

## Live web-based presentation of 3D coastal rockfall monitoring

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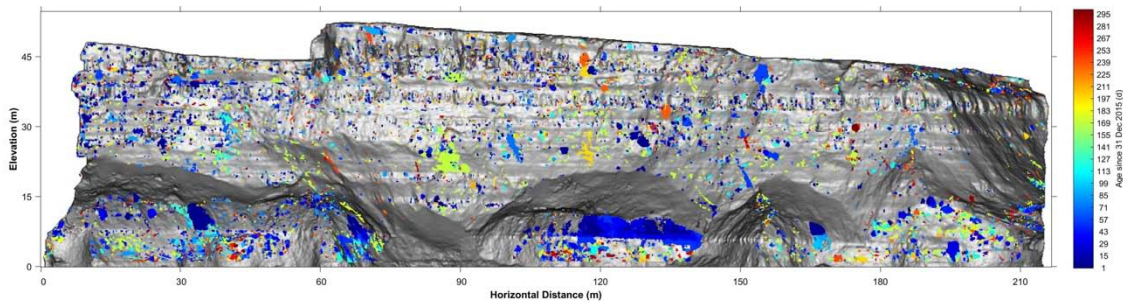
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We present a web-portal that displays near-real-time 3D data from constant 3D monitoring of rockfalls based on terrestrial laser scanning. Building on recent research on the development of algorithms that take advantage of the ability to detect small changes through time from high-frequency and high-resolution scanning, we present a platform that fully automates this workflow from data collection to dissemination. Our aim here is to make data, that can often be contentious, open and accessible to stakeholders.

Here we demonstrate the system using two monitoring installations on the NE UK coastline, where erosion is a pressing day-to-day issue for both the local government, but also for local communities who live on the coast. The first system is mains powered with fixed telecoms, mounted in a lighthouse at Whitby. The second is totally self-contained, housed in a custom box, with solar power and full 4G communications, and so can be deployed in any location (Fig. 2). Using data collected from these system, we consider specifically the case of storm events, which are suggested to dominate net erosion but are also causing increasing public concern. Our system allows the impacts of current conditions to be captured and presented. To assess the role of storm impacts, we draw on an inventory of rockfalls, gathered from March 2015 onwards to put current conditions into context (Fig. 1).



*Figure 1: 9 months of near constant 3D monitoring of rockfall at Whitby. Rockfall are colour by age of rockfall since the start of monitoring at a resolution of 1 hour.*

We find that the occurrence of storms drives an increase in the rate of rockfall activity above baseline mass wasting. Storm events account for up to 10% of the total long-term recorded erosion, suggesting a direct link between rockfall and rainfall. Our database includes storms Eva and Frank, which resulted in widespread flooding across the UK in December 2015. An analysis of the relationship between individual rockfall timing and the passage of these rainfall events shows that up to 30% of the largest 1,000 rockfall occurred during periods of rainfall, and 60% occurred within 24 h of rainfall.



*Figure 2. Deployment of an autonomous laser scanner housed in custom metal container.*

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### **References**

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