Geophysical Research Abstracts
Vol. 12, EGU2010-**PREVIEW**, 2010
EGU General Assembly 2010
© Author(s) 2010

# Geologic impact of methane storms on Titan

Mirjam Langhans (1), Ralf Jaumann (1,2), Katrin Stephan (1), Robert H. Brown (3), Bonnie J. Buratti (4), Roger N. Clark (5), Kevin H. Baines (4), Philip D. Nicholson (6), Ralph D. Lorenz (7), and Christophe Sotin (4)

(1) German Aerospace Center (DLR), Institute of Planetary Research, Berlin, Germany (mirjam.langhans@dlr.de), (2) Dept. of Earth Sciences, Inst. of Geosciences, Freie Universität Berlin, Germany, (3) Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ, 85721 USA, (4) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109, USA, (5) U.S. Geological Survey, Denver, CO, 80225 USA, (6) Cornell University, Astronomy Department, Ithaca, NY, USA, (7) Space Department, Johns Hopkins University Applied Physics Lab, Maryland 20723-6099, USA

Titan's surface is shaped by numerous of extended fluvial valleys. The most likely scenario for their development is atmospheric precipitation. Atmospheric modelling suggests precipitation through episodic methane convective storms rather than steady precipitation. This study aims to test whether Titan's valleys developed from steady rainfall or through episodic storms with long recurrence intervals. Data from the Cassini RADAR-SAR sensor provides the image database with a spatial resolution of up to 350m per pixel, appropriate to identify fluvial channels. Further, examples from terrestrial rivers where used as analogues to compare fluvial landforms with episodic and steady discharge.

Depending on their climatic background and discharge characteristics, terrestrial rivers are labelled as perennial, seasonal (intermittent) or episodic (ephemeral) rivers. Episodic or seasonal characteristics of precipitation and runoff result in certain differences of the channel morphology compared to perennial valleys with a nearly constant discharge. From terrestrial and Martian channels it is known that valleys with an ephemeral flow pattern are characterized by a shallow cross-section, anastomosing and braiding morphology. These valleys can evolve streamlined features and islands within the river bed. The riverbanks are often subject to flooding.

Several valleys at Titan's southern midlatitudes have an ephemeral or episodic flow pattern. In radar-images these features appear as broad and possibly shallow valleys with a low contrast to their surrounding. Their branches are relatively straight and interconnected. The valleys possibly represent an intermediate form between fluvial flow in valleys and surface runoff. Furthermore, radar images of Titan's midlatitudes reveal fluvial networks with unusual high radar backscatter. This effect is explained by the presence of rounded icy blocks within the riverbed. Most likely, valleys with a high radar return are recently not filled with liquids since only rough surfaces can cause high signals in radar. Although some channels and channel systems have a low radar response, indicative for a smooth, possibly liquid surface, the majority of valleys on Titan appear inactive. The predominance of dry valleys is a further argument against steady rainfall on Titan.

As a terrestrial analogue, Tagliamento River in northern Italy runs from the Alps to the Adriatic Sea. Its hydrological regime is strongly seasonally determined by thunderstorm events, snow melt, and low flow periods in between. Strong changes in water level entail a dynamic river system with a strong morphological variability. A comparison of this terrestrial ephemeral river with channels on Titan reveals a number of morphological similarities. Both, the terrestrial rivers and several channels on Titan appear bright and broadened with a braiding structure, thus implicating a similar development of the channels on Titan and Earth.

Radar images reveal several indications pointing to thunderstorm events that influence at least some of the fluvial valleys at the surface of Titan. Although fluvial features have a high morphological variability, their development from thunderstorm events is conceivable.