

**Morphology of River Deltas on Titan and Earth.** P. P. Witek<sup>1</sup> and L. Czechowski<sup>2</sup>, <sup>1</sup>Faculty of Physics, University of Warsaw, Poland (ppwit@igf.fuw.edu.pl / Fax: +48-22-5546882), <sup>2</sup>Faculty of Physics, University of Warsaw, Poland (lczech@op.pl).

**Introduction:** Volatile cycles exist in the present on Earth and Titan. They affect the rocks on surface by means of erosion, transport and deposition. There are numerous indications of processes of sediment transport on Titan, including fluvial transport: rounded grains on *Huygens* landing site, deeply eroded river valleys and many others. Sediments on Titan are generally more mobile than on Earth due to lower gravity and higher buoyancy [1]. We investigate the morphology of deposits created by fluvial transport in Titan's lakes under different discharges and with different dominant grain sizes. We use two-dimensional numerical model of flow based on the Navier-Stokes equations and the continuity equation. Sediment transport and deposition is described with additional equations (see [2]).

**Parameters of the model:** We explore the range of grain sizes and possible discharges, including natural variability of the discharge. We consider possible compositions of sediment grains in case of Titan, from pure water ice to low density organic matter. In terrestrial conditions we model the transport of quartz grains by water.

**Results:** We created two sets of delta-like landforms, one for each planetary body, by changing the grain size distribution and discharge for the same initial geometry. For the smallest grains the erosion had dominant role, while the largest grains usually form fan-like deltas of considerable slope.

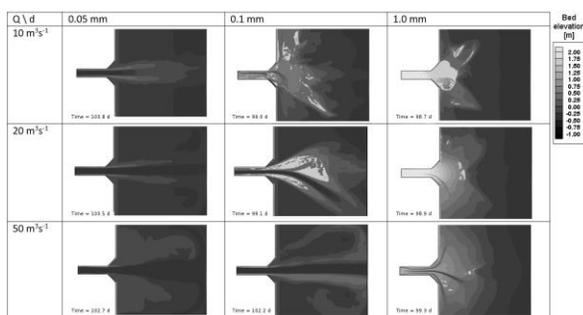


Figure 1: The sample of bed elevations for Titan for three considered discharges and sizes of icy grains after ~100 simulated days.

**Summary and Conclusions:** The sedimentary landforms in Titanian and terrestrial rivers and lakes form and develop in a similar manner. The different

parameters of the environment may however promote development of different types of landforms on Earth and Titan for a given discharge and grain size distribution. Greater mobility of Titanian sediments result in easier displacement of loose granular material. For smallest considered grains (0.05 mm) the sediments are carried away into the lake and dispersed over large area. The flat, lobate deltas develop in narrower range of grain sizes and discharges than on Earth. That result may partially explain the paucity of such landforms in dynamic environment of that unique moon.

Similar effect is observed in simulations of development of rivers, where for the same slope and grain size distribution the braided river develops on Earth, and meandering river on Titan [3].

#### References:

- [1] Witek, P., Czechowski, L., 2015. Dynamical modelling of river deltas on Titan and Earth. *Planet. Space Sci.*, 105, 65-79
- [2] Jia Y., Wang S., 2001. CCHE2D: Two-dimensional Hydrodynamic and Sediment Transport Model For Unsteady Open Channel Flow Over Loose Bed. Technical Report No. NCCHE-TR-2001-1
- [3] Misiura, K. and Czechowski, L., 2015. Numerical modelling of sedimentary structures in rivers on Earth and Titan. *Geological Quarterly* 59 (3), 565-580