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Global distribution of fluvial channels on Titan

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The presence of fluvial erosion on Titan's surface is an obvious analogy to Earth. This study investigates the global distribution of fluvial valley systems on Titan. Based on Cassini-RADAR-data we mapped the allocation of channels, their appropriate flow direction and morphological properties. A great variety of morphological valley types ranges from dendritic valleys that certainly developed from precipitation to a more canyon-like valley type whose development is possibly supported by groundwater release. Another type of fluvial valleys resembles terrestrial wadis that evolved as a result of precipitation separated by long-term intervals of dry periods.

Furthermore, based on a global Cassini-VIMS-mosaic the allocation of fluvial channels was determined with respect to spectral units. Based on the spectral signature in the infrared methane windows – expressed as VIMS wavelength ratios composed to a color image (RGB) – three major units can be distinguished: whitish material which is mainly distributed in the topographically high areas indicating equal reflectivity in all atmospheric windows; bluish material that exhibits a higher reflectivity at shorter atmospheric wavelength windows implying a clear spectral separation from the whitish material, and brownish material characterized by a higher reflectivity in the longer wavelength atmospheric windows that correlates with dunes. The majority of channels are exposed on the bright surface unit while just a few percent of channels are located on the blue and brown surface unit, respectively.

Fluvial incision has shaped Titan's surface globally. Nevertheless, from a morphological point of view as well as concerning the associated VIMS-unit fluvial shaping is not uniform. The global distribution of channels provides unique information about environmental conditions and processes forming Titan's surface. However, to date just 20% of Titans surface are covered with high resolution data, thus, the current results can only give a first impression of Titan's surface erosion.