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High resolution survey of wide sand-bedded braided river dynamics using combined digital photogrammetry and image processing

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Braided rivers represent an extreme challenge for the application of geomatics to geomorphological enquiry: they are associated with a low relative relief (+/- 2 m); the area of interest is commonly extensive (active channel widths $>$ 500 m); the rate of change of surface elevation is generally low except in the vicinity of individual braid channel banks where the rate of change is very high; there is the complication that comes from partial inundation; and there may be an added complication in the presence of vegetation. This paper presents the first application of geomatics to the quantification of sand-bedded braided river dynamics covering a 500m wide and 3 km long reach of the Saskatchewan River, Canada. Digital photogrammetry was used to quantify dry area and water edge elevations. A highly novel methodology was then used to calibrate the spectral signature of inundated areas the associated images using a combination of two media digital photogrammetric methods and image matching. This allowed the determination of detailed depth maps for inundated areas for combination with the dry area data and the creation of complete surface elevation models. Error propagation was used to determine the levels of change that could be detected from sequential digital elevation models. The result was a series of elevation models that provide the first evidence of large, sand-bed braided river dynamics, which starts to question some of the basic assumptions that we hold regarding sand-bed braided river behaviour. The development of geomatics we report in this paper is particularly important as it pro-

vides a general methodology for acquiring detailed and precise elevation data from any historical aerial imagery without the need for associated calibration data.