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Synthetic and Comparative Hydrology of Earth, Mars, and Titan

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Earth, Mars, and Titan are the only known planetary bodies in our solar system where flowing liquids have shaped surface topography and formed extensive river networks. Fed by atmospheric precipitation and carved by fluvial erosion, these channels are observable in remote sensing data. They carry information about the interactions between the atmosphere, the hydro(carbon)sphere, and the lithosphere and allow for investigation of the conditions that had prevailed during their formation. Comparison of drainage basins, which developed in these profoundly different environments, could yield insights into the past and ongoing hydrological processes in addition to climatic, chemical, and topographic conditions of the planetary bodies. Increased computing capacities allow for building and utilization of a vast database of hydrological, climatological, and geological data as well as algorithmic evaluation of remote sensing products. Here, we propose a classification of basins from Earth, Mars, and Titan using several machine learning techniques based on their morphological characteristics, network properties, spatial homogeneity, cross-scale self-similarity, and visual properties. Constraints on climatic and geologic properties of the terrestrial basin classes will be identified, and the results of their morphology-climatic relationship extrapolated to Mars and Titan. To find out more, visit our project's website <https://www.schemata-project.com/>.