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Evidence for multiple episodes of catastrophic flooding in Ares Vallis from the Mars Express High Resolution Stereo Camera

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The Martian outflow channels are the largest known valley features on Mars and are widely considered to have formed by erosion by catastrophic water floods released from subsurface reservoirs. A significant question that remains unanswered is whether the channels were carved by single or multiple episodes of flooding, and what the water discharges associated with these events were. Earlier studies were limited by a lack of high-resolution topographic data. Here we present new image and topographic data from the High Resolution Stereo Camera on Mars Express that reveal previously unknown evidence for multiple episodes of catastrophic flood erosion in the proximal sector of Ares Vallis, a major outflow channel in Xanthe Terra. We use orthoimagery and high-resolution topographic data derived from the High Resolution Stereo Camera (HRSC) on the Mars Express Mission (Neukum et al. 2004) from the proximal reach of the Ares Vallis to investigate the processes responsible for channel formation and better constrain estimates of channel-carving discharges. We interpret our observations to indicate that erosion of outflow channels by abrupt release of groundwater was not a single event rather valley erosion was achieved during multiple episodes of flooding. This indicates that catastrophic release from subsurface reservoirs in the chaos regions occurred at repeated intervals. We speculate on the possible mechanisms for such episodic water discharges.