

How will the coast around my hometown be affected by climate change in my lifetime?

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Overview

Students have asked: How will sea level rises caused by climate change and global warming affect the coastline near their homes? Studying a Site of Special Scientific Interest (SSSI) at Gibraltar Point National Nature Reserve on the North Sea Coast of Lincolnshire, students are making detailed recordings of the coastline which can be repeated in future and compared to identify any changes over time or after significant weather events.



Gibraltar Point NNR (Lincolnshire), photos taken by students.

Aims

- Produce a series of 3D models of sections of the tidal beach at Gibraltar Point
- Take samples from the beach for sedimentological analysis
- Inform future coastal modelling and defense planning

Methodology

Drone survey flight plans are created on a free app called Pix4Dcapture, and consider flight time - owing to battery capacity - and image resolution - owing to drone altitude - (at 10m minimum flight altitude the 4K camera gives a resolution of 2.7mm per pixel – enough to distinguish very small features).

Photogrammetry flights capture overlapping, high-resolution images of geomorphological features.

DNG files are imported into Agisoft Photoscan Pro to produce a point cloud and then a 3D model of the area photographed. This can be repeated at monthly intervals and compared to show aggradation rates.

Samples collected from the beach where the photogrammetry survey was conducted are dried, sieved and their composition of different size particles recorded. Data are then sent to STEM partner organization, Basin Dynamic Research Group (BDRG) at Keele University for further investigation. Subsequent analyses are explained to the students in workshops led by representatives from BDRG & Keele University.

Background information

As global warming and climate change cause sea levels to rise and weather patterns to become more energetic, it might be expected that coastal erosion in areas already susceptible will increase. Will the spit at Gibraltar Point be lost to the sea (and the valuable habitat behind it), or will erosion further up the coast cause increased deposition and the growth of the spit and expansion of the habitat behind it? In just a couple of years before our project began, it has been noted that new sandbars have formed just offshore due to beach nourishment schemes up-shore. Our project may complement data now being collected by the Environment Agency who have recently installed a LiDAR monitoring station.

Predicted results

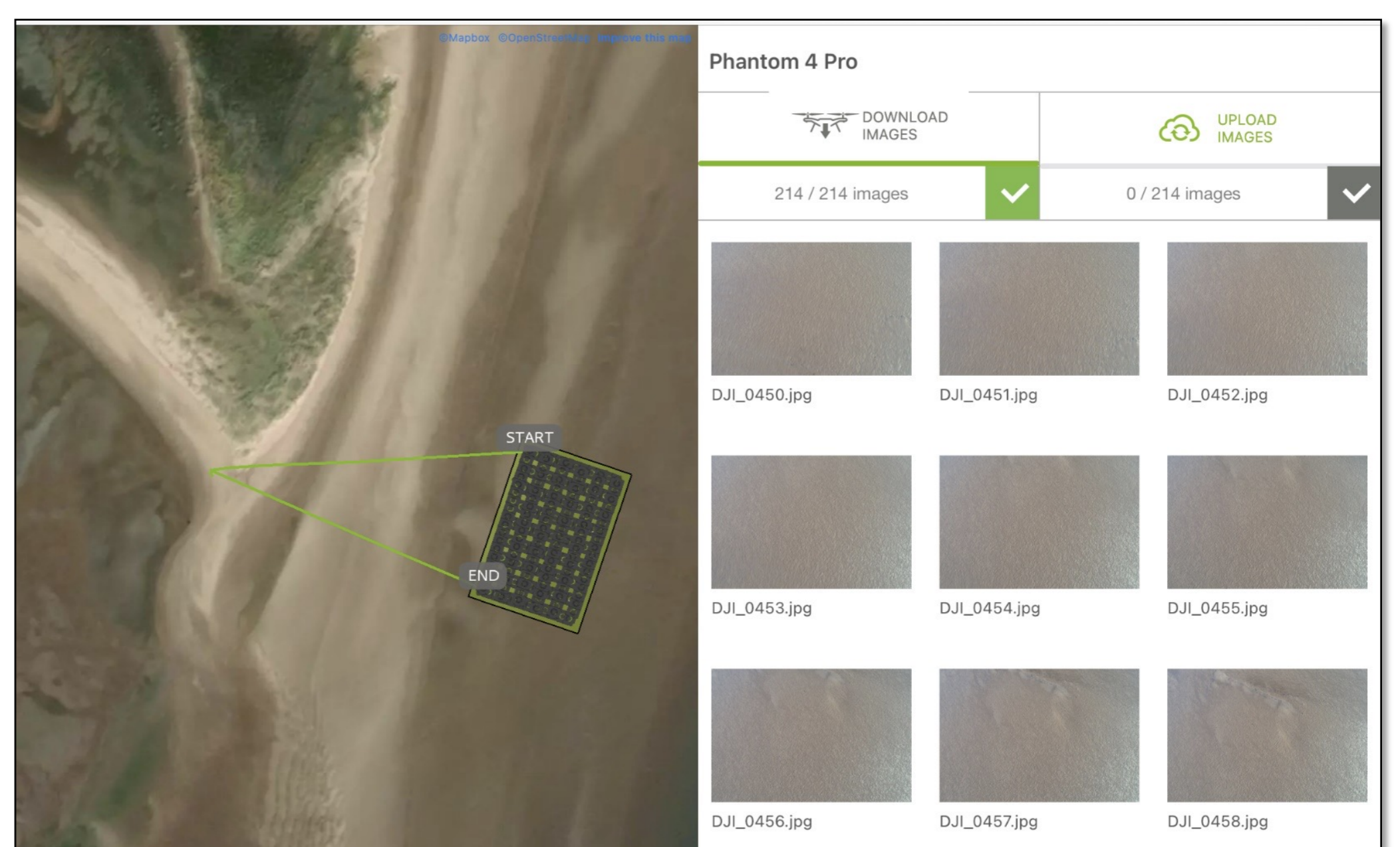
Results will become clear over time as we return to Gibraltar Point in future months and years to survey the same areas – we will then be able compare models of those sections of the beach down to sub-centimetre scale. Changes may be explained by significant weather events or coastal remediation works further up the coast.

Conclusion

Comparing our images and models of the coastline, it is immediately clear that we are achieving much higher resolution than satellite images of the same area. However, we are only able to survey much smaller areas. Consequently, our findings might be considered representative of that type of coastline and applied elsewhere, via publication in scientific journals.

Next steps

We have learned a lot about the drone technology we are using, and its limitations. Because the project is so popular, we will seek to increase the number of drones we have to survey a greater area and increase student participation.



Pix4Dcapture drone photogrammetry app.