Dissolution on Titan and on Earth: Towards the age of Titan's landscapes

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Résumé en anglais	Titan's polar surface is dotted with hundreds of lacustrine depressions. Based on the hypothesis that these depressions are karstic in origin, we aim at determining the efficiency of surface dissolution as a landshaping process on Titan, in a comparative planetology perspective with the Earth as a reference. Our approach is based on the calculation of solutional denudation rates and allow to infer formation timescales for topographic depressions developed by chemical erosion on both planetary bodies. The model depends on the solubility of solids in liquids, the density of solids and liquids, and the average annual net rainfall rates. We compute and compare the denudation rates of pure solid organics in liquid hydrocarbons and of minerals in liquid water at Titan and Earth timescales. We then investigate the denudation rates of a surface organic layer in liquid methane over one Titan year. At this timescale, an organic surface layer on Titan would behave like salts or carbonates on Earth depending on its composition, which means that dissolution processes would likely occur, but would be 30 times slower on Titan compared to the Earth due to the seasonality in precipitations. Assuming an average depth of 100 m for Titan's lacustrine depressions, these could have developed in a few tens of million years at high polar latitudes and a few hundreds of million years at low polar latitudes. The ages determined are consistent with the youth of Titan's surface (< 1 Gyr) and the repartition of dissolution-related landforms on Titan.
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