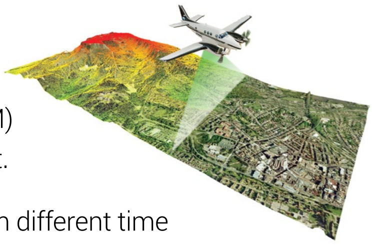
THE BIG FLOOD:
WILL IT HAPPEN AGAIN?

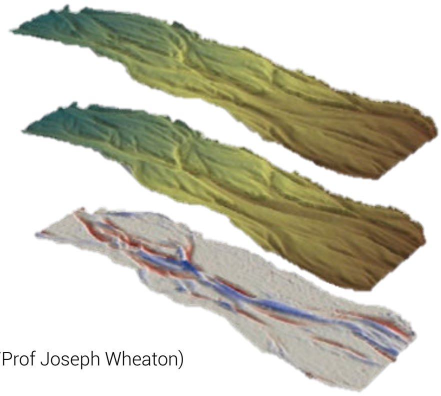
LiDAR - Helping to keep soil on the paddock

Soil erosion costs farmers, councils and water supply agencies millions of dollars each year. Knowing where soil is eroded or deposited in a catchment can inform better management decisions.

Using LiDAR creates an accurate Digital Elevation Model (DEM) of a whole catchment.



Analysis of DEMs from different time periods, such as before and after a major flood, allows assessment of the amount, position and processes of erosion and deposition over the entire river system.



(Figure courtesy of A/Prof Joseph Wheaton)

The Big Flood Project found that channel banks and benches were net erosional, while the inner channel and floodplains were net depositional. Investment in on-going catchment LiDAR capture is essential to understand sediment movement to enable appropriate management plans to be developed and monitored for adaptation. Keeping soil on the paddock reduces the sediment that ends up in our drinking water, in Moreton Bay and protects valuable farming land in the Lockyer Valley, which provides more than 35% of Queensland's vegetable production valued at more than $160 million annually (SEQ Catchments and others, 2013). So the cost to collect LiDAR for the entire Lockyer catchment is less than 1% of this value – a relatively small price for accurate information to inform decisions.

Erosion and deposition in the Lockyer catchment after the 2011 floods.

FURTHER READING

Croke, J., Todd, P., Thompson, C., Watson, F., Denham. R., Khanal, G. 2013. The use of multi temporal LiDAR to assess basin-scale erosion and deposition following the catastrophic January 2011 Lockyer flood, SE Queensland, Australia. Geomorphology. 184:111-126.

LiDAR - Further reading

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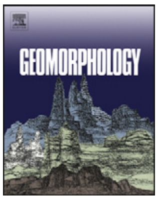

The use of multi temporal LiDAR to assess basin-scale erosion and deposition following the catastrophic January 2011 Lockyer flood, SE Queensland, Australia

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A B S T R A C T

Advances in remote sensing and digital terrain processing now allow for a sophisticated analysis of spatial and temporal changes in erosion and deposition. Digital elevation models (DEMs) can now be constructed and differenced to produce DEMs of Difference (DoD), which are used to assess net landscape change for morphological budgeting. To date this has been most effectively achieved in gravel-bed rivers over relatively small spatial scales. If the full potential of the technology is to be realised, additional studies are required at larger scales and across a wider range of geomorphic features. This study presents an assessment of the basin-scale spatial patterns of erosion, deposition, and net morphological change that resulted from a catastrophic flood event in the Lockyer Creek catchment of SE Queensland (SEQ) in January 2011. Multitemporal Light Detection and Ranging (LiDAR) DEMs were used to construct a DoD that was then combined with a one-dimensional flow hydraulic model HEC-RAS to delineate five major geomorphic landforms, including inner-channel area, within-channel benches, macrochannel banks, and floodplain. The LiDAR uncertainties were quantified and applied together with a probabilistic representation of uncertainty thresholded at a conservative 95% confidence interval. The elevation change distribution (ECD) for the 100-km^2 study area indicates a magnitude of elevation change spanning almost 10 m but the mean elevation change of 0.04 m confirms that a large part of the landscape was characterised by relatively low magnitude changes over a large spatial area. Mean elevation changes varied by geomorphic feature and only two, the within-channel benches and macrochannel banks, were net erosional with an estimated combined loss of 1,815,149 m^3 of sediment. The floodplain was the zone of major net deposition but mean elevation changes approached the defined critical limit of uncertainty. Areal and volumetric ECDs for this extreme event provide a representative expression of the balance between erosion and deposition, and importantly sediment redistribution, which is extremely difficult to quantify using more traditional channel planform or cross-sectional surveys. The ability of LiDAR to make a rapid and accurate assessment of key geomorphic processes over large spatial scales contributes to our understanding of key processes and, as demonstrated here, to the assessment of major geomorphological hazards such as extreme flood events.

For more information about the project

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