



東北大学におけるデータベースの現状

東北大学観測チーム（八木学、小原隆博、熊本篤志、土屋史紀、鍵谷将人、米田瑞生、三澤浩昭、寺田直樹、笠羽康正、佐藤慎也）、岩井一正（NICT）、大矢浩代（千葉大）

Acknowledgement

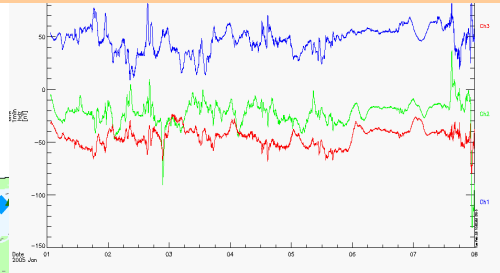
This work is supported by Dr. Cecconi (Obspm, France) to develop Virtual Observatory for planetary radio observation data.

Radio & Geomagnetic Observations

LF radio wave (Ny-Alesund)

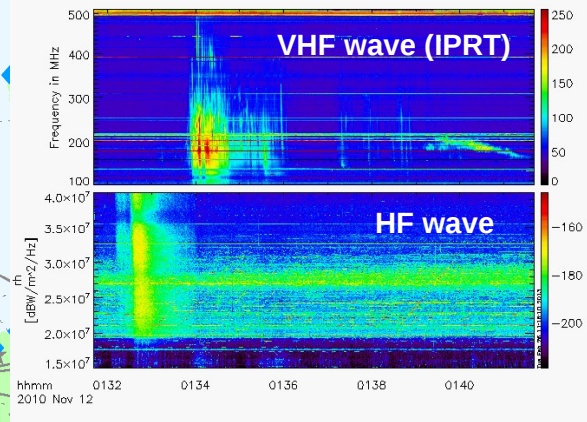
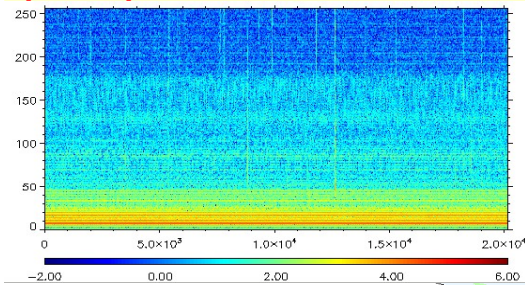
Geomagnetic data (Onagawa)

LF radio wave (Athabasca)



Asia VLF Observation Network (AVON)

IPRT/HF (Iitate Observatory)



Provided by Dr. Ohya (Chiba Univ.)

Database List

	Data Format	IUGONET MDDDB (Granule update)	UDAS
IPRT/AMATERAS	FITS	Automatically	Registered
litate wideband HF	CDF	Automatically	Registered
litate narrowband HF	Printed paper	-	-
LFRT0(LF-STD)	CDF	Automatically	Registered
AVON	CDF	Manually	Registered
Onagawa mag	CDF	Manually --> Stop	Registered s*released by ERG-SC

Metadata(Granule) submission

Check tool for real data and metadata

2015年 メタデータ(XMLファイル)チェック

解説 << 2014

date	IPRT		litate HF (PNG)		litate HF (CDF)		LFRTO: ATH		LFRTO: NAL		script LOG
	実データ	メタデータ	実データ	メタデータ	実データ	メタデータ	実データ	メタデータ	実データ	メタデータ	
2015/01/01	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/02	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/03	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/04	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/05	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/06	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/07	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/08	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/09	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/10	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/11	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/12	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/13	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/14	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/15	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/16	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/01/17	okl	okl	okl	okl	okl	okl	okl	okl	okl	okl	Detail
⋮											
2015/07/16	okl	error	okl	okl	okl	okl	no data	-	no data	-	Detail
2015/07/17	okl	error	okl	okl	okl	okl	no data	-	no data	-	Detail
2015/07/18	okl	error	okl	okl	okl	okl	no data	-	no data	-	Detail
2015/07/19	okl	error	okl	okl	okl	okl	no data	-	no data	-	Detail
2015/07/20	okl	error	okl	okl	okl	okl	okl	okl	okl	okl	Detail
2015/07/21	okl	error	okl	okl	okl	okl	no data	-	okl	okl	Detail
2015/07/22	okl	error	okl	okl	okl	okl	okl	okl	okl	okl	Detail

Detail LOG

```

[Datafile existence in server (HTTP)]
https://radio.gp.tohoku.ac.jp/db/IPRT-SUN/DATA/2015/20150722_IPRT.fits.xml...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072200_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072201_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072202_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072203_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072204_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072205_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072206_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072207_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072208_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072209_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072210_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072211_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072212_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072213_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072214_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072215_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072216_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072217_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072218_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072219_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072220_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072221_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072222_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/jupiter/it/hf/cdf/20150722/it_hf_2015072223_v02.cdf...ok!
https://radio.gp.tohoku.ac.jp/lf/cdf/ath/201507/lf_rto_30sec_ath_nal_20150722_v01.cdf...ok!
https://radio.gp.tohoku.ac.jp/lf/cdf/ath/201507/lf_rto_30sec_ath_nsk_20150722_v01.cdf...ok!
https://radio.gp.tohoku.ac.jp/lf/cdf/ath/201507/lf_rto_30sec_ath_nlx_20150722_v01.cdf...ok!
https://radio.gp.tohoku.ac.jp/lf/cdf/ath/201507/lf_rto_30sec_ath_nmq_20150722_v01.cdf...ok!
https://radio.gp.tohoku.ac.jp/lf/cdf/ath/201507/lf_rto_30sec_ath_nrk_20150722_v01.cdf...ok!
https://radio.gp.tohoku.ac.jp/lf/cdf/ath/201507/lf_rto_30sec_ath_mec_20150722_v01.cdf...ok!
https://radio.gp.tohoku.ac.jp/lf/cdf/ath/201507/lf_rto_30sec_ath_www_20150722_v01.cdf...ok!
https://radio.gp.tohoku.ac.jp/lf/cdf/ath/201507/lf_rto_30sec_nal_dcf_20150722_v01.cdf...ok!
https://radio.gp.tohoku.ac.jp/lf/cdf/ath/201507/lf_rto_30sec_nal_gbz_20150722_v01.cdf...ok!
https://radio.gp.tohoku.ac.jp/lf/cdf/ath/201507/lf_rto_30sec_nal_msf_20150722_v01.cdf...ok!
https://radio.gp.tohoku.ac.jp/lf/cdf/ath/201507/lf_rto_30sec_nal_nsk_20150722_v01.cdf...ok!

[Metadata existence in repository directory (Local:automount)]
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_png/20150722_png.xml...not found!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072200_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072201_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072202_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072203_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072204_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072205_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072206_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072207_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072208_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072209_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072210_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072211_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072212_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072213_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072214_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072215_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072216_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072217_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072218_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072219_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072220_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072221_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072222_cdf.xml...ok!
/home/iugonet/workspace/metadata/Tohoku/Granule/Granule/Tohoku/radio_obs/it/hf/spec/hfsec_sun_cdf/it_hf_2015072223_cdf.xml...ok!
    
```

Granule作成ツール

IUGONETメタデータ Granule作成

dataset site start-date end-date

lf_rto
 tnn
 2010 8 24 今日の日付 観測開始日

avon
 srb
 2014 8 8 今日の日付 観測開始日

hf_cdf
 ptk

hf_png
 lbs

iprt

開始

実データ
作成状況

実データ
作成状況

Low Frequency wave observation

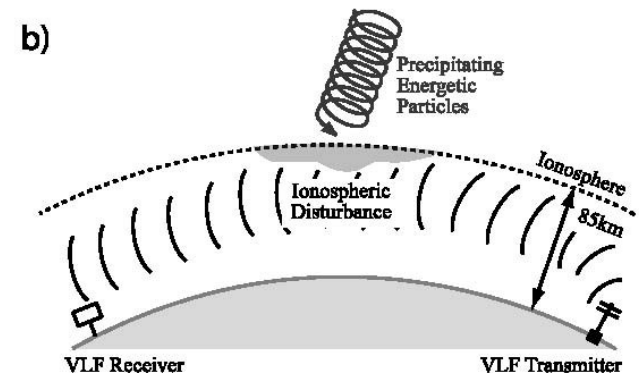
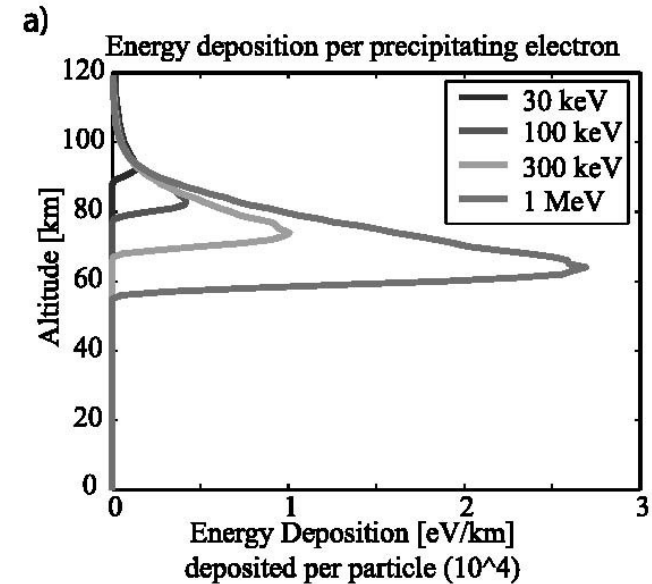
Precipitation of high energy electrons (>100keV) into the atmosphere

- **In-situ particle observation**

- Near the magnetic equator
 - loss cone \ll FOV of the instrument
- Low-altitude
 - Electrons in the loss cone
 - Time resolution \sim satellite orbital period (1~2hrs)

- **Ground based radio observation**

- High-energy electron precipitation
- Ionization in the lower ionosphere
 - Riometer: Absorption of galactic radio noise
 - **~30keV electron precipitation** (contribution of high altitude absorption)
 - **VLF, LF signal perturbation**: Propagation between the lower edge of the ionosphere and the ground (Reflection height \sim 70km)
 - **sensitive to higher energy electrons than the riometer observation.**
 - **>100keV electron precipitation**

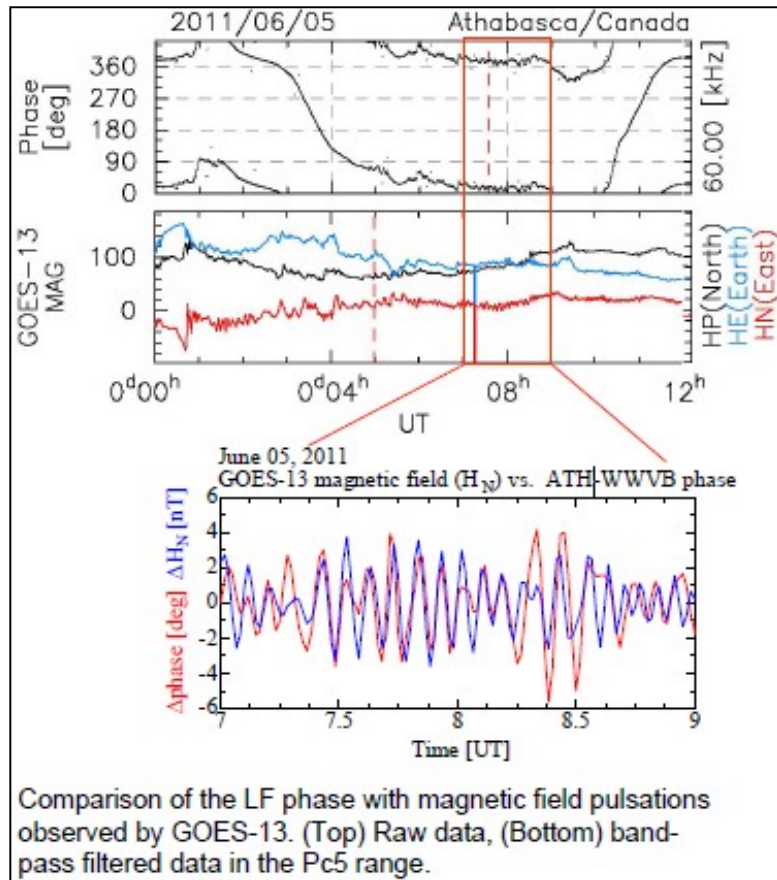


Electron precipitation, ionization, and radio wave modulation (Chevalier et al. 2007)

Low Frequency wave observation

LFRTO (Low Frequency Radio Transmitter Observation)

URL <http://iprt.gp.tohoku.ac.jp/lf/cdf/ath/>



- CDF Format
- Automatically submit to IUGONET MDDDB
- Included in UDAS

Plot by IDL (TDAS/UDAS)

> thm_init

> timespan, '2011-06-05'

> iug_load_lfrto

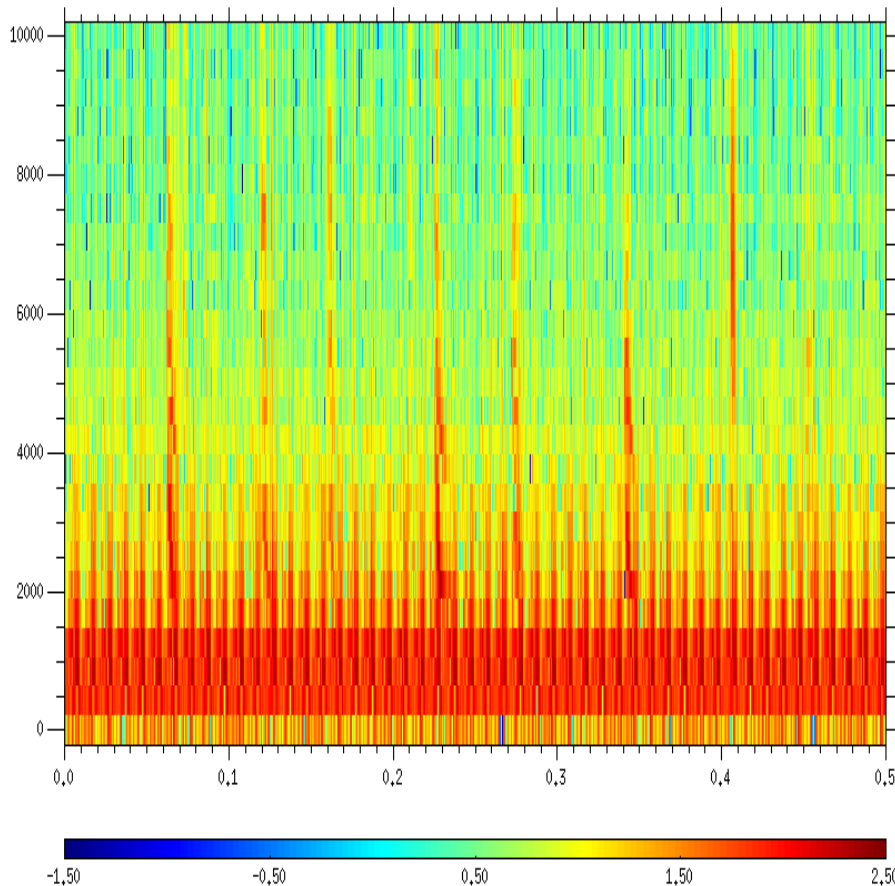
> tplot,

['power_30sec', 'phase_30sec']

VLF wave observation

AVON (Asia VLF Observation Network) Tweeks data

URL <http://iugonet02.gp.tohoku.ac.jp/>



- CDF Format
- Included in IUGONET Database
- Included in UDAS

```
Plot by IDL (TDAS/UDAS)  
> thm_init  
> cdf_leap_second_init  
> cdf2tplot,  
file='vlf_waveform_tnn_200  
81130080000_v01.cdf'  
> tplot,[1,2]
```

VLF wave observation

Quick Look page (under development)

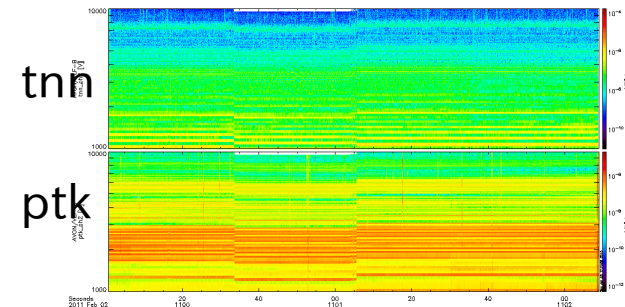
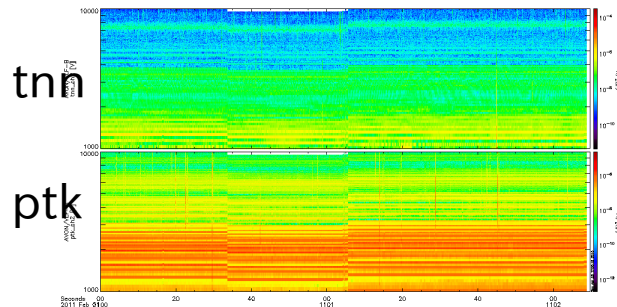
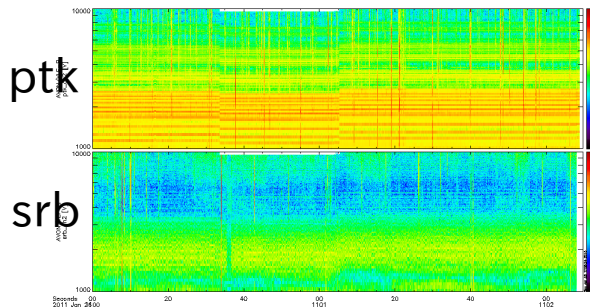
using **opensearch**

date	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2
tnn	×	×	×	×	×	×	×	○	○
srb	○	○	×	×	×	×	×	×	×
ptk	×	○	○	○	○	○	○	○	○

2011/1/26 11:00-11:02

2011/2/1 11:00-11:02

2011/2/2 11:00-11:02



<http://iugonet02.gp.tohoku.ac.jp/avon/qltest/ql.html> (公開予定)

IPRT / AMATERAS

The system consists of wide-band polarimeter and high-speed FFT spectrometer installed on the IPRT, Tohoku University. The system enables to observe the solar radio bursts in **100-500MHz** with world-eminent specifications; i.e., with the sensitivity of **0.7s.f.u**(solar flux unit) and time resolution of less than **10msec**. The observations have been made everyday.

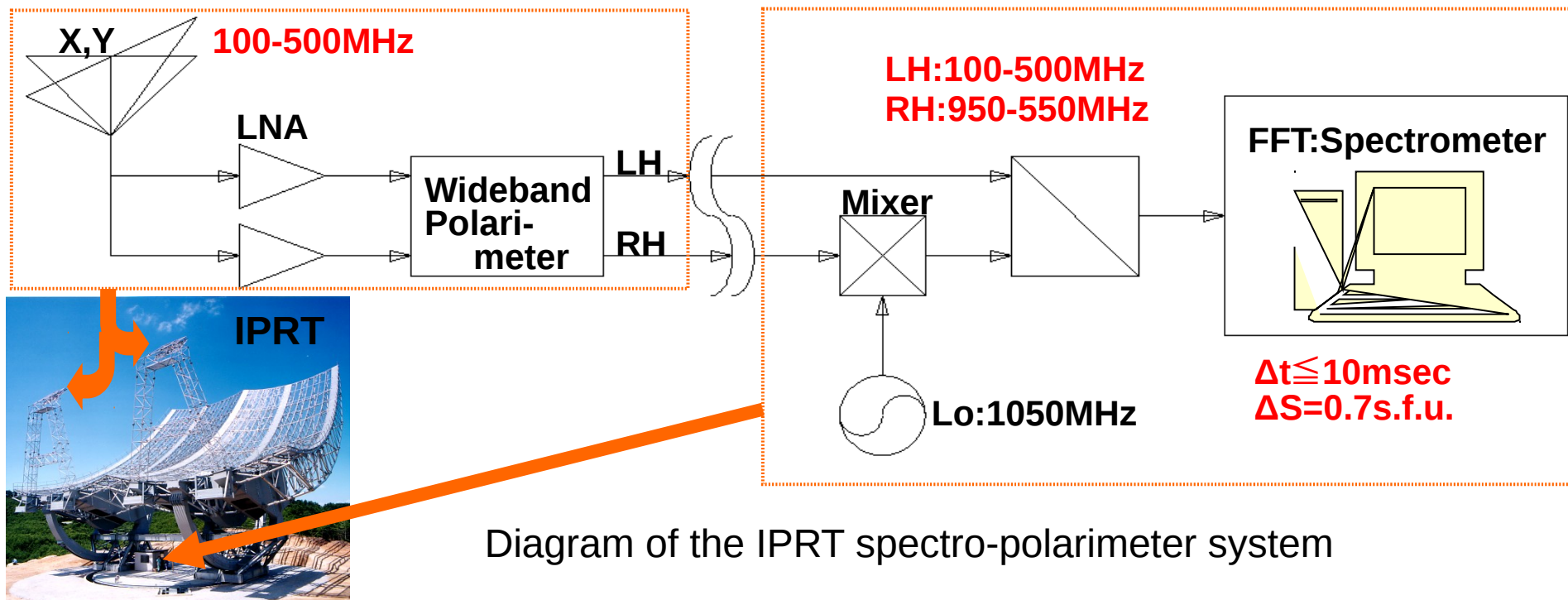
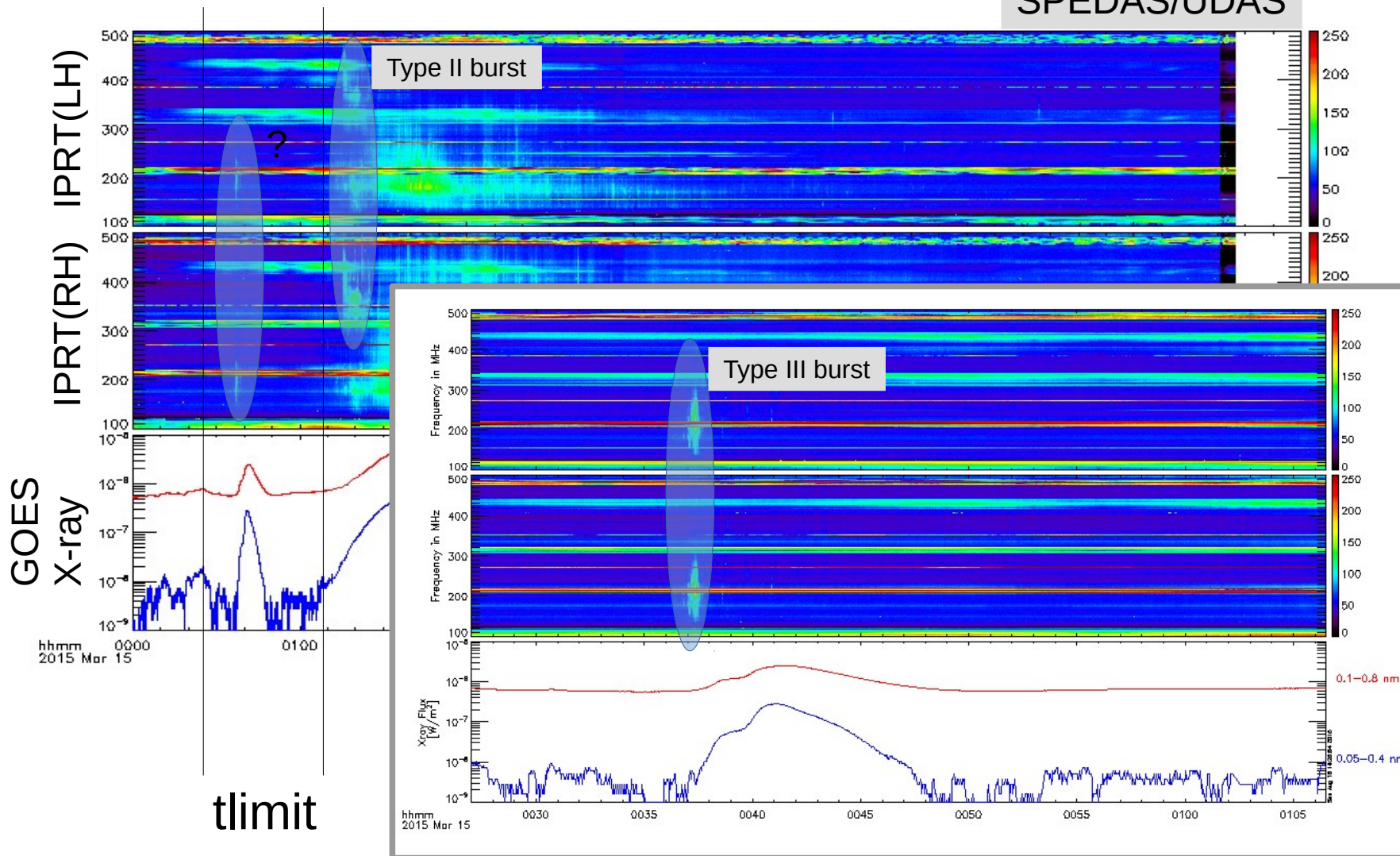


Diagram of the IPRT spectro-polarimeter system

IPRT / AMATERAS

Solar radio burst event (2015/03/15)

SPEDAS/UDAS



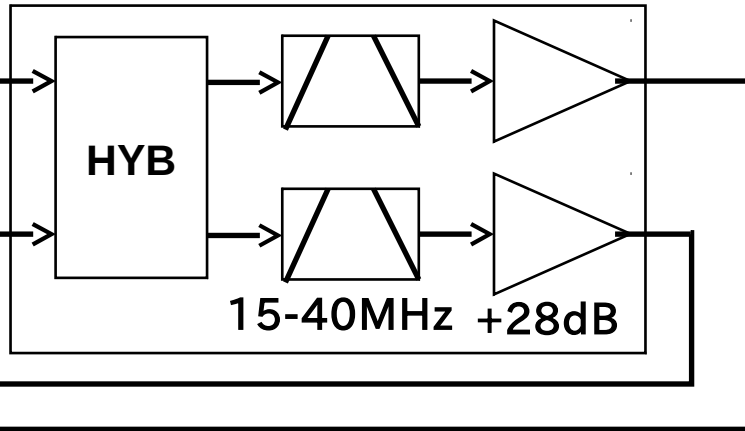
litate HF wideband receiver

http://ariel.gp.tohoku.ac.jp/~jupiter/it_hf/cdf/

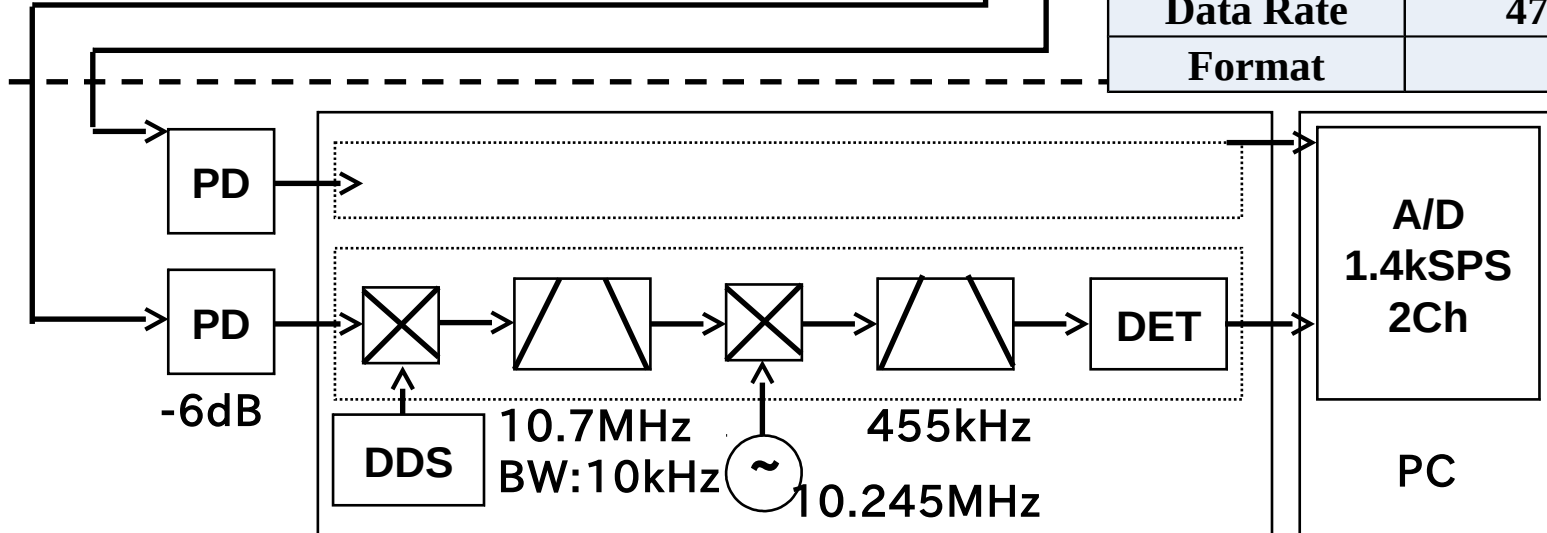
Location (140.40E, 37.42N)



Log-periodic Antenna



Polarization	R&L
Interval	0.5s
BW	10kHz
Step #	700
F range	15-40 MHz
Sensitivity	-200dBWm ⁻² Hz ⁻¹
Precision	12 bit
Data Rate	470MB/day
Format	CDF



Observation of Jovian decametric radiation (DAM) from the ground stations

Purpose

Remote sensing of ionosphere-magnetosphere-satellite coupling processes in the Jovian magnetosphere

Merits (compared to in-situ observations)

Possible to use enough facilities

- Large array antenna

- Receivers with high frequency & time resolutions

- High-speed networks & huge storages

Demerits (compared to in-situ observations)

Artificial noises on the Earth

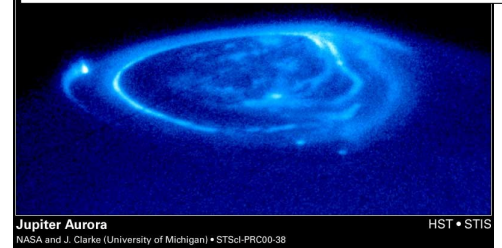
- We need efforts to reduce/avoid them...

Possible only while the Jupiter is above the horizon

- Avoidable with multi-station observation

→ **Integrated data archives like VO will be useful for analysis**

Jovian aurora (HST)



http://apod.nasa.gov/apod/image/0012/jupiteraurora_hst_big.jpg



litate

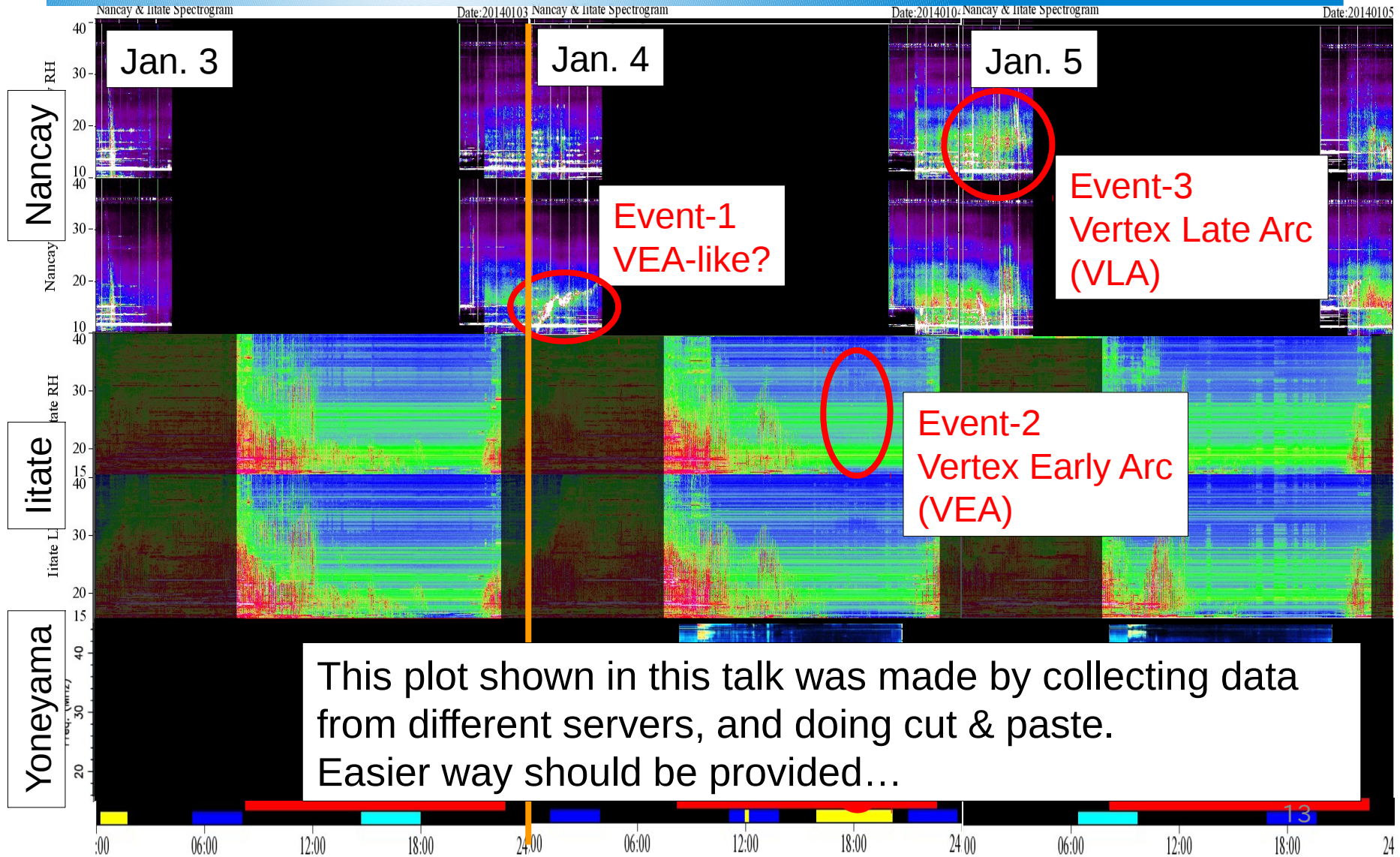
<http://ariel.gp.tohoku.ac.jp/~jupiter/>



Nancay

<http://www.obs-nancay.fr/-Le-reseau-decametrique-.html>

Multi-station data of Jovian DAM



VOのRepository検索server

<http://voparis-europlanet-new.obspm.fr/>

ファイル(E) 編集(E) 表示(V) 履歴(S) フックマーク(B) ツール(I) ヘルプ(H)

Europlanet Client

voparis-europlanet-new.obspm.fr/planetary/data/epr/query/all/

VESPA

Virtual European Solar and Planetary Access

All VO Custom resource

Query form: All VO

Target name

Resource type

Dataset ID

Time selection

Time min

Time max

Dataproduct type

Measurement type

Target class

Plotting tools

- TOPCAT
- Aladin
- VOSpec
- SPLAT

Example queries

- Saturn in March 2012

Location +
Spectral +
Time +
Photometry +
Instrument +
Optional +

VO提供Data Browser (TOPCAT)※DBとも連動

Time Plot

RadioJove

Window Layers Subsets Plot Export Help

2013-01-13T01:40

2013-01-13T01:45

Time Plot

litate

Window Layers Subsets Plot Export Help

2013-10-20T17:00

17:15 17:30 17:45 18:00

Count: 3,600 / 3,600

Summary

- LFRTO(CDF), AVON(CDF), IPRT(FITS), and litate HF(CDF) database are provided.
- We develop a automatic submission system for iugonet metadata(granule).
- Now we are planning to develop a Virtual Observatory of Jovian HF radiation collaborating with Dr. Cecconi.