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Pre-landslide topographic reconstruction using a Digital Elevation Model from CaSSIS onboard the Trace Gas Orbiter.

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Landslides are common features on the surface of Mars. They have morphologies that resemble debris slides, mudflows [1], or giant rock avalanches [e.g., 2] on Earth. They can mobilise large quantities of material up to 10^{12} m³ and spread over areas of up to 10^9 m² [e.g., 3].

The topography before the landslide event occurred is required to both estimate the volume of mobilised material and quantify the distribution and thickness of the deposit. The mass distribution of the deposit can also be used to compare with 3D flow simulations of landslides [e.g. 1, 3]. However, on Mars there are no landslides that have known topographic data before the event occurred, hence we have to rely on topographic reconstruction.

This type of reconstruction, which we have already carried out using HiRISE (High Resolution Imaging Science Experiment) Digital Elevation Models (DEM) with 1-2 m vertical resolution [e.g., 1], has never been undertaken using DEMs with 4-5 m vertical resolution derived from CaSSIS (Colour and Stereo Surface Imaging System) stereo pairs [4]. CaSSIS uses a 180° camera rotation to capture stereo images of a given site in a single pass. DEMs are then generated using 3DPD (three Dimensional reconstruction of Planetary Data) software [5].

Our aim is to test whether a landslide reconstruction can be carried out with a CaSSIS DEM. For our purpose we use a 6 km long landslide in Baetis Chaos region, Mars.

Our reconstruction consists of three main steps: 1) We first calculate contour lines. 2) Reconstructed contour lines are then drawn by connecting contour lines on either side of the boundary taking into account the overall topography outside the landslide. 3) Then, the reconstructed contour lines are converted into points at intervals equal to the spatial resolution of the DEM. These points are then interpolated using a natural neighbour algorithm to calculate a new DEM without the landslide. We were able to estimate that the landslide in Baetis Chaos has a volume of 10^8 m³ and the deposit has a maximum thickness of 200 m using CaSSIS data.

Our successful reconstruction using a CaSSIS DEM increases the potential coverage of high-

resolution stereo-topographic data beyond those already available with CTX and/or HiRISE. The resolution CaSSIS DEMs fills a gap in the topographic data currently available for studying landslides. Landslides > 15 km long can be studied with MOLA or HRSC data, and landslides < 5 km long can be studied using HiRISE data. Now, landslides and other landforms 5-15 km can be studied using CaSSIS data with equivalent quality to CTX stereo-topography.

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