Clim. Past Discuss.,
https://doi.org/10.5194/cp-2018-4-AC2, 2018

Climate of the Past Discussions

Interactive comment on "Technical note: Optimizing the utility of combined GPR, OSL, and LiDAR (GOaL) to extract paleoenvironmental records and decipher shoreline evolution" *by* Amy J. Dougherty et al.

Amy J. Dougherty et al.

adougher@uow.edu.au

Received and published: 7 March 2018

Hi Zhixiong Shen,

Thank you for your comments on this technical note. Glad to hear you think GOaL makes perfect sense and see the potential of having a more systematic and semi-standardized data collection as well as interpretation. I also appreciate the specific comments and the reminder to reference the good work by Mallinson and co. in some of my examples. In order to be sure that I address all of your other feedback, I will go

through your remarks one by one below:

One advantage of combining Li-DAR topography and GPR not mentioned yet is that the former is very useful for elevation correction of the latter. However, some common pitfalls of the individual technique are not mentioned, which makes the strategy practically less useful to follow.

-LiDAR is useful for rough topographic correction. Due to the fact that I use most of my data to try and infer sea level from heights of beachfaces and storms form their geometry, I like to use the most accurate topographic correction possible. To eliminate the uncertainties associated with LiDAR and extracting the exact transect line form the image that the GPR was collected along (usually the two data sets are acquired on different dates allowing possible discrepancies), I prefer the old school method of levelling or laser levelling in the actual elevations of the GPR transect line. This should be done at the time of collection and include a survey of the active beach and tie in any existing benchmarks. This is standard along with coring to ground-truth depth to water table on the day of GPR collection.

GPR data collection and interpretation depend not only on gain, but also on the frequency of radar, antenna shielding, spacing of traces, and speed of radar in sediments of different nature. I am not sure why the note specifically picked gain, but not others in the recommendation.

-True there are many different set up and settings when it comes to collecting GPR. What is ultimately chosen depends greatly on the access to gear, the field conditions, the scientific question to be answered, etc. At this point there are plenty of papers and books about GPR that people can turn to in order to understand how GPR works and what settings are best for each particular study. The aim of this paper was to show the potential of optimizing the use of GPR in combination with OSL and LiDAR, not a' how-to' guide with specifics for acquiring and analysing each data set. Rather this paper works on the basis that readers have a standard knowledge of, and some

experience with, these techniques. As advocated in the paper, it is important to lean from or collaborate with experts using each of these three methods as they are specific fields within geophysics, geochronology and remote sensing.

-With respect to GPR, the units have become so affordable and user-friendly it has become relatively easy to access a machine, turn it on, and get data. While this is absolutely fantastic for the expansion of its use in many fields, there is a danger that without proper knowledge and training data can be collected incorrectly and/or misinterpreted. For the most part in the field of coastal research this is not the case, probably because it has been used in this field for so long with many people and papers to turn to. Therefore, most papers have the basics correct. The reason gain is singled out is for two reasons: 1) applying a high gain (as well as highlighting every reflection) is one very common occurrence in coastal data and 2) it is an incredibly important adjustment when trying to extract storm and sea level records from sandy barriers. I have increasingly noticed that along with the proliferation of GPR use, more papers and conference presentations don't have the gain adjusted so that the signal strength aptly reflects the contrast in the stratigraphy. I have seen high gain inhibit the identification and extraction of a sea level curve from otherwise good data and result in an exaggeration of the storm frequency and impact as demonstrated in Oliver et al. (2017b).

OSL age determination is affected by many assumptions about bleaching, distribution of radioactive sources in the sediment, water content variation, post depositional disturbance, disequilibrium in the uranium and thorium decay series, and cosmic radiation (often a very important component to the total radiation a beach sample received) change because of change of overlying sediment thickness. The choice of appropriate age model does not handle all these complications. -These are important considerations and will be assessed for incorporation within the manuscript.

One more recommendation about OSL date is that the ages should be reported in a way to enable comparison across different publications. This is because OSL ages refer to the time before OSL measurement and the measurement time must be reported

to ensure comparison. As an example of inappropriate reporting OSL data, I noted that the note used 'BP' as a unit for OSL data, which suggests to me that these OSL data refers to AD 1950 following the most common use of BP in the geochronology community. However, my sense is that I am reading the unit 'BP' in the note wrongly.

-Another good point, this will be addressed in the final draft of the manuscript if accepted.

Hopefully that provided the insight you were seeking. Cheers, Amy

---

Interactive comment on Clim. Past Discuss., https://doi.org/10.5194/cp-2018-4, 2018.