Split-beam calibration of the OOI echosounder

Mei Sato[1], Kelly J. Benoit-Bird[1], Kent Fletcher[1, 2], Walt Waldorf[1, 2], Christopher Wingard[1, 2]

[1] College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, 104 CEOAS Admin Bldg., Corvallis, OR 97331

[2] Ocean Observatories Initiative

Summary

In-situ calibrations of the 120 kHz, split-beam EK 60 echosounder were conducted at 80-m site on the OR line (CE02SHBP; 44.6370 ºN, 124.3059 ºW). A tungsten carbide sphere (38.1-mm diameter) was floated 10 – 12 m above the transducers on the August 2, 2015 deployment of the instrument and floated away from the instrument via a sacrificial burn link on August 18, 2015 (Figs. 1, 2). Data were collected at 1 Hz for the first 20 min of every hour. We used the standard calibration method (Demer et al., 2015) for the 120-kHz split-beam echosounder, where on-axis single targets can be isolated. On-axis single targets were selected in Echoview (version 6.1; Echoview Software Pty Ltd), using their 'single target detection – split beam (method 2)' and 'filter targets' algorithms. The settings were chosen so that only on-axis targets could be selected, resulting in 270 single targets. Target strength (TS in dB) values beyond 1.5 interquartile range were identified as outliers and removed from the analysis. TS of the single targets was determined using the least square method. The integrated area scattering measured as Nautical Area Scattering Coefficient (NASC in m^2 nmi^{-2}) that corresponding to the single targets was obtained through Echoview by integrating over 5 bins (0.96 m). Calibration values were determined by comparing the measured TS and NASC values to the sphere's theoretical values (Tables 1, 2). Recommended parameters for the data analysis of EK60 (OOI's Serial Number = 05) using Echoview were summarized in Table 2. Use of default vs. recommended parameters resulted in 5 dB difference in mean S_v values (Fig. 3), affecting our ability to separate organism types using multifrequency echosounders as well as biomass estimates that may result from these data. In-situ calibrations provided critical foundation for quantitative analysis of the OOI acoustic time-series data.

Acknowledgements

We thank the Ocean Observatories Initiative for deployment of the bioacoustics platform and collecting the data.

Reference

Demer, D.A., Berger, L., Bernasconi, M., Bethke, E., Boswell, K., Chu, D., Domokos, R., others, 2015. Calibration of acoustic instruments. ICES Coop. Res. Rep. 326, 1–133.

Table 1. Parameters used for calibrations. Sound speed and absorption coefficient values are default values used in EK60.

Frequency (kHz)	120
Sound speed (m/s)	1493.9
Density of seawater (kg/m^3)	1026.6
Absorption coefficient (dB/m)	0.0374
Theoretical TS (dB)	-39.45

Table 2. Recommended parameters for the data analysis of EK60 (OOI's Serial Number = 05) using Echoview, with default values in parenthesis. Absorption coefficient and sound speed values depend on the data period of interests, therefore excluded from the summary.

Frequency (kHz)	120
Beam type	split
Transmit power (W)	250
Pulse duration (ms)	1.024
3 dB beam angle: minor (º)	7.3 (7.0)
3 dB beam angle: major (º)	7.4 (7.0)
Angle offset: minor (º)	0 (0)
Angle offset: major (º)	0 (0)
Angle sensitivity: minor	23.0 (23.0)
Angle sensitivity: major	23.0 (23.0)
2-way beam angle (dB)	-20.3 (-20.7)
TVG correction	Simrad Ex60
Transducer gain (dB)	27.88 (25.0)
Sa correction (dB)	-0.48 (0.0)

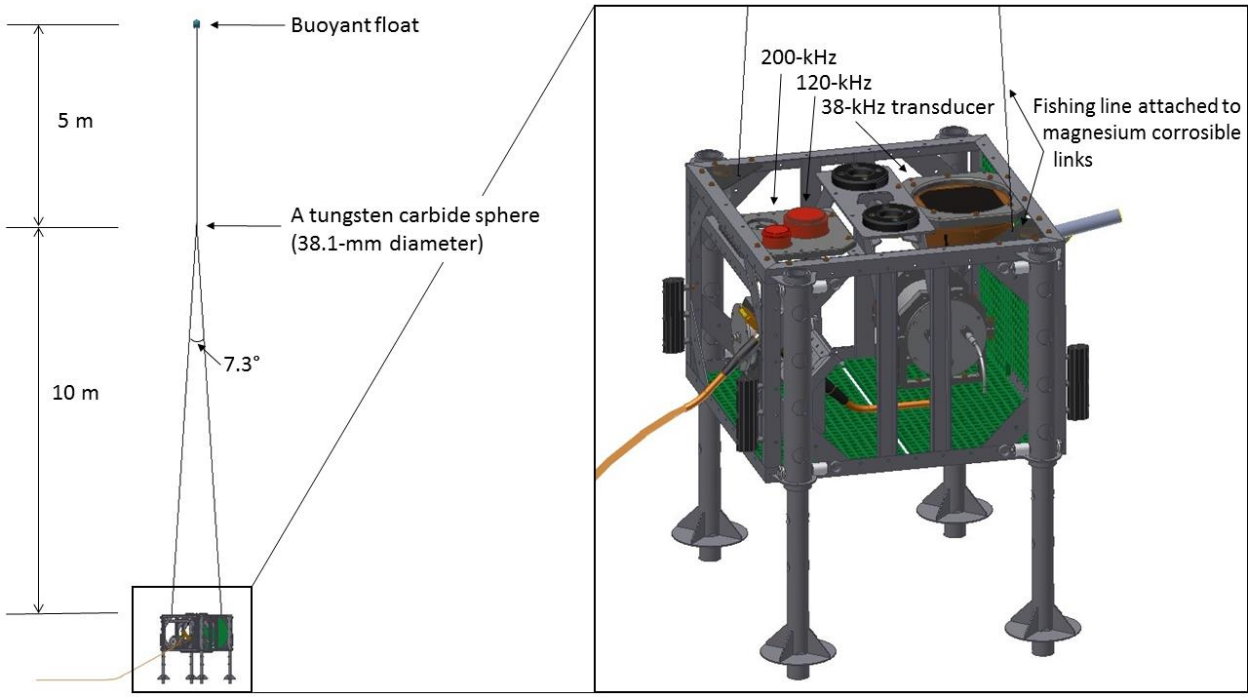

Figure 1. Deployment configuration of the bioacoustics platform with EK60s and a calibration sphere at 80-m site on the OR line.

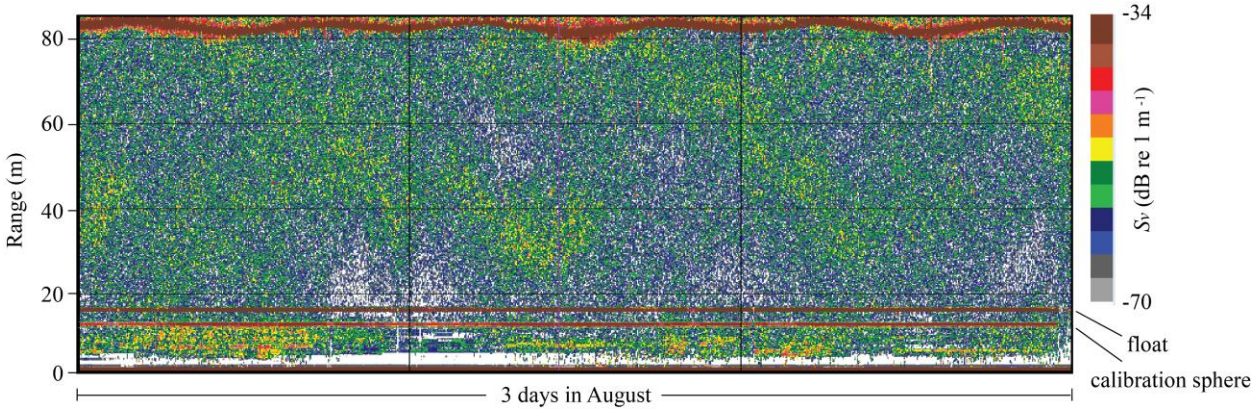

Figure 2. Example echogram with a calibration sphere located at ~ 11-m range along with a float at ~ 14 m.

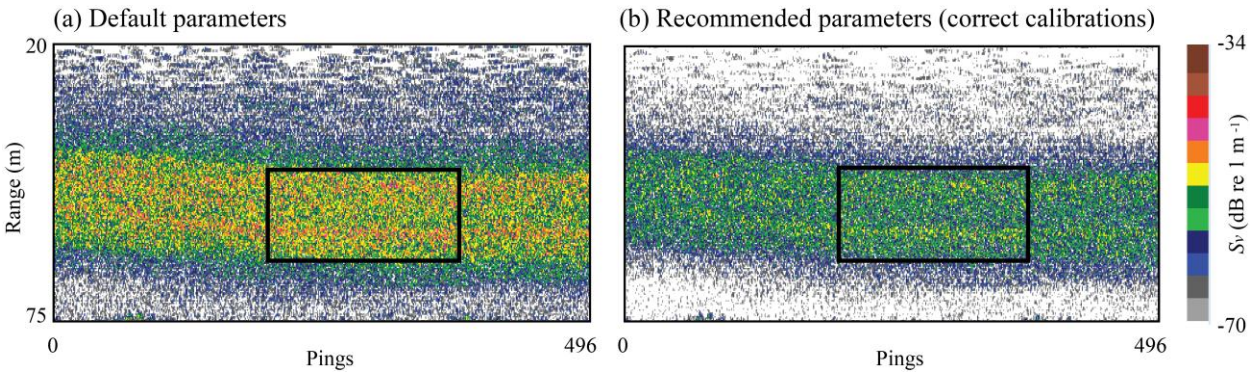

Figure 3. Effect of calibration values on the frequency response at 120 kHz. Mean S_v values shown in the black boxes resulted in 5 dB difference between the use of (a) default values and (b) recommended parameter.