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Possible observations of Length-of-day Variations of Titan from Cassini data between 2004 and 2009

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The determination of rotation variations of Titan is based on measurements of the shift in orientation of Cassini RADAR images taken different flybys. Between 2004 and 2009, these images have shown that Titan was rotating slower than expected for a satellite in synchronous rotation (non-synchronous rotation (NSR) of -0.024±0.018°/year, Meriggiola et al., 2016).

We here model the rotation of Titan from the angular momentum equations (or Liouville equations) of the different interior layers of Titan. Our model includes the effect of tidal deformations of the different layers, of the deviation from the hydrostatic equilibrium, of the dense atmosphere of Titan and of the flow in the subsurface ocean on the rotation of Titan.

Our results (published in Coyette et al., 2018) show that length-of-day variations with a period of a few years and due to angular momentum exchanges between Titan and its atmosphere can be large enough to explain the observed deviation from synchronous rotation. This observed NSR could therefore be interpreted as an observation of the length-of-day variations of Titan in that period of time. If our interpretation is correct, we expect a rotation faster than the synchronous rotation rate between 2009 and 2014, period of time that has not been studied yet.

References :

Coyette, A., Baland, R.-M. and Van Hoolst, T. (2018). Variations in rotation rate and polar motion of a non-hydrostatic Titan, Icarus 307, 83-105.

Meriggiola, R., Iess, L. and Stiles, B. W. and Lunine, J. I. and Mitri, G. (2016). The rotational dynamics of Titan from Cassini RADAR images, Icarus 275, 183-192.