

Global Connectivity and Transport within Titan's Sand Sea

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Meta-Abstract Haiku

Global sand river,
dunes like a Möbius strip:
Xanadu, the twist.



Figure 1: Kuiseb River stopping the dunes, as seen from the air. Here we show that the longitudinal dunes of the Namib Sand Sea (visible as red-orange near the horizon to the south) do not continue past the Kuiseb river despite sand transport in the south-to-north direction. The dark material is vegetation that lives in the channel bottom even though the river flows only a few tens of days per year on average. The nearfield desert north of the riverbed is devoid of sand cover. The Gobabeb Desert Research Station is visible at the right, near the river.

height is comparable to that of the atmospheric boundary layer. Liquid rivers, on the other hand, can stop dunes cold by transporting their sediment downstream. I will show the rationale behind my suggestions and then explore the consequences of this idea for global sediment sources and sinks. Such an integrated global system also implies that Titan's sand seas are geologically old and that its present atmospheric regime is not of recent construction.

Abstract

I propose that Titan's extensive equatorial dune fields represent a single interconnected sand sea. Individual sand seas such as Belet and Shangri-La all have connections to their west, from which they import sediment, and to their east, to which they export sediment. Titan's sand may therefore represent an ancient, continuous conveyor belt flowing from west to east. The only break in the chain is the continent-sized badlands of Xanadu in the middle of the leading hemisphere. To bypass Xanadu, dune sands may form fast-moving sub-pixel barchan chains to the north, eventually arriving in northern Fensal near Menrva. The sharp boundary between Shangri-La's dunes and Xanadu at the south end may be due to fluvial activity. Mountains can detain or divert dunes, but have difficulty stopping them unless their

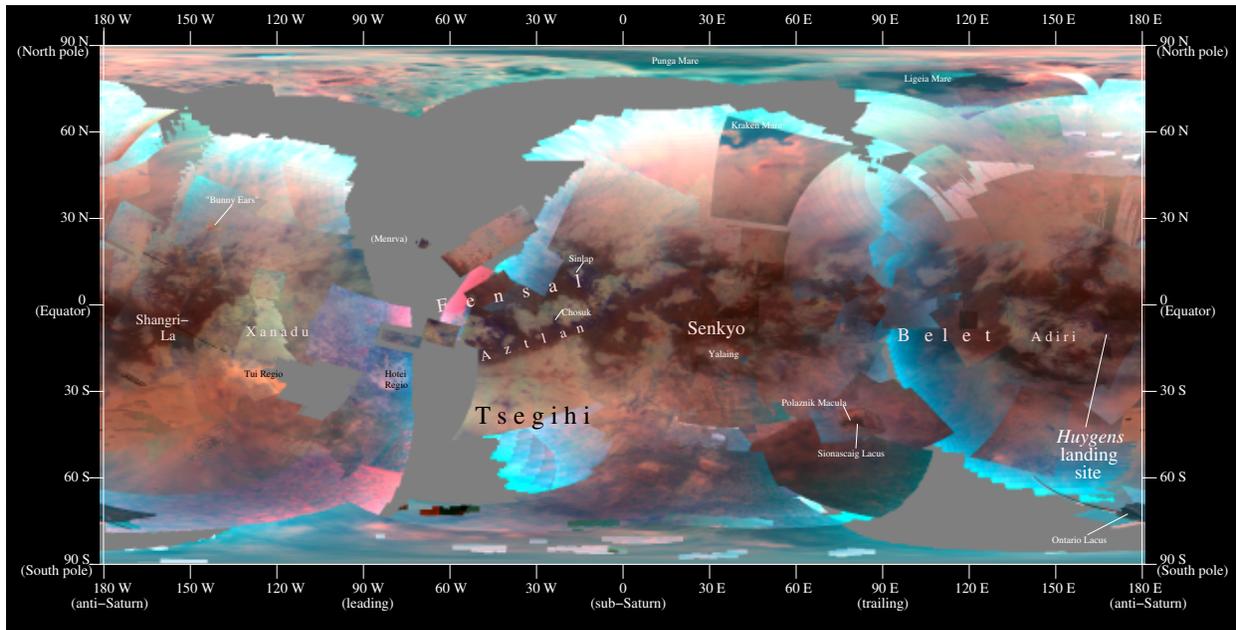


Figure 2: Global VIMS color mosaic of Titan. We used an empirical atmospheric correction for Titan’s atmospheric windows at 1.08 μm , 1.28 μm , 1.6 μm , 2 μm , and 2.8 μm , and a single-scattering atmospheric model for 5 μm . The map uses the best views of each area, but we remove pixels with incidence, emission, or phase angles above 80°. Those removed pixels are grey in the map. The correction works best at longer wavelengths; hence some residual haze becomes prominent in blue given our color mapping of R=5 μm , G=2 μm , B=1.28 μm . The bright pink areas represent overcorrections of the 5- μm window and are thus artifacts.

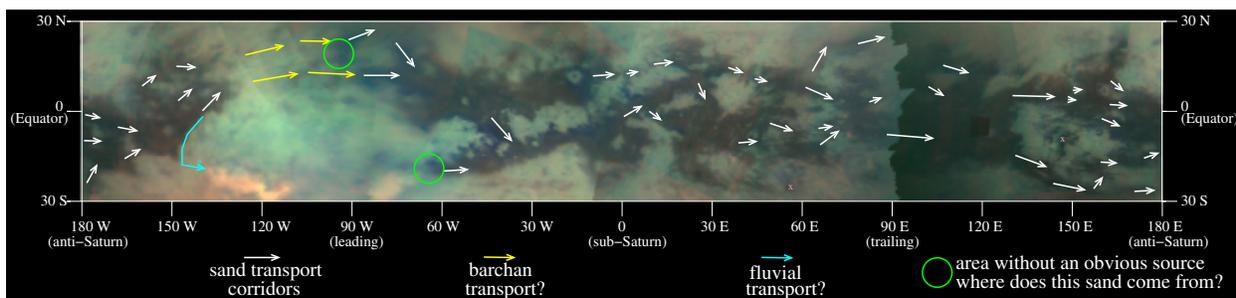


Figure 3: Notional sand transport map with VIMS R=5 μm , G=2 μm , B=1.3 μm of Titan’s equatorial region in cylindrical projection. The annotations on the map show that each major sand sea or dune field has sand corridors from the west from which new sand can arrive and sand corridors to the east for it to exit. Two possible exceptions are indicated as pink ‘x’s: small dune fields within Adiri and some east of Yalaing Terra. The major obstacle to global sand transport then is Xanadu, for which we propose two possible mechanisms for the sand to bridge the gap (see text), fast-moving barchan dunes and fluvial sediment transport in river channels. These particular sand transport corridors are hypothetical, though consistent with both topography and observed sand transport directions .