Geophysical Research Abstracts
Vol. 15, EGU2013-4299, 2013
EGU General Assembly 2013

Geomorphological Study of Martian Valley Networks in Terra Sirenum

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Today, Mars is an extremely arid, cold and fluvial inactive planet, but valley networks are still preserved indicating a fluvial active period more than 3.5 Ga ago. Due to the strong action-related dependency between fluvial activity and climate valley networks point to specific environmental conditions on early Mars. However, it is still unclear what processes caused climate changes on early Mars.
In order to investigate regional conditions we focus on three dendritic valley networks systems located in Terra Sirenum between 37.5°S/39.5°S and 157.5°W/155°W. High Resolution Stereo Camera (HRSC) digital terrain models (DTM) are used to derive morphometric parameters of valleys and interior channels in order to constrain fluvial discharge and runoff production rates. The correlation of the findings combined with results of the crater-size frequency distribution (CSFD), allows interpreting the development and timing of possible events that were characterized by fluvial processes. The resulting data set might give clues to ancient climatic conditions and its influence on the morphology and fluvial activity of the channel systems on early Mars. The work shows that Mars experienced a time of high fluvial activity with discharges of more than 1000 m^3/s for each dendritic valley system, accompanied by intensive erosion processes and runoff events in a range from some mm/d up to several cm/d at the time of maximum discharge hydrographs around the late Noachian-Hesperian-boundary. Comparing with terrestrial fluvial erosion rates, we derived that Mars must have undergone a warmer period under semi-arid or a humid period under glacial or periglacial conditions.