100.0
Period (s)
In the wintertime, the basin noise at 1 s exceeds the noise in the ocean microseism band at 8 s.

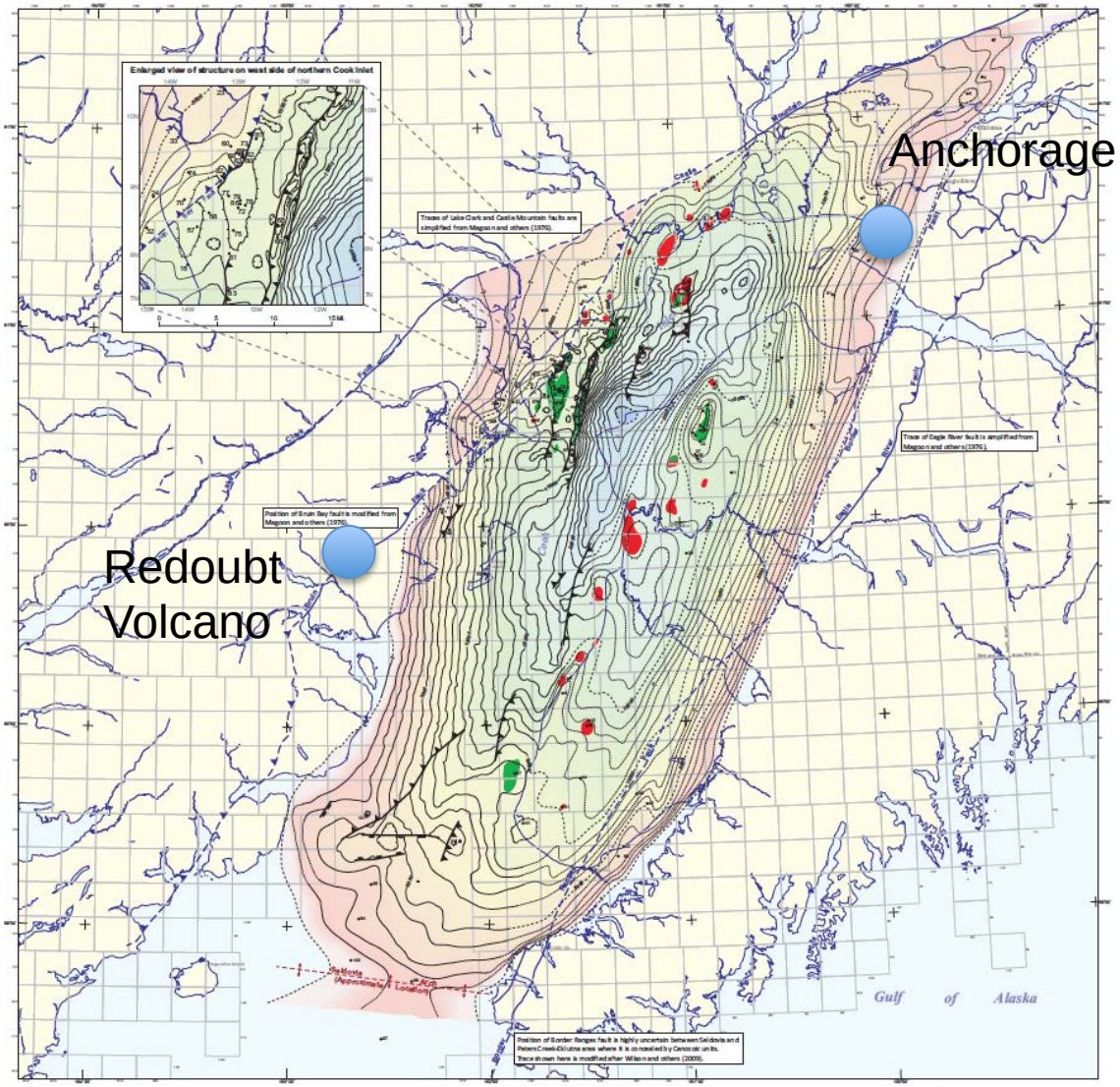

(b)
Monthly Median Comparisons, Jun-Sep
Basin stas (11)
Nonbasin stack (7)
Power (dB)
Period (s)


(b)
Monthly Median Comparisons, Jun-Sep
Basin stas (11)
Nonbasin stack (7)
Power (dB)
Period (s)

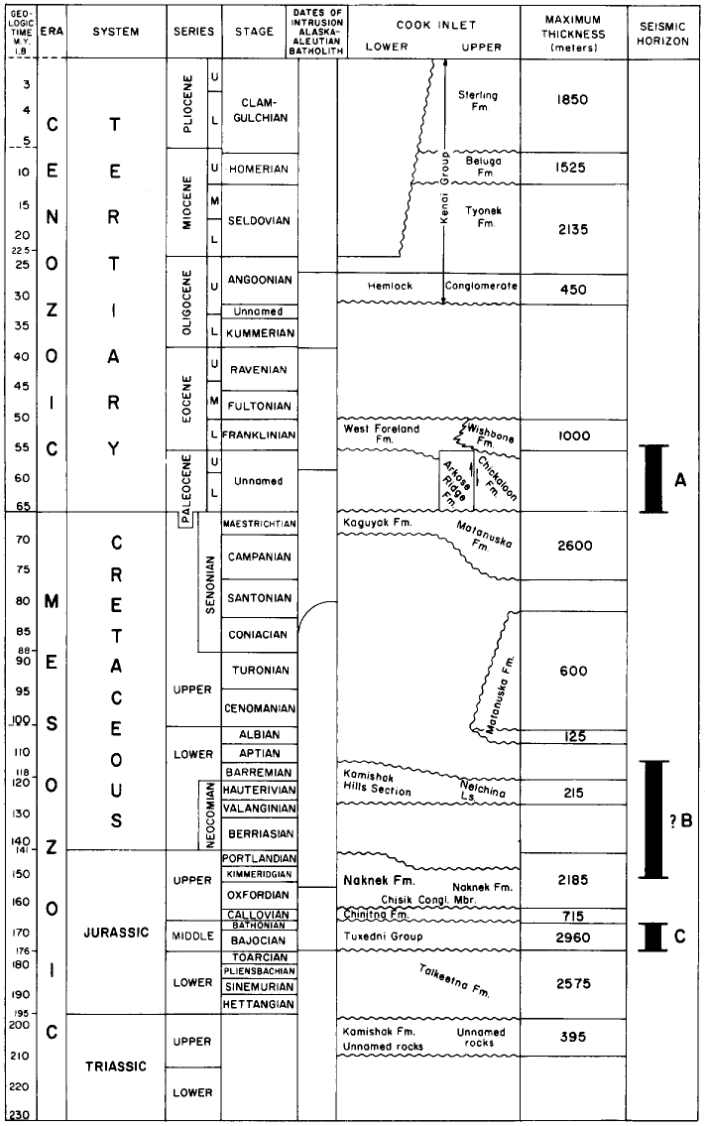

(c)
Monthly Residual Medians BHZ, Jun-Sep
ZE.NSKI
ZE.SOLD
ZE.WHIP
ZE.LTUY
ZE.CLAM
ZE.KALN
ZE.BING
ZE.NNIL
ZE.SALA
ZE.CONG
ZE.LTUX
Power (dB)
Period (s)


(c)
Monthly Residual Medians BH[E/N], Jun-Sep
ZE.NSKI
ZE.SOLD
ZE.WHIP
ZE.LTUY
ZE.CLAM
ZE.KALN
ZE.BING
ZE.NNIL
ZE.SALA
ZE.CONG
ZE.LTUX
Power (dB)
Period (s)

Cook Inlet forearc basin = 160 Ma of sedimentation and subduction

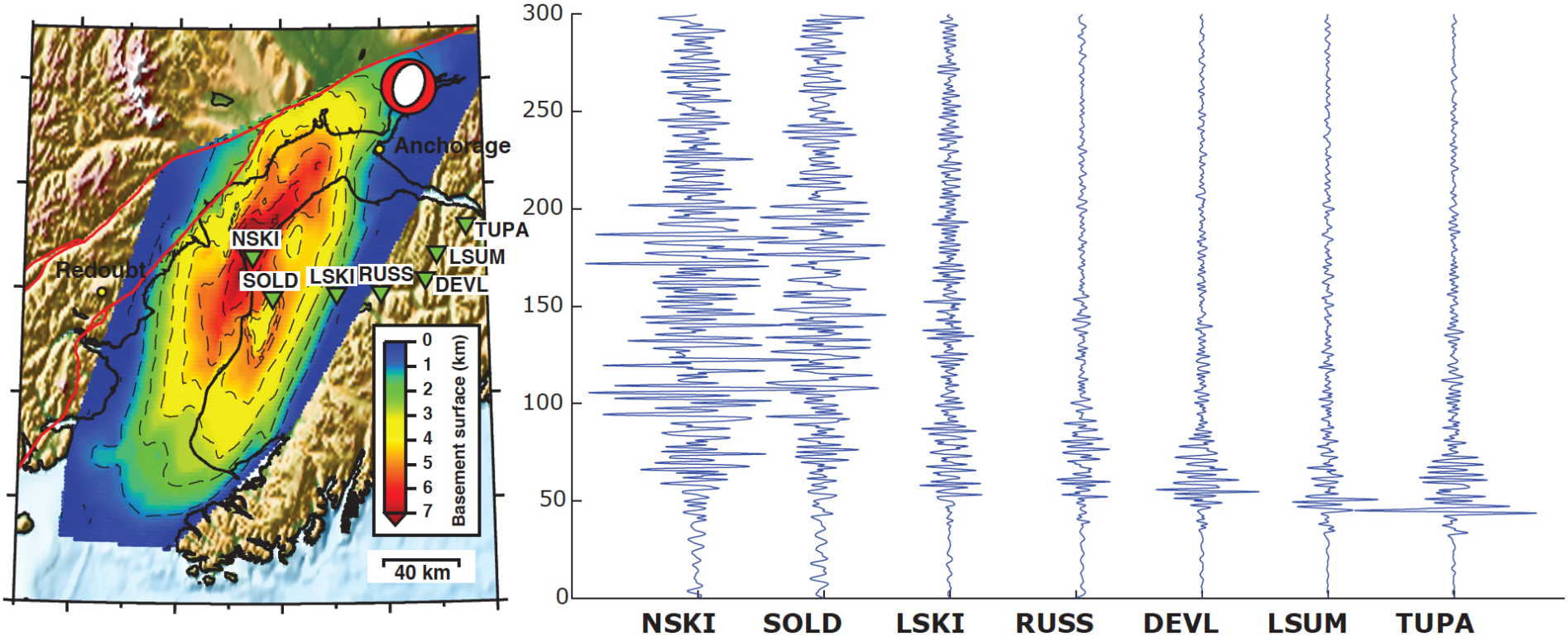


Cook Inlet basin (depth to base Tertiary)
Shellenbaum et al. (2010)



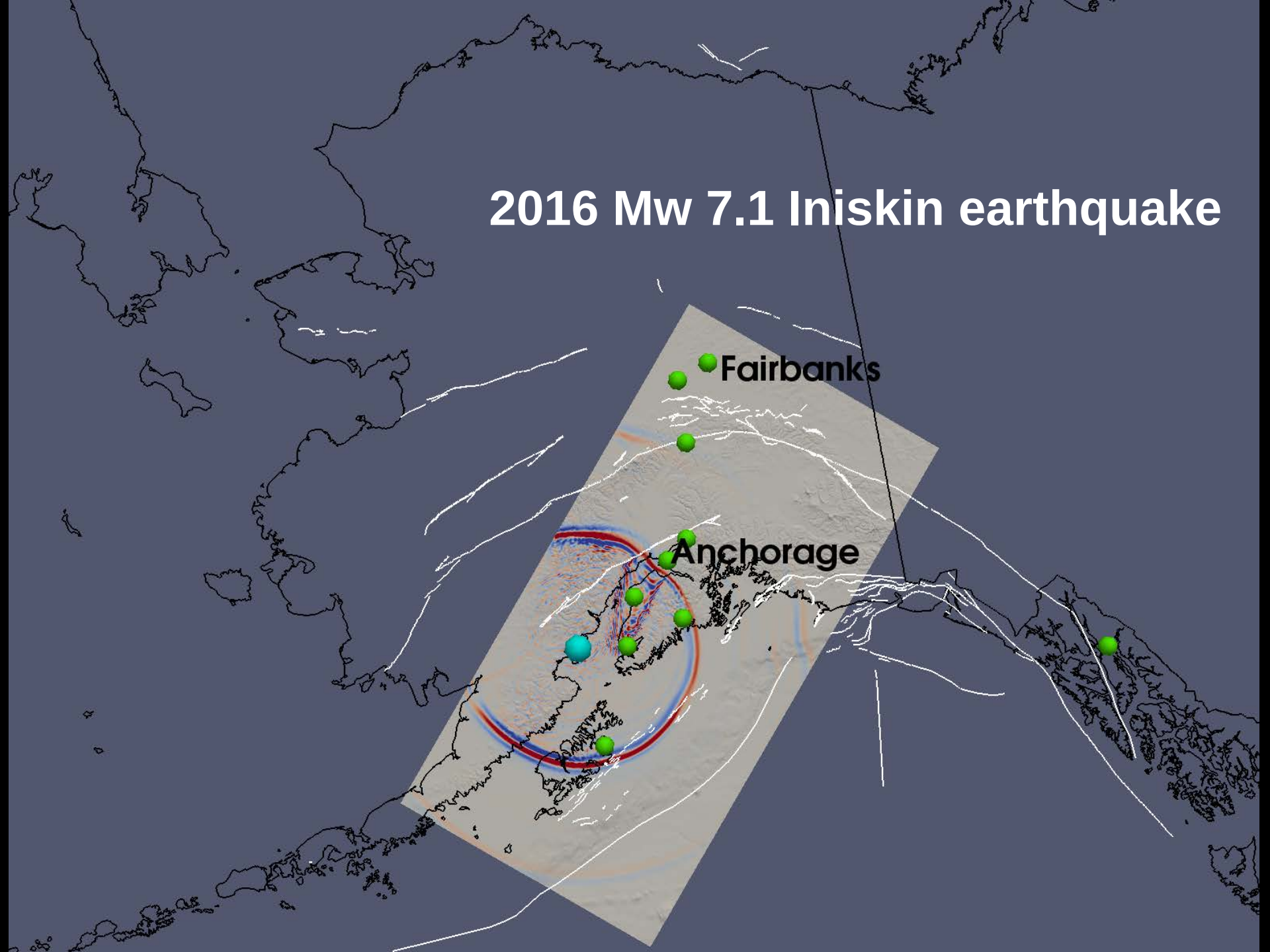
Cook Inlet stratigraphy
Fisher and Magoon (1978)

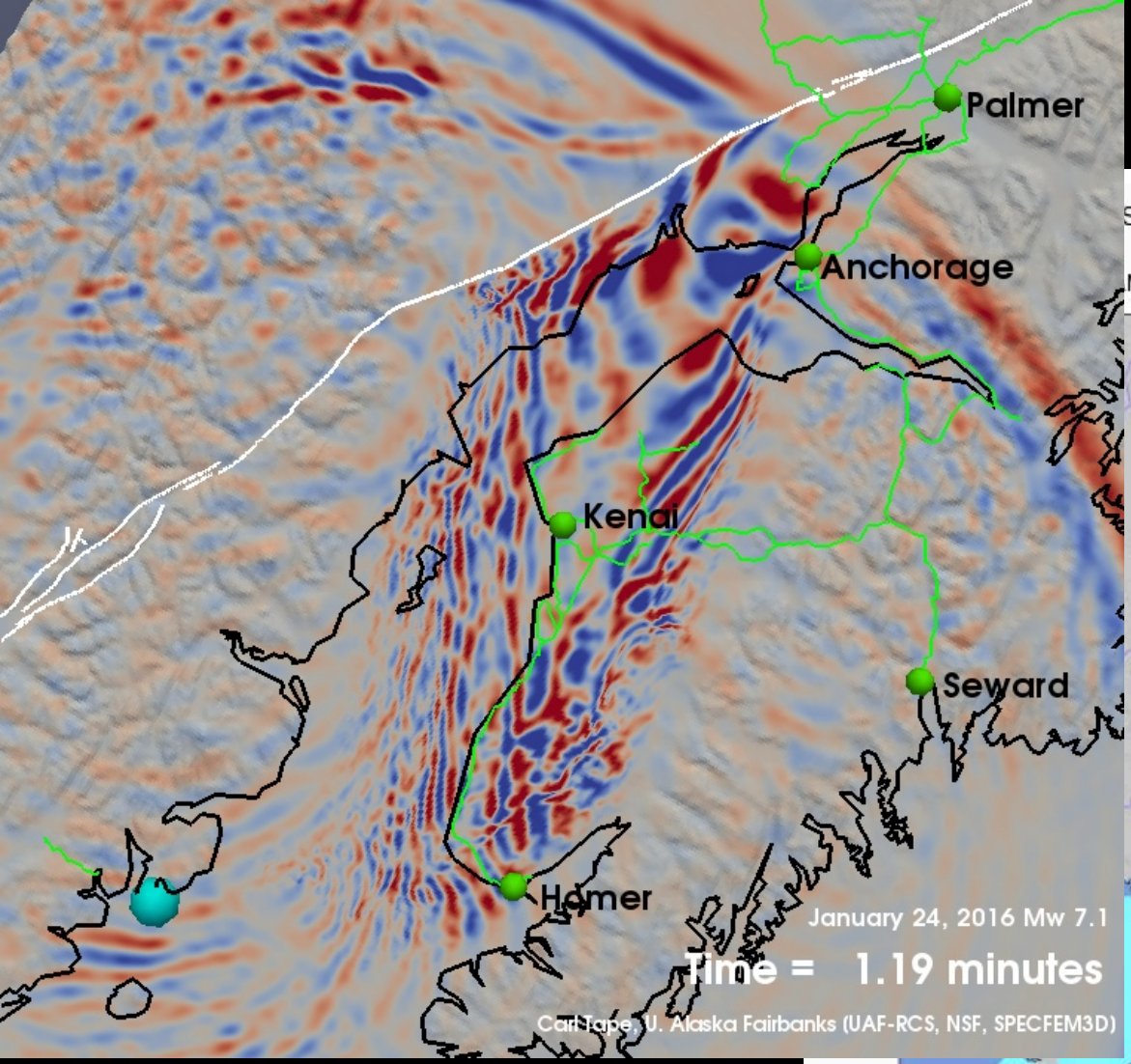
Amplification and extended shaking in sedimentary basins

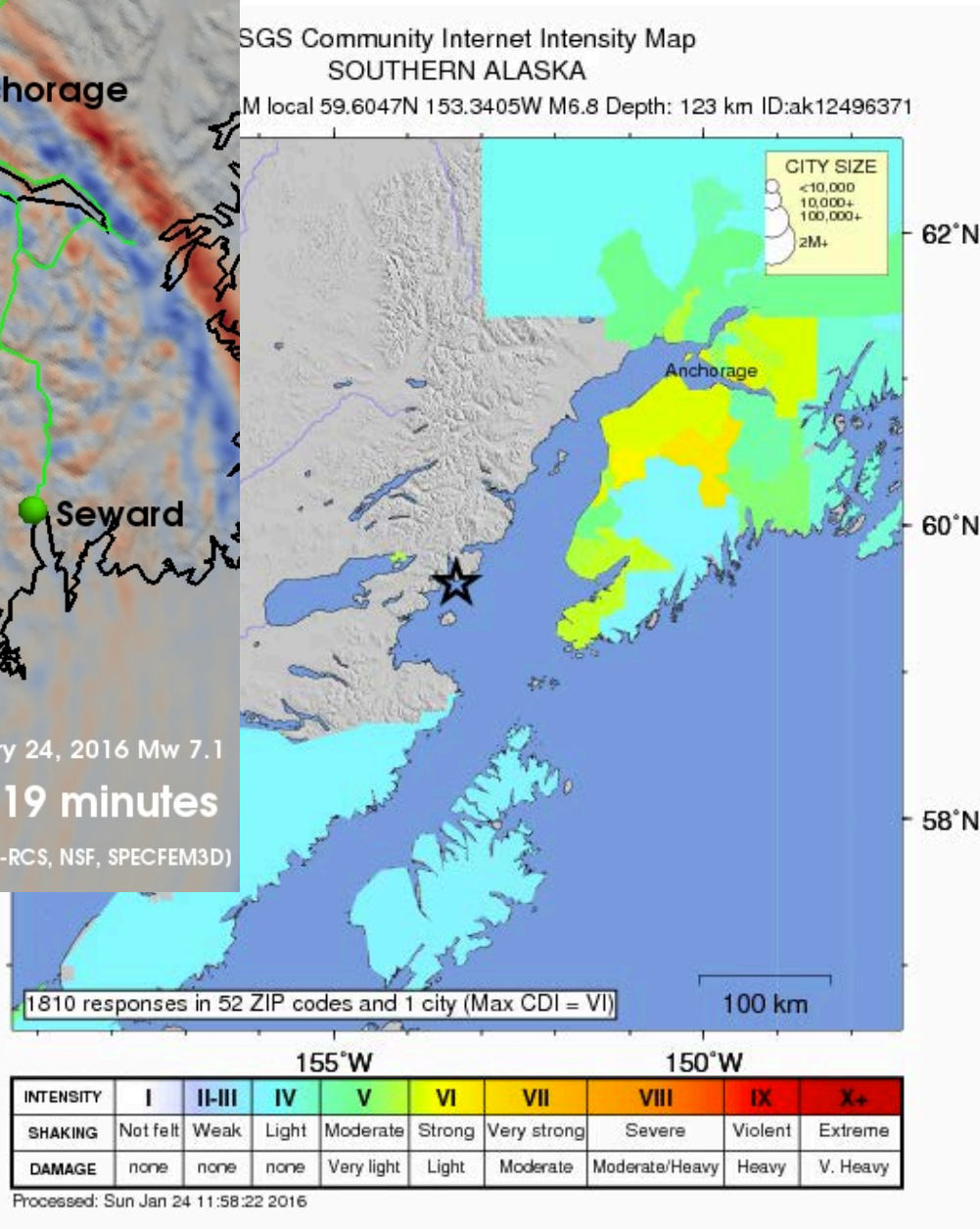


Basin geometry: Shellenbaum et el., 2010

Seismic stations: MOOS experiment (Christensen and Abers, 2007-2009)

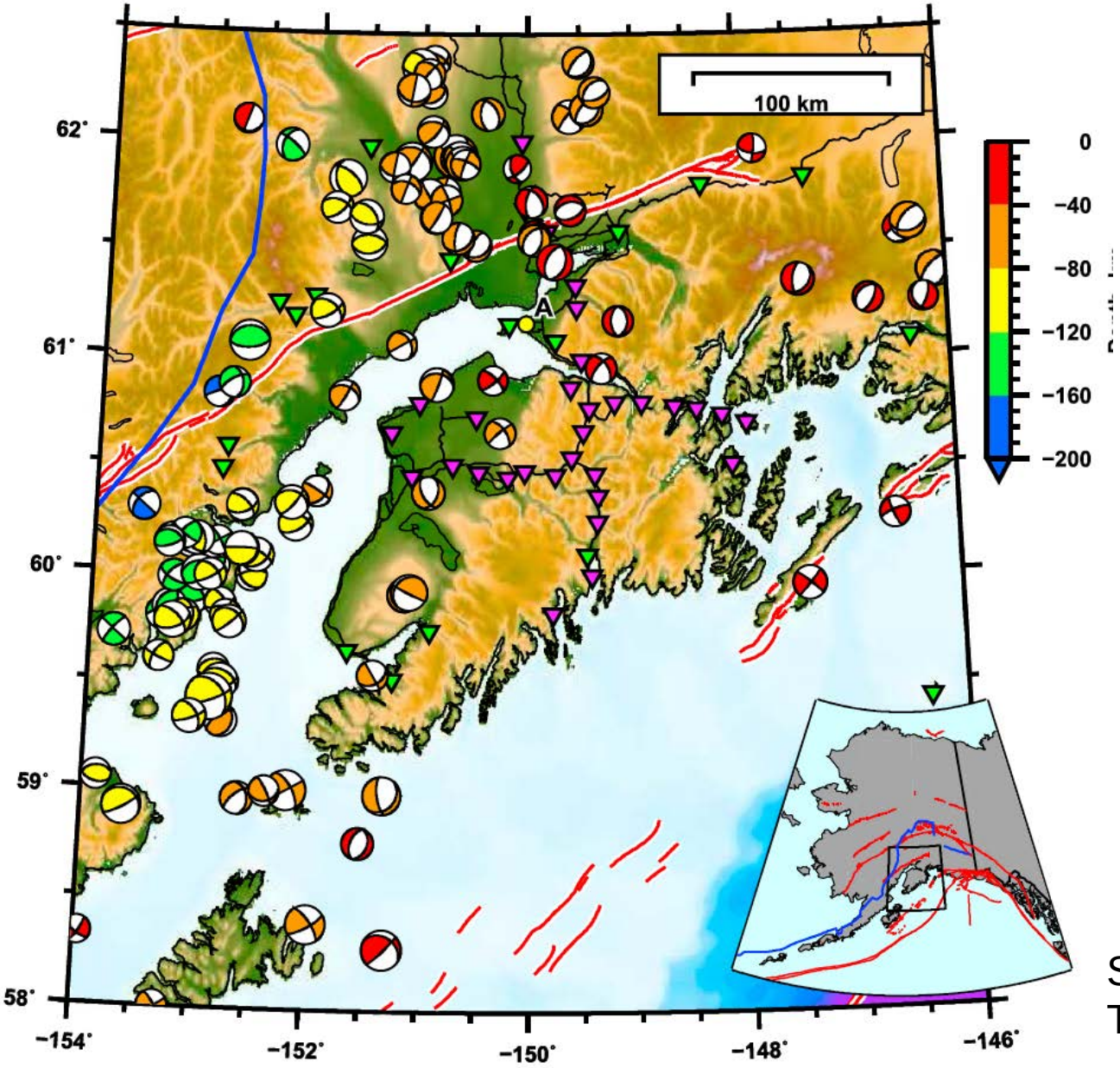

2016 Mw 7.1 Iniskin earthquake
Fairbanks
Anchorage





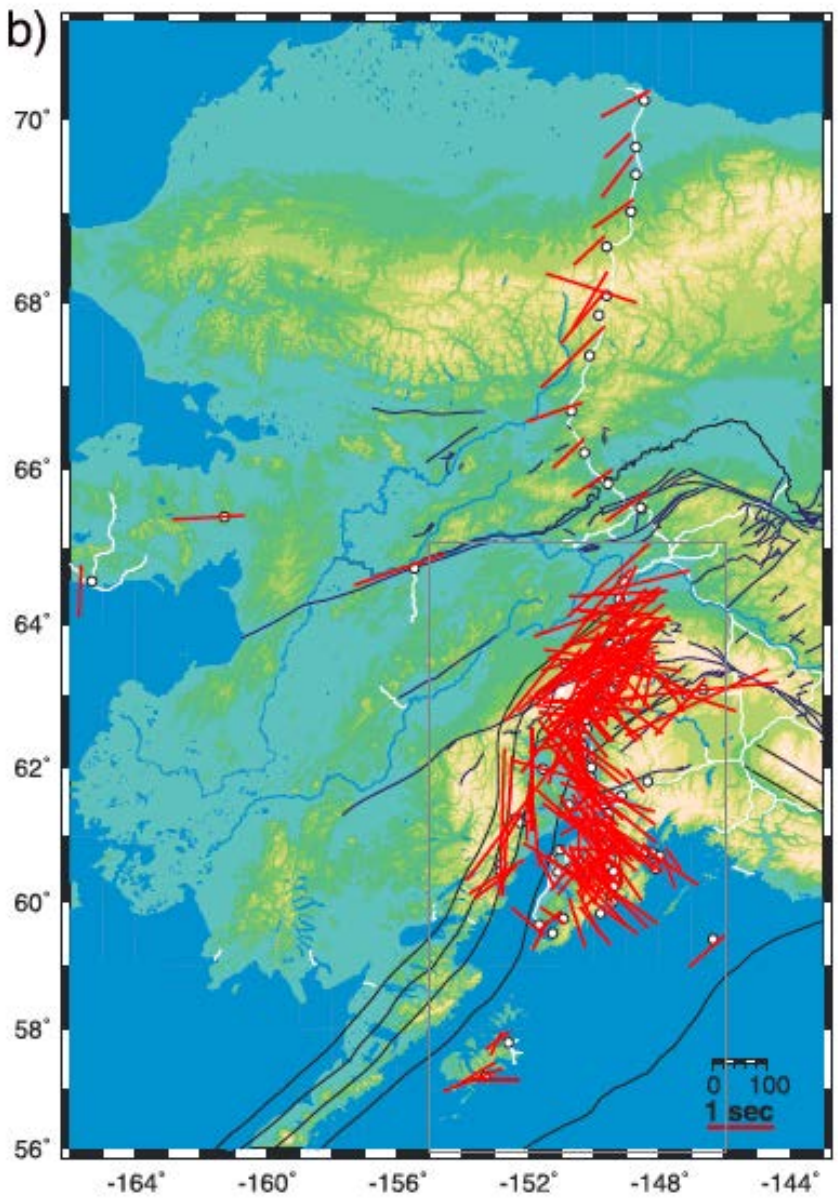
2016 Mw 7.1 Iniskin earthquake

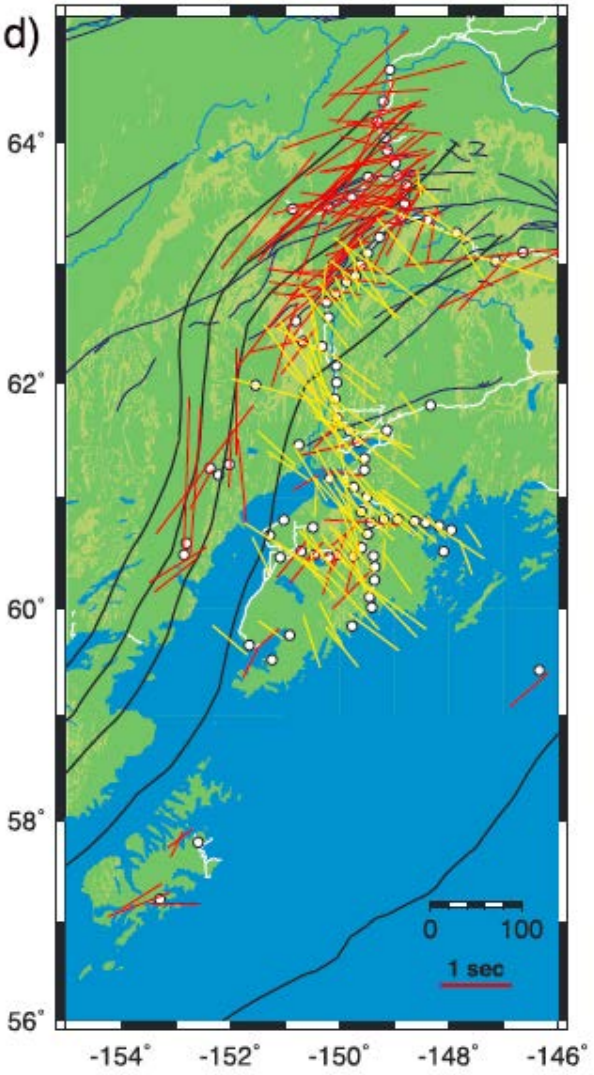
Moment tensor catalog for adjoint tomographic inversion



Silwal and Tape, 2016

A remarkably sharp transition in SKS splitting observations





Perttu et al., 2014

EXTRA SLIDES

[SALMON] Each entry in the table corresponds to a station-year, for example BING/15 is for station BING for the time period summer-2015 to summer-2016. Three stations are omitted from the table for sites where there are no bears, on Kalgin Island (KALS+, KALN+) and inside a 2 km^2 gated moose pen (MPEN+). The * indicates a site where the sensor cable was ruined (which leads to an automatic B5/B6 category). The bold entries denote stations with Lysol used as bear deterrent. HOLG was 2015-6 only; JOES was 2016-7 only.

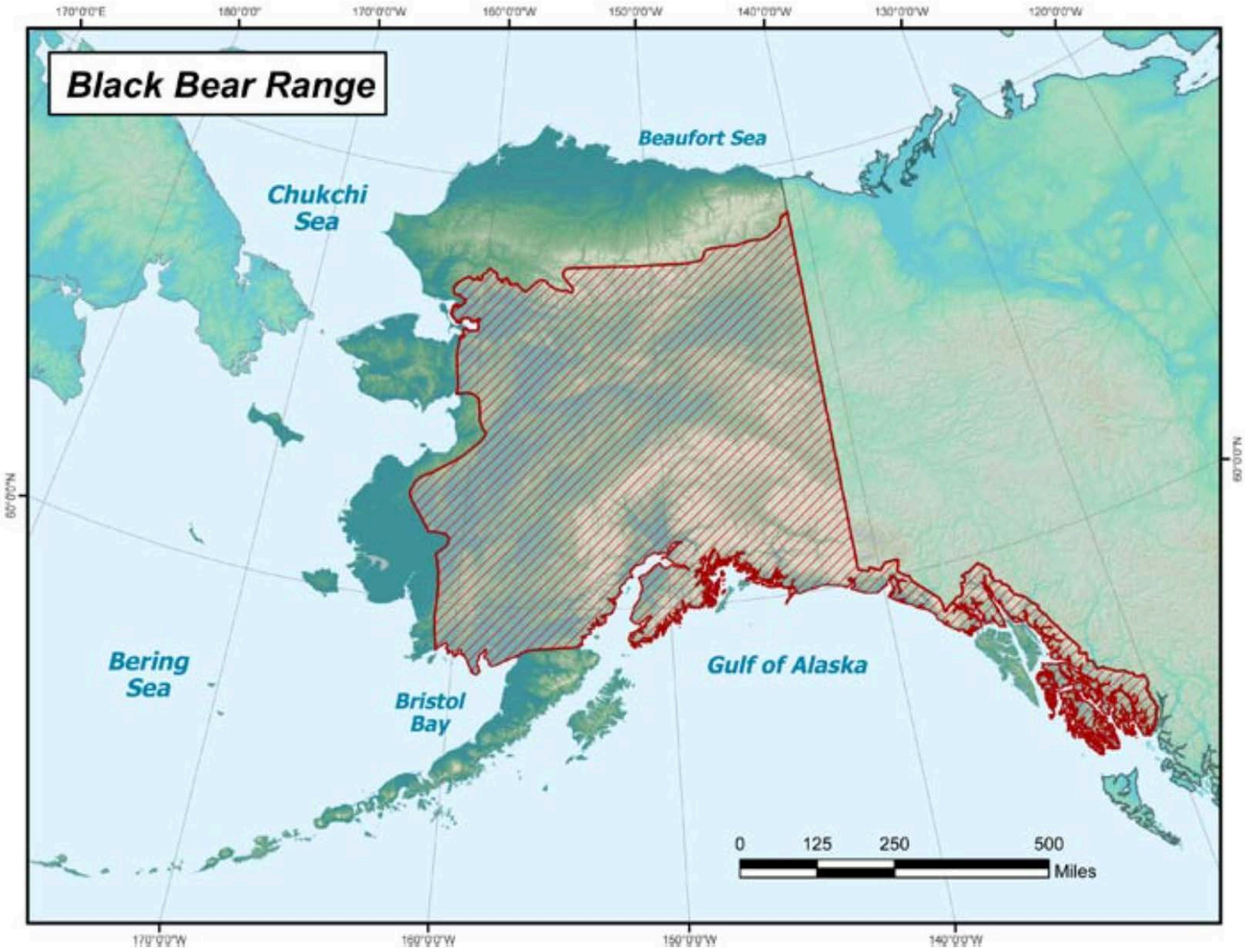
	B1 *undisturbed by bears*	B2	B3	B4	B5	B6 *most disturbed by bears*
R1 [7] *least remote site* BING, CLAM, GOOS, MPEN+, NNIL, NSKI, SOLD	BING/15, CLAM/15, GOOS/15, NNIL/15, NSKI/15, SOLD/15, BING/16, CLAM/16, GOOS/16, NNIL/16, NSKI/16, SOLD/16					
R2 [2] HOPE, KALS+	HOPE/15				HOPE/16	
R3 [7] BULG, CONG, HOLG, SALA, WHIP, JUDD, JOES	CONG/15, CONG/16, JUDD/15, BULG/16, WHIP/16, JUDD/16, JOES/16			SALA/15, WHIP/15		HOLG/15*, BULG/15, **SALA/16***
R4 [12] *most remote site* HARR, HLC1, HLC2, HLC3, HLC4, HLC5, KALN+, LTUW, LTUX, LTUY, WFLS, WFLW	LTUX/15, LTUY/15, LTUY/16	**WFLS/16**, WFLW/16, **HLC5/16**	HLC5/15, WFLW/15, **LTUW/16**, **HLC4/16**	HLC3/15, WFLS/15, **HLC2/16**	**HLC3/16**	HARR/15, **HARR/16***, LTUW/15, LTUX/16, HLC1/15*, **HLC1/16**, HLC2/15*, HLC4/15*

Non-remote sites [6]: BING, CLAM, GOOS, NNIL, NSKI, SOLD

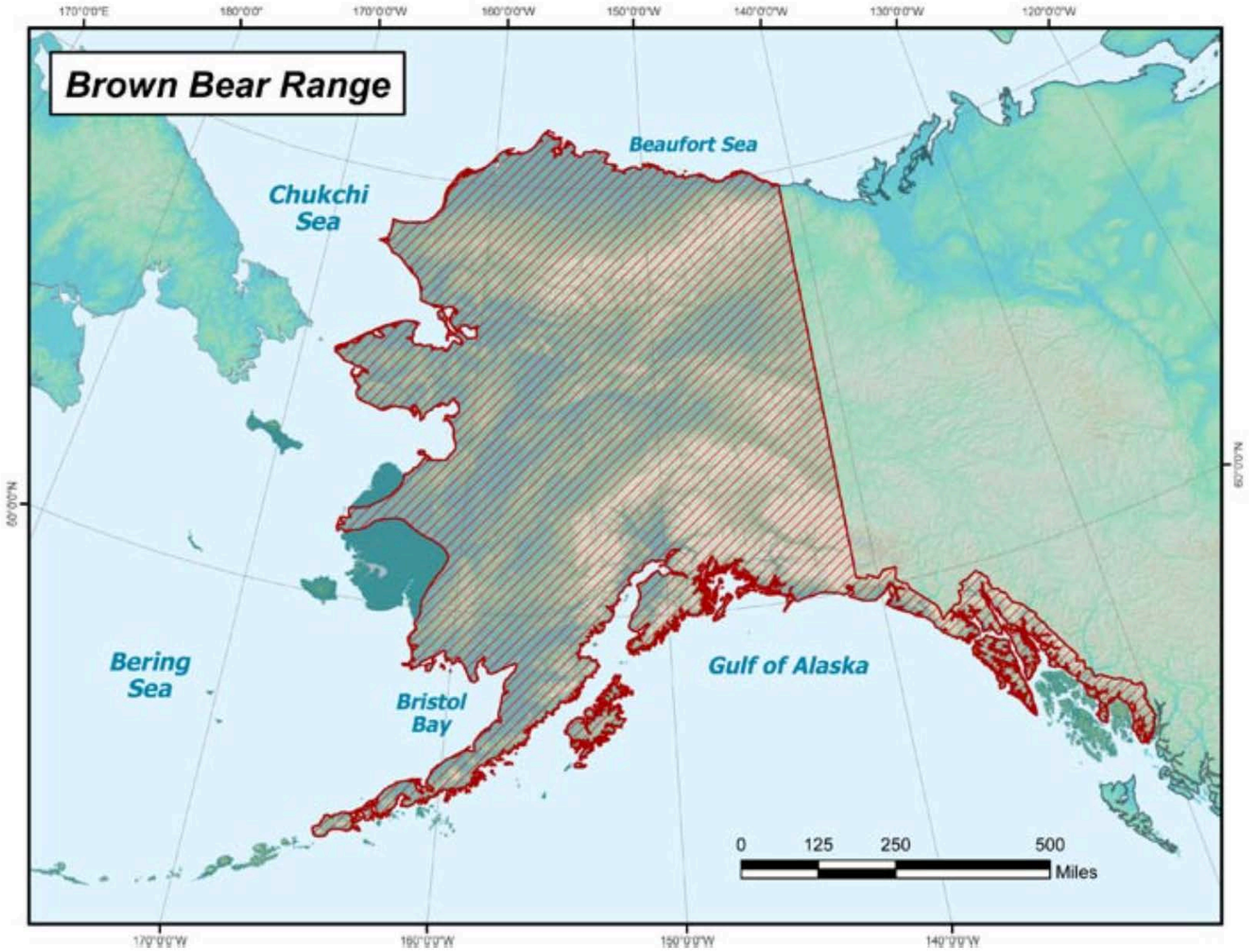
Remote sites [18]: HOPE, BULG, CONG, HOLG, SALA, WHIP, JUDD or JOES, HARR, HLC1, HLC2, HLC3, HLC4, HLC5, LTUW, LTUX, LTUY, WFLS, WFLW


MULTRIE
11°C
F3TNMOV
18 MAY 2017 10:07 pm

Maps to keep in mind for fieldwork



Maps to keep in mind for fieldwork



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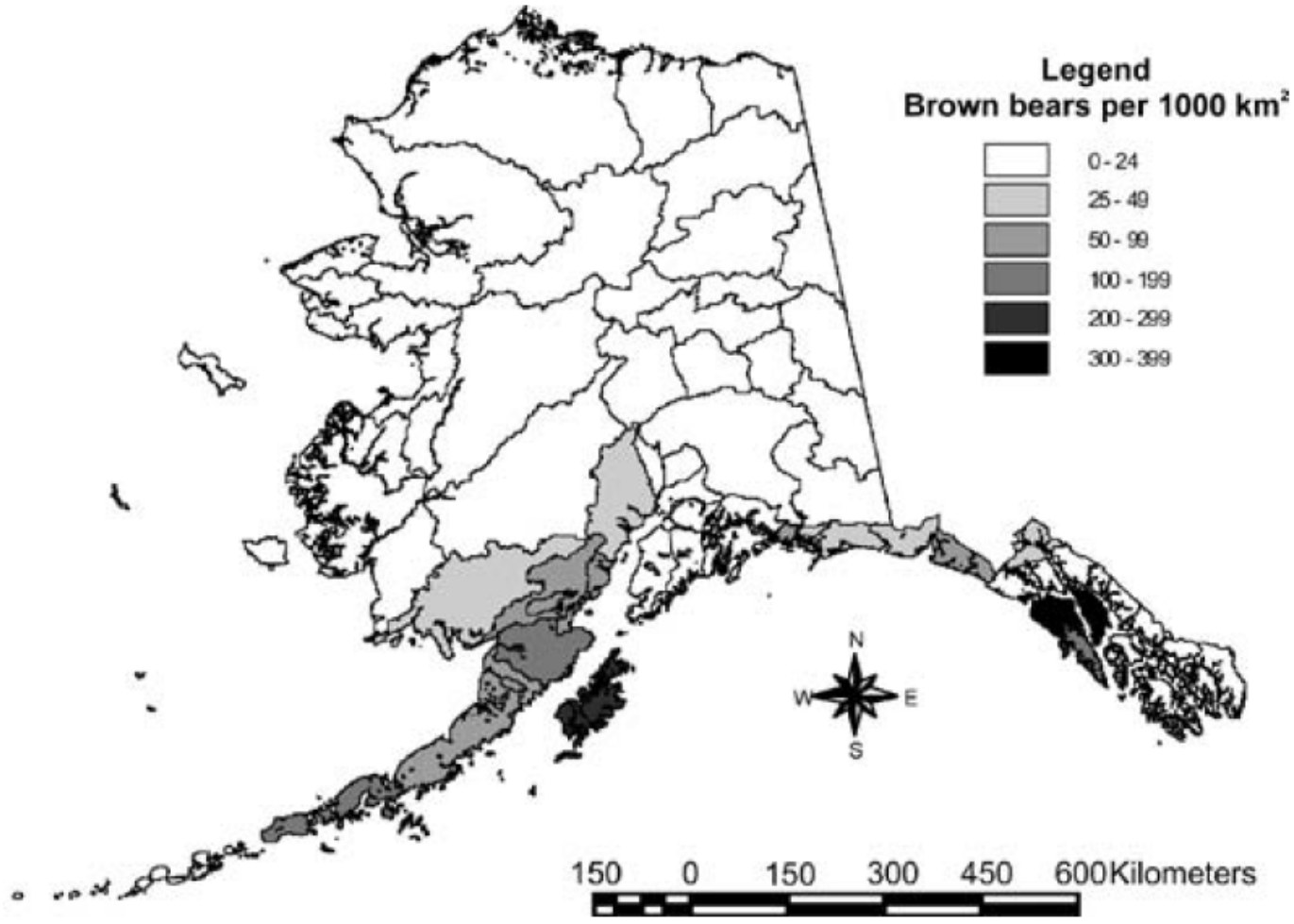
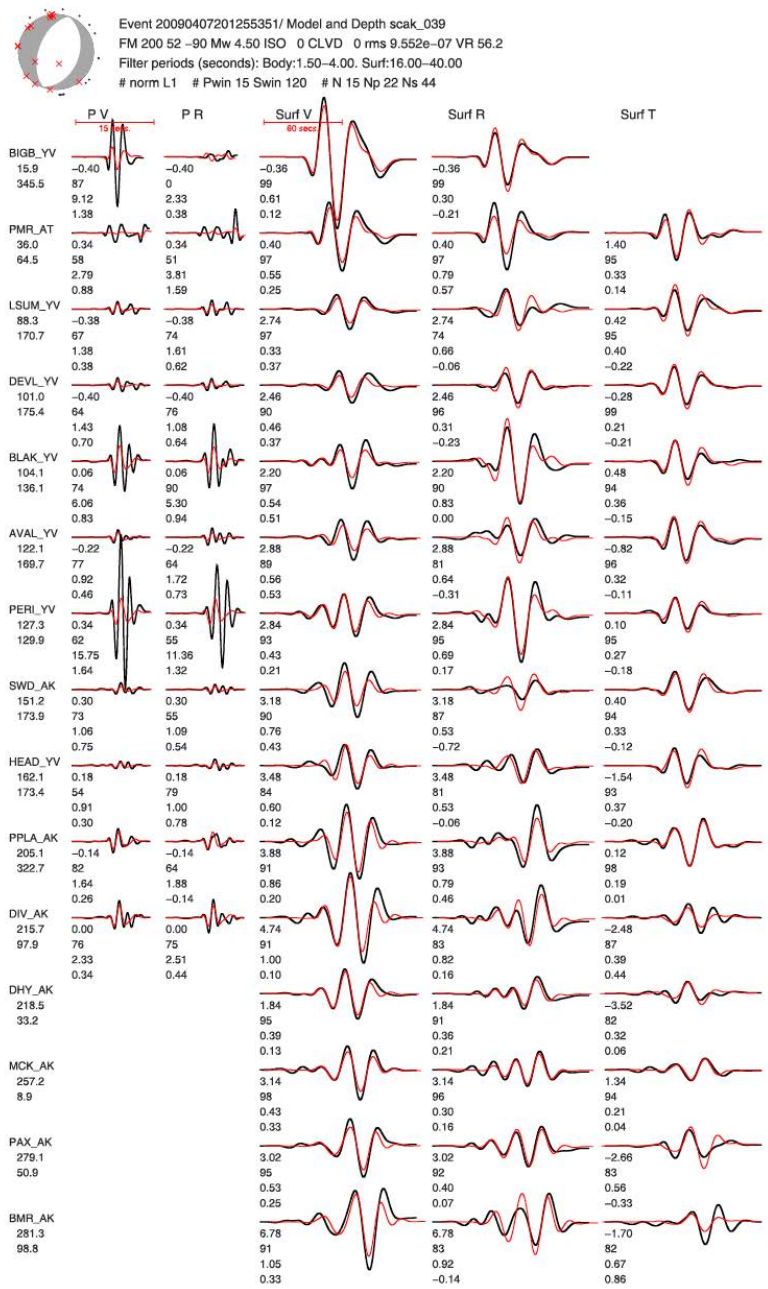
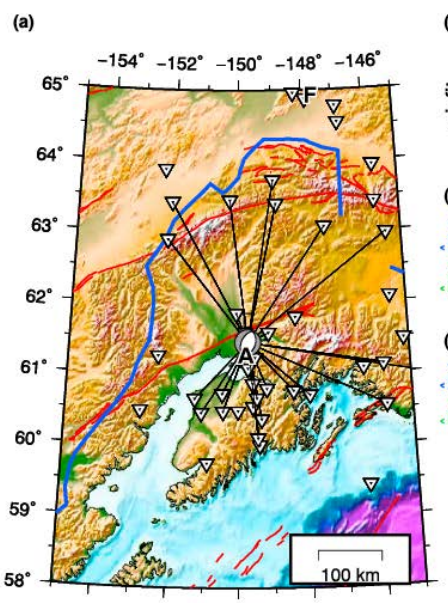
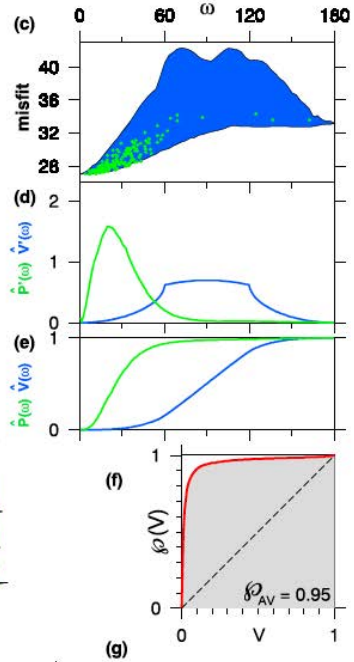


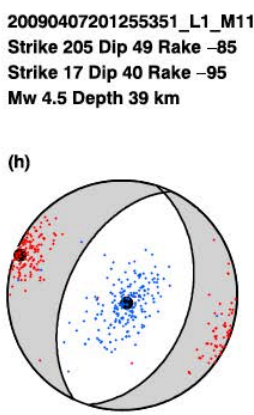
T. Smith (2005)

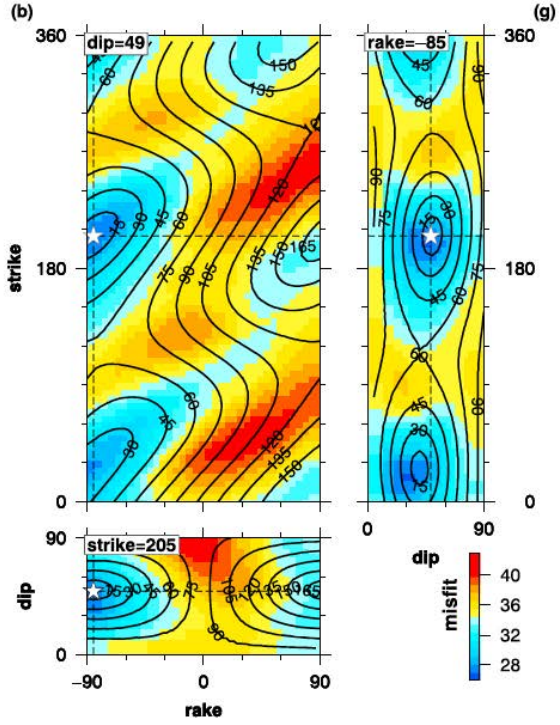
Silwal and Tape (2016)

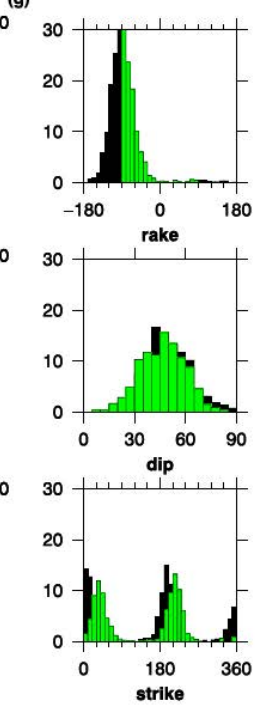


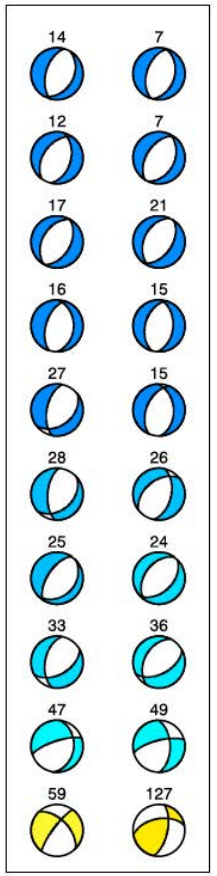


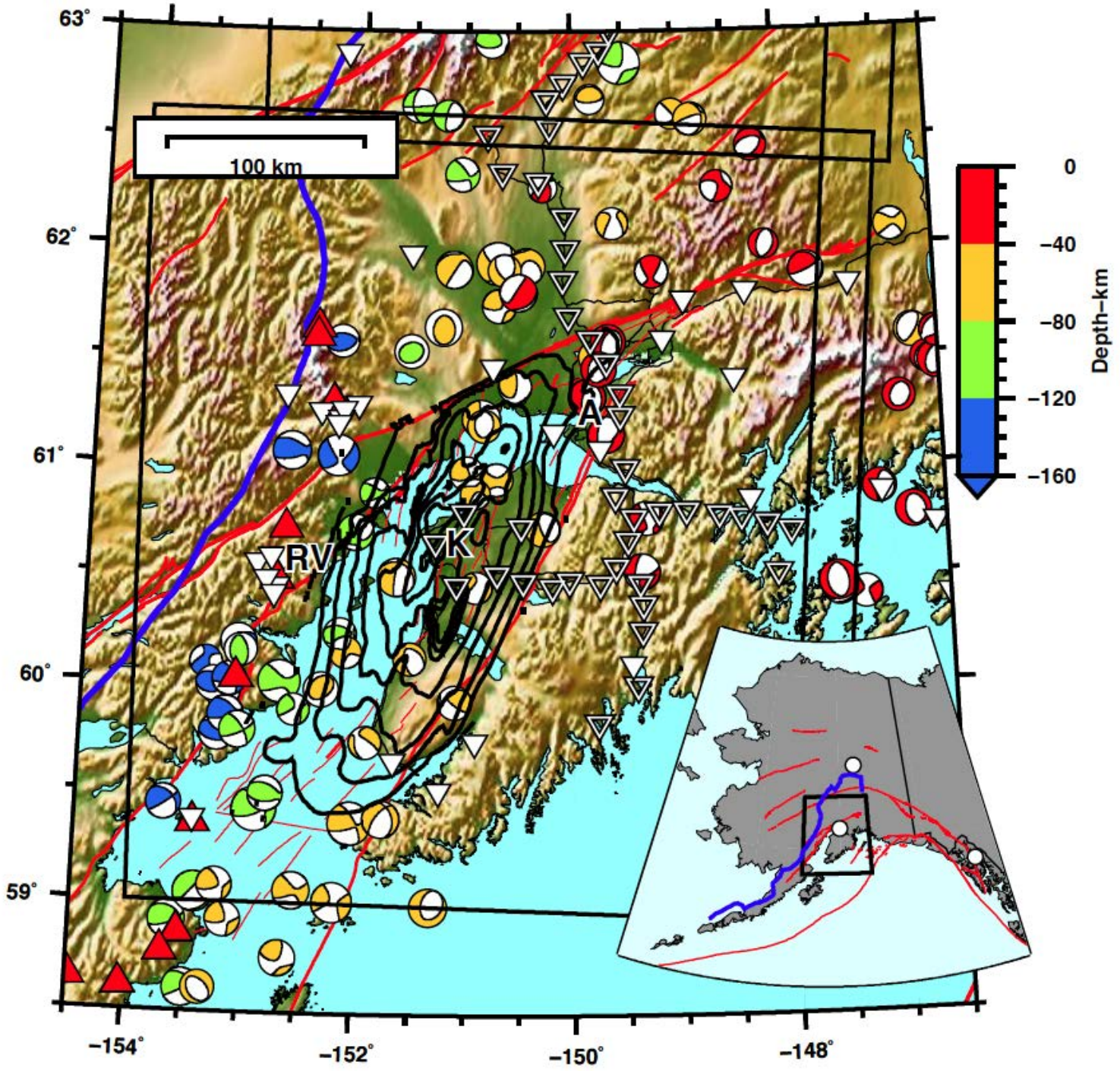


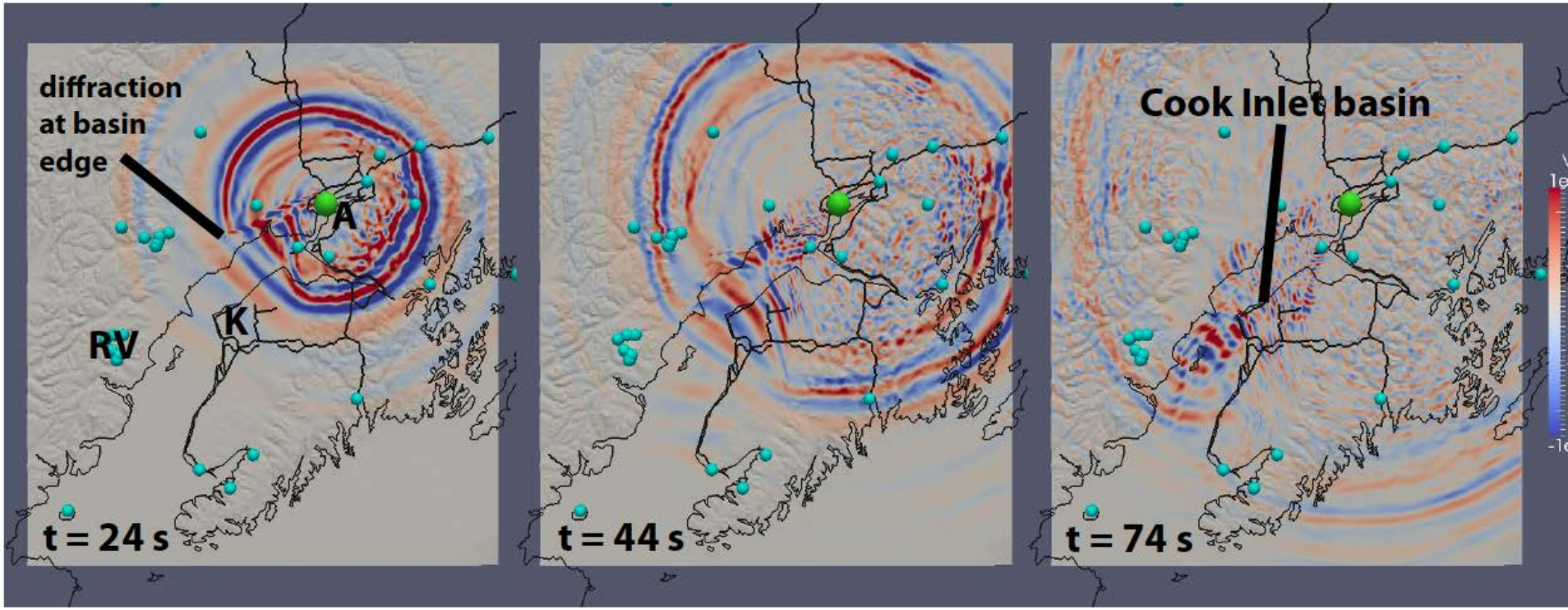









63°
62°
61°
60°
59°
−154°
−152°
−150°
−148°
100 km
0
−40
−80
−120
−160
Depth−km
A
RV
K


diffraction
at basin
edge
A
K
RV
t = 24 s
t = 44 s
Cook Inlet basin
t = 74 s

EarthScope Seismic Array in Alaska (2014–2019)

A monumental achievement by IRIS/NSF !!