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Comparison of mega-flood features of the Channeled Scabland and Martian outflow channels using DEMs

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Although current Martian surfaces are too cold and dry to hold liquid water, fluvial features such as valley networks and outflow channels have been observed on the surfaces. The analyses of the fluvial features on Mars are useful for examining past climatic conditions. Outflow channels are the characteristic large flood features on Mars and similar to some large terrestrial flood features such as those in the Channeled Scabland in east-central Washington, USA. The channeled scabland was formed by the Pleistocene Missoula Flood derived from the margins of the Cordilleran Ice Sheet, Glacial Lake Missoula. Thus the Channeled Scabland is useful for a comparison with Martian flood features and examining the paleoenvironment on Mars. However the effect of the Missoula Flood on the formation of the Channeled Scabland has some unresolved questions.

Therefore, in this study we analyze the topography of the Channeled Scabland and the area of Glacial Lake Missoula using the ASTER Global Digital Elevation Model (ASTER GDEM) and The National Elevation Dataset (NED). We compare the topography of the Channeled Scabland with that of neighboring areas that has been free of megafloods., Topography in the area of Glacial Lake Missoula is also compared with neighboring areas without glacial lakes. We analyze the frequency distribution and statistical parameters of geomorphometric properties, e.g. slope angle, slope aspect, curvature, and drainage density of each region. We then compare the results with those for Martian outflow channels.

The results show that average slope angle increases from the Channeled Scablands to non-megafloods areas, from areas without glacial lakes to the area of Glacial Lake Missoula, and from Martian flood areas to the Channeled Scabland. The same relation holds true for standard deviation except that the standard deviation of the Channeled Scabland is larger when compared to non-megafloods areas, reflecting the generally flat but locally steep topography of the former.