



Potential for an environmentally safer technological alternative to marine seismic airguns

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Marine seismic surveys using airguns, can, on occasion, be heard over thousands of kilometers of ocean. Documented impacts on marine mammals, fish, and invertebrates include changes in vocalizations which can affect feeding, mating, or navigation; displacement from habitat, changes in abundance, or lower catch rates. Behavioural or physiological (stress) effects and “masking,” or obscuring of signals important to an animal, are possible even at long ranges. Marine Vibroseis (MV) may provide a marine seismic sound source that has less environmental impact than conventional airguns. Modelled sound levels from a realistic MV array and airgun array with similar downward energy at frequencies < 100 Hz were compared under three scenarios: shallow, deep, and slope. Changing the layout of the MV array’s higher frequency sources reduced sound exposure levels (SELs) by 4 dB. At 100 m range this MV was 20 dB lower in peak-to-peak sound pressure level vs. the airgun array, decreasing to 12 dB lower at 5 km, the maximum modelled range for peak levels. SELs were less clear-cut, but for both shallow and deep water, MV produced 8 dB lower SELs than the airguns at 100 km range because of MV’s reduced bandwidth. Overall, MV produced lower broadband SELs, especially at long range, and lower peak pressure, especially at short range, than airguns. MV thus shows potential in providing an environmentally safer alternative to airguns without compromising effectiveness for seismic exploration. The acoustic footprint, as measured in terms of peak-to-peak pressure, is substantially smaller for the MV array than the airgun array, which could greatly reduce the number of animals exposed to sound likely to cause injury. These results can be added to the previously recognized environmental benefits of MV over airguns, namely the elimination of the rapid rise time and unnecessary (unused) high frequencies of airguns, and the greater real-time control and flexibility of the MV signal. MV could have particular advantages in shallow water, both from a geophysical point of view and biologically, because SELs drop off more rapidly in these waters, which tend to be richer in marine life. However, attention must be paid to the MV array layout, especially of the higher-frequency sources, to reap the greatest reduction in sound emission levels. In terms of the Marine Strategy Framework Directive Descriptor 11 (Noise), noise registers, used to document human-generated noise sources, need to adapt to include different types of seismic sources such as MV.