E021-011 Room: C304 Time: May 31 11:45-12:00

The effect of the solar fluxes delay time on the orbital accuracy

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ABSTRACT

Low altitude satellites below 1000km are to

effect of the upper atmosphere drag. This upper atmosphere is varied with solar activity. The solar fluxes delay time is known as elapse time between the solar flare and prasma clouds (2-nd group) to generate and the earth upper atmosphere to effect.

In this paper, we describe the solar fluxes delay time and the orbital estimated accuracy from the analysis of satellite's orbital data. Especially, the solar fluxes delay time was estimated 1.8-2.0 day and this values are different with 1.0 day in Jacchia1971 model. We also confirmed to improve the estimated orbital accuracy with this delay time 1.8 day, and seemed for this delay time to vary.

(1)The estimated solar fluxes delay time

The method of the orbital determination is a Bayssian weighted least squares (Batch filter) with S-band range data. The estimated parameters are orbital six elements and the darag coefficient Cd. The Cd is the characteristic parameter of the satellite surface, therefore is expected to a constant. However, the estimated Cd is often various values on the extreme solar activity.

Therefore, we attended to the solar fluxes delay time for the model error of orbital dynamic system. The solar flare 2-ed group is known to be plasma clouds and to effect the earth upper atmosphere after 1.0-2.0 day from observed time. Magnetic storm and on aurora are well known for this plasma clouds to effect.

We understood to be important to estimate the solar fluxes delay time. In order to estimate the delay time precisely, the conditions of the calculation are as fellows.

delay time ; 1.0, 1.2, 1.4, 1.6, 1.8, 2.0day

estimated day ; every day for 2 weeks used data span ;3 days

satellite MOS-1, ASTRO-C analyses data span; 9/3/1989 - 9/16/1989

EXOS-C, EXOS-D 4/17/2000 - 5/3/2000

The other conitions are solar flux data : NOAA F10.7 (20:00 UT), atmosphere model : Jacchia - Robert and Earth gravity model : GEM-T3 (50*50).

Figure2 shows the estimated Cd for every day in data span. It seems plausible that the solar

flexes delay time is 1.8-2.0 day, because the Cd is lower variation then others.

(2) The orbital accuracy relation to solar fluxes delay time model.

In this section, we describe that the accuracy of the orbital determination and prediction is difference by the solar fluxes delay time models. The solar fluxes delay time models are so follows.

J71 ;1.0 day (Jacchia 1971)

J77A ; 1.26 + 0.37sin (H-92) day (Jacchia,Slowey, and Campbell 1973)

J77B ; 1.74 + 0.26cos(H) day (Paul, Volland, and Roemer 1974)

Where H = L.S.T + 12, L.S.T is a local sun time. In addition to our evaluated value; 1.8 day for the above delay time, we analyzed for the accuracy of the orbital determination and prediction.

Tables shows the overlap difference between the orbital determination values and 2 weeks prediction values. The solar fluxes delay time is equivalents to the time which the solar flare plasma clouds collision with the upper atmosphere of the earth. The delay time error is therefore the calculation error of atmosphere exospheric temperature and density. In this result, the effect of these drag model errors is. the orbital in-plane errors. Tables shows for these parameters to improve 20-30% for the accuracy.

(3) The study from now

We understand that it's important for the solar flare plasma clouds to estimate precisely the time to collusion with the earth upper atmosphere. Especially, the solar flexes delay time error is seemed the dominant error for the high precise orbital detemination.

The studies from now are as fallows.

To research for the solar fluxes delay time to differ or/not in quiet and extreme (initially middle, latter term) solar ativity.

To research to estimate the precise generate time of the solar flare plasma clouds by using the world-wide observation data of the solar flaxes.

受付番号　000502

日本語タイトル　太陽フラックス遅延時間が衛星軌道精度に及ぼす影響

投稿著者　山本 富嘉

セッション番号　E021

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①1989年9月3日～1989年9月17日

表2-1　遅延量と予報精度（ぎんが：高度490km～690km　傾斜角 31度）

大気密度モデル	フラックス遅延量	Δa(m)	Δe	Δi(deg)	Δφ(deg)	ΔR(km)
Jacchia71	-1.0日	429	3.2E-05	0.0076	-2.020	-244.42
	-1.2日	401	3.4E-05	0.0075	-1.919	-232.199
	-1.4日	372	3.6E-05	0.0074	-1.813	-219.373
	-1.6日	341	3.8E-05	0.0073	-1.701	-205.821
	-1.8日	309	4.0E-05	0.0072	-1.585	-191.785
	-2.0日	276	4.2E-05	0.0070	-1.467	-177.507

表2-2　遅延量と予報精度（MOS-1：高度901km～920km　傾斜角 99度）

大気密度モデル	フラックス遅延量	Δa(m)	Δe	Δi(deg)	Δφ(deg)	ΔR(km)
Jacchia71	-1.0日	7.6	1.5E-06	0.000052	-0.036	-4.576
	-1.2日	6.7	1.4E-06	0.000051	-0.032	-4.067
	-1.4日	5.8	1.5E-06	0.000050	-0.028	-3.559
	-1.6日	4.9	1.5E-06	0.000050	-0.025	-3.178
	1.8日	3.9	1.5E-06	0.000050	-0.021	-2.669
	-2.0日	2.9	1.5E-06	0.000050	-0.017	-2.161

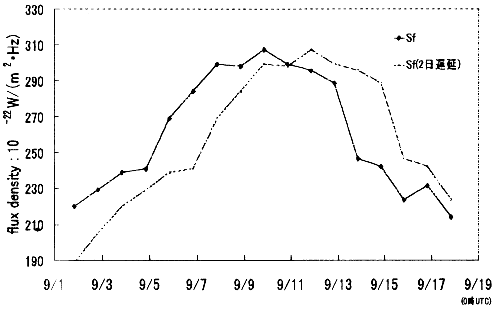

図1-1　Sfと2日の遅延を考慮したSf

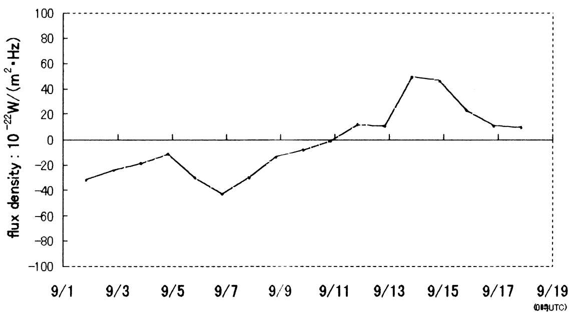

図1-2　2日の遅延を考慮したSfとSfの差

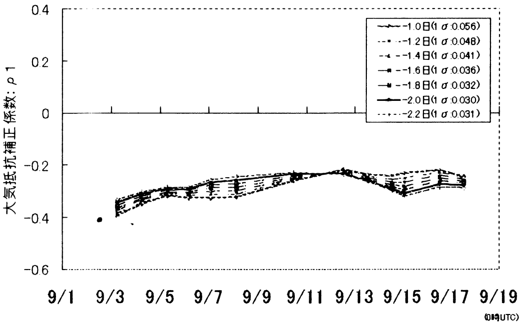

図2-1　ぎんが：遅延量とρ1の関係

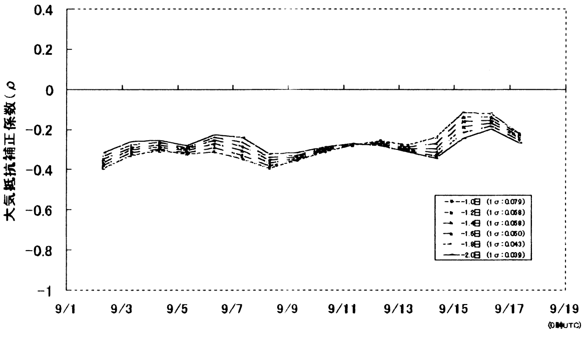

図2-2　MOS-1：遅延量とρ1の関係