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Academic "Treasure" from Industry "Trash"- Unconventional Imaging with Large N Seismic Exploration Datasets

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The rapidly expanding use by the oil and gas industry of “nodal”, large channel capacity areal arrays that record continuously for extended periods of time is generating large volumes of data in excess of that needed for the conventional CMP reflection imaging that is the primary goal of such surveys. These excess data, once considered as simply “noise”, have recently been recognized to have utility not only for the exploration seismologist but also for addressing a diverse range of phenomena. The most widely recognized use for these “noise” records is surface wave tomographic imaging of near surface velocity structure via seismic interferometry of ambient natural noise. Such results are proving to be of great value in enhancing conventional 3D exploration imagery, but they should be appreciated in their own right for the information they provide on the shallow subsurface to the hydrologist, engineer and tectonicist. Another relatively dramatic application is the delineation of local structure by tracing the propagation of body and surface waves from local and teleseismic events across these dense arrays. Here I would like draw attention to three other promising uses for such data: a) detection and mapping of microseismicity below the detection thresholds of conventional earthquake monitoring networks, especially in areas of low conventional seismicity; b) body wave and surface wave imaging of structure using cultural, as opposed to natural, energy sources, and c) systematic mapping of the basement in 3D using the existing exploration sources recorded at travel times longer than that typically harvested for resource purposes. We conclude by emphasizing that these potentially invaluable “extras” are now being recorded routinely around the world, but there is as yet no mechanism in place to ensure they are exploited rather than simply deleted.

