Quantifying erosion rates on Mars

Contact persons: *at least 2 supervisors*
Sébastien CASTELLTORT (sebastien.castelltort@unige.ch), Abdallah ZAKI (Abdallah.Zaki@etu.unige.ch)

Context

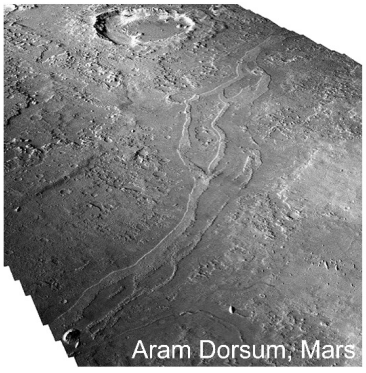
Geomorphological landforms, including fluvial and aeolian landscapes, suggest a widely Martian global transition from a complex history of fluvial activity to long-lived aeolian processes, most likely, ca. 3 billion years ago (e.g., Carr and Head; 2010; Kite, 2019). A quantitative understanding of landscape response to this climatic transition is fundamentally important to constrain the landscape evolution on Mars.

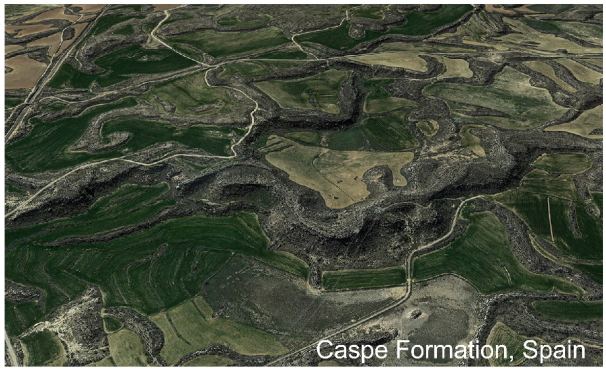
Objectives and Methods

This project aims to quantify the landscape response to wet to arid climatic transition. The formation of fluvial ridges is intimately tied to climate as they record a regional and a planet-wide lowering of the surface due to net landscape lowering by differential erosion during the transition from wet-to-dry conditions (Zaki et al., 2021). Thus, they can be used as a proxy to estimate the minimum erosion/exhumation rates at different sites across the Martian surface. Erosion/exhumation rates can be simply calculated by dividing the ridge thickness by the ages modeled from the crater-counting technique. Surveying High-Resolution Imaging Science Experiment (HiRISE) and Mars Reconnaissance Orbiter Context Camera (CTX) images with resolutions ranging from 0.25 to 6 m/pixel to select the fluvial ridge sites that morphologically are amenable for this investigation. The ridge thickness will be measured from CTX and HiRISE digital terrain models (DTMs). A field trip is also planned to apply this method to a natural system in Caspe Formation, Spain, and constrain the uncertainties on measuring ridge thickness from DTMs.

Literature

Carr, M. H., & Head, J. W. (2010). Geologic history of Mars. Earth and Planetary Science Letters, 294(3–4), 185–203. https://doi.org/10.1016/j.epsl.2009.06.042
Kite, E. S. (2019). Geologic Constraints on Early Mars Climate. Space Science Reviews, 215(1). https://doi.org/10.1007/s11214-018-0575-5
Zaki, A. S., Pain, C. F., Edgett, K. S., & Castelltort, S. (2021). Global inventory of fluvial ridges on Earth and lessons applicable to Mars. Earth-Science Reviews, 216, 103561. https://doi.org/10.1016/j.earscirev.2021.103561





WEB sites

Choice of orientation : (supprimer les orientations qui ne conviendraient pas)

1) Sedimentary, Environmental and Reservoir Geology