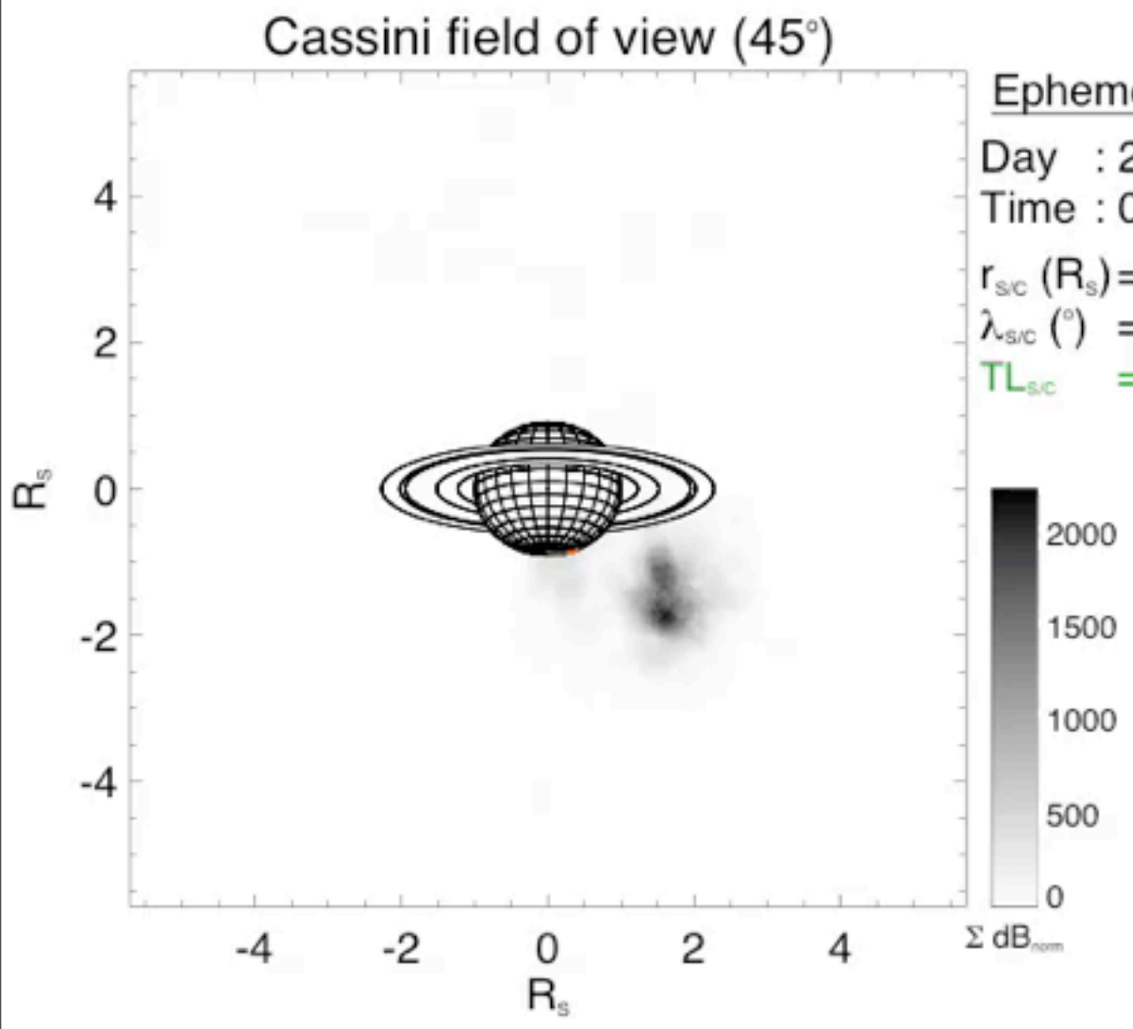
Variability of SKR sources

L. Lamy, P. Zarka, B. Cecconi

Imperial College London
LESIA, Observatoire de Paris

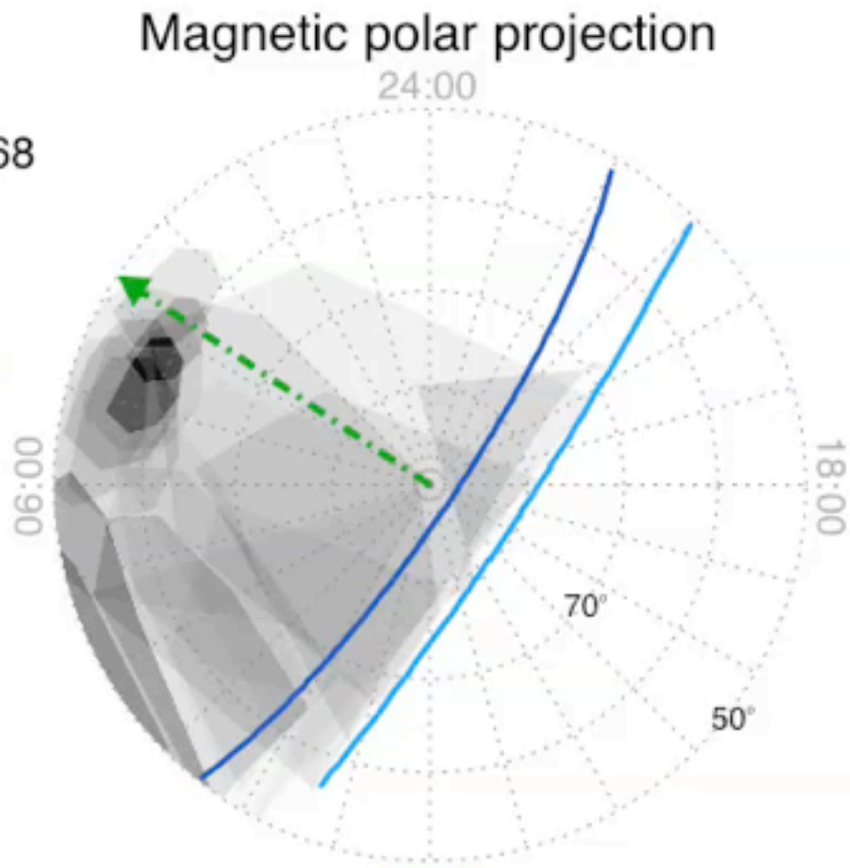
RPWS Team meeting 13/05/2009

I. Distribution of SKR sources:



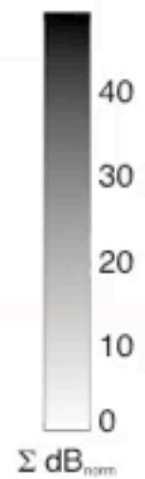
Ephemeris:

Day : 2006-268
Time : 00:00
$r_{s/c}$ (R_s) = 11.4
$\lambda_{s/c}$ (°) = -15.8
$TL_{s/c}$ = 03:44



Data selection:

δt (min) = 10.
f_{min} (kHz) = 100
f_{max} (kHz) = 1000
V = [0.80,1.10]
$SN_{x,z}$ (dB) ≥ 30
β (°) ≥ 20 (57)



I. Distribution of SKR sources:

1- Huge effet of visibility depending on the S/C location

2- Even in good visibility conditions:

a) Instrumental limits on radio imaging:
- direction of arrival close to the antenna plane
- non purely circular polarization affecting 2-antenna DF results
- low SNR affecting all DF results
- low accuracy due to large distances
- etc ...

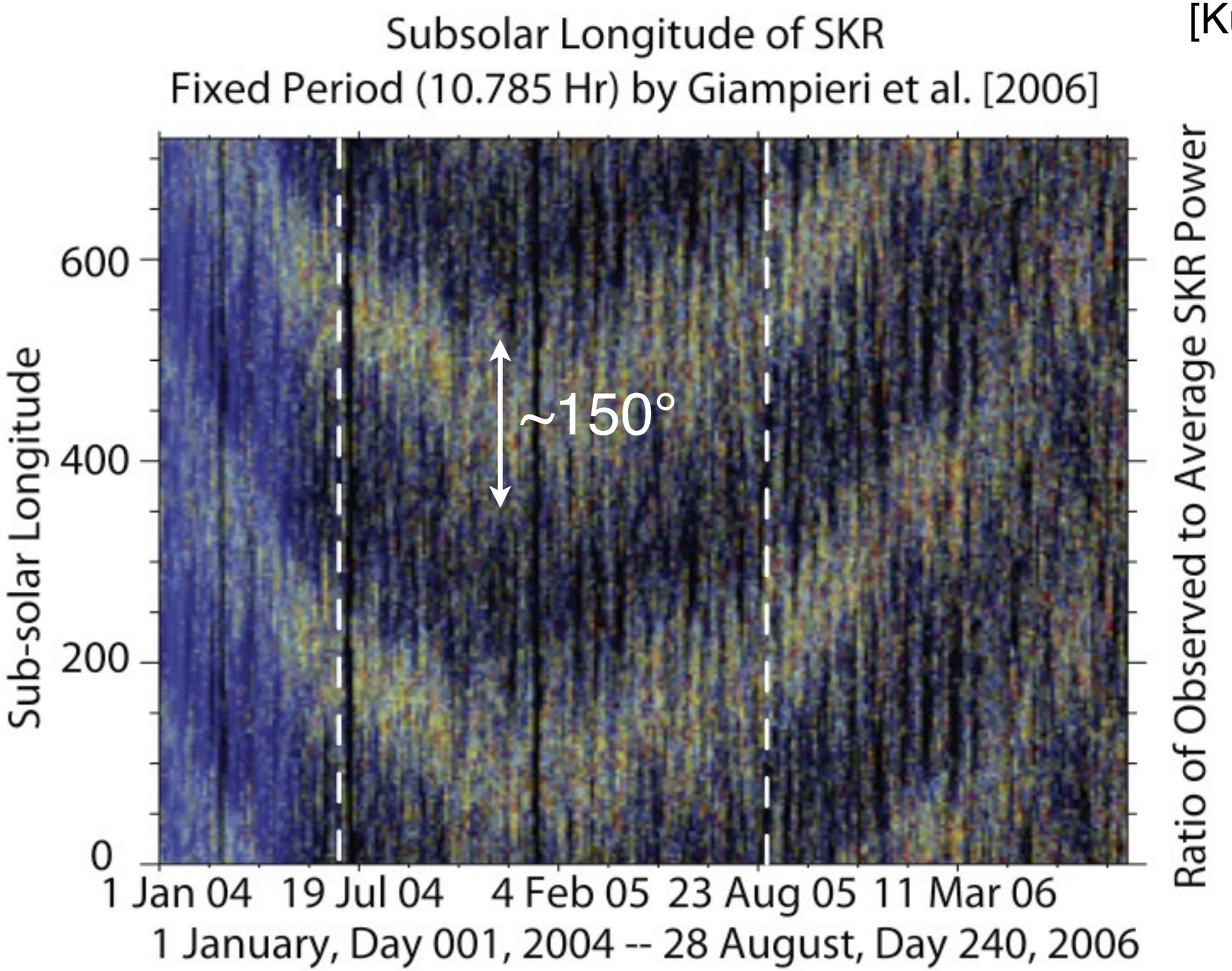
b) Physical properties of the observed emission:
- mixing of sources with similar intensity => apparent sources
- refraction along the ray path

=> difficult to simply investigate possible rotating sources with consecutive radio images

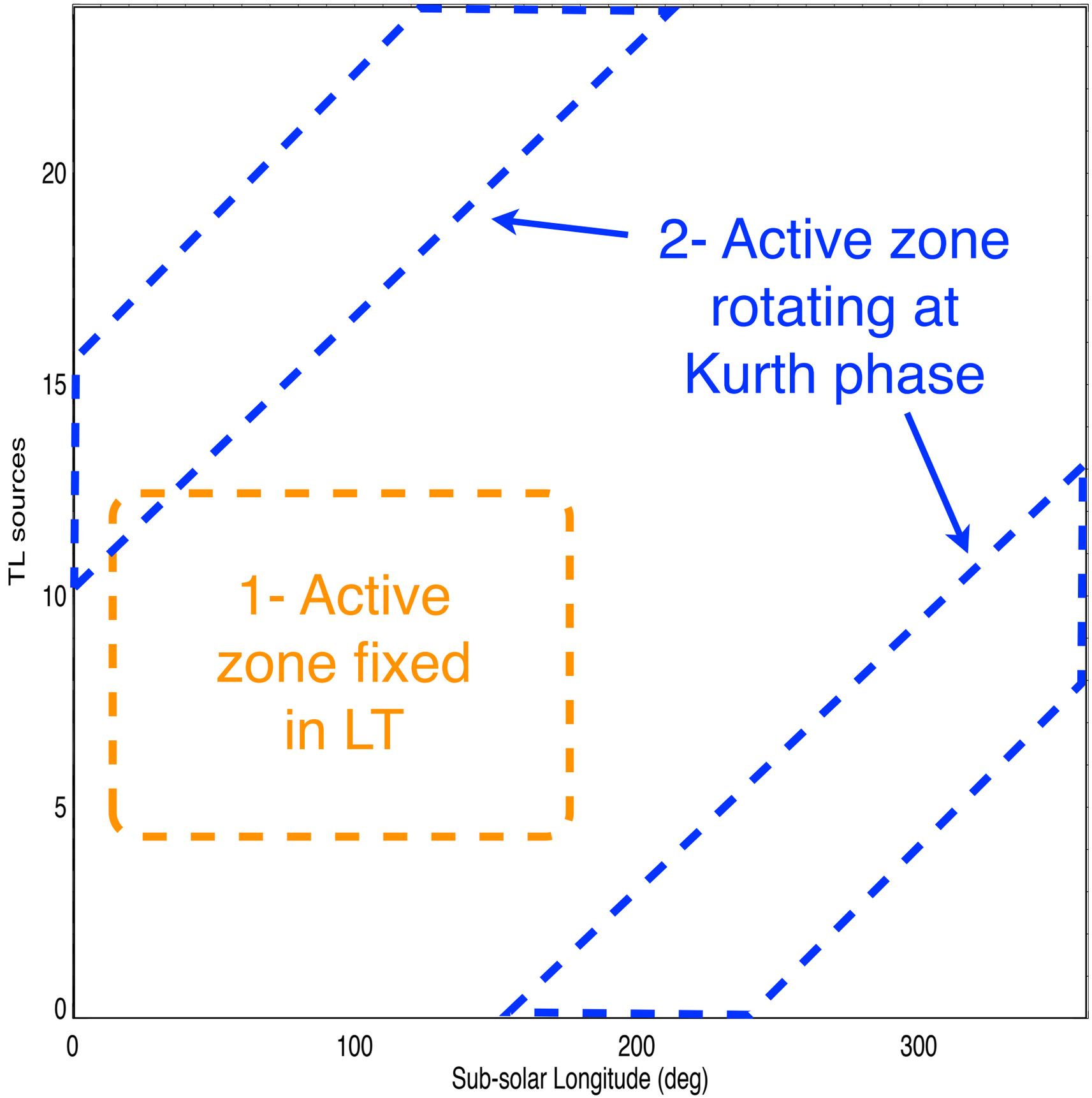
=> statistical study

I. Distribution of SKR sources:

[Kurth et al, 07]

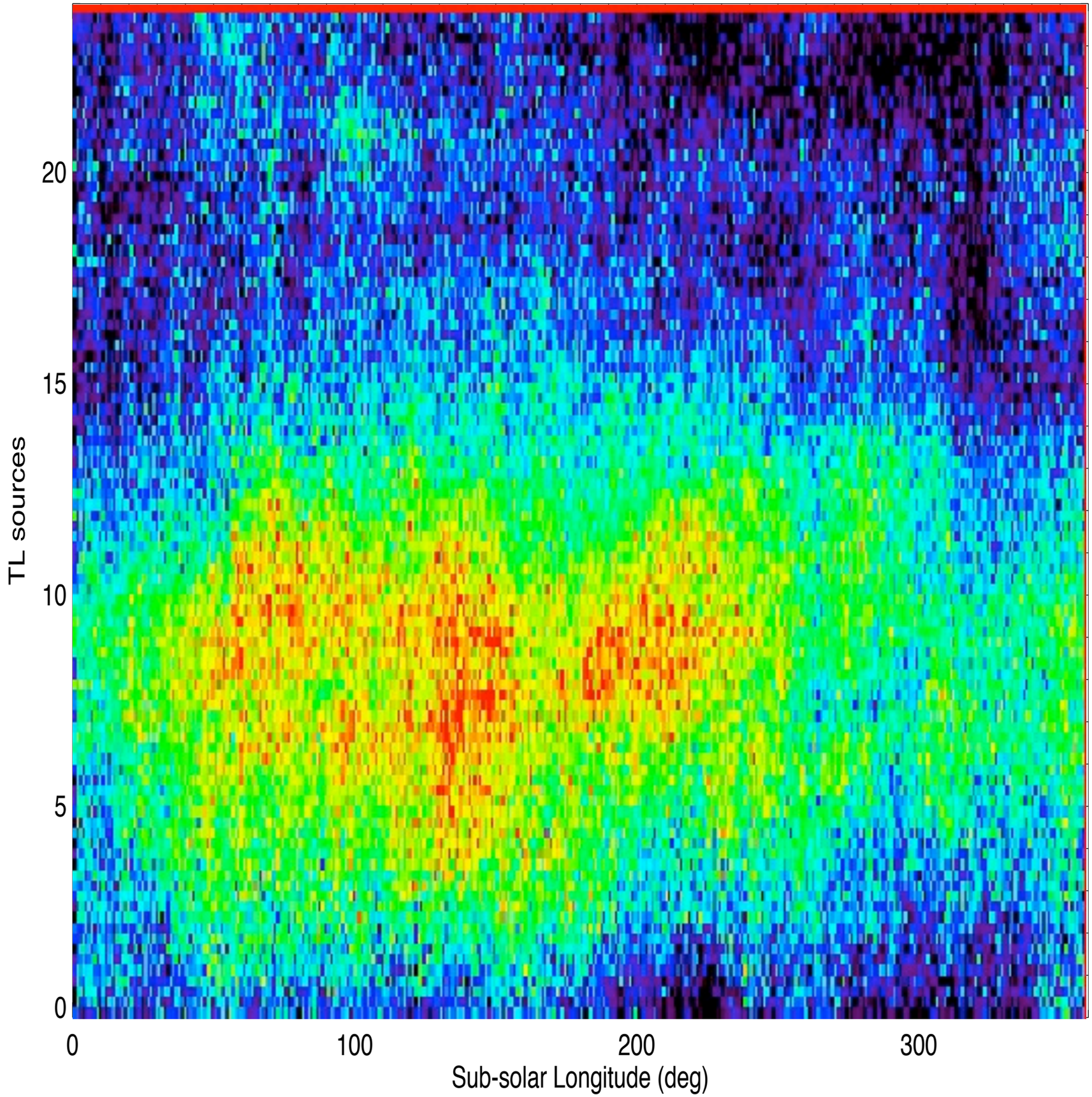


I. Distribution of SKR sources:



I. Distribution of SKR sources:

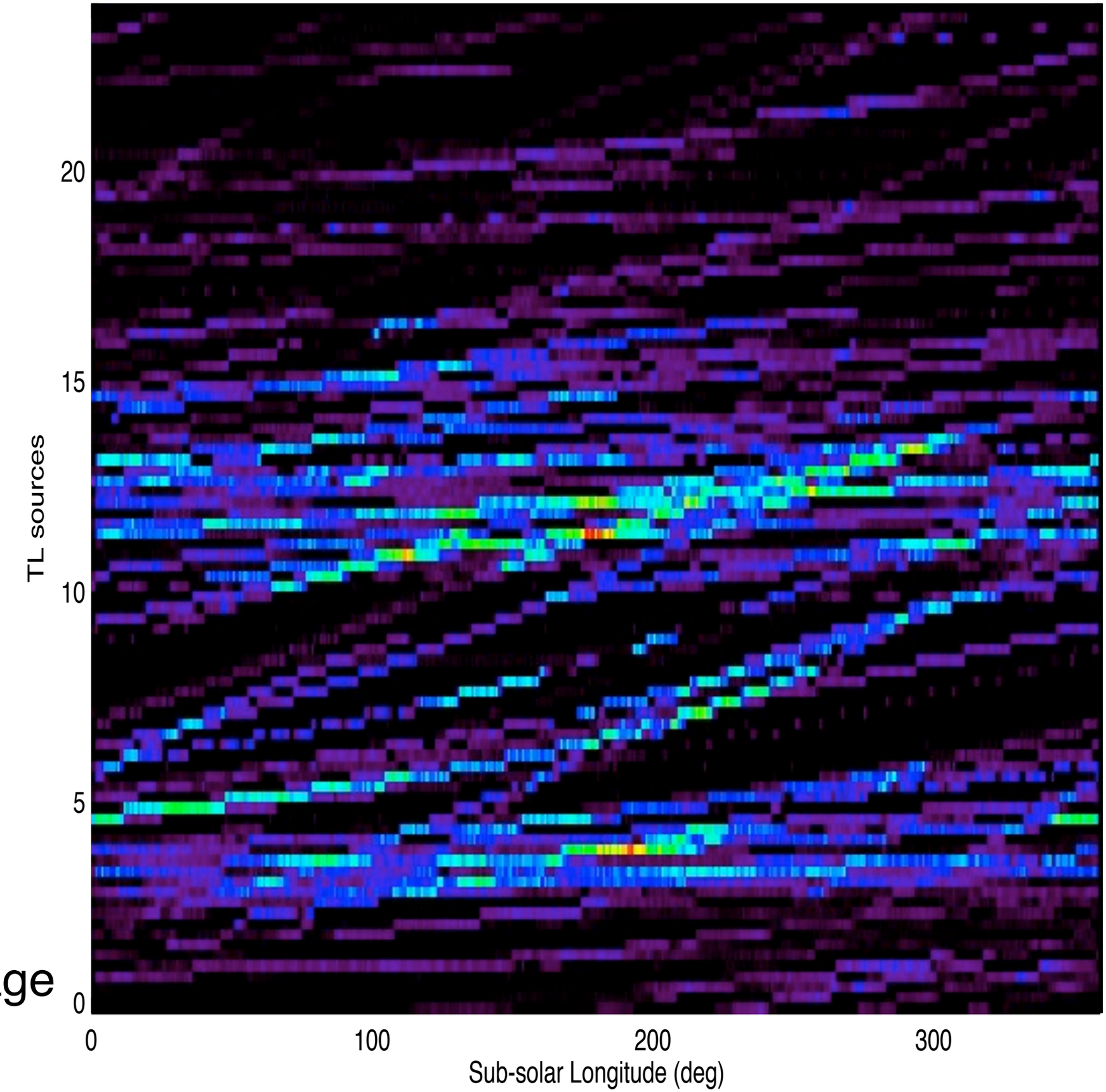
2004181-2007222 $\lambda < 30°$



Median flux

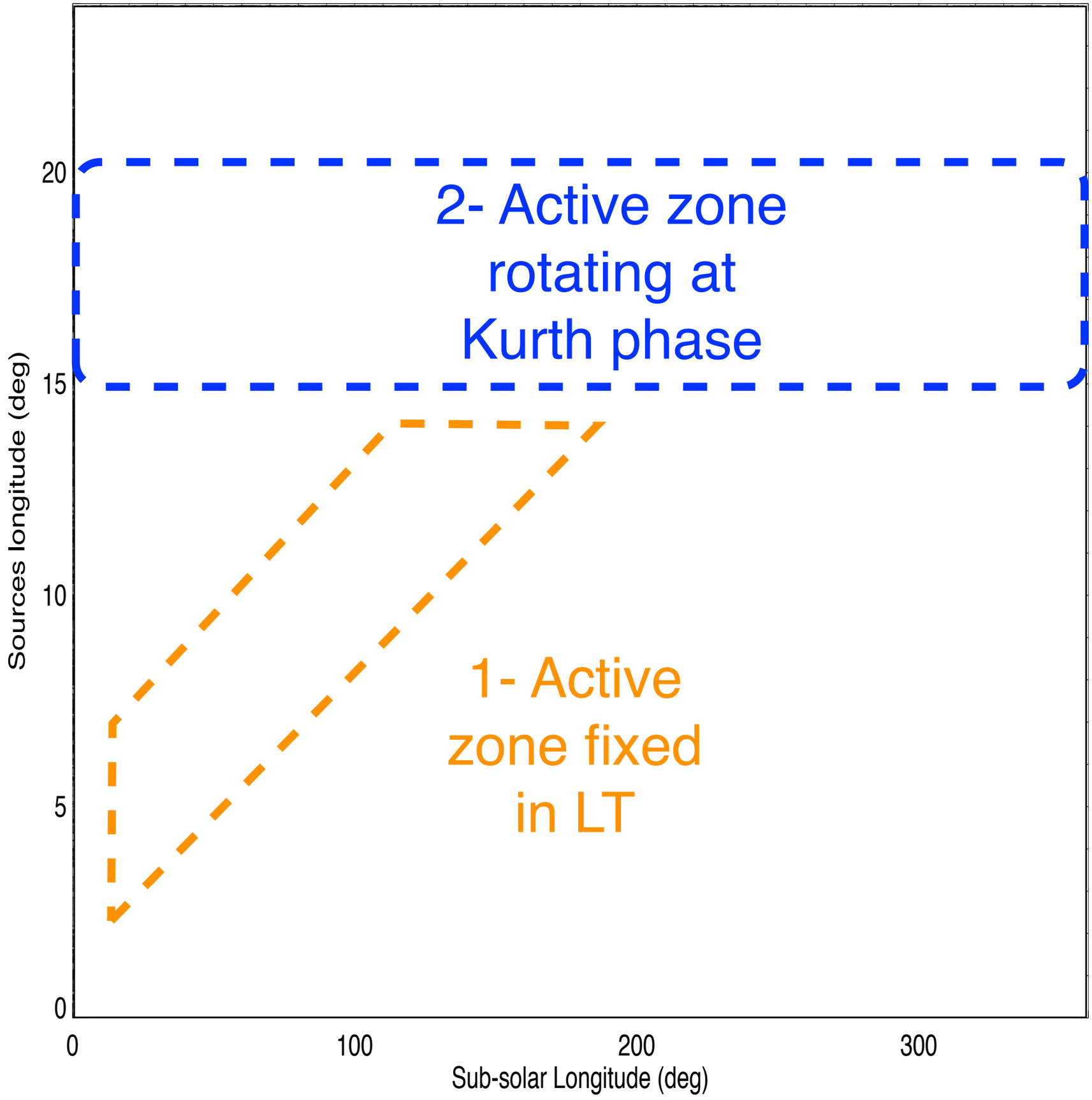
I. Distribution of SKR sources:

2004181-2007222 $\lambda < 30°$

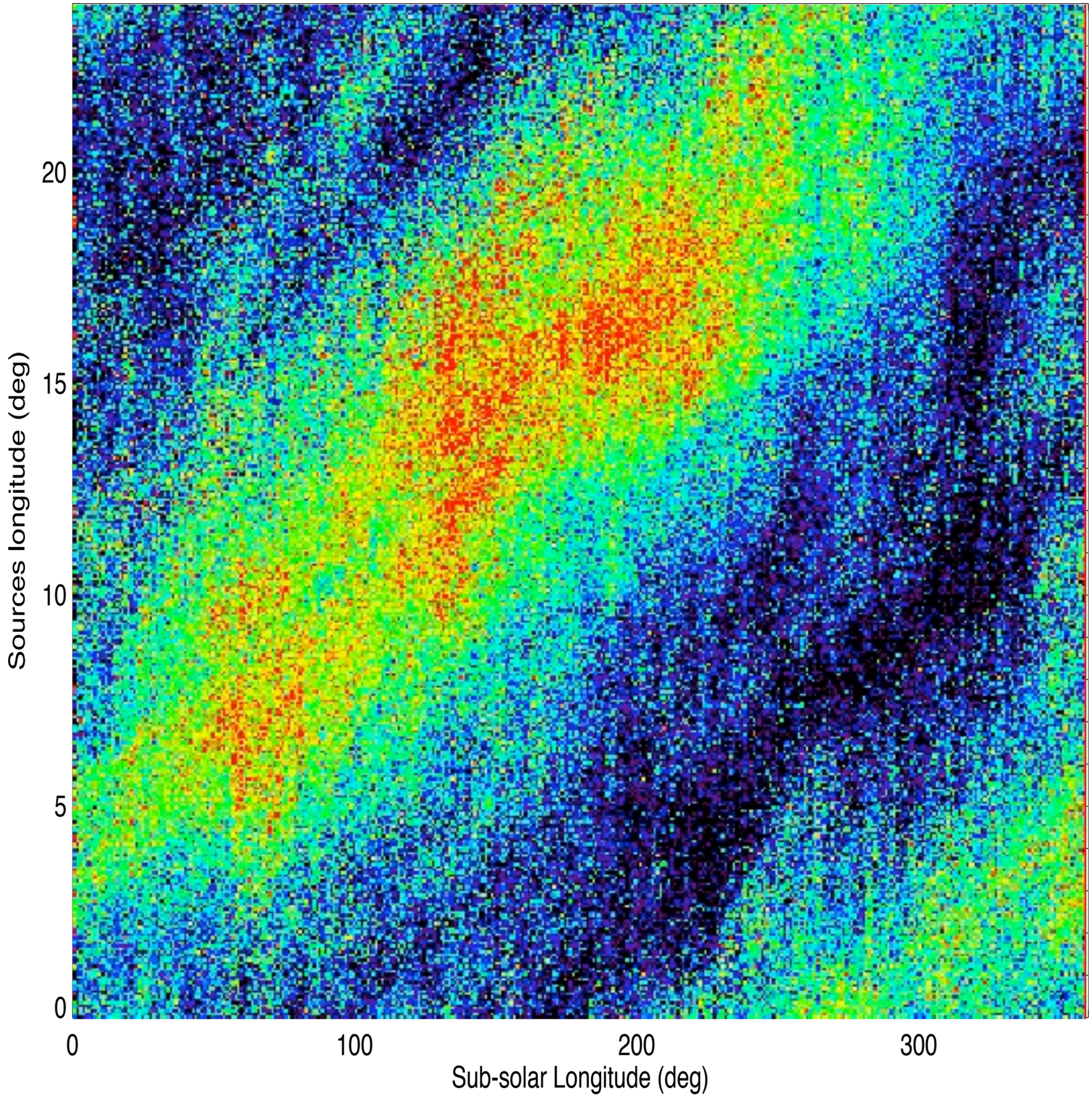


S/C coverage

I. Distribution of SKR sources:



I. Distribution of SKR sources: 2004181-2007222 $\lambda < 30°$

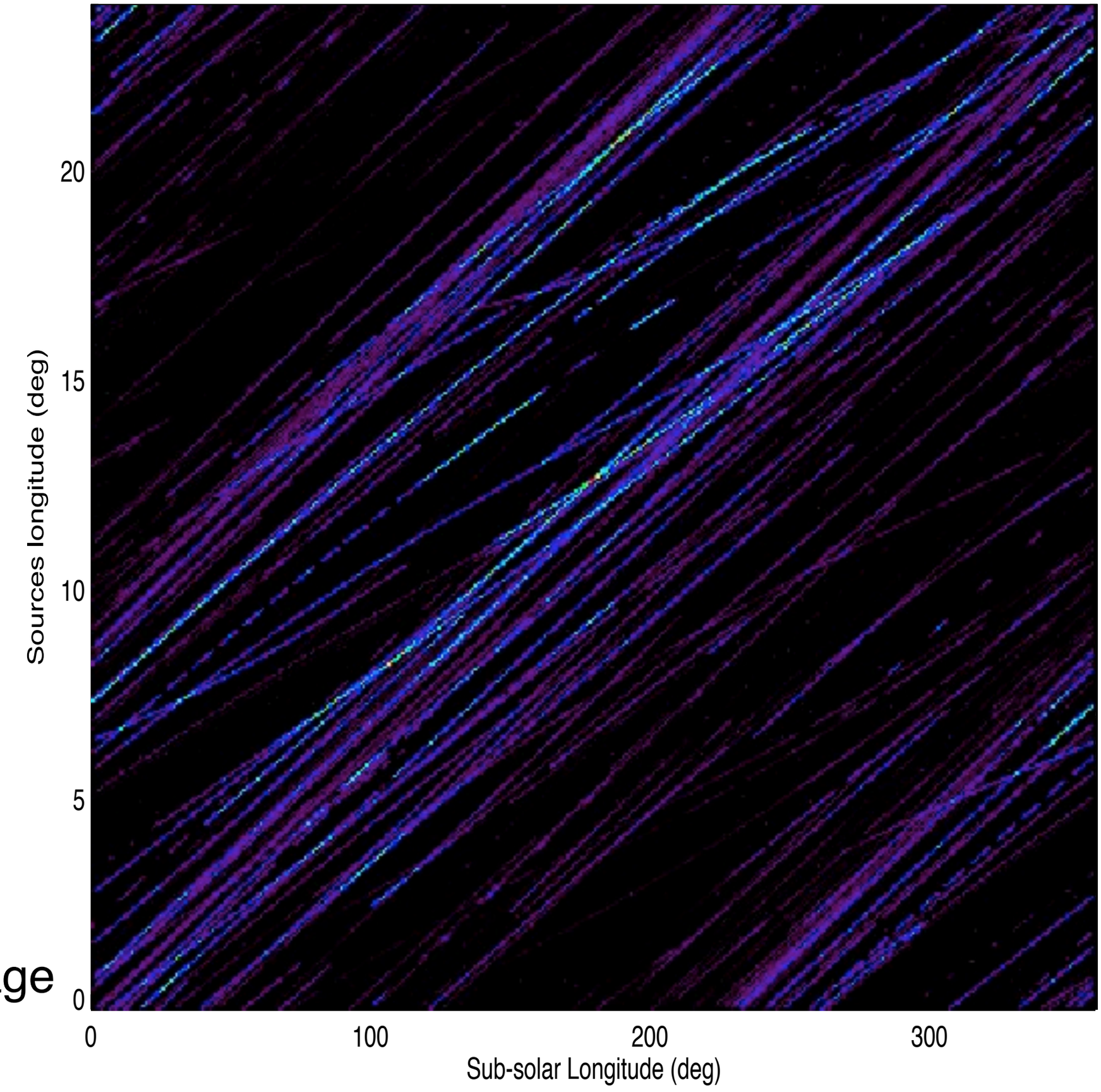


No evidence of a rotating pattern

Median flux

I. Distribution of SKR sources:

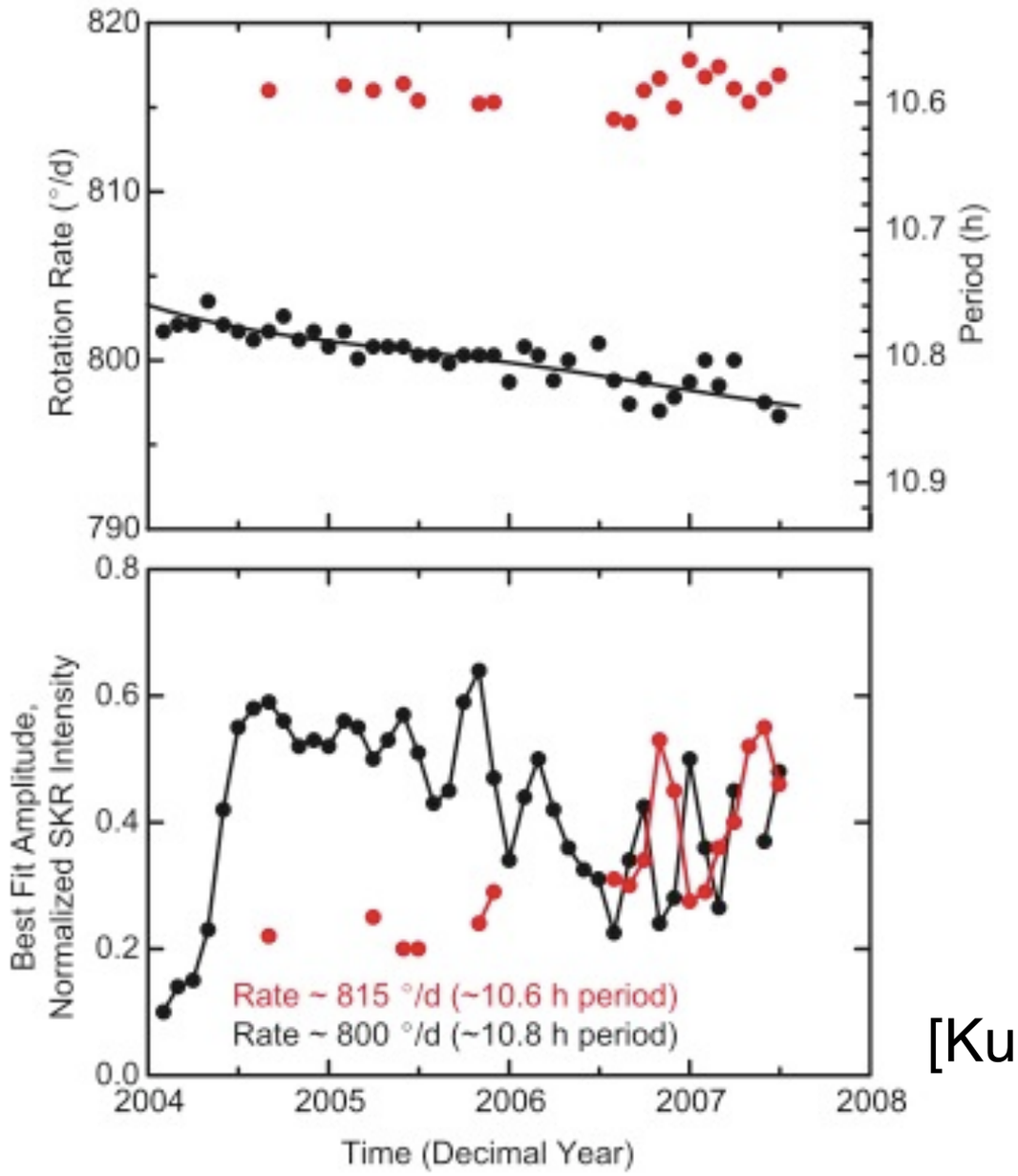
2004181-2007222 $\lambda < 30°$



S/C coverage

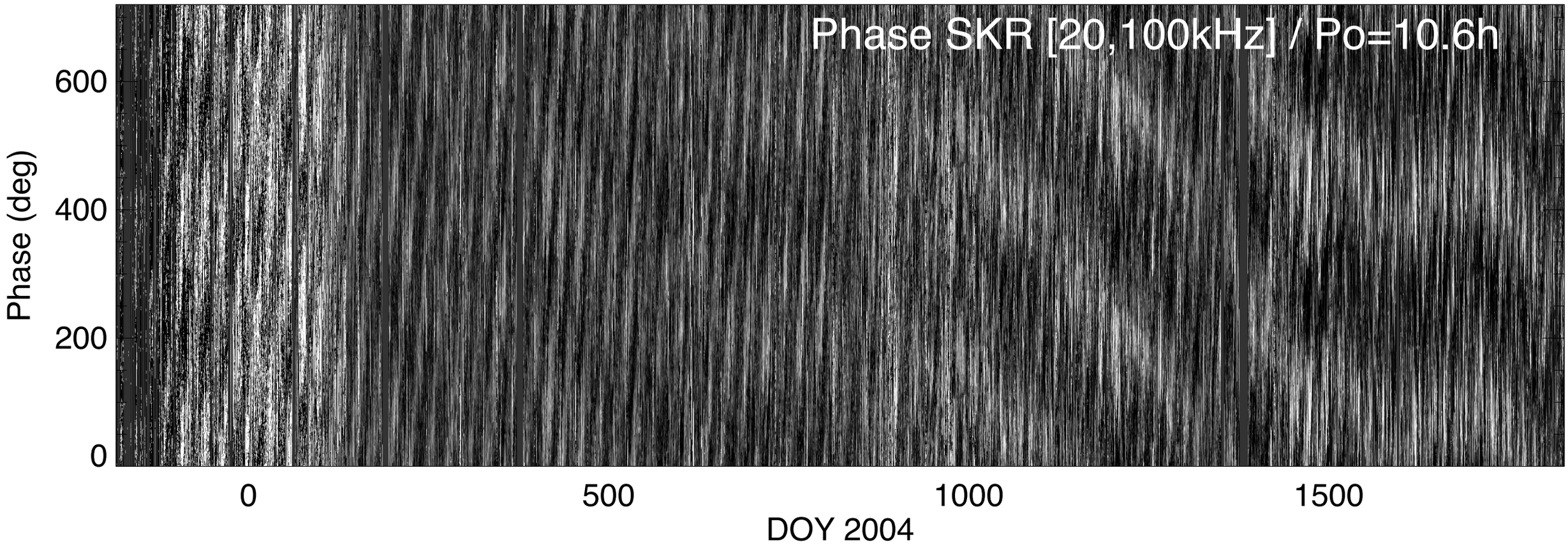
II. Variable period:

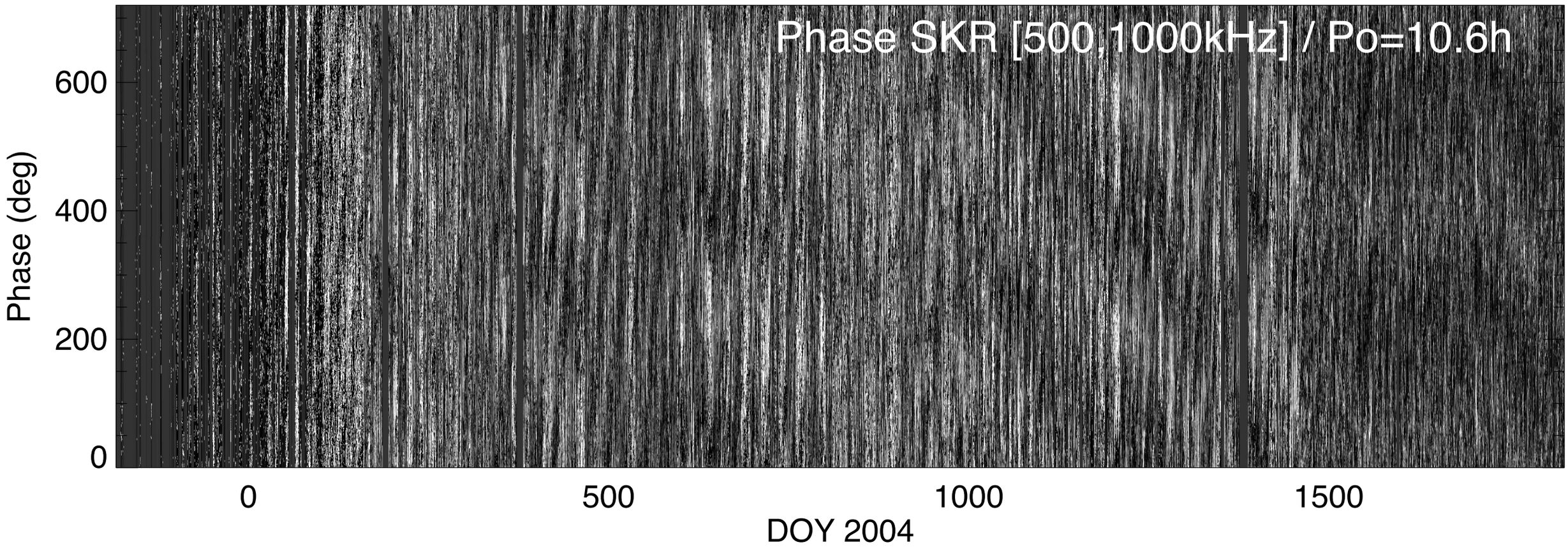
- correlation between MAG oscillations and 10.8h-based Kurth phase (SLS3) [Andrews et al, 08; Provan et al, 09]

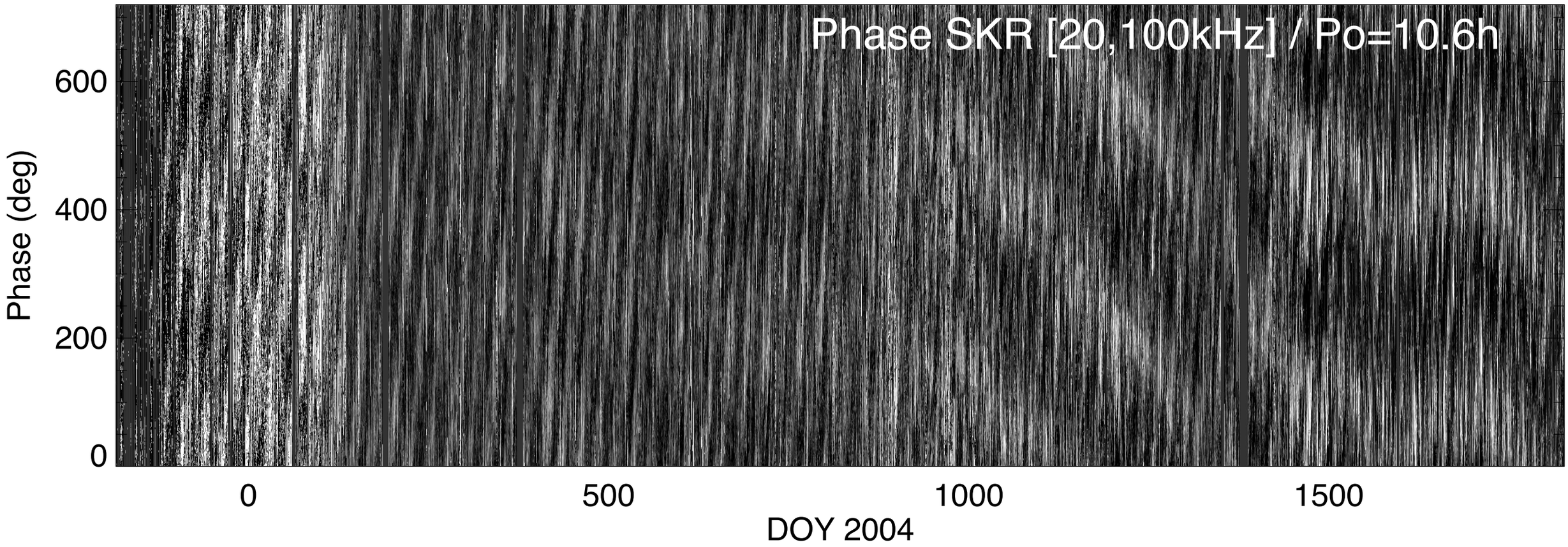


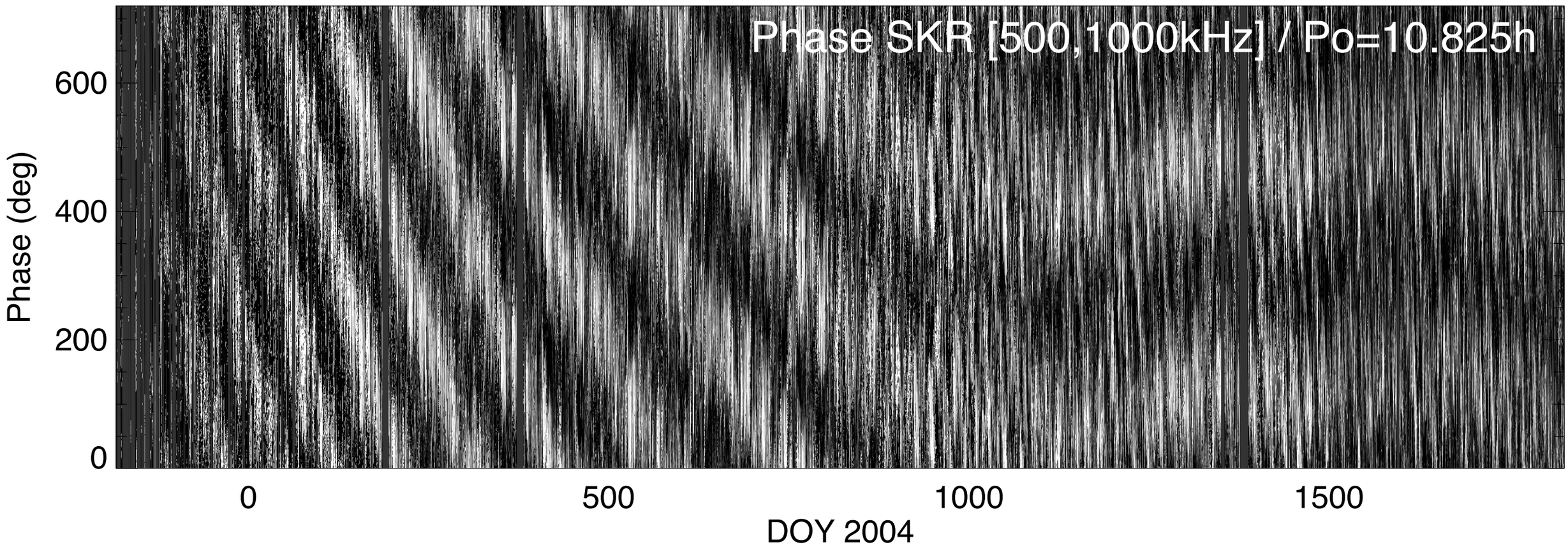
- secondary 10.6h period observed in 2008?
- origin?

[Kurth et al, 08]


Phase SKR [20,100kHz] / Po=10.6h
Phase (deg)
0
200
400
600
0
500
1000
1500
DOY 2004


Phase SKR [500,1000kHz] / Po=10.6h
Phase (deg)
0
200
400
600
0
500
1000
1500
DOY 2004


Phase SKR [20,100kHz] / Po=10.6h
Phase (deg)
0
200
400
600
0
500
1000
1500
DOY 2004


Phase SKR [500,1000kHz] / Po=10.825h
Phase (deg)
0
200
400
600
0
500
1000
1500
DOY 2004

IDL 0

SKR Lomb analysis over 2008 (500-1000kHz)

SKR HF
[500,1000kHz]

10.8h 10.6h

20h

10.53h

SKR Lomb analysis over 2008 (100-500kHz)

SW

Satellites

SKR MF
[100,500kHz]

10.8h 10.6h

SKR Lomb analysis over 2008 (20-100kHz)

S/C latitude

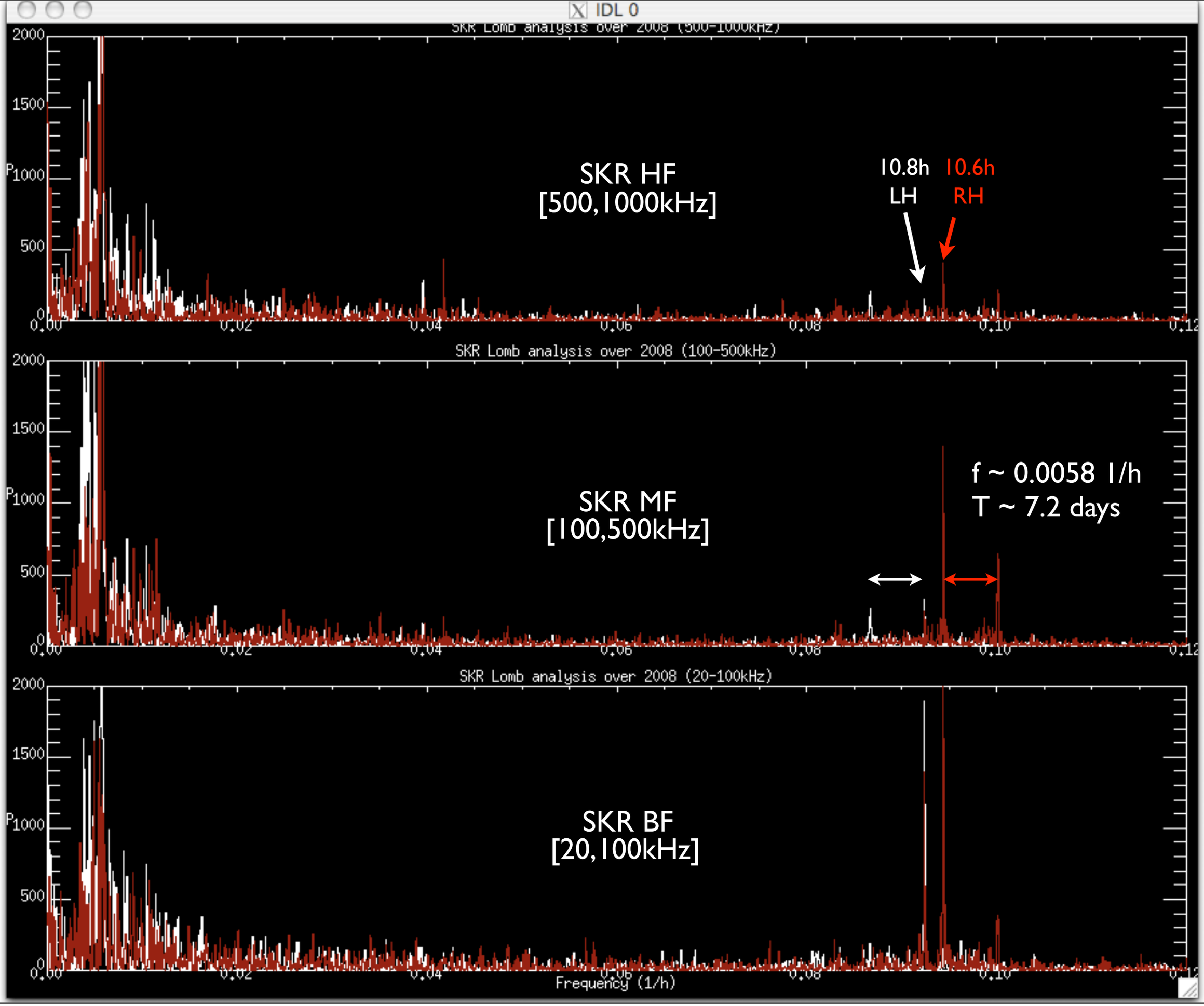
6days

10.75h 10.53h

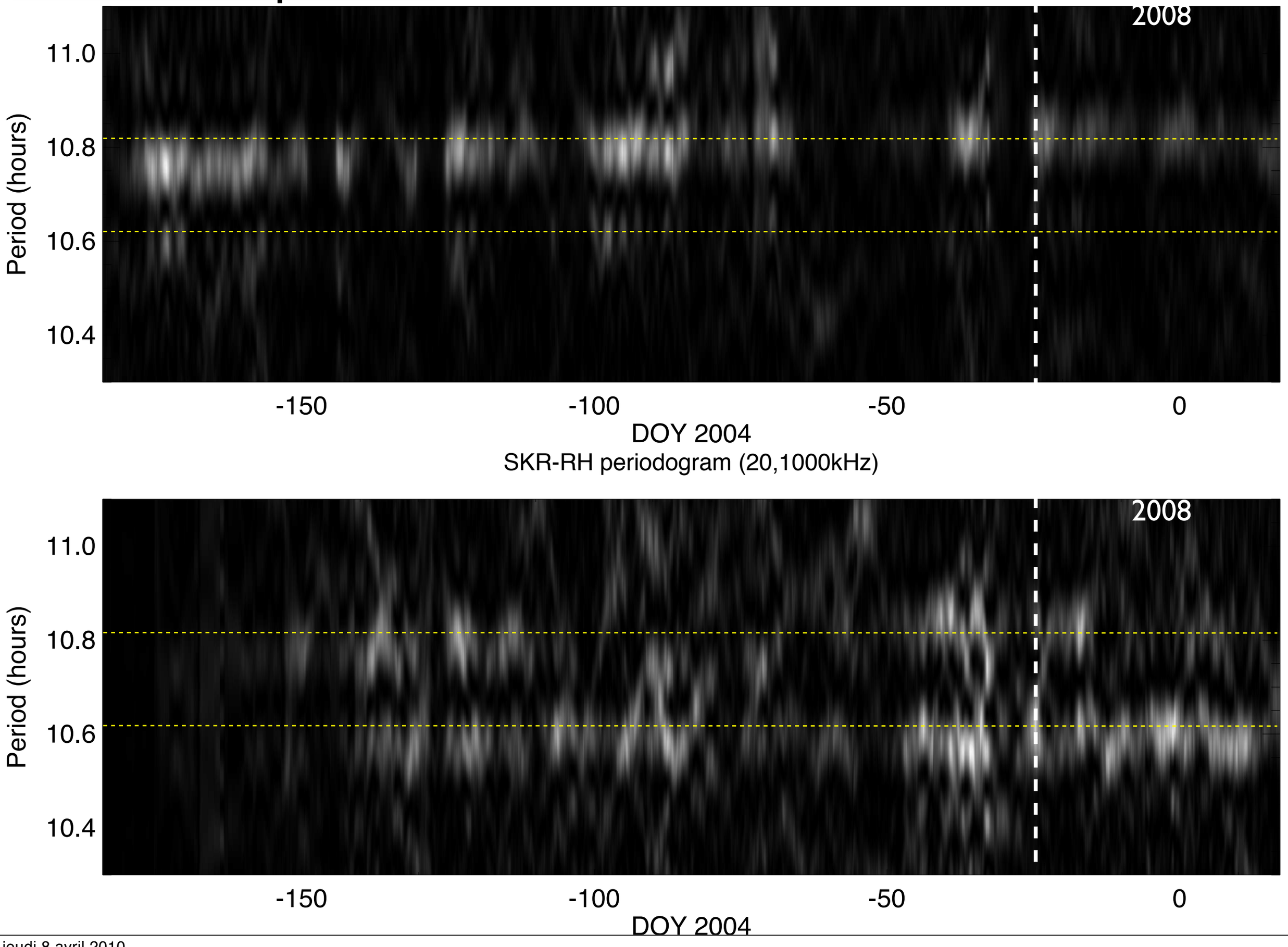
SKR BF
[20,100kHz]

10.8h 10.6h

Frequency (1/h)

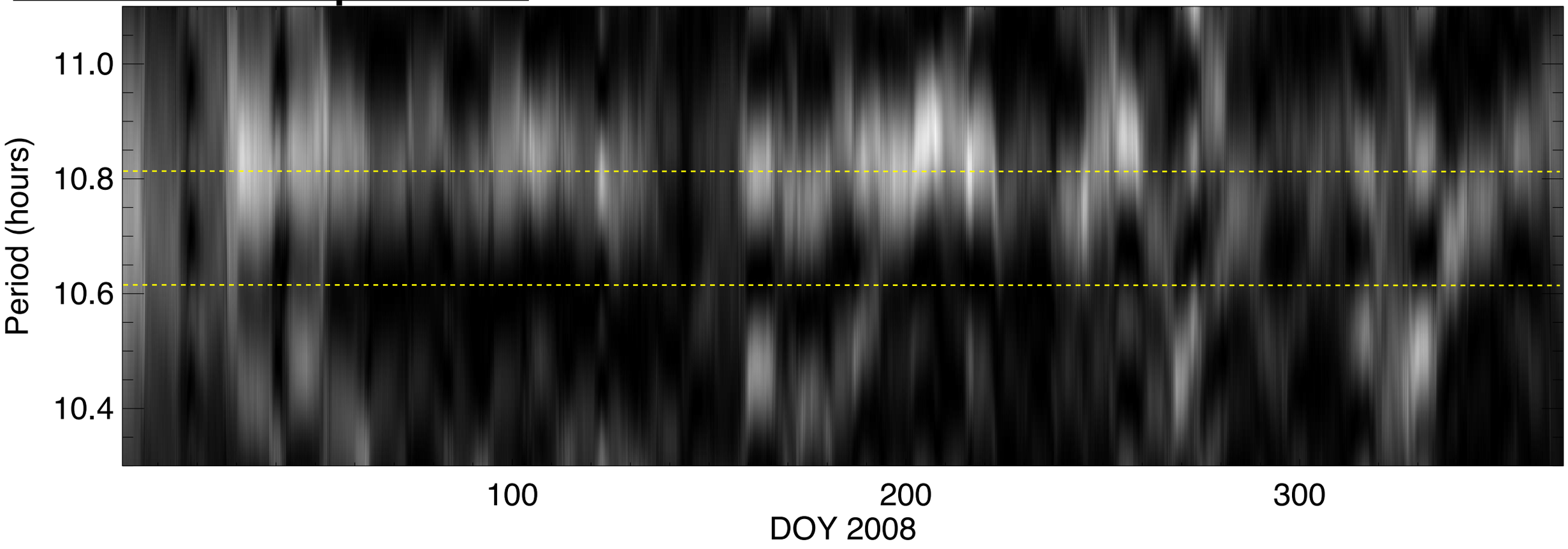

IDL 0
SKR Lomb analysis over 2008 (500-1000kHz)
SKR HF
[500,1000kHz]
10.8h
LH
10.6h
RH
SKR Lomb analysis over 2008 (100-500kHz)
SKR MF
[100,500kHz]
f ~ 0.0058 1/h
T ~ 7.2 days
SKR Lomb analysis over 2008 (20-100kHz)
SKR BF
[20,100kHz]
P
Frequency (1/h)

II. Variable period:

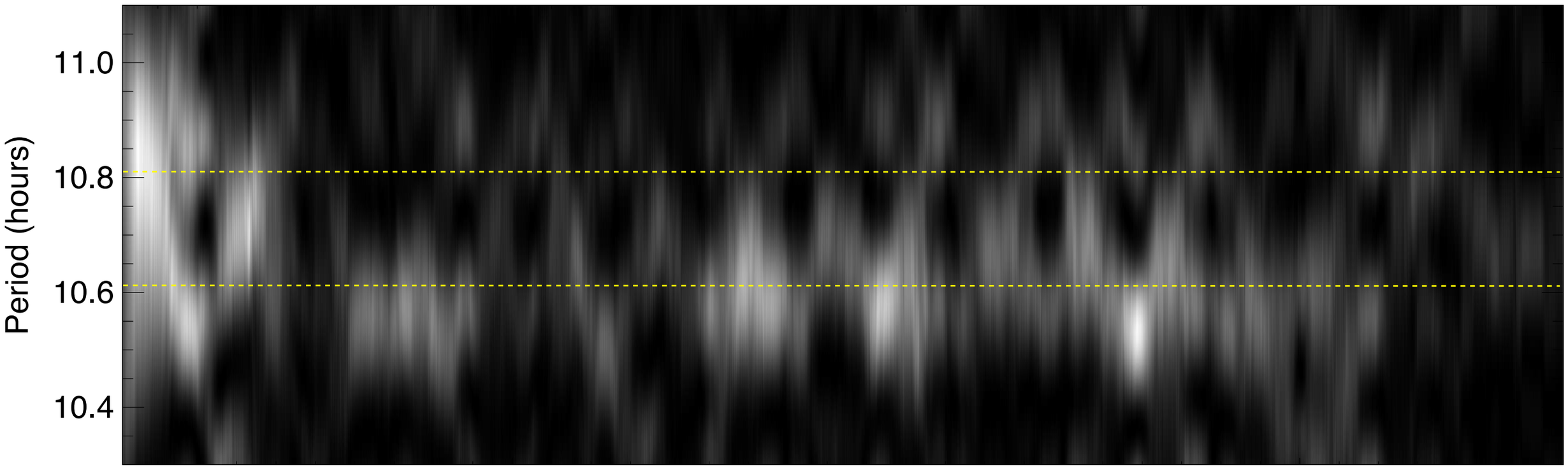


II. Variable period:

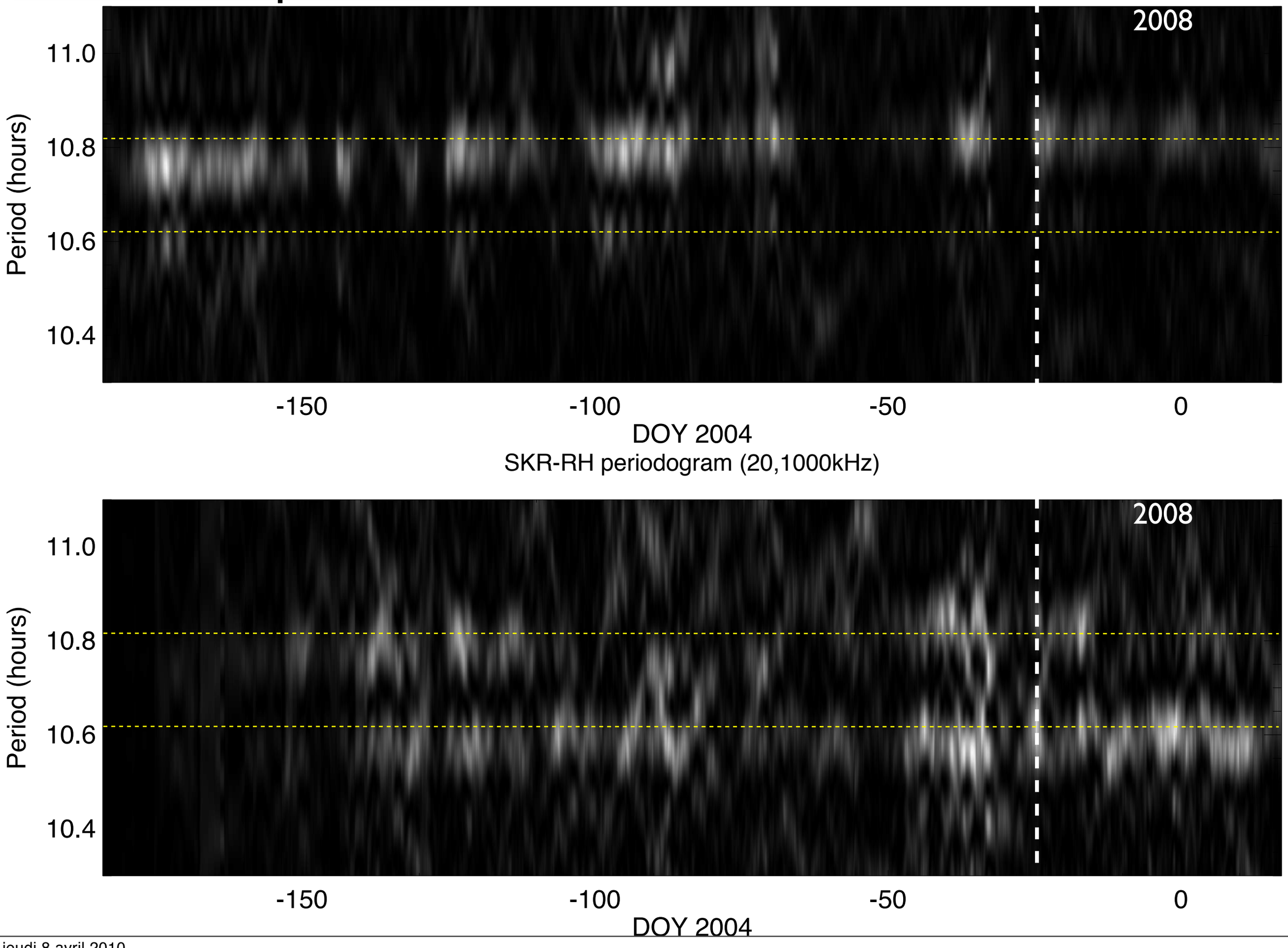
SKR-LH periodogram (20,100kHz)



SKR-RH periodogram (20,100kHz)



II. Variable period:



III. Conclusion:

Results:
- longitude of SKR sources not well organized by SLS3
- double period observed in RH data (10.6h & 10.8h)
- both periods vary similarly with time
- possible beatings related to S/C orbits

Perspectives:
- investigate 3-D SKR sources location using 3-antenna measurements
- investigate separately southern (LH) and northern (RH) components
- relationship with B periodicities