Seismic Array Analysis on Maer Down Cliff, Bude

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From 1st-7th November 2021 I undertook fieldwork in Bude, Cornwall for my PhD, supported by the British Geophysical Association's Gray-Milne Travel Bursary. The area is known for its geology, with regional deformation of sedimentary rock (the Bude Formation) with folds visible in the cliffs and on the beach. The specific site used (for which I was given permission by the National Trust) was where the sedimentary layers are rotated to near vertical which, for my purposes, forms a simple natural sandbox with a layer of soil over a half space of near horizontal transverse isotropy (HTI). My study looked at active-source array analysis (partly as a proxy for passive-source), with various other survey types to act as constraints. The goal was to get data in a simple geological setting to test my array analysis workflow, before applying the methods to seismic data in more complex geology, because synthetic tests are limited by idealistic fake noise.

We took 65 three component wireless seismic nodes and ERT (electrical resistance tomography) kit. First, we did 4 differently oriented refraction surveys, to try to observe P-wave anisotropy and estimate the soil layer depth to constrain surface wave inversion.

We then did two resistivity lines perpendicular to the cliff, hoping these can be used to identify where the different sediment layers go further back into the cliff, particularly to check whether there is a significant change in geology under the array. Some passive seismic data was used that may be able to be used for seismic gradiometry.

Finally, the main experiments involved setting out 2D arrays using 65 seismometers and doing an active-source walk-around surveys using a hammer and plate source. Based on initial estimates of surface wave velocity very small arrays were used, one 3m wide and the other 5m. Using these arrays, we also did walk-away surveys at different orientations (one to the North, one to the East, etc.) and lines of shots offset from the array, walk-past surveys if you will.

Data analysis is ongoing, and I am very grateful for the bursary that helped me to do this fieldwork for my PhD and all the people and organisations that helped me along the way.