

Mars Hydrologic Environments

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There is strong evidence for the presence of surface water in Mars' past. One of the most ostensible and persuasive pieces of evidence is the channel-like features observed on the present day surface. These features suggest that water once flowed freely on the surface of Mars. Still, questions remain as to the nature of the surface flow, and the characteristics of streams and basins associated with this flow. You will use images created from Mars Orbiter Laser Altimeter (MOLA) data to uncover remnants of past fluvial activity on the Martian surface.

Martian Hydrologic Environments

Objective: Examine characteristics of Mars topography for hydrologic geomorphology. Use your results to determine an analogous hydrologic environment on Earth. Determine if the results show evidence for a global hydrologic model.

Before the Lab:

Define the following terms: Stream, Drainage Basin, Drainage Density, Confluence, Headwater, Source, Mouth, Meander, Oxbow, Watershed.

Instructions:

Step 1: Examine the data grids

- A. Topography
 - a. Does the grid appear to have an ordered stream network? Hypothesize as to where water would drain towards if this grid were flooded.
- B. Streams
 - a. Look at the image of streams mapped using GIS at each grid. Lay a piece of transparency paper over the image and order these streams using Strahler Stream Order. What is the highest stream order you found?
 - b. What is the major direction of flow for this grid?
- C. Basins
 - a. What shape do the mapped basins take? Where do these boundaries come from?
 - b. Assume that the total lengths of streams for each grid is as follows: Kasei = 5,959 km, Lucus = 8,059 km, and Margaritifer = 5,563 km. What is the drainage density of all basins and streams?

Step 2: Analysis

- A. Local Hydrologic Environment (answer these questions for each grid):
 - a. Does the basin shape reflect topography or stream networks?
 - b. Is the drainage density value high (closer to 1) or low (closer to 0)? What does this mean?
 - c. Would you say that this area has a highly developed stream network or a poorly developed network?
 - d. Suggest a comparable hydrologic environment on Earth for this grid compatible with the results of your analysis.
- B. Global Hydrology
 - a. Where would most water on Mars drain towards?
 - b. Do these systems connect?
 - c. Can you suggest a global history of surface flow for Mars based on these three different hydrologic environments?