NEW CHALLENGES IN PLANETARY DUNES

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Dune fields have been extensively studied in the domain of physical geography, where there is still much work to be done, for example regarding the impact of climate change on desertification. However, the center of mass of this domain of research progressively shifts to mathematical geophysics thanks to new experimental, numerical and theoretical methods as well as new observations using satellite data on Earth, Mars and Titan (the Saturn's largest moon). Recent studies have established scaling laws (Claudin et al., 2006) and distinguished between two dune growth mechanisms in multidirectional regimes (Courrech du Pont et al., 2014), especially where there is a change in sediment availability. Here we show how these results could be used to revisit the description of planetary dune fields and test new conjectures on their present and past dynamics. Using Earth analogs, we pay a particular attention to dune fields on Mars and Titan to bring new quantitative constrains on General Circulation Models (Fig. 1). Then, we discuss the role of grain-size segregation in controlling sediment availability as well as the systematic changes in dune shape and orientation along sand flow paths.

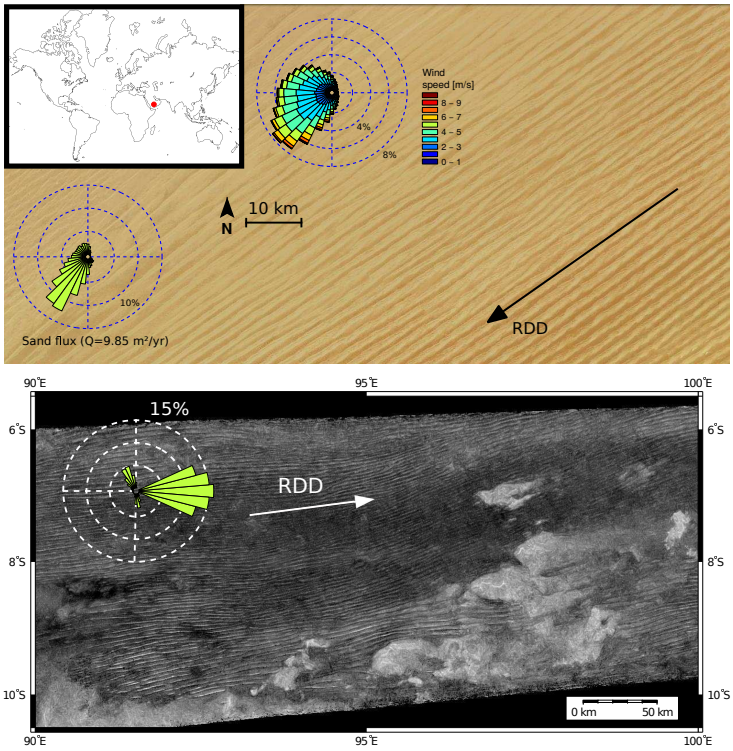

Figure 1. Analogy between linear dunes on Earth (top) and Titan (bottom). In presence of multidirectional wind regimes, dunes align along the resultant sand flux direction in both cases. For the terrestrial case, in the Rub al-Khali desert, inset show the wind and sand flux roses extracted from the ERA-Interim-project from the 1/1/1979 to the 31/12/2012. For Titan, the inset shows the sand flux rose calculated at 7.5° considering storms and averaging the effect of Saturn's eccentricity (Charnay et al., 2015).

References

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