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Study of Actual Jupiter Observation Days at UFRO Station During 2004 Year

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Abstract

In this Paper, There are attempts to compare the actual Observation Days in Decametric range (18-28 MHz), For Jupiter received by UFRO Earths' station with the Prediction Observation Days that the Jupiter can be observed at Jupiter's suitable location. The Jupiter's Radio Observations actual data during year 2004, was taken from (Radio JOVE Data Archive website). The determination of the prediction days carried out by using the (Radio-Jupiter pro Jove Edition) software for Jupiter radio storms at UFRO station coordinates. Some Cases are considered according to Jupiter's altitudes and Sun location at UFRO station Sky. The conclusion is, it could be found that there are (82) number of Predictions Observation Days, and It's found that the actual number of Observation Days; is only (16) Observation Days.

Keywords: Jupiter radio emission, Jupiter actual Observation Days, Jupiter Prediction Observation Days, Jupiter radio signal.

دراسة أيام مشاهدات المشتري الفعلية على محطة افرو خلال سنة 2004

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الخلاصة

في هذا البحث، هناك محاولات لمقارنة ايام المشاهدات الفعلية في نطاق الترددات الديكامترية(18−28) ميكاهيرتز للمشتري من قبل المرصد الارضي(افرو) مع الايام التي يفترض بها رصد المشتري بانسب موقع للمشتري في السماء الراديوية، المشاهدات الراديوية الفعلية للمشتري خلال سنة 2004، اخذت من صفحة الويبRadio−Jupiter pro)، تعيين الايام الافتراضية تمت باستخدام برنامج (Radio Jove Data Archieve Edition) البرمجي للعواصف الراديوية القادمة من المشتري على احداثيات موقع محطة (افرو)، المشتري مع موقع الشمس على سماء محطة (افرو)، الاستنتاج، انه تم بعض الاحداث اعتبرت تبعا لارتفاعات ايجاد (82) يوم رصد افتراضي من المحتمل رصد الاشارة الراديوية من المشتري فيه. وقد وجد ان عدد الايام الفعلية لرصد المشتري هي فقط (16) يوما.

Introduction:

The Jovian decameter Radio emission which is called (DAM) showed that the occurrence Probability of the radiation depended on two parameters:

The central meridian longitude (CML, System III (the meridian of longitude on Jupiter that is in the direction of the observer (usually on Earth) at a given time; since Jupiter rotating once, every 10 hours, The CML is constantly changing from 0^0 to 360^0(which is a return to 0^0), The rotating magnetic field and the orbital phase of the satellite Io, [1]. The angular distance which Io has from SGC (superior geocentric conjunction) is called the Io Phase, increases in the direction of Io's orbital motion.

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CML-Io Phase Diagram

The CML-Io phase diagram displayed the occurrence of the emission as a function of the CML and The Io phase, reveals several zones of enhanced occurrence probability which have been named Io-controlled sources: Io-A, Io-B, Io-C, and Io-D, as shown in Figure-1 [2].

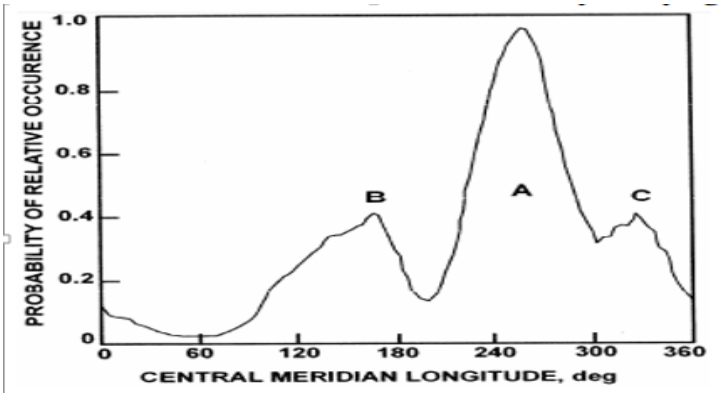


Figure 1- Relative probability of occurrence of DAM against central meridian Longitude [2]

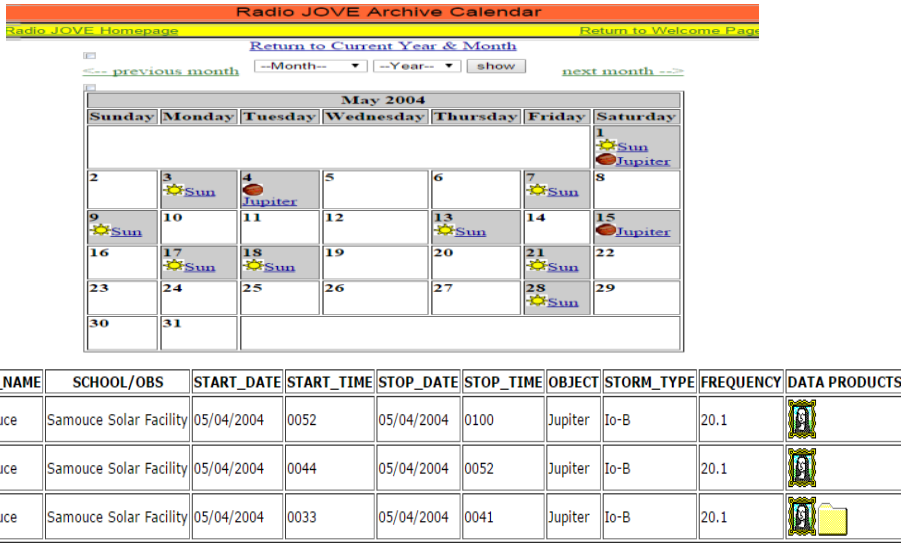
Table 1- Jovian decametric source locations in the CML- Io coordinate Source Designation CML (λIII) range, deg; Io-phase (ΦIo), deg [2]

Source designation	CML(λ_{III})range, deg;	Io-phase(ΦIo)
Io A	180^0-300^0	180^0-260^0
Io B	15^0-240^0	40^0-110^0
Io C	280^0-60^0	200^0-260^0
Io D	0^0-200^0	95^0-130^0

Description for Research Management Tools

Radio JOVE Data Archive

The archive website may be found at radiojove.org/archive.html. One of NASA's Sites, Figure-2 shown an example calendar view for the month of May 2004 and the list of data emission characteristics records for Jupiter on the same date. Can reached it by (Radio Jove data Archieve calendar) in This Site, [3]. The Radio Jove Telescope and Antenna, used in The University of Florida 26.3-MHz array, 640- dipole array was frequently used for Spectrograph observations because of its high gain. A linearly polarized array of 640 dipoles with a gain of 30 dBi, Yagi or a wire antenna designed for single frequency operation has sufficient bandwidth to work with this type of spectrograph [4].



FIRST_NAME	LAST_NAME	SCHOOL/OBS	START_DATE	START_TIME	STOP_DATE	STOP_TIME	OBJECT	STORM_TYPE	FREQUENCY	DATA PRODUCTS
"Dusty"	Samouce	Samouce Solar Facility	05/04/2004	0052	05/04/2004	0100	Jupiter	Io-B	20.1	
"Dusty"	Samouce	Samouce Solar Facility	05/04/2004	0044	05/04/2004	0052	Jupiter	Io-B	20.1	
"Dusty"	Samouce	Samouce Solar Facility	05/04/2004	0033	05/04/2004	0041	Jupiter	Io-B	20.1	

Figure 2- The Radio Jove data archive is shown with the Jupiter and solar data entries for Marc at 2014 (Credit: Radio Jove) [3].

Radio -Jupiter Pro Jove Edition Software

Radio Jove is a hands-on educational activity that brings the radio sounds of the Sun, Jupiter, the Milky Way Galaxy, and terrestrial radio noise to students, teachers, and the general public. Radio Jove is a non-profit group specifically founded to educate the general public about radio astronomy. The website http://radiojove.gsfc.nasa.gov [4].

Radio -Jupiter Pro Jove Edition Software

The Main Application Screens used in this Software can be identified as Noise Storm Prediction and ALT/AZ Plot

Noise Storm Prediction

The most important function of the Radio-Jupiter software is its ability to predict times of higher probability for the reception of Jupiter's decametric noise storms. The Figure-3 estimate the visibility of Jupiter for location is readily determined for a given time by the background color of the graph. Blue areas indicate that Jupiter is below the horizon. The yellow to white area(s) indicate Jupiter is above the horizon, with whiter areas roughly indicating a higher elevation in the sky [4].

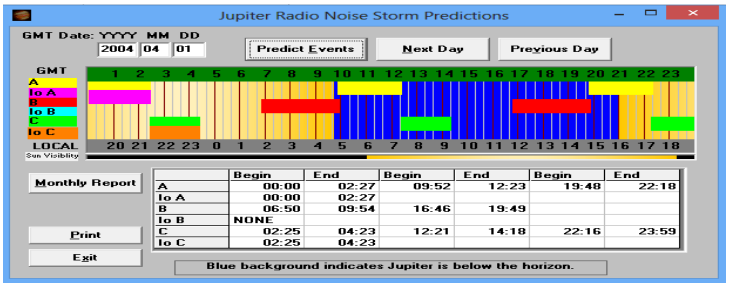


Figure 3- Jupiter Radio Noise Storm Prediction [4]

ALT/AZ Plot

Alt stands for altitude, and AZ stands for azimuth. Altitude in this sense is the angle in degrees that an object appears in the sky above the horizon. Azimuth is the compass direction in degrees with 0 degrees representing north, 90 degrees East, 180 degrees south, and 270 degrees west. Using these two coordinates you can place an object in the sky. A trail appears for the path of Jupiter or the Sun throughout the day, with the obvious icon representing the actual position of the body in real or fixed time. May select which object(s) appear with the checkboxes, as shown in Figure-4, [4].

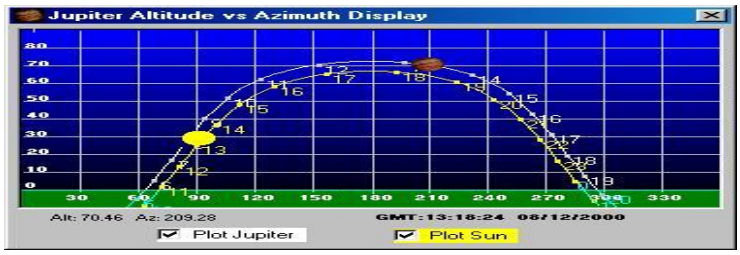


Figure 4- Altitude per Azimuth, [4].

The Results:

The Number of actual Observation Days as a result, Can be represented in Table-2.

Table 2- Represent the Number of actual Observation Days (N.O.D.) detect from UFRO station at Radio Jove Data Archieve for the Jupiter at 2004.

Name of Station	Date of O.D. at 2004		N.O.D.
	Months	O.D	
UFRO	Jan.	7,8,14,21,22 ,28	16
	Feb.	4,15,16,22,23,29	
	Mar.	1,25,26	
	Apr.	2	

The Positions of Sun, Jupiter according to UFRO station

There are events of Jupiter's Altitudes over the horizon, according to the exits of the sun or not, comparable with an observer on the Earth's surface.

A: In case of existence the Sun

The Sun existed with Jupiter in Conjunction or Apposition:

A1: Case of existence of the sun the altitude of the Jupiter is between (0-60) degrees, A1 can be classified into:

A1.1: Alt (40-60) degree, A1.2-Altitude (20-40) degree, A1.3: Altitude (0-20) degree

A2: when the Sun is existed and Jupiter at the astronomy sky

In this Case, the Jupiter can be observed in spite of the existence of the Sun, in apposition and near best apposition, A2can be classified into:

A2.1: Altitude (40-60) degree, A2.2: Altitude (20-40) degree, A2.3-Altitude (0-20) degree

A3: Altitude is negative

B- Case of the absence of sun

B1: Case of absence of sun, and the Jupiter at altitudes (0-60)

In all these altitudes The Jupiter can be observed, B1 can be classified into:

B1.1: Altitude (40-60) degree, B1.2: Altitude (20-40) degree, B1.3: Altitude (0-20) degree

B2: Altitude negative not exists on the horizon

There are three Altitudes for Jupiter, can be observed directly or by enhanced the field of view of the telescope: A2 (A2.1, A2.2, and A2.3), B1 (B1.1, B1.2, and B1.3)

Predictions Radio Storms

Using the Radio- Jupiter Pro Jove Edition program as mentioned previously, and by using the UFRO coordinates to find all the Prediction days of Storm type, small example of Table-3 explain these:

Notice: the thick border cells represents the Jupiter's high peak position at the astronomy sky, that exist at the cases A2 and B1 for altitude's at peak or near the peak (40-60),and altitudes(20-40). Possible to observe it if the telescopes enhanced field of view.

The grey color referred to the collected character of the prediction O.D taking from Radio- Jupiter Pro Jove Edition Software, and the real observation days taking from Radio Jove Data Archive

Table 3- Represented the Predictions of the days(82) Observation Days, that the Jupiter supposed observed, from Radio -Jupiter Pro Jove Edition Software program at UFRO station coordinate

Date of Prediction Day	Altitude (40-60) degree	Altitude (20-40) degree	Jupiter radio noise storm Prediction Local-time
3/1/2004	B1.1:Io B(44.41)		Io B(02:13)
7/1/2004	B1.1:Io A(62.24)		Io A(5:37)
8/1/2004		B1.2:Io C(21.29)	Io C(23:59)
9/1/2004	B1.1:IoC(43.56)		Io C(1:45)
10/1/2004	B1.1:IoB(58.78)		Io B(03:06)
14/1/2004	B1.1:IoA(51.56)		Io A(6:19)
Date of Prediction Day	**Altitude (40-60) degree**	**Altitude (20-40) degree**	**Jupiter radio noise storm Prediction Local-time**
16/1/2004	B1.1:IoC(45.02-56.53)		Io C(1:24-2:27)
17/1/2004	B1.1:IoB(54.38-65.61)		Io B(02:10-03:49)
21/1/2004	B1.1.: IoA(55.52)		Io A 2:00
22/1/2004		B1.2:IoA(28.66-33.54)	Io A(23:36-23:59)
23/1/2004	B1.1:IoA(48.55)		Io A(1:13)
24/1/2004	B1.1:IoB(65.26-62.17)		Io B(3:56-4:31)
25/1/2004	B1.1:IoA(61.88)		Io A(0002:26)
28/1/2004	B1.1:IoA(60.18)		Io A(2:00)
30/1/2004	B1.1:IoA(56.29-60.71)		IOA(1:26-1:55)

1/2/2004	**B1.1:IoA(53.66-64.89)**		**Io A(1:02-3:32)**
2/2/2004	**B1.1:IoB(63.25-62.8)**		**Io B(3:46-3:50)**
4/2/2004	**B1.1:IoA(63.95)**		**Io A (2:00)**
8/2/2004	**B1.1:IoA(64.21-55.76)**		**Io A(01:44-04:14)**
9/2/2004	**B1.1:IoB(52.54)**		**Io B(04:28)**
10/2/2004	**B1.1:IoB(41.01)**		**Io B(23:13)**
15/2/2004	**B1.1IoA(65.92-42.19)** **B1.1:IoC(42.6)**		**Io A(2:25-4:56)** **Io C(4:54)**
16/2/2004		**B1.2:IoB(38.43)** **B1.2:IoC(22.76-38.33)**	**Io B(05:10-07:18)** **Io C(21:20-22:33)**
17/2/2004	**B1.1:IoB(55.25)**		**Io B(23:55)**
21/2/2004	**B1.1:IoB(45.56)**		**Io B(4:14)**
22/2/2004	**B1.1:IoA(57.28**		**Io A(3:07)**
23/2/2004	**B1.1:IoC(50.72-52.97)**		**Io C(23:3-23:15)**
24/2/2004	**B1.1:IoB(59.29-61.11)**		**Io B:(23:47-23:59)**
25/2/2004	**B1.1:IoA(44.43)** **B1.1:IoB:61.26-65.59)**		**Io A:(22:22)** **Io B: (00:00-00:37)**
29/2/2004	**B1.1:IoA(43.74-**		**Io A:(3:49)**
1/3	**B1.1:IOA(44.79**		**Io A(22:01)**
3/3	**B1.1:IoB(63.4)**		**Io A(23:38)**
Date of Prediction Day	**Altitude (40-60) degree**	**Altitude (20-40) degree**	**Jupiter radio noise storm Prediction Local-time**
10/3	**B1.1:IoA(41.71-67.9)**		**Io A(21:5-23:59)**
11/3	**B1.1:IoA(67.93-67.85)**		**Io A(00:00-00:20)**
12/3/2004	**B1.1:IoB(66.96-61.27)**		**Io B(00:34-01:23)**
17/3	**B1.1:IoA(63.43-67.78)**		**Io A(22:32-23:59)**
18/3/2004	**B1.1:IoA(67.73-60.65)** **B1.1:IoC(60.97-53.85)**		**Io A(00:00-01:02)** **Io C(01:00-01:41)**
19/3/2004	**B1.1:IoB(57.62)**		**Io B(01:16)**
24/3/2004	**B1.1:IoA(68.61-65.42)**		**Io A(23:14-23:59)**
25/3	**B1.1:IoA(65.3-47.48)** **B1.1:IoC(47.68)**		**Io A:(00:00-1:44)** **Io C(1:43)**
26/3	**B1.1:IoB(43.76)**		**Io B(1:58)**
27/3/2004	**B1.1:IoB(52.89)**		**Io B(20:44)**
31/3/2004	**B1.1:IoA(61.75-61.43)**		**Io A(23:57-23:59)**
1/4/2004	**B1.1:IoA(61.27)**		**Io A(00:00)**
2/4/2004		**A2.2:IoA(26.12)** **B1.2:IoB(24.67**	**Io A(18:09)** **Io B(2:58)**
3/ 4	**B1.1:IoB(64.13-65.18)**		**Io B(21:19-21:27)**
4/4	**B1.1:IoA(48.44)**		**Io A(19:46)**
8/4	**B1.1:IoA(48.53-**		**Io A(00:40)**
11/4	**B1.1:IoA(61.65)**		**Io A(20:29)**
12/4	**B1.1:IoB(64.65-67.87)**		**Io B(20:43-21:12)**
18/4	**A2.1:IoA(47.62)** **B1.1:IoA(69.37)** **B1.1:IoC(69.32-68.66)**		**Io A(18:42-21:13)** **Io C(21:11-21:45)**
19/4	**B1.1:IoB(69.31-58.23)**		**Io B(21:27-23:00)**
25/4	**A2.1:IoA(61.31)** **B1.1:IoA(64.76)**		**Io A(19:26-21:56)** **Io C(21:55-23:34)**

	B1.1:IoC(64.76-46.95)		
26/4	**B1.1:IoB(61.62-40.92)**		**Io B(22:10-23:59)**
27/4	**B1.1:IoB(40.71)**		**Io B(00:00)**
2/5	**B1.1:IoA(69.32-52.16)** **B1.1:IoC(52.36)**		**Io A(20:10-22:40)** **Io C(22:39)**
Date of Prediction Day	**Altitude (40-60) degree**	**Altitude (20-40) degree**	**Jupiter radio noise storm Prediction Local-time**
3/5	**B1.1:IoB(47.36)**		**Io B(23:00)**
5/5	**A2.1:IoB(46.61-49.50)**		**Io B(17:28-17:40)**
9/5	**B1.1:IoA(65.48**		**Io A(20:54)**
11/5	**B1.1:IoA(46.66)**		**Io A(22:32)**
13/5	**A2.1:IoA(44.15)**		**Io A(16:45)**
14/5	**A2.1:IoB(47.81-53.76)**		**Io B(16:59-17:29)**
16/5	**B1.1:IoA(43.06)**		**Io A(22:30)**
20/5	**A2.1:IoA(57.95)** **A2.1:IoC(57.77-63.54)**		**Io A(17:29)** **Io C(17:28-18:03)**
21/5	**A2.1:IoB(61.16-69.24)**		**Io B(17:44-19:21)**
27/5	**A2.1:IoA(42.32-67.79)** **A2.1:IoC(67.71)** **B1.1:IoC(63.67)**		**Io A(15:44-18:14)** **Io C(19:57)**
3/6	**A2.1:IoA(56.23-67.24)** **A2.1:IoC(67.42)** **B1.1:IoC(48.55)**		**Io A(16:29-19:00)** **Io C(18:58-20:55)**
4/6	**B1.1:IoB(63.14)**		**Io B(19:30)**
10/6	**A2.1:IoA(66.52)** **B1.1:IoA(56.96)** **B1.1:IoC(45.52)**		**Io A(17:14-19:45)** **Io C(20:44)**
12/6	**A2.1:IoA(64.18)** **B1.1:IoA(52.41)**		**Io A(18:52-20:02)**
17/6	**A2.1:IoA(58.71)** **B1.1:IoA(42.93)**		**Io A(19:9-20:31)**
19/6	**B1.1:IoA(52.9)**		**Io A(19:38)**
21/6	**A2.1:IoC(47.06)**		**Io C(14:40)**
22/6	**A2.1:IoB(40.77-62.78)**		**Io B(14:6-16:5)**
28/6	**A2.1:IoA(51.01)** **A2.1:IoC(50.63-** **A2.1:IoC(67.39)**		**Io A(14:37)** **Io C(14:35-16:33)**
27/11	**B1.1:IoB(43.44)**		**Io B(6:31)**
10/12	**B1.1:IoA(41.1**		**Io A(5:37)**
11/12	**B1.1:IoB(51.36)**		**Io B(6:46)**
Date of Prediction Day	**Altitude (40-60) degree**	**Altitude (20-40) degree**	**Jupiter radio noise storm Prediction Local-time**
12/12	**B1.1:IoA(40.13)**		**Io A(5:25)**
17/12	**B1.1:IoA(50.59)**		**Io A(6:21)**
19/12	**B1.1:IoA(44.29**		**Io A(5:28)**
26/12	**B1.1:IoA(52.42)**		**Io A(6:12)**

Notice: B1.1: Io B (44.41), the (44.41) referred to the Jupiter's Altitudes, and so as the whole table.
Io B (02:13): referred to the Jupiter's Storm Local Time.

The Discussion and Conclusion:

1. Choosing UFRO Station at Florida City as the station of this work because, it's clear location coordinate on the Florida University, its wide range of receiving frequencies, and it's not amateur observatory station, for monitoring the Jovian Decametric Emission the UFRO TP arrays are used in the frequency range from 18 to 40 MHz's.
2. In Table-3, cannot observed the Jupiter if it is in conjunction situation with the Sun, because it's much stronger radio source than Jupiter. In the Opposition case, the Jupiter can be observed in multi altitudes if the field of view of the telescopes enhanced.
3. According the Jupiter altitude's and Table-3, Jupiter couldn't observed the in case A1 (the conjunction situation with the Sun), but the Jupiter could be observed in case A2 (opposition situation of Jupiter with the Sun), and in case B1 (the absence of the Sun), in altitudes (40-60) degree, Jupiter's high peak in the astronomy sky , and if the telescopes' field of view enhanced, The Jupiter can observed at altitudes (0-40) degree also.
4. It could be found that there are (82) number of Predictions Observation Days, and It's found that the actual number of Observation Days; is only (16) Observation Days.

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