

Citizen Science UAVs for Monitoring Shoreline Change

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Introduction

Climate change is projected to increase risks to coastal environments through drivers such as sea-level rise, changes in wave-direction and increases in swell energy and storm tide events. These drivers affect coastal erosion, sediment supply and inundation and are expected to vary geographically across Victoria's coastal zone.

We have developed an integrated system of modelling shoreline change, and the rate of coastal erosion or accretion and sediment budgets over different temporal scales using Unmanned Aerial Vehicles, or UAVs. UAV coastal mapping provides an effective, non-destructive way to monitor shorelines that have been difficult to achieve with traditional approaches. The resultant data can be used for assessing and monitoring shoreline change, sand erosion and accretion, land slips, sand height, and cliff change.

The Victorian coastline is too vast to us to monitor alone. For that reason, the Victorian Coastal Monitoring Program (VCMP) is training Citizen Science groups in the use of UAVs for Monitoring Shoreline Change in priority areas. The Citizen Science groups operate under the < 2 kg Excluded category for UAV operation in the We are providing the communities with the skills and understanding to capture meaningful data on coastal change, and subsequently inform management processes along the entire Victorian coastline.

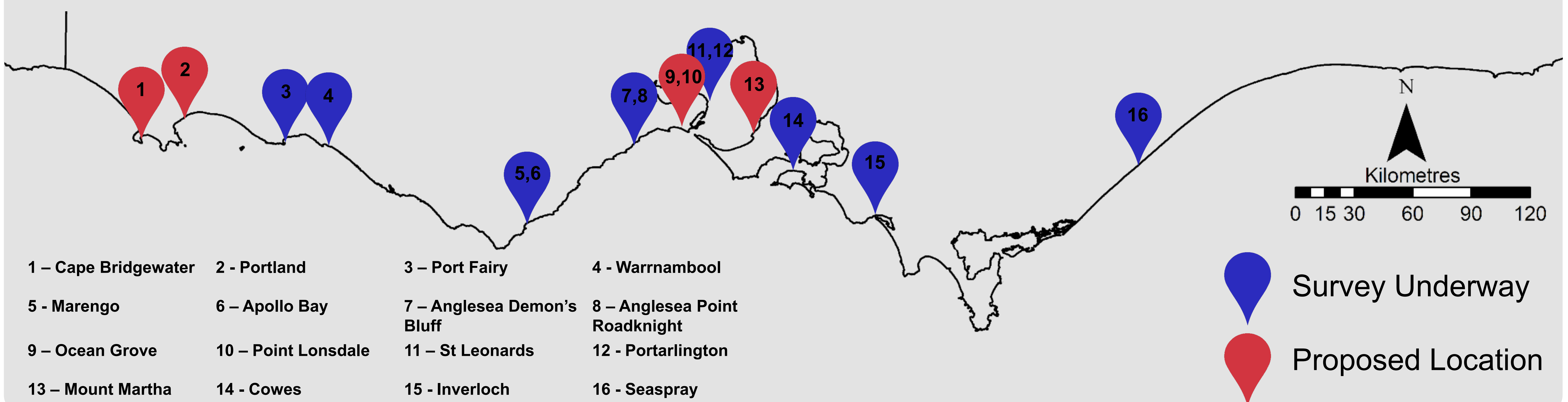
Equipment and Training

Each Citizen Science group is provided with professional survey-grade equipment, including:

- DJI Phantom 4 Pro
- 3 Batteries
- Spare Propellers and SD Cards
- Launch Pad
- iPad Mini
- Propeller AeroPoint high-precision PPK Ground Control Points
- Standard Survey & Operational Procedures for UAV Mapping Coastal Erosion

The survey methods were designed for citizen science groups to maximise the collection of geophysical information related to shoreline change within a timeframe of half a day using a single airframe, 3 batteries and smart targets for positioning.

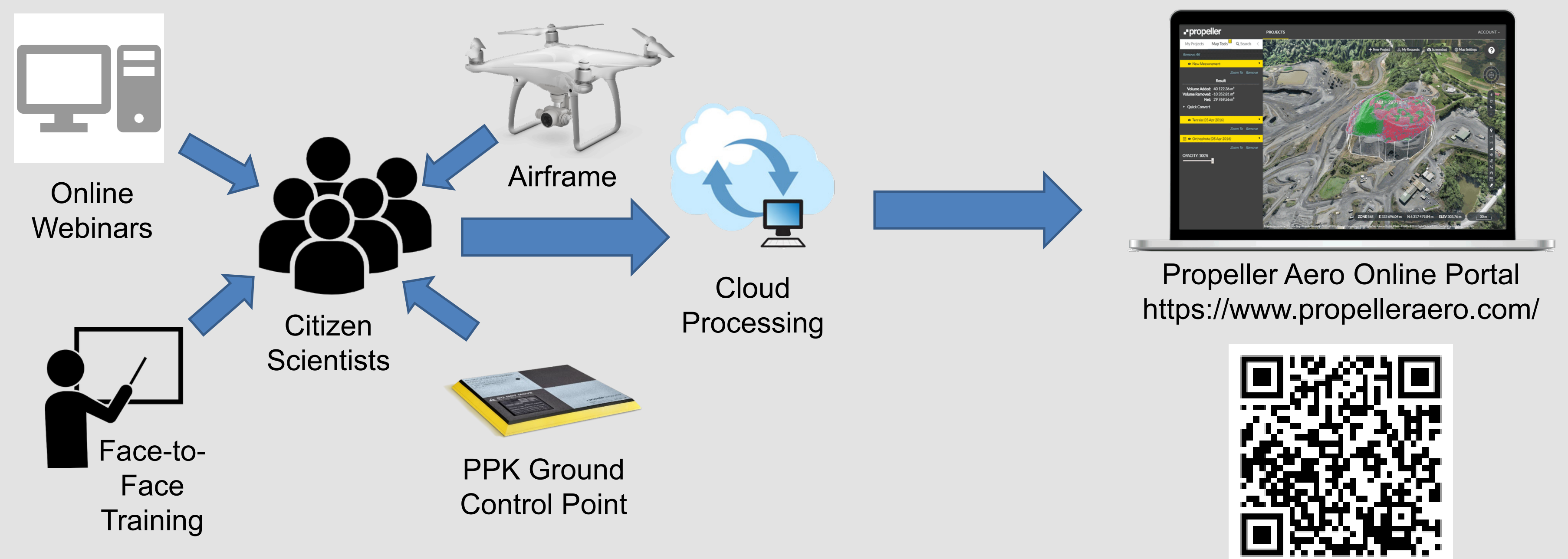
Sites of Interest



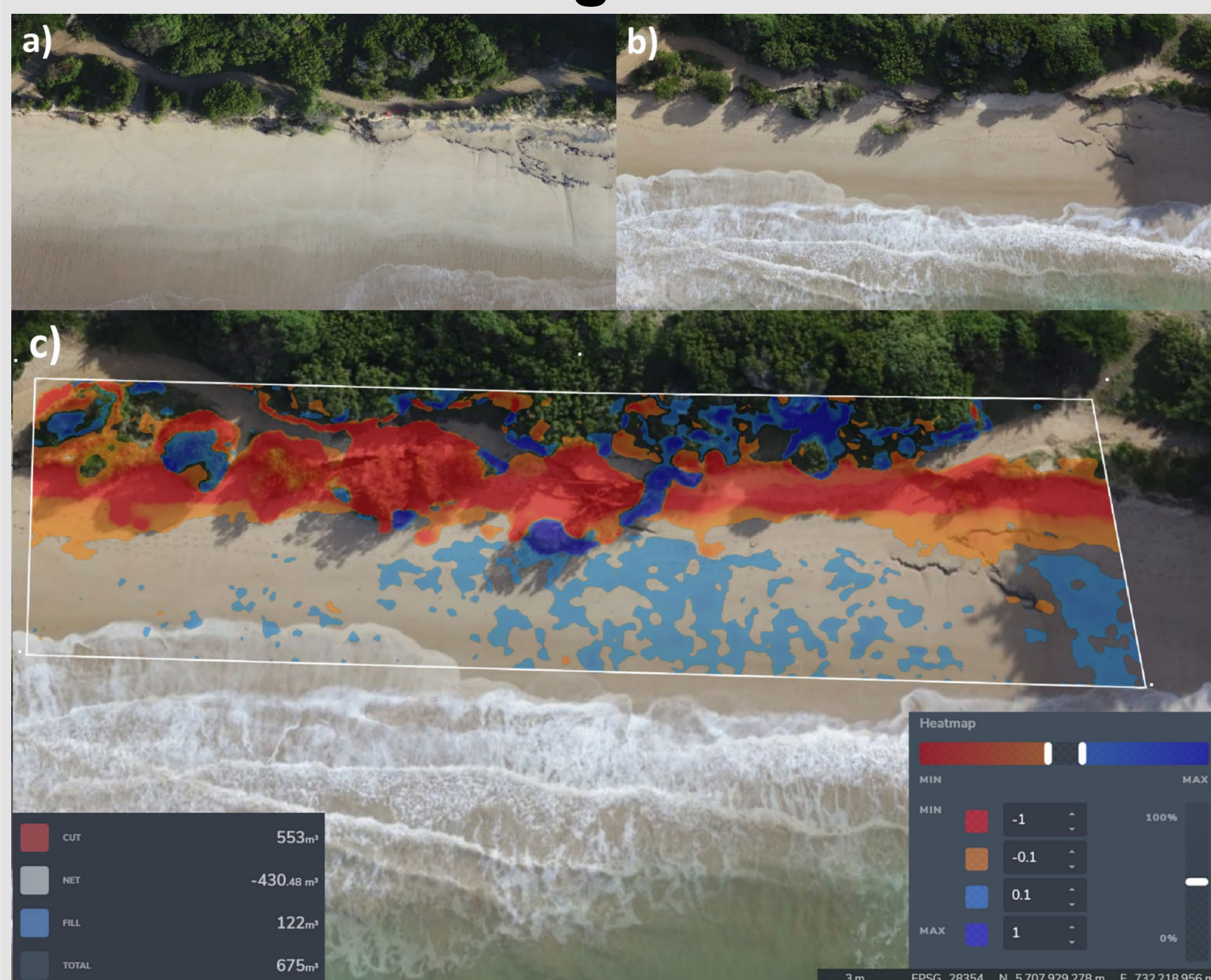
Data Processing

We have teamed up with PropellerAero, a cloud-based data processing and analysis portal. The portal was developed for the mining and surveying industry, but is extremely intuitive and user-friendly.

The PropellerAero Online Portal ensures the data is freely accessible to land managers and the wider community not only to visualise, but to take measurements and perform analysis. From this, we are able to visualise and calculate the extent of coastal erosion and accretion at priority locations along the Victorian coastline.

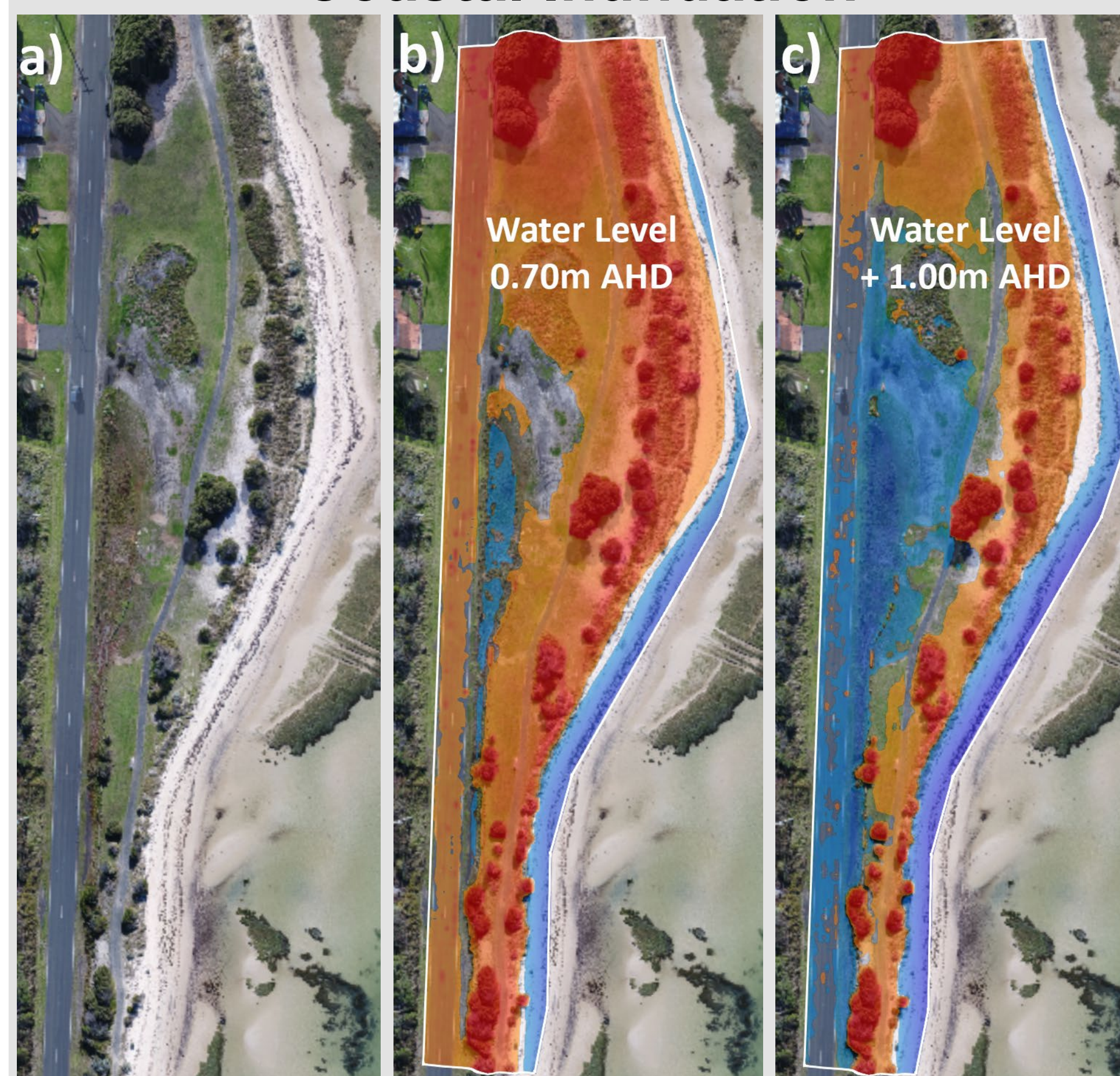


Storm Damage Assessment



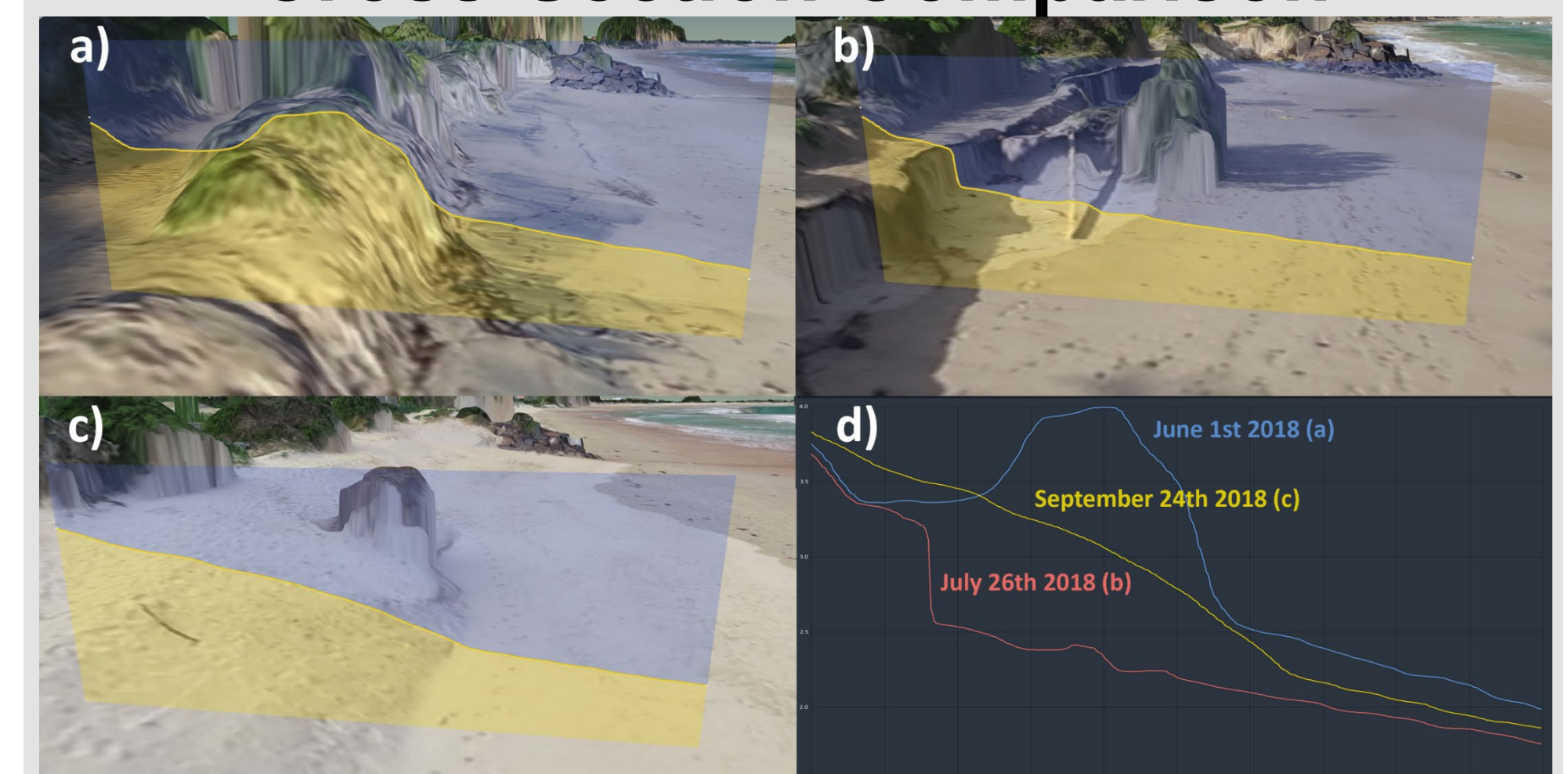
Storm damage before and after a major storm event at Apollo Bay. Red indicates erosion, and blue indicates accretion. a) June 1st 2018, b) July 26th 2018, c) Volumetric comparison between the two dates. Over 430 m³ of sand was lost along a 75 m stretch of beach.

Coastal Inundation



Coastal inundation predictions in St Leonards. Red indicates locations above reference, and blue indicates locations below the reference. From left to right; a) image of location, b) inundation based on a 0.70 m AHD, c) inundation based on a 1.00 m AHD. Note that the dune and vegetation currently protect the road from inundation.

Cross-Section Comparison



A 10 m cross-section comparison of storm damage at Apollo Bay. a) June 1st 2018, b) July 26th 2018, c) September 24th 2018, d) graphical representation of all cross-sections at Apollo Bay.

Conclusion

The VCMP Citizen Science Coastal Monitoring Program has currently trained 24 community members in the safe operation of UAVs, independent data collection by the Citizen Scientists at 5 sites, and 70 datasets collected across the 11 sites currently being monitored. By June 2019, we intend to have baseline data collected at all the identified priority locations, and independent data collection by the Citizen Scientists at 9 sites. By the end of 2019 we intend for data collection at all sites to be undertaken independently by the Citizen Scientists.

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