VISUALISATION OF 3D MULTI-RESOLUTION ORBITAL IMAGES FOR FLUVIAL GEOMORPHOLOGY IN GALE CRATER, MARS. D. M. Persaud[1], J. D. Campbell[1], Y. Tao[1], and J.-P. Muller[1], [1]Imaging Group, Mullard Space Science Laboratory, University College London, Department of Space & Climate Physics, Holmbury St. Mary, Dorking, Surrey RH5 6NT, d.persaud.17@ucl.ac.uk

Introduction: MSL Curiosity landed in Gale Crater in August 2012 with the objective of identifying environments that could have supported life in Mars history. [1] first performed comprehensive mapping of the channel morphology in Gale Crater using CTX and HiRISE images in order to correlate fluvial and larger flood events in this region. 3D visualisation provides an opportunity for planetary geologists to explore orbital datasets in greater detail and scope, best approximating the experience of "field" (in situ) research. The fluvial geomorphology of Gale Crater was investigated using multi-resolution 3D products in a visualisation suite to test this utility.

Methods: The Co-registration ASP-Gotcha Optimised (CASP-GO) processing chain [2] was used to generate seven 18-m digital terrain models (DTMs) and 6-m orthorectified images (ORI) of Gale Crater using Context Camera (CTX) images, in addition to 75-cm DTMs and 25-cm ORI from HiRISE images. "Landscapes" were then generated using the NASA DERT LayerFactory to drape these ORIs on the DTMs for visualisation in stereo in DERT [3]. The extent and slope of each channel system were then measured in DERT. Profiles were then extracted along the length of each channel system, including secondary channels from the CTX products. Channel widths and depths were calculated from these profiles, adjusted for slope, to assess the energy of these systems.

The channels were divided into classes, including classic V-shaped channels and "flood" channels, based on their morphology. Secondary channels and other flow features were additionally mapped with the aid of the higher-resolution HiRISE products to reconstruct the relative timing of these events.

Results: One V-shaped channel to the west of Aeolis Mons (Mount Sharp) cross-cuts and is superimposed by yardang fields, pointing to dry conditions—dominated by aeolian processes—punctuated by two or three high-energy events down the slope of this peak (Figures 1, 2).

A network of channels to the east of Mount Sharp presents as a series of relatively flat canyons (to the limit of DTM resolution) with pronounced arc-shaped scarps, amphitheatre headwalls, and lateral ridges (Figure 3). These are interpreted as either having formed during catastrophic flooding from subsurface melt (e.g. a box canyon-like formation) or slower erosion by entrained sediment (earth flows). The lack of depositional fans downstream, however, suggest a more complex origin.

Another V-shaped channel system was analysed in the southwest rim of Gale Crater. This channel exhibits at least three flooding events that originate at the rim and terminate at the southwest boundary of Mount Sharp, and represents another high-energy system that grades into a meandering river in the crater. Additional channels point to a mix of high- and low-energy environments preceded and succeeded by dry conditions.

The DERT software is found to be useful for analysing multi-resolution 3D datasets for geomorphology. HiRISE provides additional insight into more complex or ambiguous features, such as scarps and secondary flood deposits, while CTX gives regional context for morphology.

Conclusions: These results provide insight into the complex fluvial history around Mount Sharp, and suggest a periodic wet environment in Gale Crater. Furthermore, the utility of combining 3D CTX and HiRISE datasets for geomorphology studies of complex terrain is demonstrated.

References: [1] Anderson, R.B., J.F. Bell III, *JGR: Planets* 111 (2), 2010. [2] Tao, Y., Muller, J.-P., *PSS*, 154, 2018. [3] Keely, L. et al., DERT, *Planet. Data Workshop*, 2017.

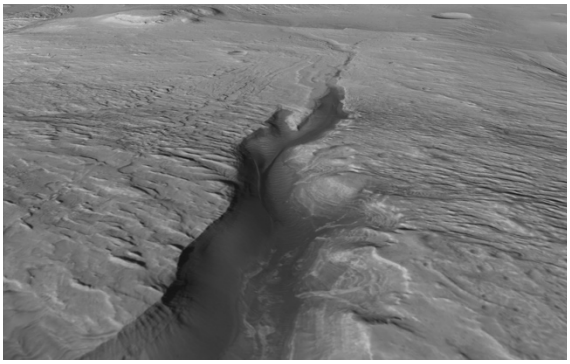

Figure 1. V-shaped channel to the west of Mount Sharp, visualised in DERT.

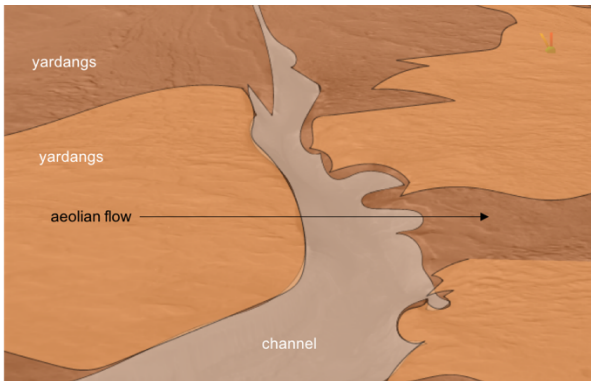

Figure 2. The channel from Figure 1, annotated with the crosscut and superimposed yardangs.

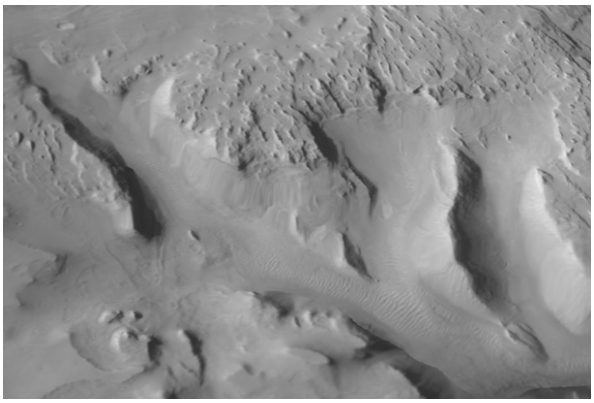

Figure 3. Network of channels to the east of Mount Sharp, including canyons, visualised in DERT.