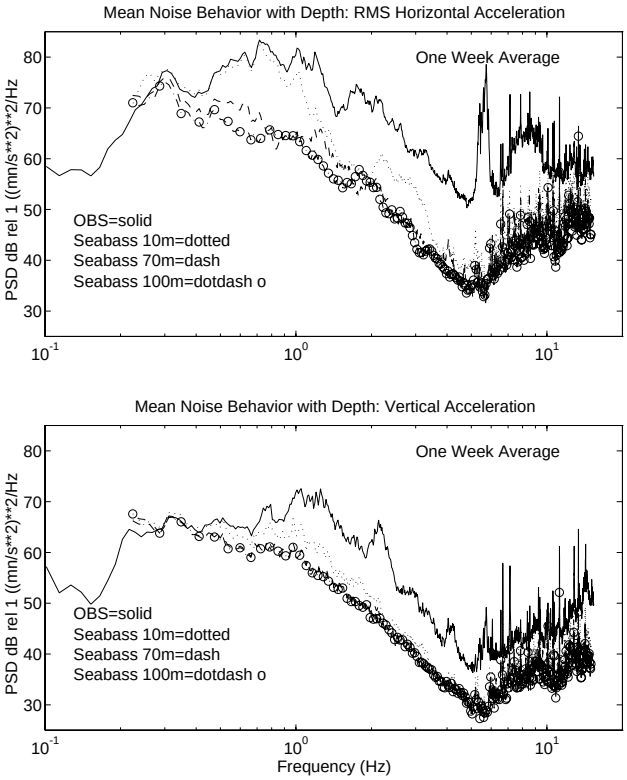
Seismoacoustic noise below the seafloor

Ralph A. Stephen, Woods Hole Oceanographic Institution, and
Christopher R. Bradley, Scripps Institution for Oceanography

The Seafloor Borehole Array Seismic System (SEABASS) was developed as a VLF system (2-50Hz) to study ambient noise at and below the seafloor. The system uses the wireline reentry system to reenter boreholes on the seafloor [*Spiess et al.,* 1992]. The borehole array on SEABASS is a VLF system (2-50Hz) consisting of four three-component, individually clamped, borehole geophones and a borehole hydrophone. On the deployment at Site 534 in the Blake-Bahama Basin in 1989 [*Stephen et al.,* 1994] the sondes were clamped at depths of 10m, 40m, 70m, and 100m below the seafloor. Acceleration spectra from SEABASS [*Bradley,* 1994; *Bradley et al.,* in press] are valid down to 0.3Hz (see figure) but do not show the noise notch between 0.1 and 0.2Hz which is seen on the adjacent Ocean Bottom Seismometer (OBS). SEABASS and the OBS used 4.5Hz and 1.0Hz geophones respectively and the 4.5Hz phones roll off considerably below their cutoff frequency. The noise notch marks the transition from infragravity waves whose wavelengths are long enough to directly force the crust (less than 0.05Hz; [*Webb et al.,* 1991]) to the microseism band (0.01-5.0Hz) where non-linear wave-wave interaction is acoustically interacting with the crust [*Hasselman,* 1963; *Kibblewhite and Wu,* 1991; *Longuet-Higgins,* 1950). The microseism band can be further subdivided into four bands/ At the microseism peak (0.03-0.04Hz) spectral levels vary by less than 2 dB over the full length of the array. Just above the peak (0.4-0.75Hz) the noise levels are much quieter, up to 15dB on horizontal components, at the deep sensors. The 0.75-2.1Hz band is characterized by peaks in the OBS spectra near 0.75, 1 and 2Hz. None of the peaks are observed on the horizontal or vertical channels at 70 or 100m. In the 2.1-5.0Hz band (the Holu band [*McCreery et al., 1993*]) the borehole sondes all have comparable levels which are about 20dB and 10dB lower than the OBS for horizontal and vertical sensors respectively. At 5.0Hz there is a strong peak on the OBS horizontal components which we suspect is an instrument resonance. Above 5Hz local wave breaking, shipping, biologics and industrial sources have been postulated to control ambient noise levels [*Urick,* 1983]. Between 5.0 and 20Hz the borehole sensors have uniform values and are 20 and 10dB quieter than the OBS for horizontal and vertical components respectively. Most of the improvement in ambient noise occurs in the upper 10m. Figures like this, which compare spectral levels for various sensor types, can be used to determine the best sensor configurations for particular objectives.



Comparisons of SEABASS and OBS spectra for horizontal (above) and vertical (below) components show that borehole sensors are generally quieter than seafloor sensors from 0.3-20Hz.

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