Exploring the Alaska Peninsula subduction zone with AACSE: The Alaska Amphibious Community Seismic Experiment

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North America's largest earthquakes and most powerful volcanic eruptions occur along the Alaska Peninsula subduction zone. Despite the region's high hazard, it has received relatively little attention because of its remoteness. That changed with the GeoPRISMS focus on the Aleutian-Alaska system, and a focused call for major community data collection highlighted by AACSE. The Alaska Amphibious Community Seismic Experiment (AACSE) is a large shoreline-crossing passive- and active-source seismic experiment that lasted from May 2018 through August 2019 (Abers et al., 2019; Barcheck et al., 2020). The AACSE experimental footprint spanned the Alaska Peninsula subduction zone from Kodiak Island in the northeast to the Shumagin Islands in the southwest, crossing along-trench variation in coupling, seismicity rates, incoming plate structure and hydration, and arc volcanic chemistry (von Huene et al., 2012; Buurman et al., 2014; Shillington et al., 2015; Li and Freymueller, 2018; see Fig. 1). The experiment consisted of 105 broadband seismometers: 75 offshore in ocean-bottom seismometer (OBS) packages deployed from the outer rise to the trench to the shelf, and thirty seismometers onshore on Kodiak Island, the Alaska Peninsula, and the Shumagin Islands.

Broadband seismometers were complemented by a suite of additional geophysical instrumentation, including strong motion sensors, absolute and differential seafloor pressure gauges, hydrophones, and temperature and salinity sensors. OBS were deployed by the *R/V Sikuliaq* during two cruises in May and July 2018 and retrieved by the *R/V Sikuliaq* and *R/V Langseth* during two cruses in August-September 2019.

AACSE instruments were deployed concurrently with the EarthScope Transportable Array (TA) across Alaska, extending the footprint of the TA offshore near the Alaska Peninsula. The AACSE footprint also includes part of the aftershock region of the January 2018 M7.9 offshore Kodiak earthquake (Ruppert et al., 2018), as well as the Shumagin Islands region that later ruptured in the July 2020 M7.8 and October 2020 M7.6 earthquakes. A complementary array of 398 nodal instruments was deployed for four weeks in May-June 2019 on Kodiak Island, and an offshore active source survey was conducted concurrently by the *R/V Langseth* in June 2019 to shoot into the AACSE broadband network and the nodes. AACSE is a "community" experiment, with all data becoming available openly as soon as possible – the full data set was released by early 2020. This approach enables rapid engagement with a range of science questions by all researchers interested in this fascinating subduction zone. Data availability for AACSE is described in detail in Barcheck et al., 2020. ■

The R/V Sikuliaq offshore the Kenai Peninsula. Photo credit: R. Martin-Short

Aerial view heading towards a station near King Salmon, AK. Photo credit: A. Adams.

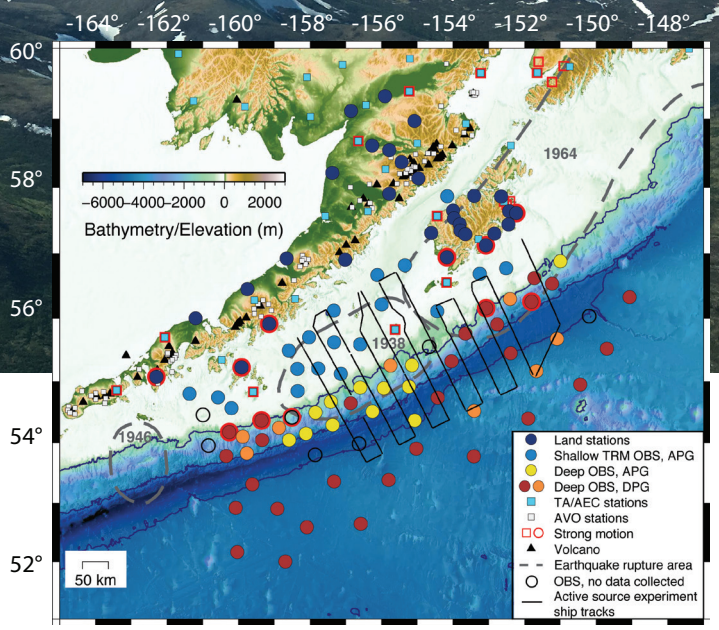

Figure 1. The Alaska Amphibious Community Seismic Experiment (AACSE) broadband array. Symbols corresponding to different instrument types are shown in the legend. Gray dashed lines outline rupture areas of historical earthquakes (Davies et al., 1981). Dark blue lines are the 1000 and 5000 m oceanic depth contours. Empty circles indicate sites that were either not recoverable or that failed soon after deployment and recorded little to no data of any kind. AEC, Alaska Earthquake Center; APG, absolute pressure gauge; AVO, Alaska Volcano Observatory; OBS, ocean-bottom seismometer; TA, Transportable Array; TRM, trawl-resistant mounted. Modified from Barcheck et al. (2020).

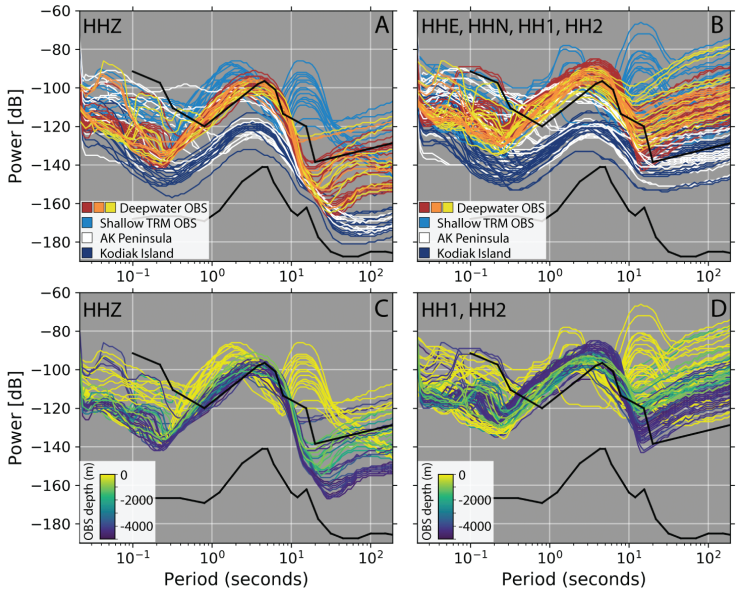

Figure 2. Median noise spectra of broadband seismometers in the AACSE network. (A,B) Median noise spectra on (A) vertical and (B) horizontal channels of all AACSE sites, colored by region of the network. Colors match Figure 1, except for Alaska Peninsula sites, which are white here. (C,D) Median noise spectra on (C) vertical and (D) horizontal channels of OBS sites, colored by water depth. Data plotted in all panels are median noise spectra at each site for the duration of the experiment. Sites with excessive instrumental noise or data quality issues are removed. Thick black lines are the high- and low-noise reference models of Peterson (1993). Modified from Barcheck et al. (2020).

References can be found in

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