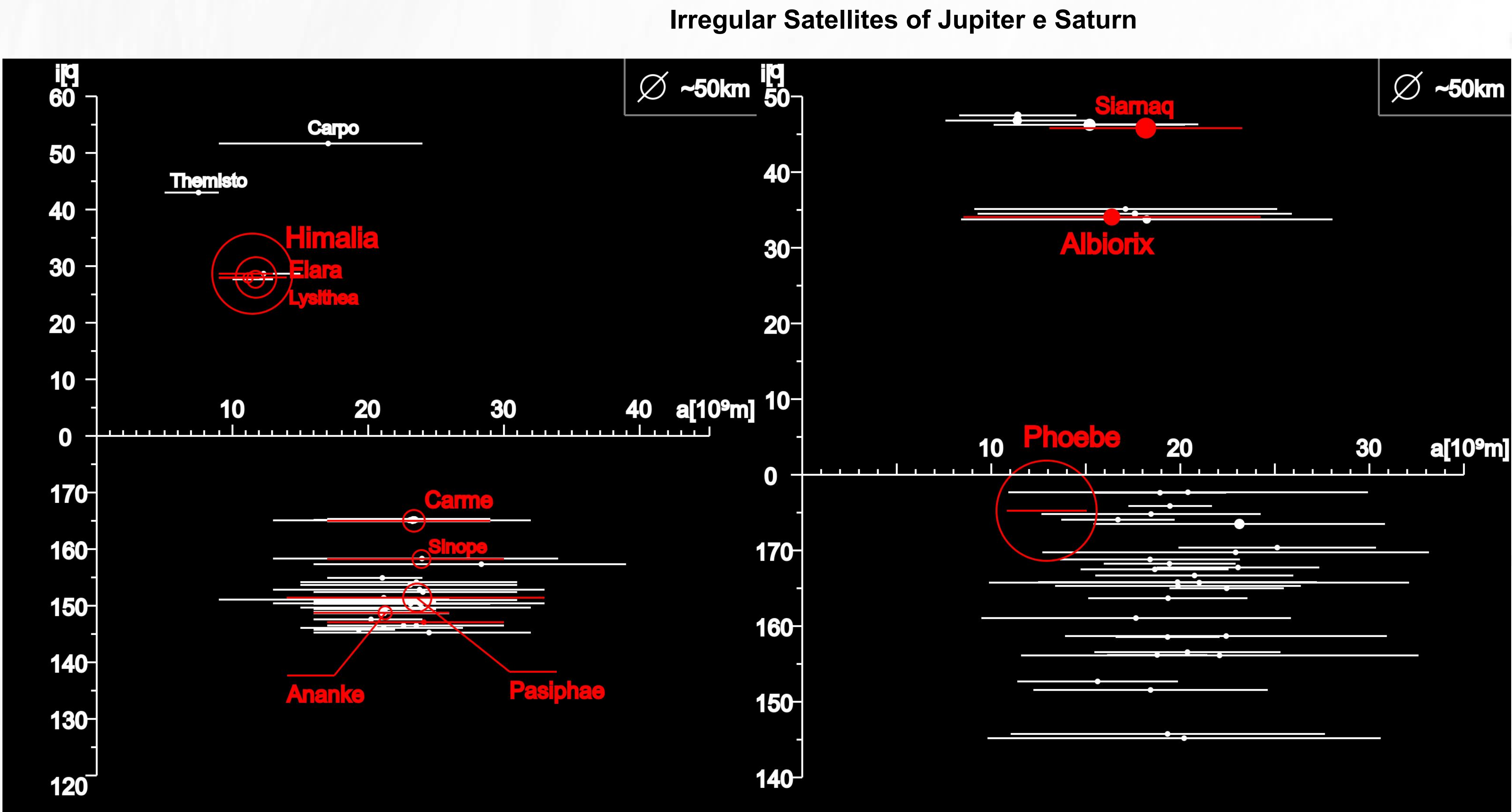# Predictions of Stellar Occultations by Irregular Satellites up to 2020
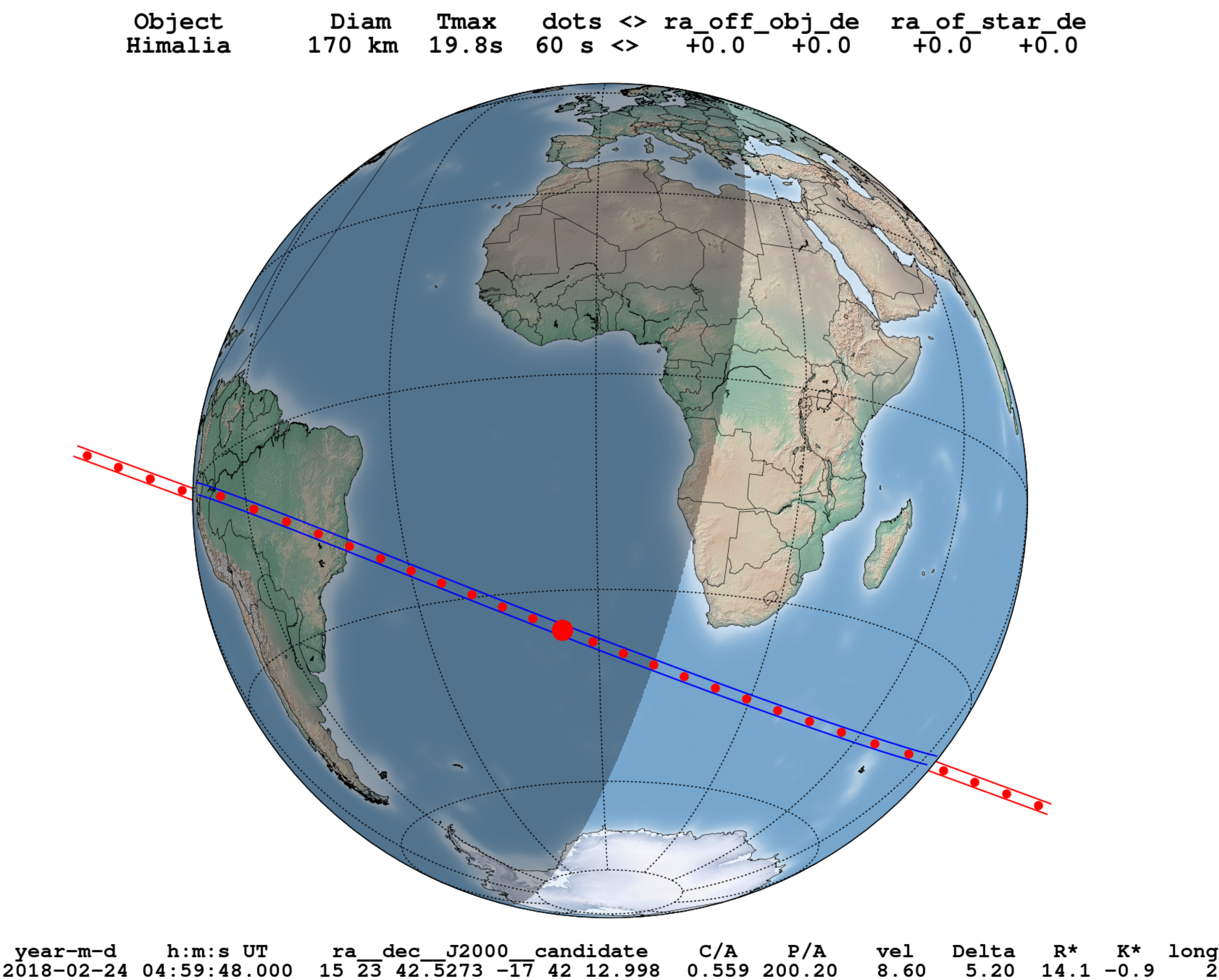
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Roberto Vieira Martins[2], Júlio I. B. Camargo[2], Felipe Braga-Ribas[2]
1-OV/UFRJ; 2-ON/MCT; 3-OBSPM

The irregular satellites of the giant planets, mainly from Jupiter and Saturn, are much smaller than the regular ones. They have irregular shapes and their orbits are more eccentric with larger semi-major axes. Some of them have retrograde orbits. Explaining their existence is an interesting study in orbital dynamics. It's generally accepted that, due to their orbital configuration, they were captured by their planets. Stellar occultations are a method that would allow us to know better their physical features (size, shape, density) since they are not visited, at the moment, by any spacecraft. But their orbits are known with little precision, which is bad to obtain a good prediction for an occultation.

Irregular Satellites of Jupiter e Saturn

In this work, we predicted stellar occultation by the 8 largest irregular satellites of Jupiter (Himalia, Elara, Pasiphae, Carme, Lysithea, Leda, Sinope and Ananke) and the largest irregular satellite of Saturn (Phoebe) up to 2020. In 2019-2020, Jupiter will pass in front of the central side of the Galactic Plane creating the best opportunity to observe stellar occultations due to the large number of stars in the region. The same goes for Saturn in 2018. With the release of Gaia Catalogue, the positions of the stars will have high accuracy and the only source of error in the prediction will be caused by the ephemeris. In order to improve the ephemeris of these 9 satellites, we updated the ephemeris of Desmars et al. (2013) for Phoebe and created a new numerical fit for the Jovian satellites, called STE. The latter was created using only the positions published by Gomes-Júnior et al. (2015) in order to eliminate systematic errors from former ephemeris as shown by the authors. We didn't use all the positions available in the literature because we don't need ephemeris for a long time, only up to 2020, and the recovery of all the positions was not worth it.
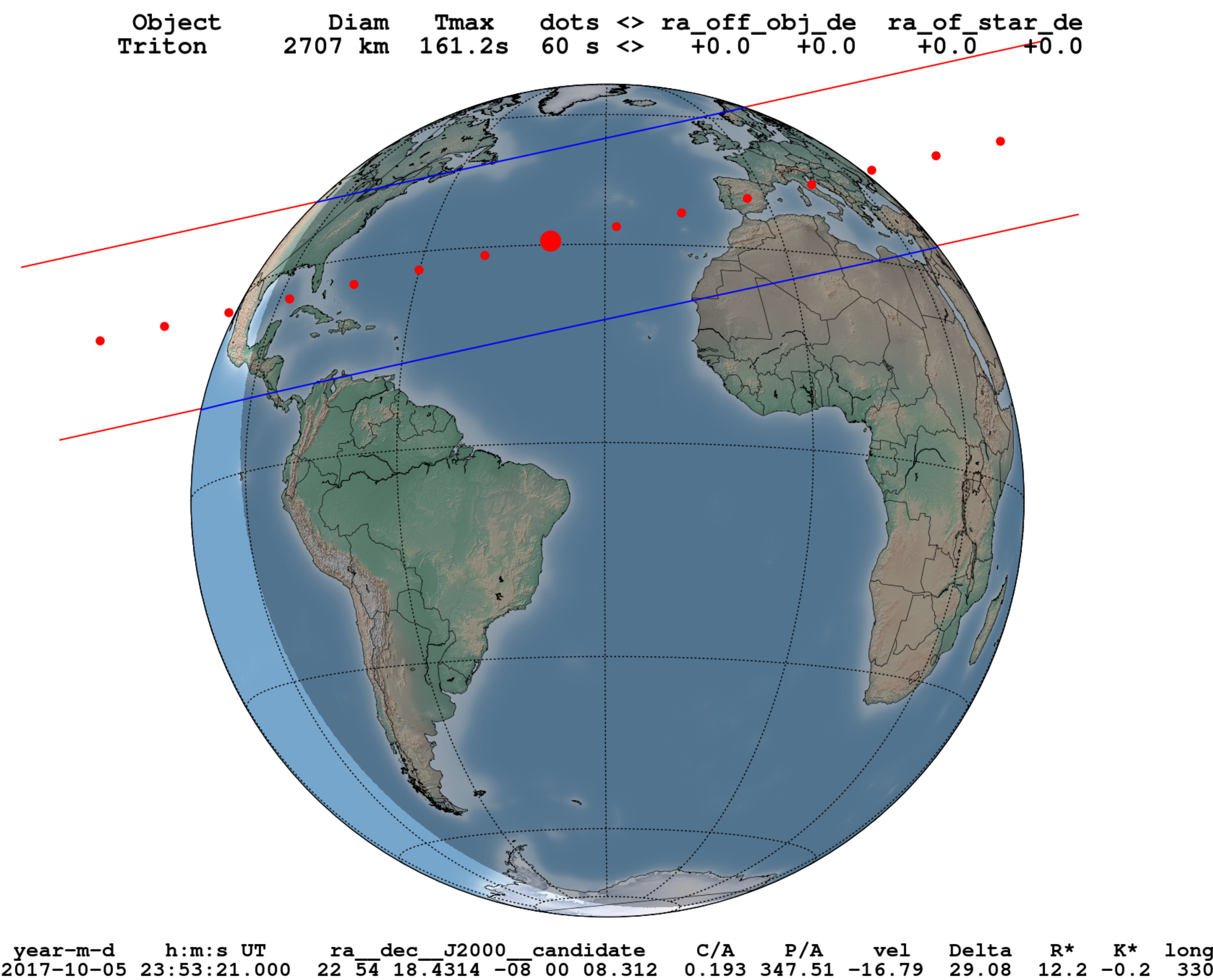
Number of Occultations predicted (G < 16.5)

Satellite	2017	2018	2019	2020	Total
Ananke	16	44	359	187	606
Carme	16	33	369	235	653
Elara	17	39	305	193	554
Himalia	13	55	380	222	670
Leda	24	51	536	207	818
Lysithea	10	35	414	221	680
Pasiphae	20	44	522	226	812
Sinope	21	45	491	279	836
Phoebe	234	274	78	15	601

Exemple: Occultation by Himalia (Feb 24, 2018)

Object	Diam	Tmax	dots <>	ra_off_obj_de	ra_of_star_de
Himalia	170 km	19.8s	60 s <>	+0.0 +0.0	+0.0 +0.0

year-m-d	h:m:s UT	ra__dec__J2000_candidate	C/A	P/A	vel	Delta	R*	K*	long
2018-02-24	04:59:48.000	15 23 42.5273 −17 42 12.998	0.559	200.20	8.60	5.20	14.1	−0.9	2

Exemple: Occultation by Triton (Oct 10, 2017)

Object	Diam	Tmax	dots <>	ra_off_obj_de	ra_of_star_de
Triton	2707 km	161.2s	60 s <>	+0.0 +0.0	+0.0 +0.0

year-m-d	h:m:s UT	ra__dec__J2000_candidate	C/A	P/A	vel	Delta	R*	K*	long
2017-10-05	23:53:21.000	22 54 18.4314 −08 00 08.312	0.193	347.51	−16.79	29.08	12.2	−0.2	330

Acknowledgement