RING-DIAGRAM FREQUENCY SHIFTS FOR CR 2099-2103

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LoHCo, February 8 2011

ACKNOWLEDGMENTS

- Computing support generously provided by GONG/NSO
- HMI data courtesy NASA/SDO and the HMI science team
- This work utilizes data obtained by the Global Oscillation Network Group (GONG) program, managed by the National Solar Observatory, which is operated by AURA, Inc. under a cooperative agreement with the National Science Foundation. The data were acquired by instruments operated by the Big Bear Solar Observatory, High Altitude Observatory, Learmonth Solar Observatory, Udaipur Solar Observatory, Instituto de Astrofisica de Canarias, and Cerro Tololo Interamerican Observatory.

INTRODUCTION

- As we know, magnetic activity influences local (and global) mode parameters.

- Position on the disk and/or detector also changes parameters.

- Synoptic or statistical approach fits all frequencies in a large assembly of patches to a simple parameterization:

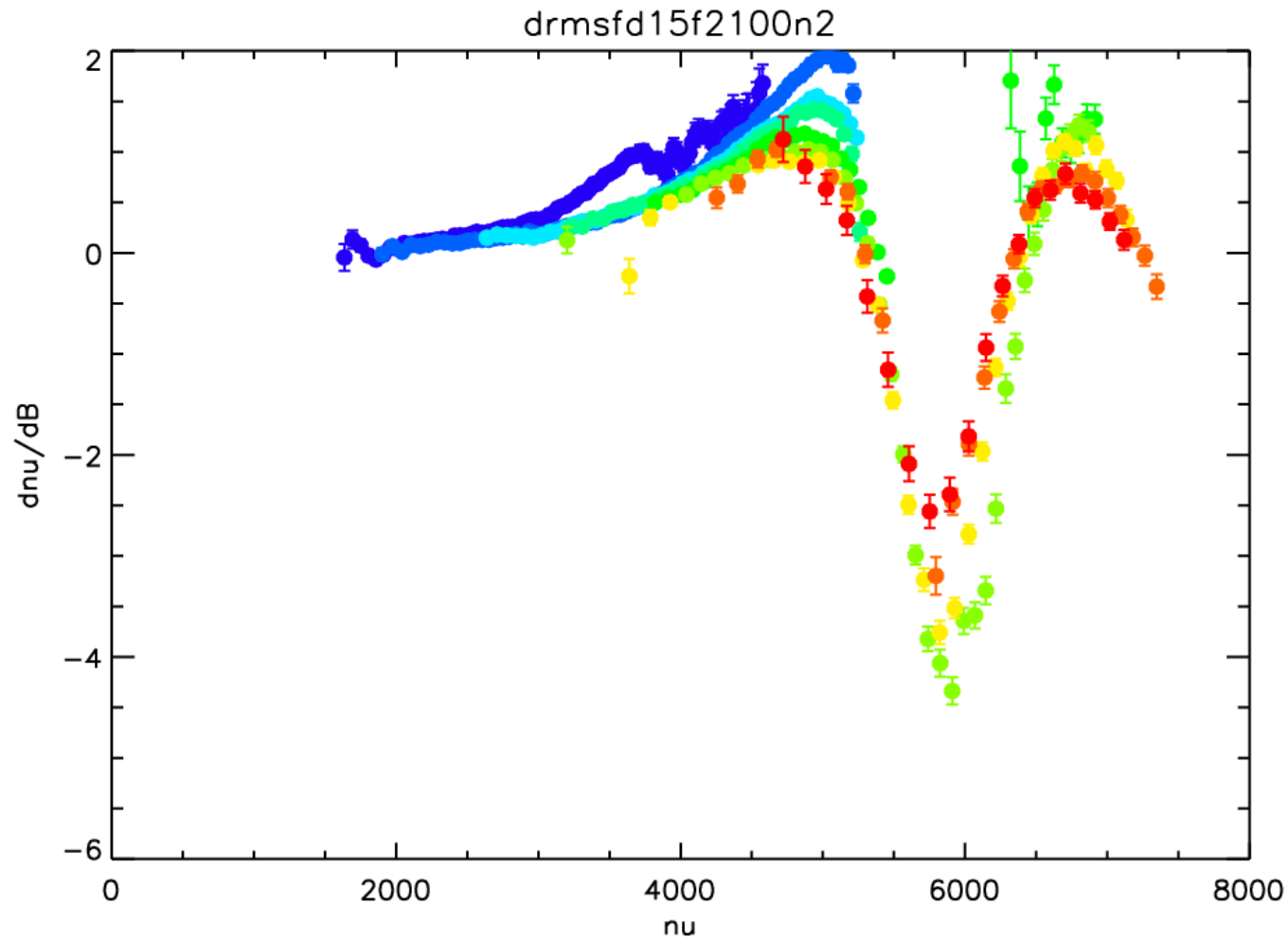- $\nu = \nu_0 + a_1 x + a_2 x^2 + a_3 y + a_4 y^2 + a_5 B + a_6 B^2$

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INTRODUCTION (CONT.)

- For HMI, we have most of CR 2101-2103 and parts of 2099, 2100 analyzed, with "f" [Colorado] and "c" [Yale] fits for 5, 15, 30-degree patches.
  - Will not discuss 30-degree patches today.
  - 15-degree c fits only for central meridian/equator; not discussed here.
- GONG also has partial coverage of 2099-2100 (15-degree "f" fits only).
- For target regions, use 5-degree patches.
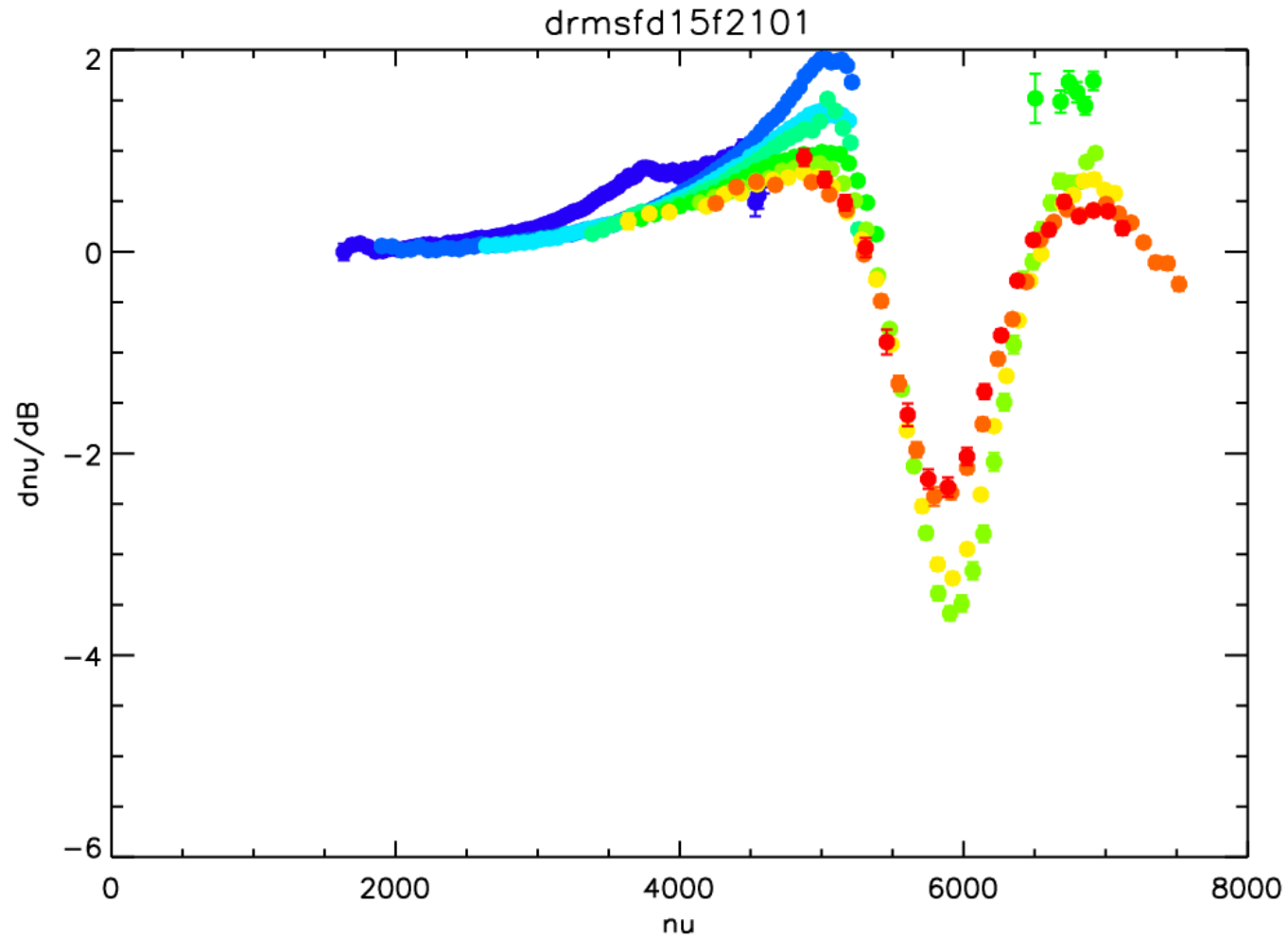- MAIs from HMI pipeline for HMI, home-made from MDI magnetograms for GONG.

Synoptic fits: 2099 f 15 degree

drmsfd15f2099n2

drmsfd15f2100n2
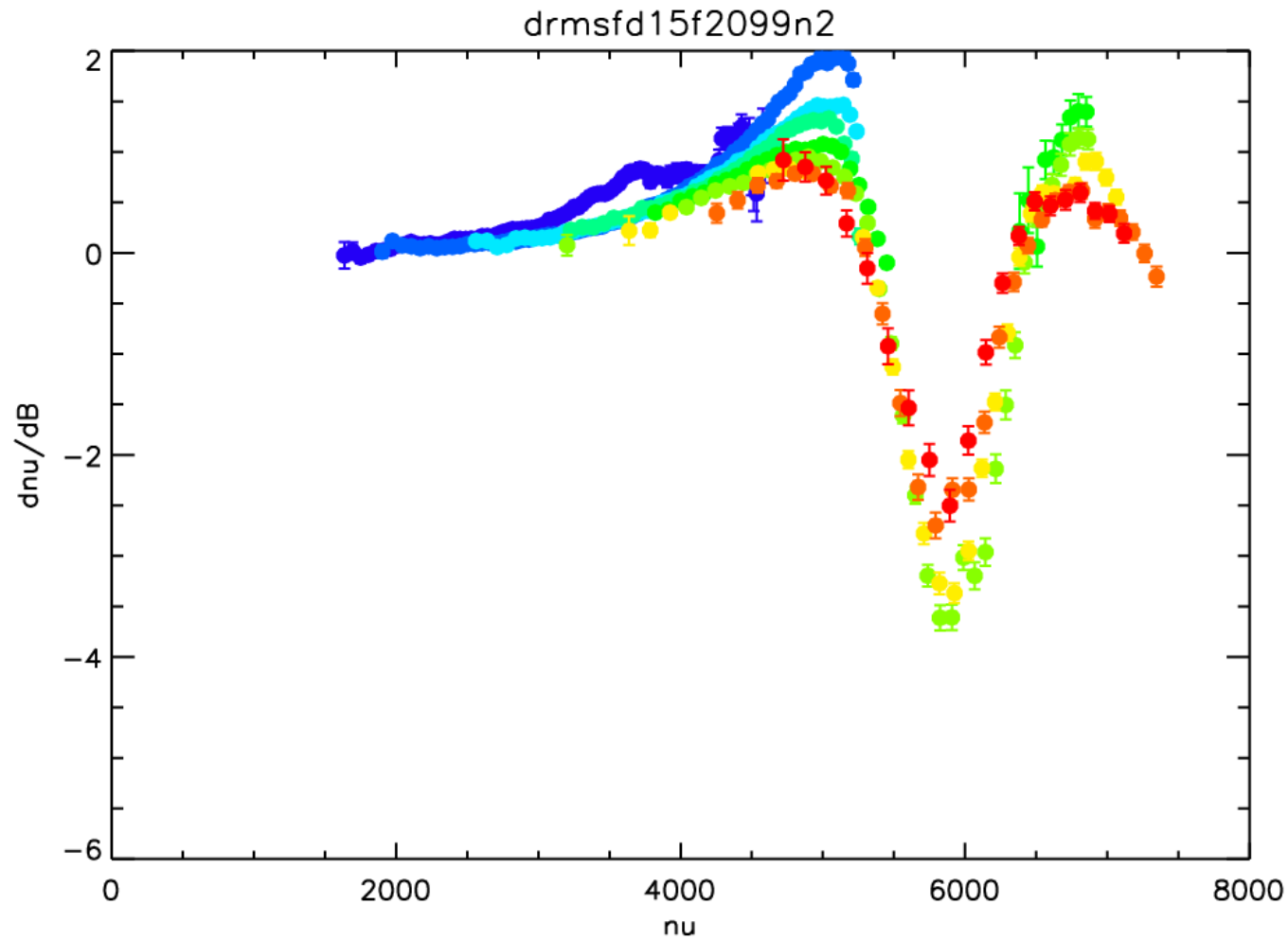
Synoptic fits: 2101 f 15 degree

SYNOPTIC FITS: 2102 F 15 DEGREE

drmsfd15f2102

drmsfd15f2103
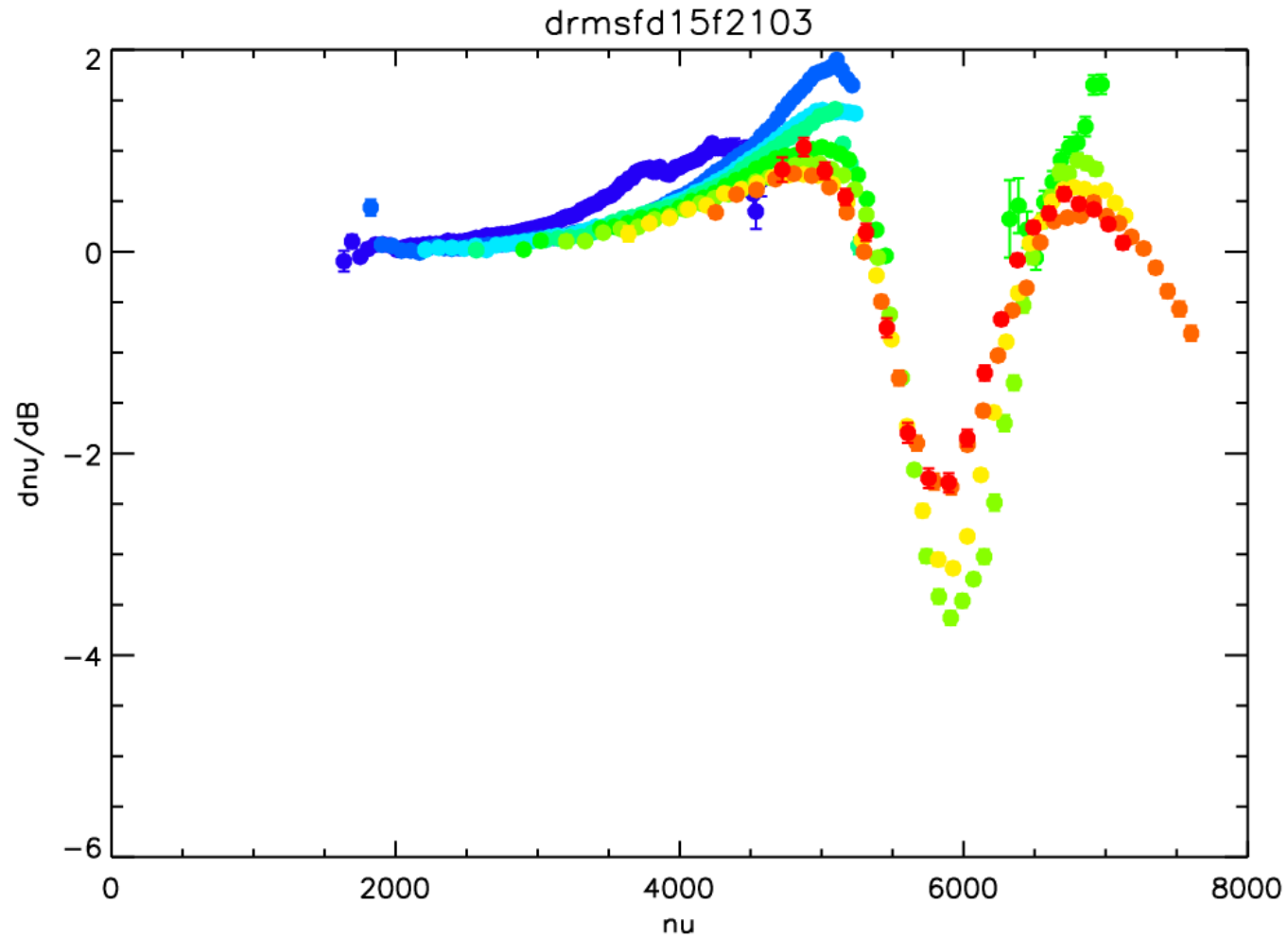
Synoptic fits: 2099 5 degree f fits

drmsfd05f2099n2
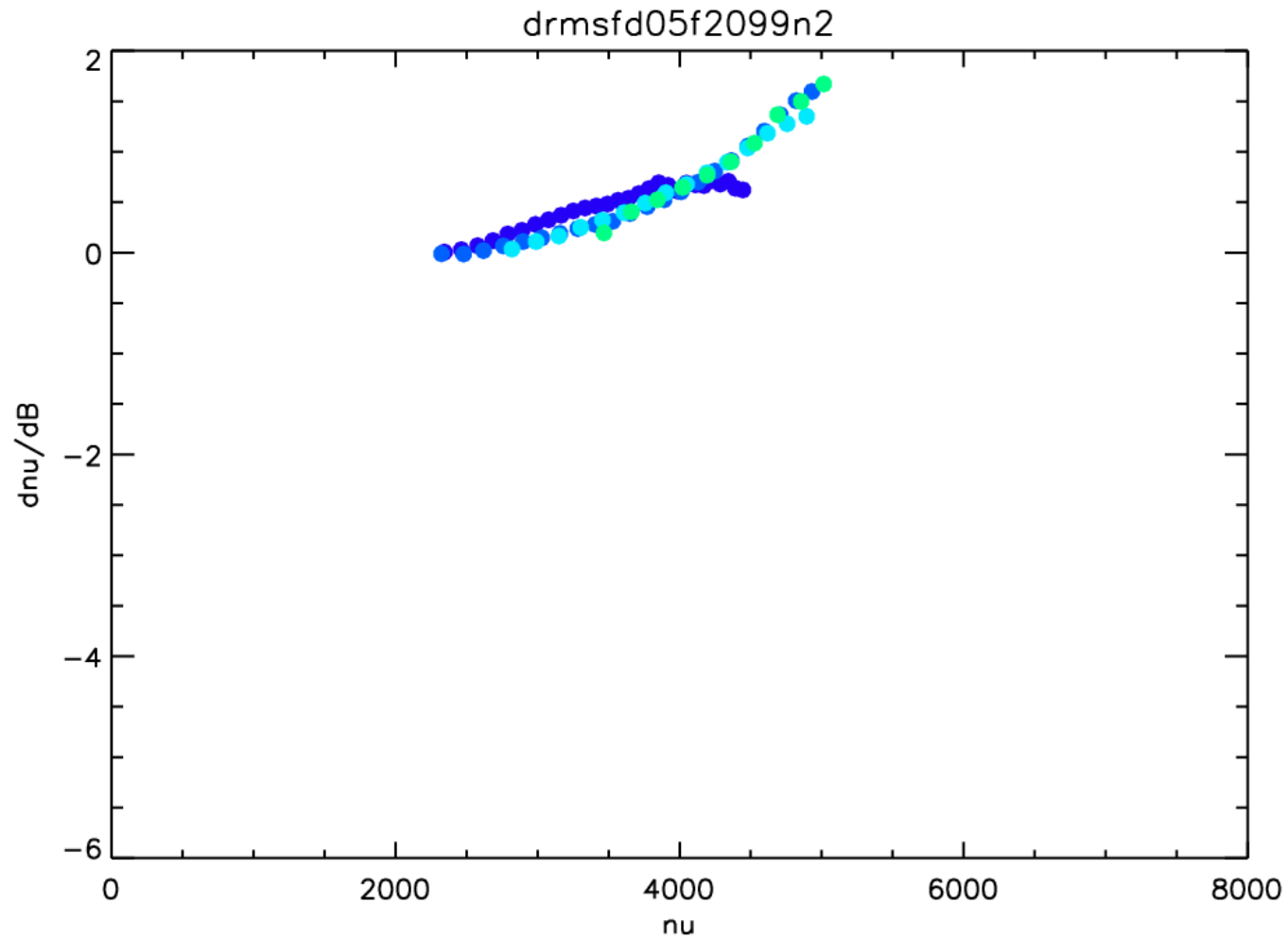
SYNOPTIC FITS: 2100 5 DEGREE F FITS

drmsfd05f2100n2
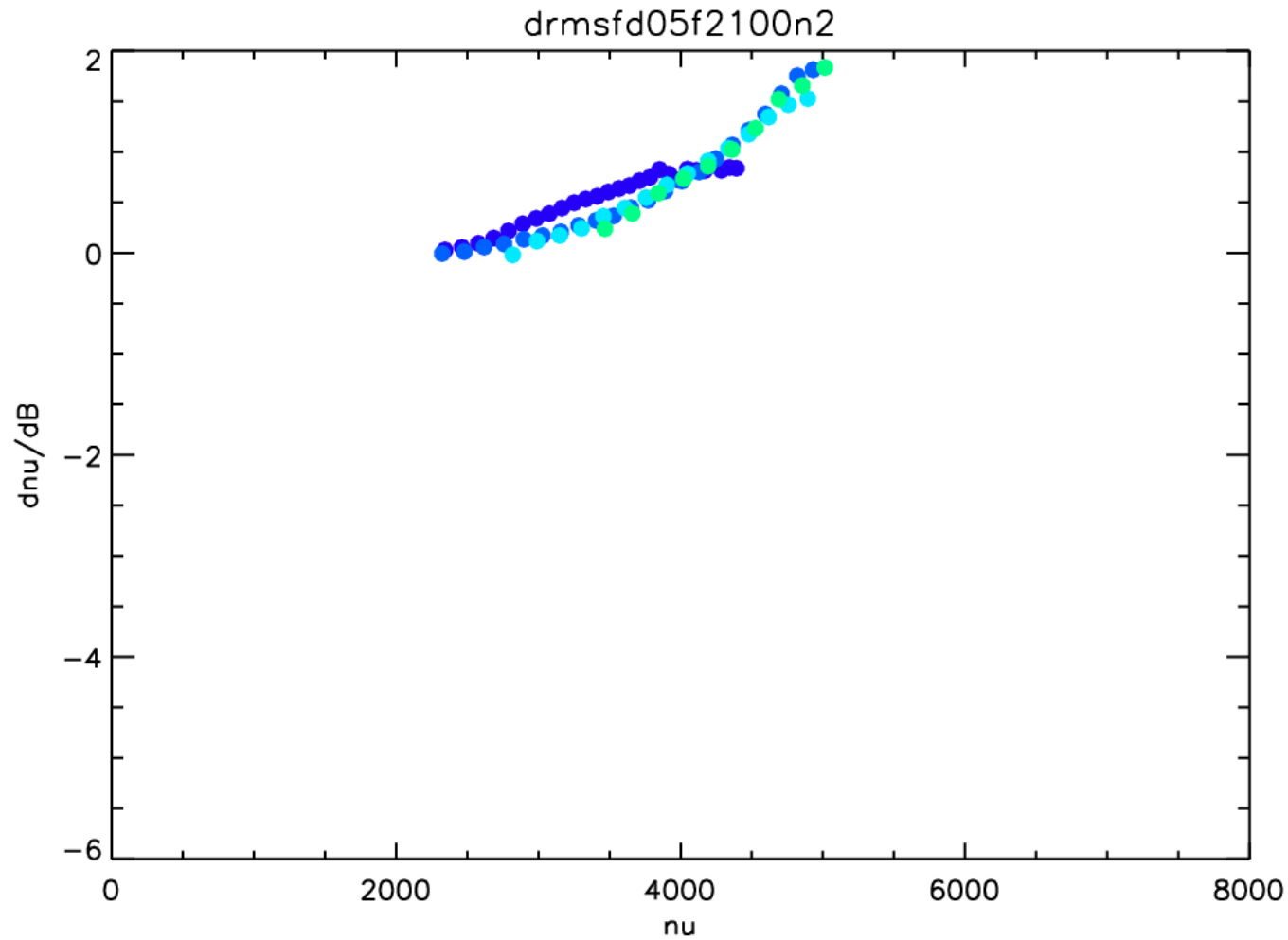
Synoptic fits: 2099 5 degree c fits

drmsfd05c2099n2
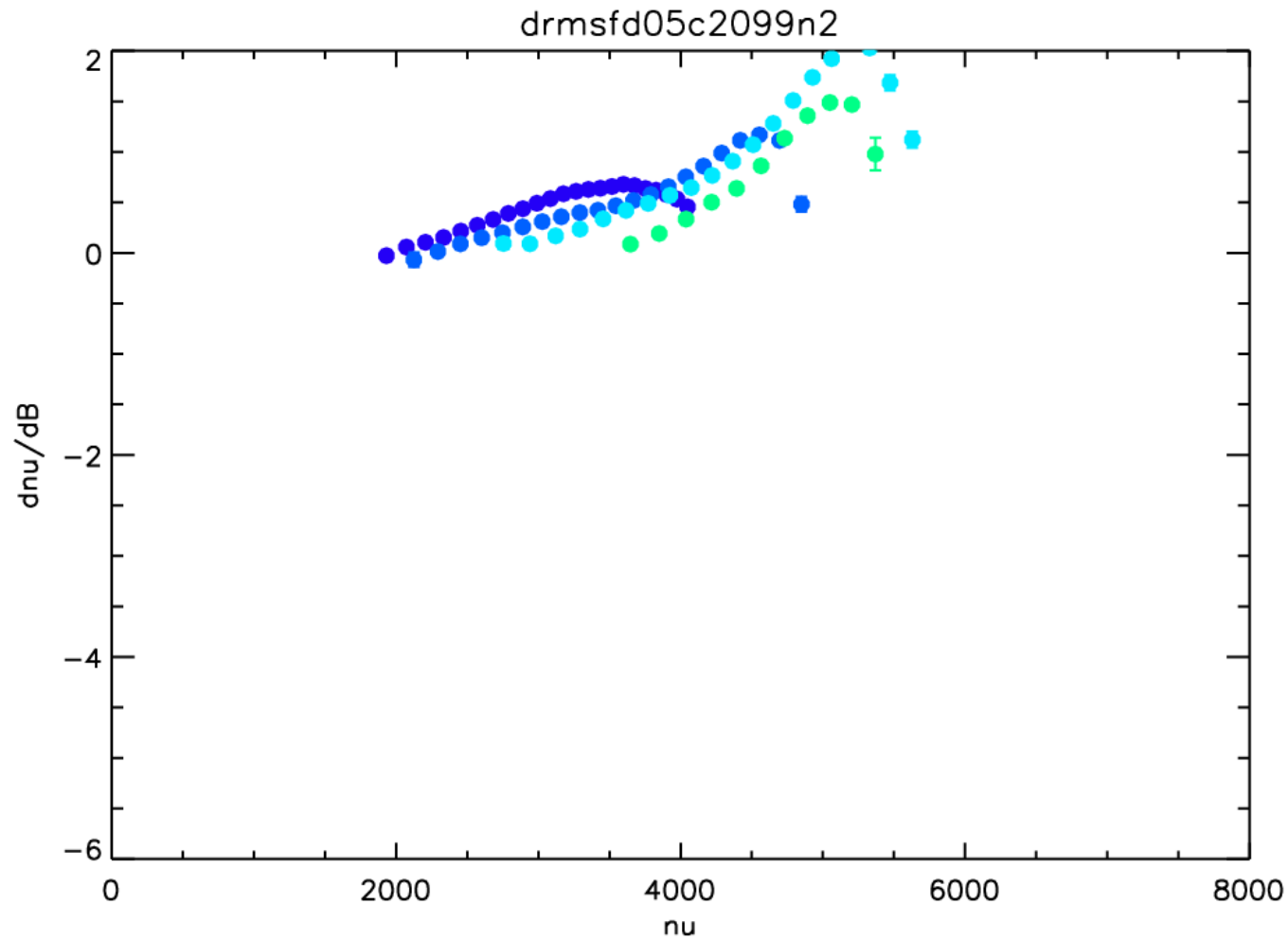
SYNOPTIC FITS: 2100 5 DEGREE C FITS

drmsfd05c2100n2
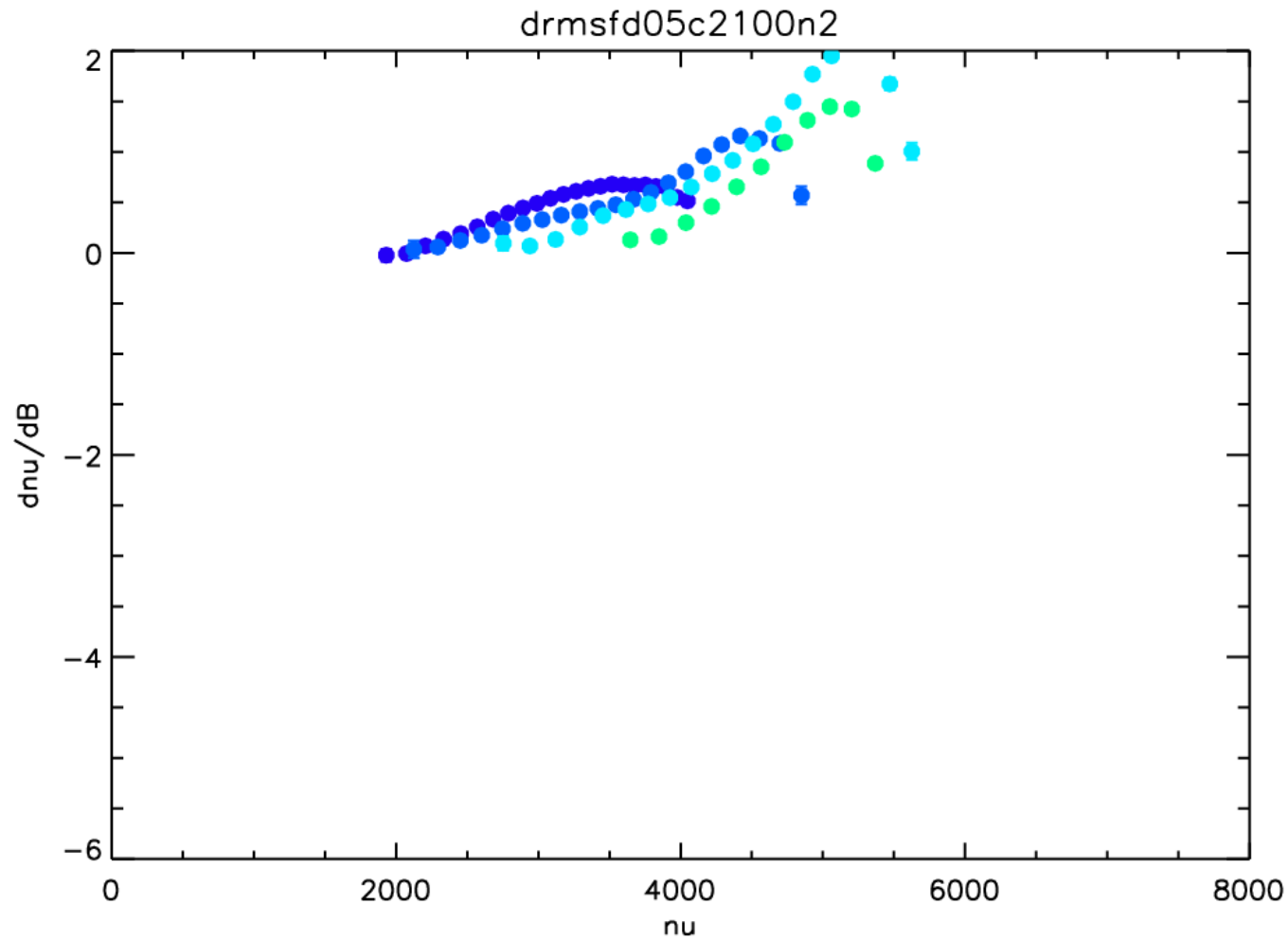
GONG 2099 15-DEG FITS

GONG 2099
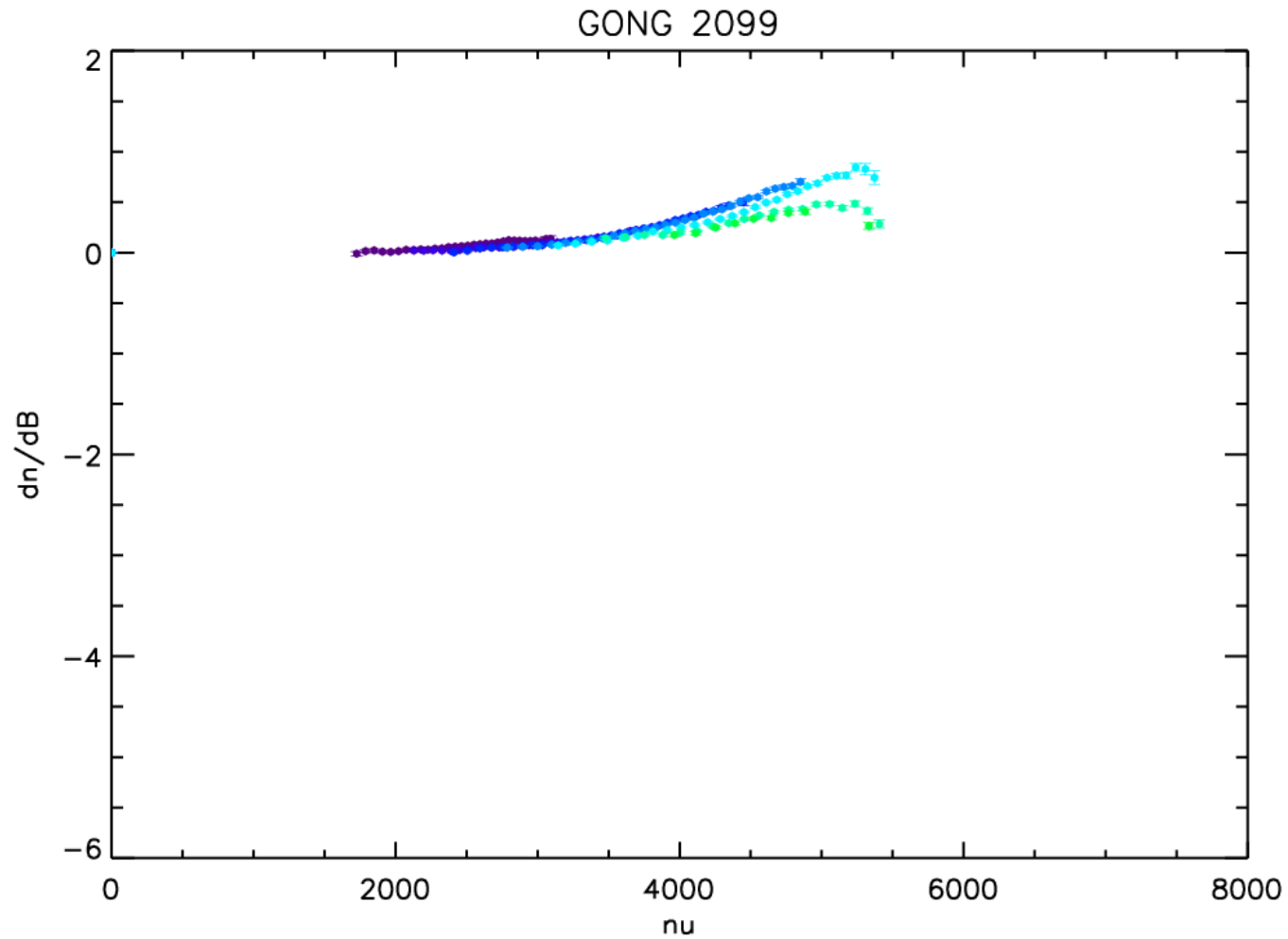
GONG 2100 15 DEG F FITS
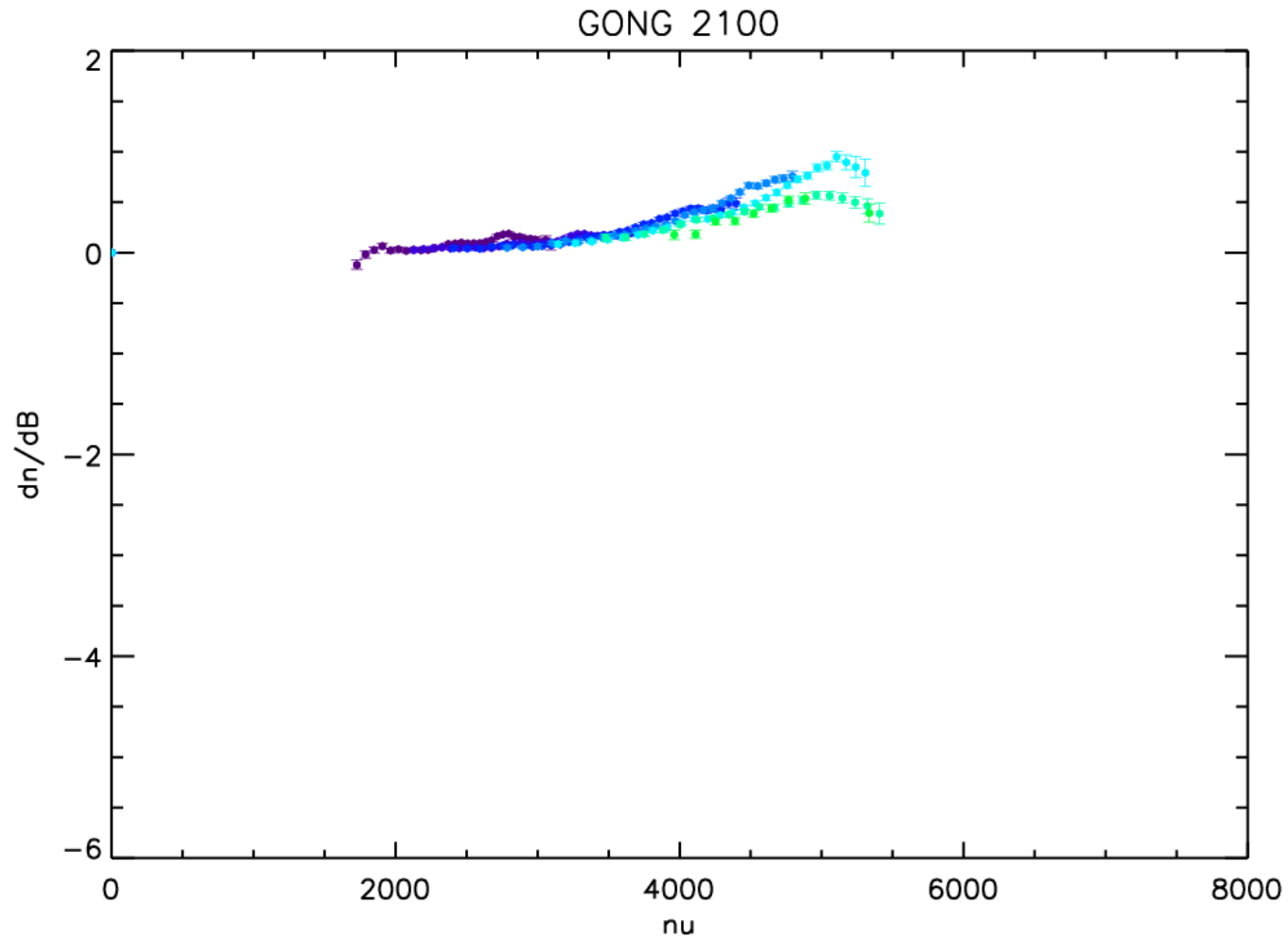
COMMENTS ON SYNOPTIC FITS

- Parameterization is not perfect, but gets fairly consistent results from one rotation to the next.

- The $d\nu/dx^2$ and $d\nu/dy^2$ terms are similar enough that it probably should be just a $d\nu/d\rho^2$ term.

- $d\nu/dB$ term is consistent from 15-deg to 5-deg tiles.

- GONG results show similar signature but lower sensitivity. Noise? Different MAIs? Or different lines?

TARGET REGIONS

- 11092: CR 2099, longitude 70-85, latitude 7.5-22.5
- 11093: CR 2100, longitude 345-360, latitude 7.5-22.5
- Consider 3 peaks from 5-degree fits
- Plots are after removal of geometric terms from 6-term fit to whole rotation
- Crosses show data from region of interest, color-coded by central longitude

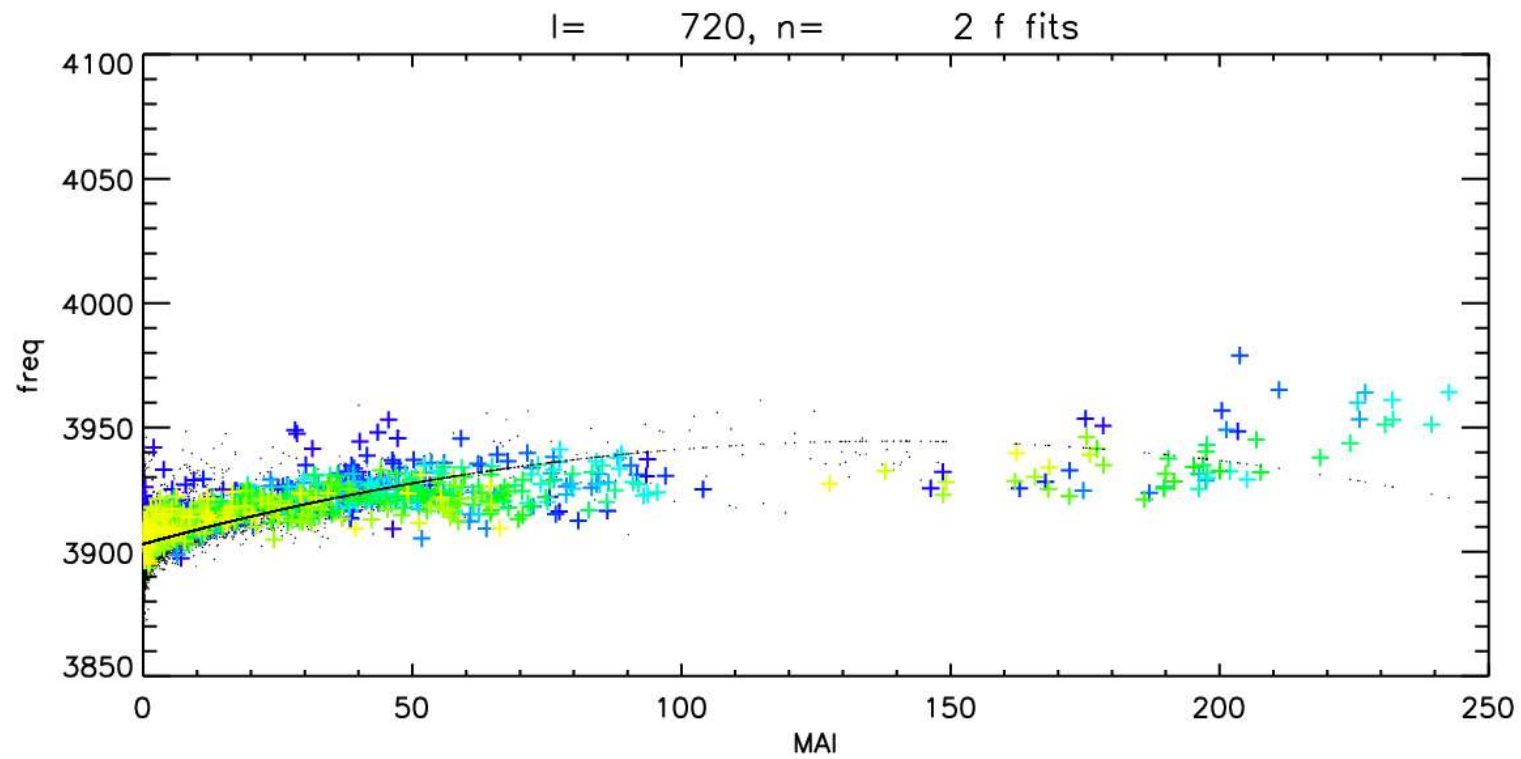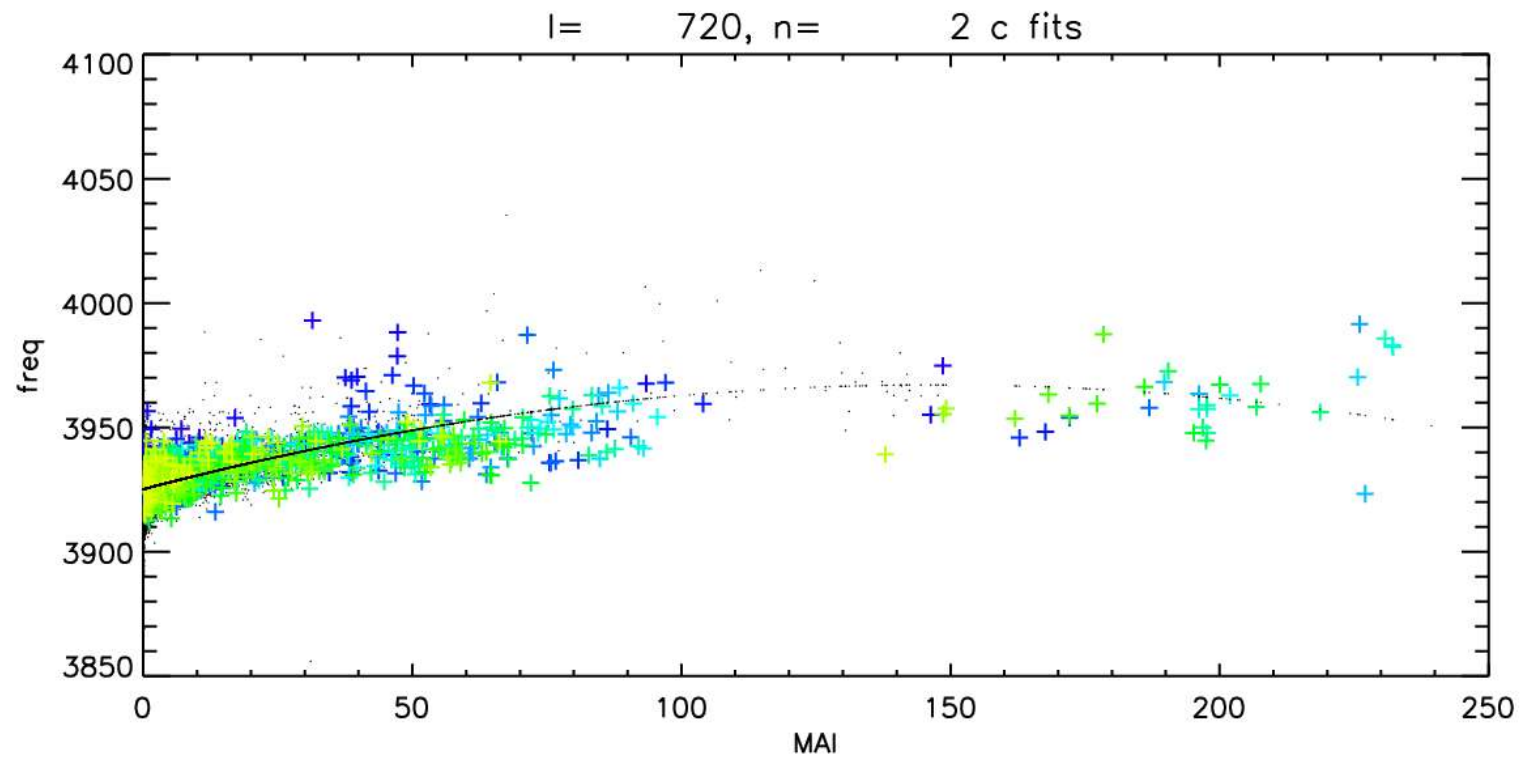# 11092: L=1600, N=0 F FITS
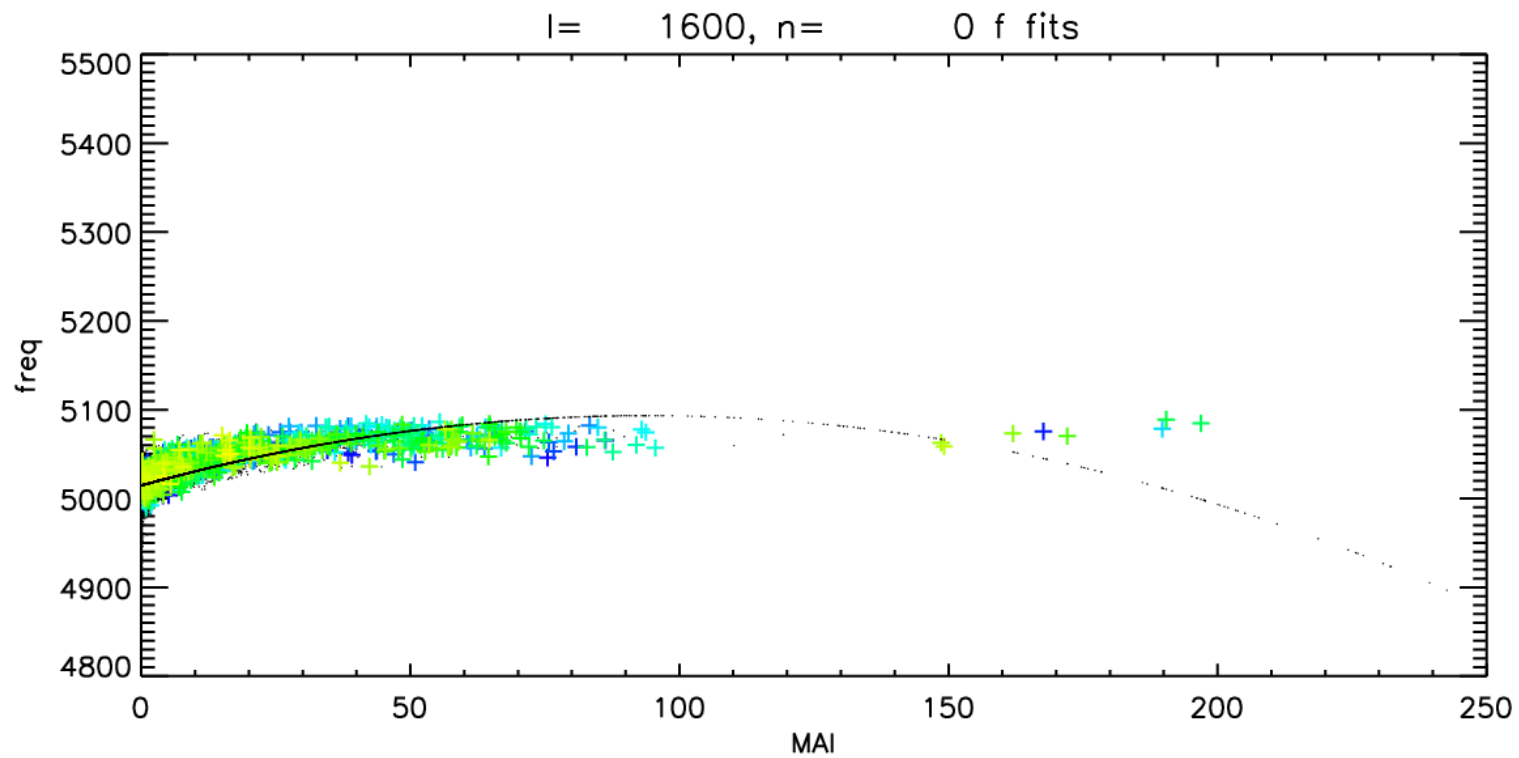
l=   1600, n=   0 f fits

11092: L=1600, N=0 C FITS
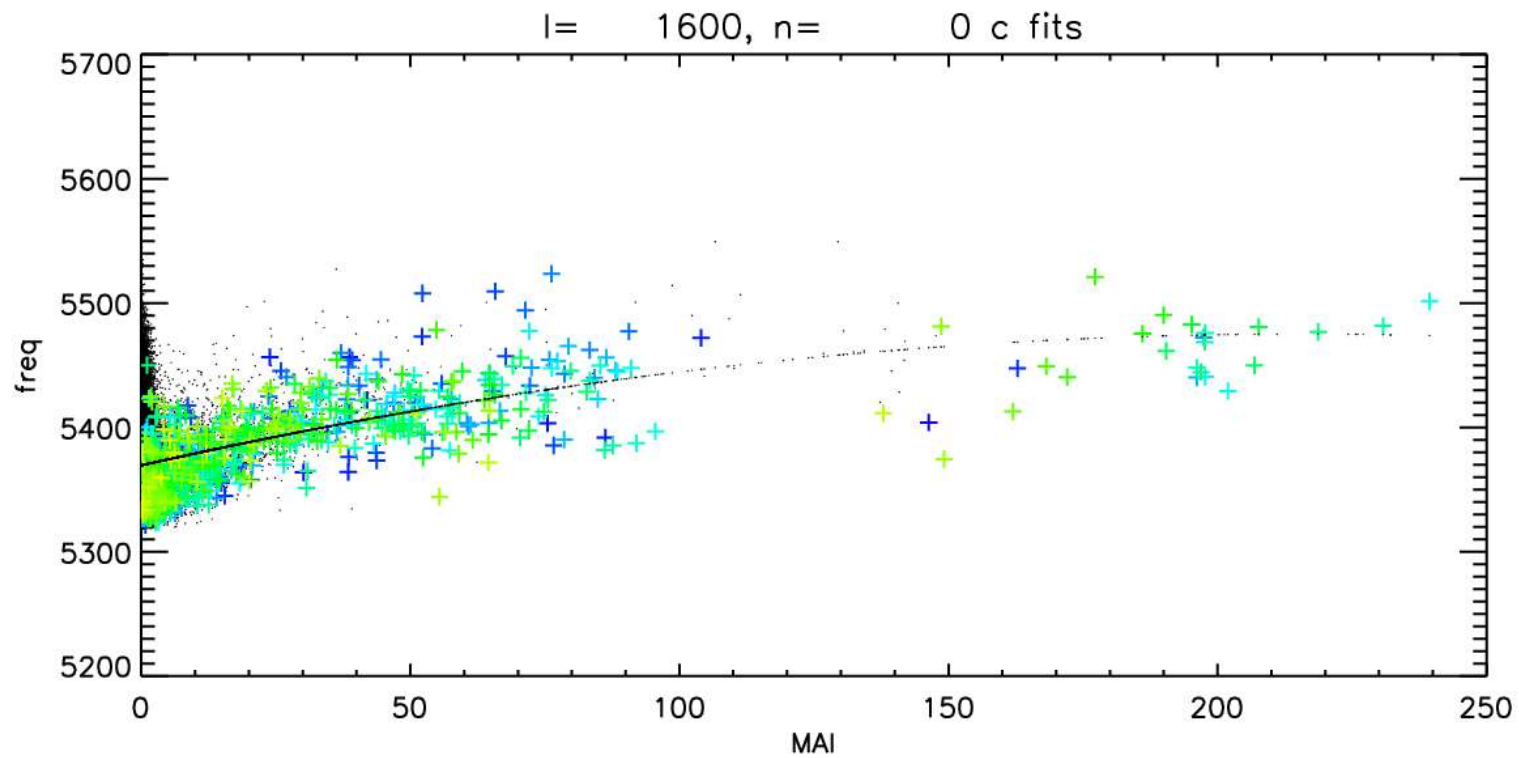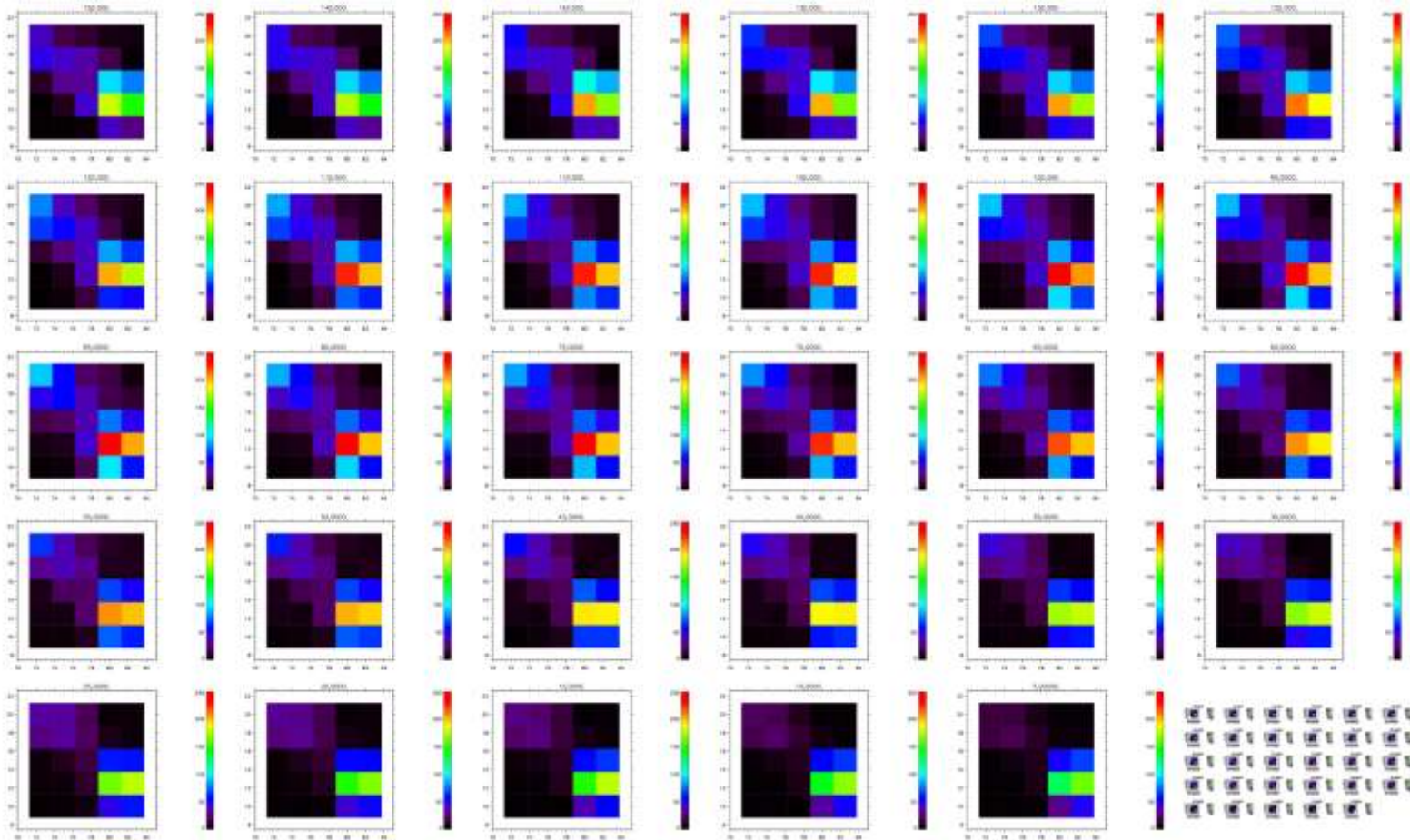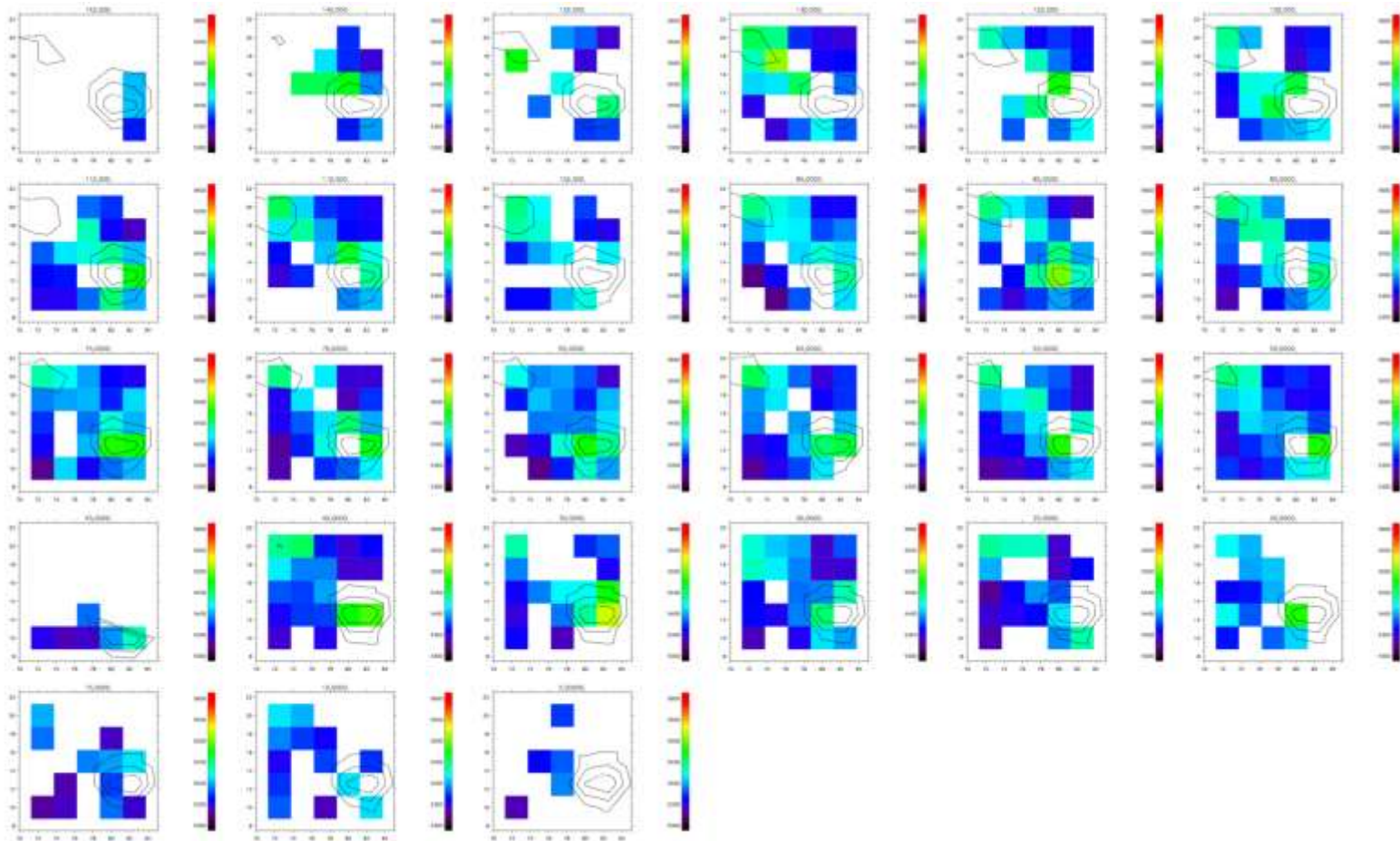
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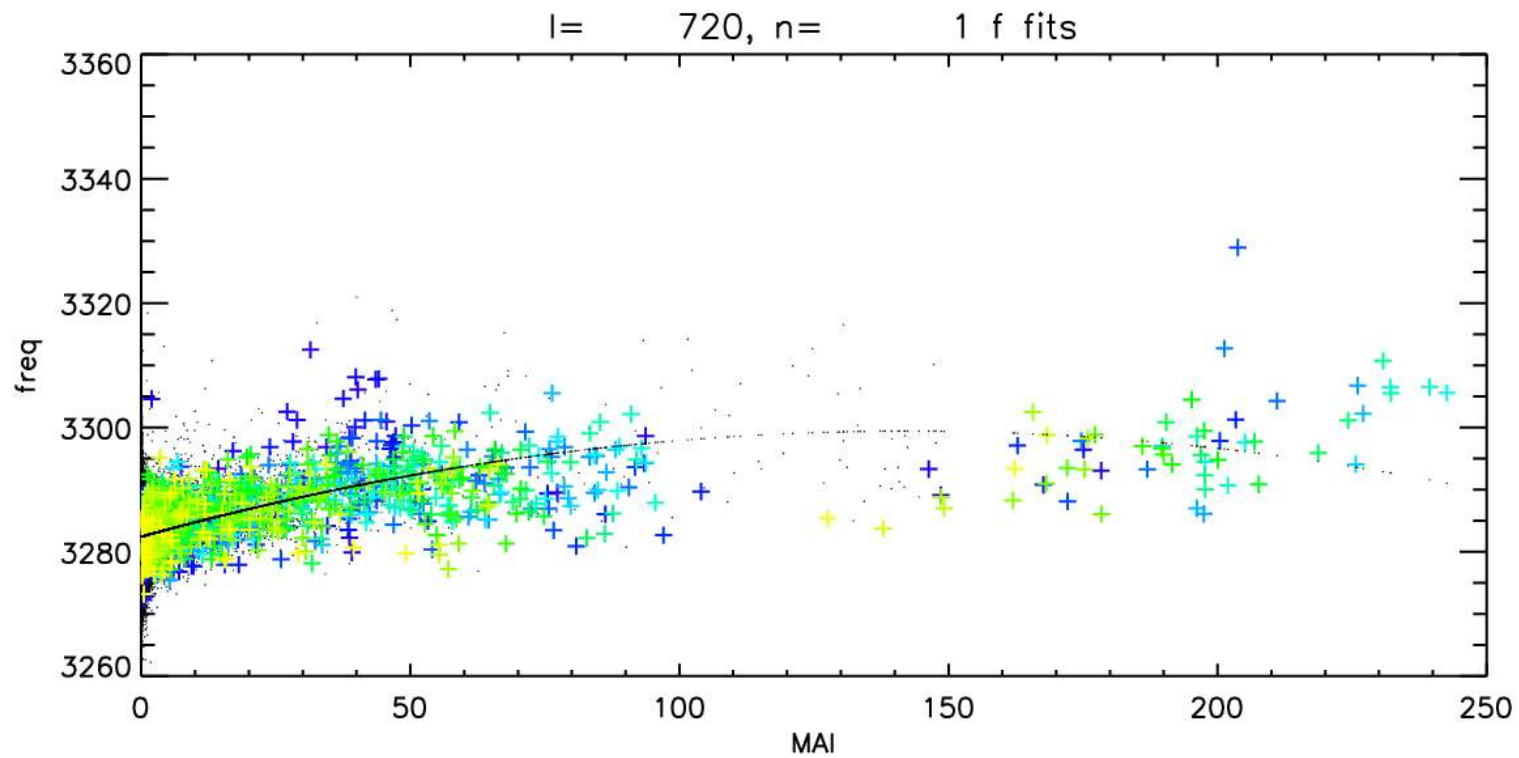
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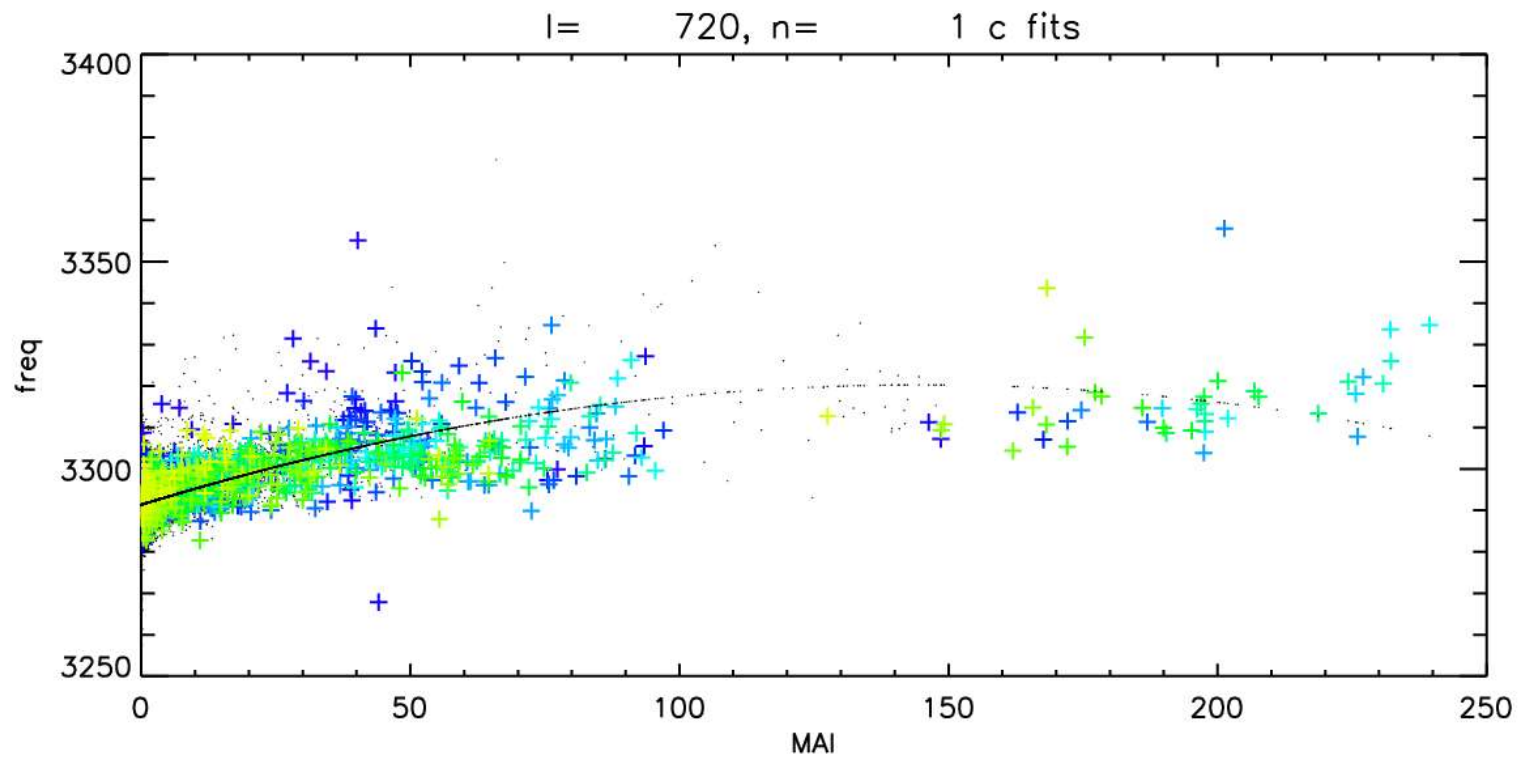
11092: L=720 N=2 F FITS

l=   720, n=   2 f fits
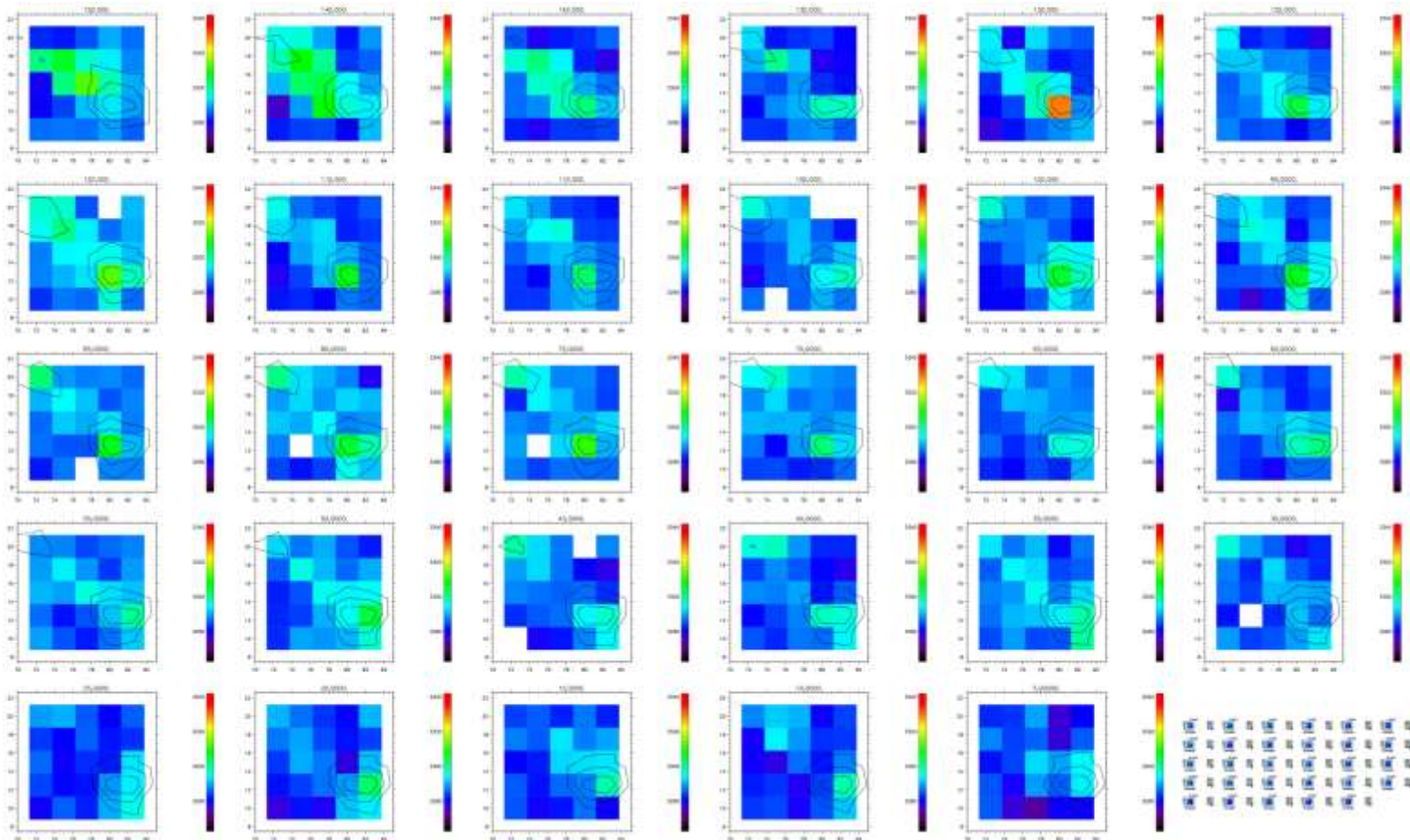
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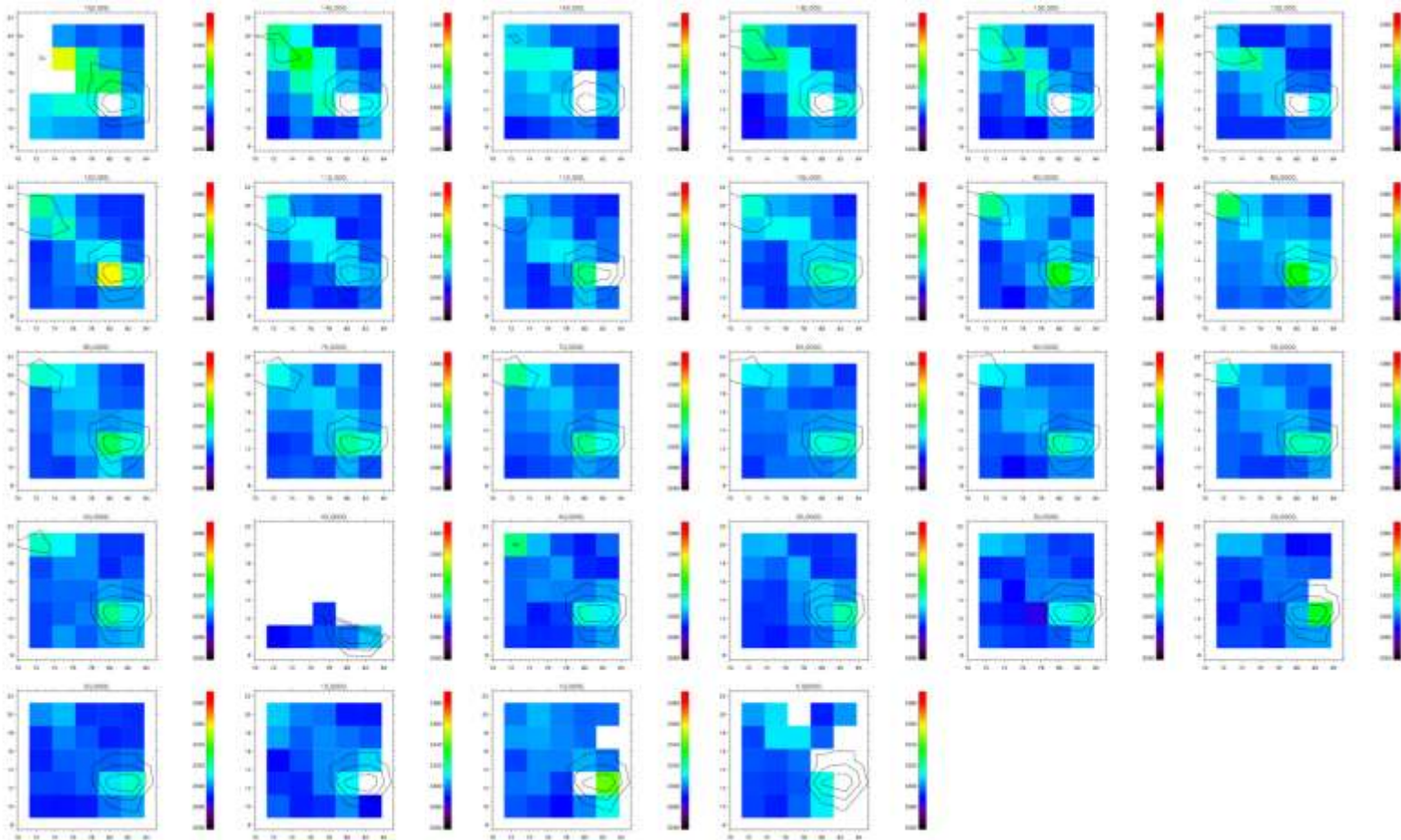
11092 MAIs

11092 L=1600 N=0 F FITS
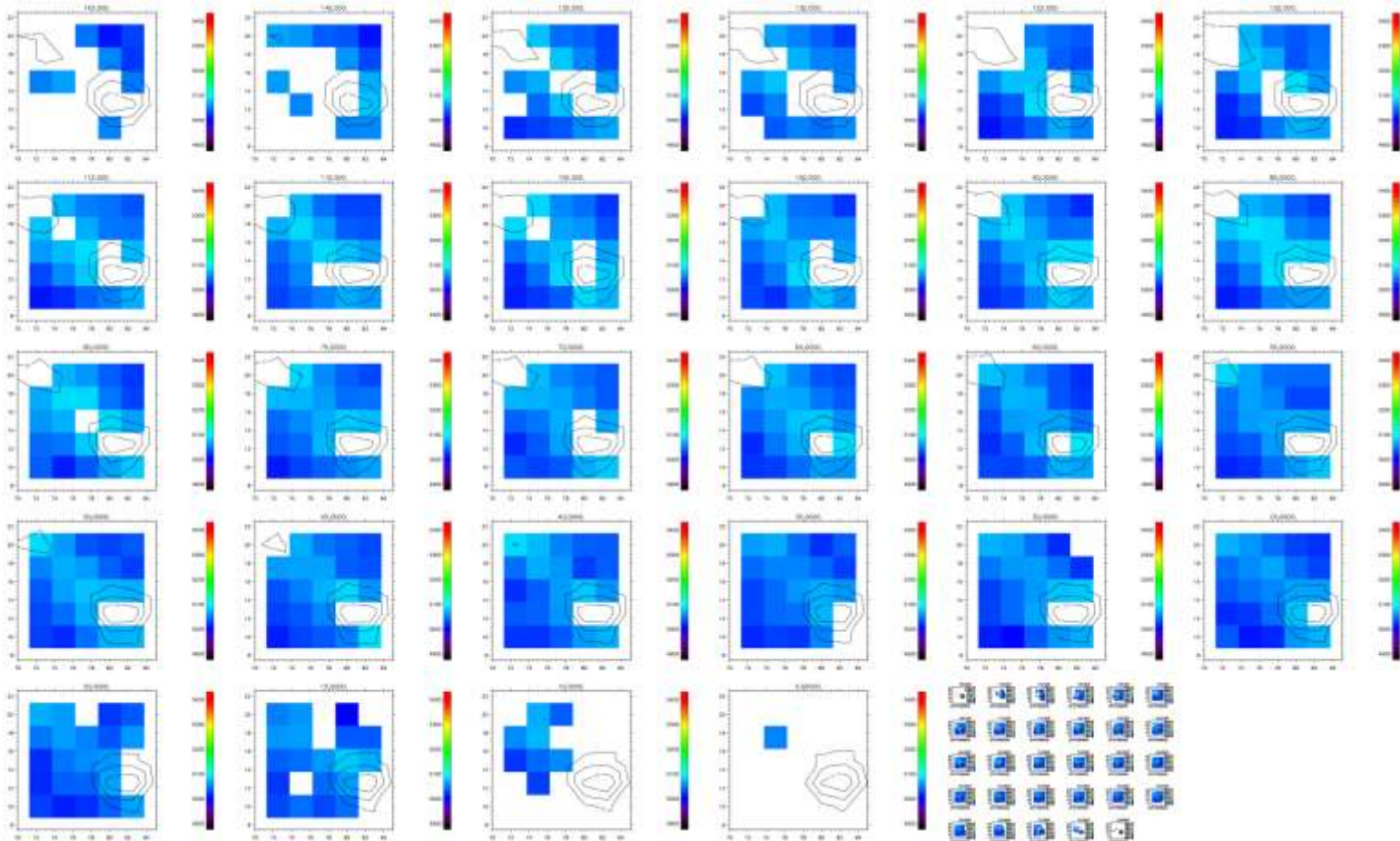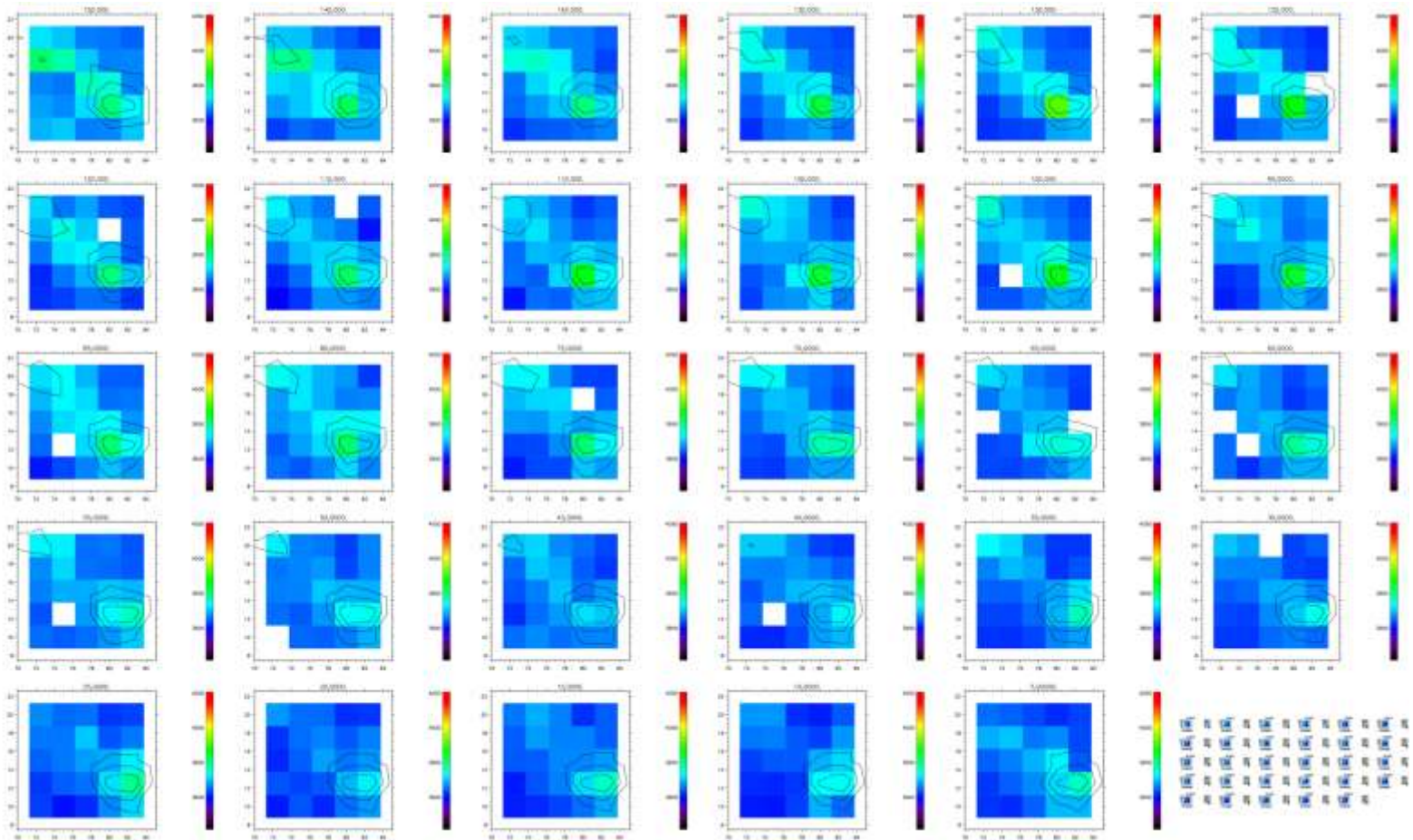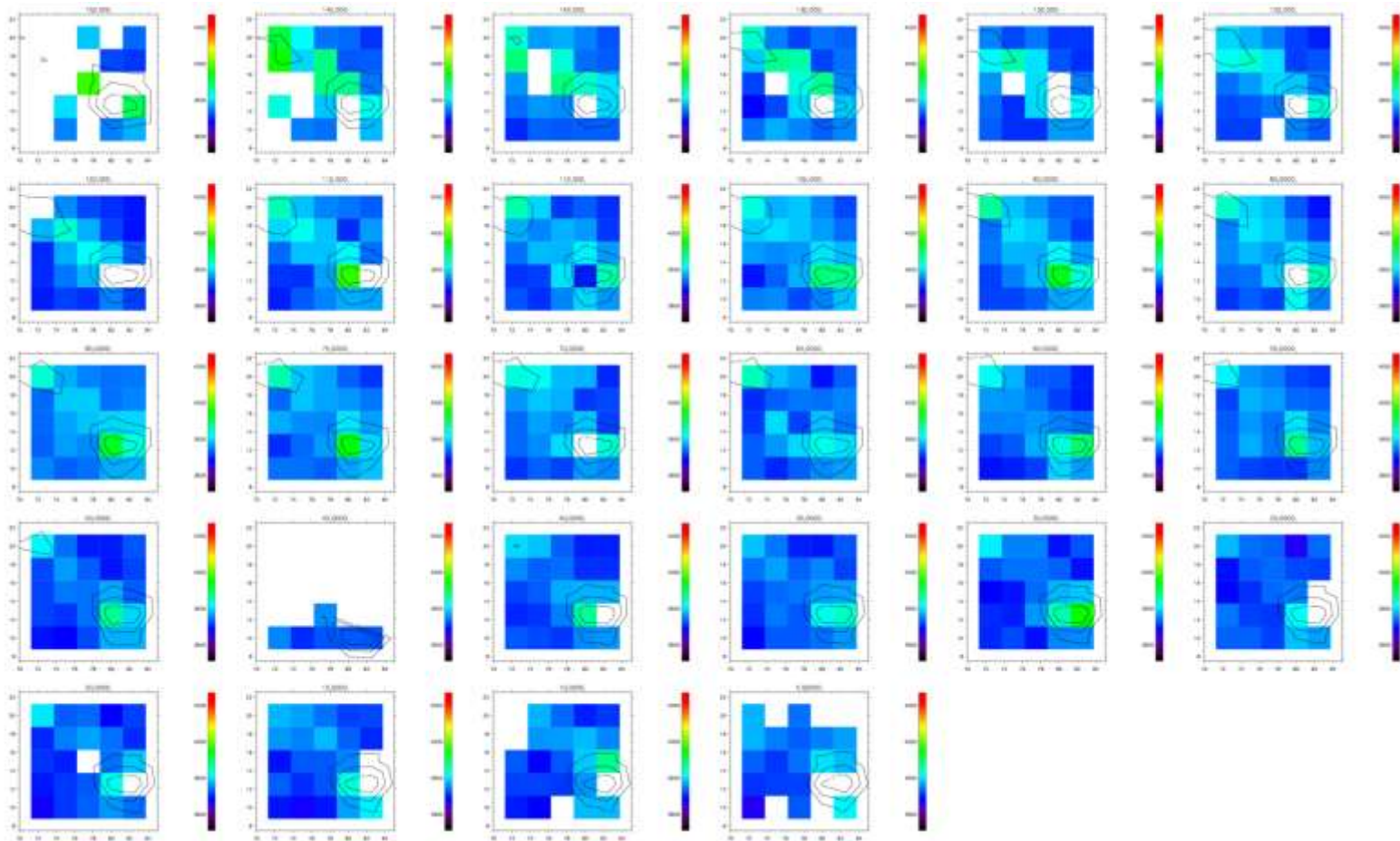
11092 L=1600 N=0 C FITS

11092 L=720 N=1 F FITS
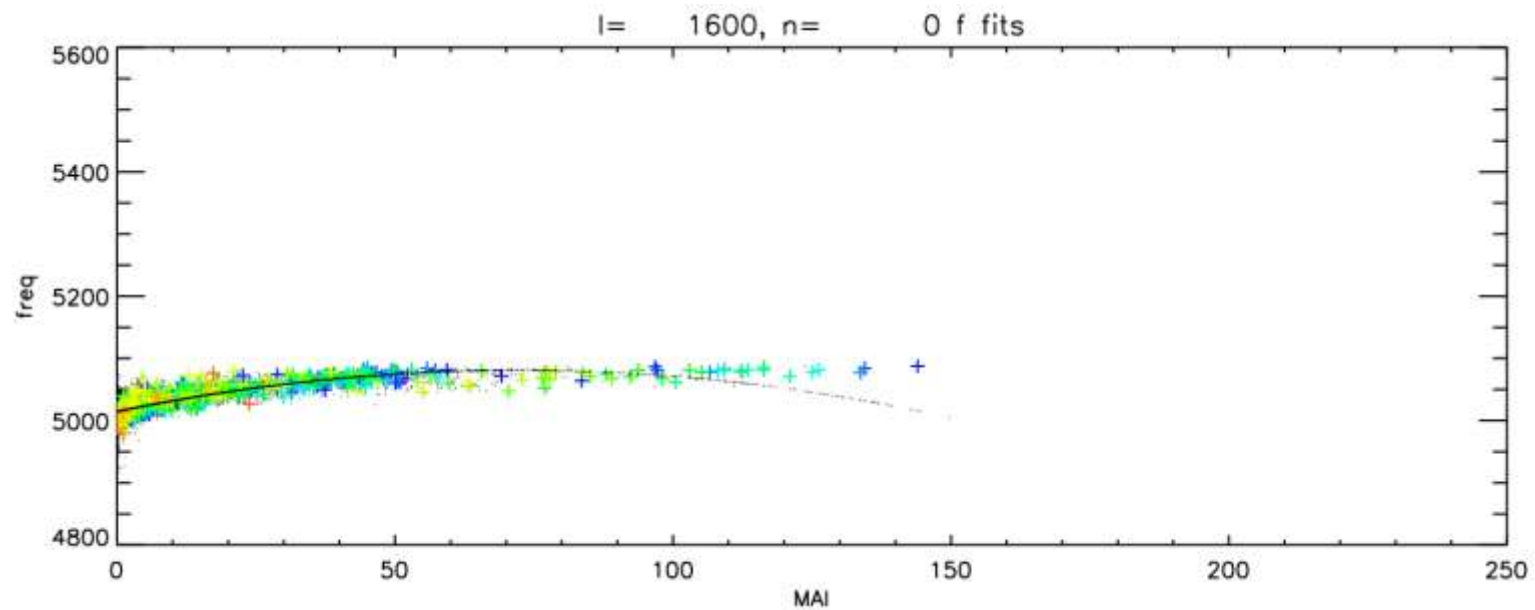
11092 L=720 N=1 C FITS

11092 L=720 N=2 F FITS
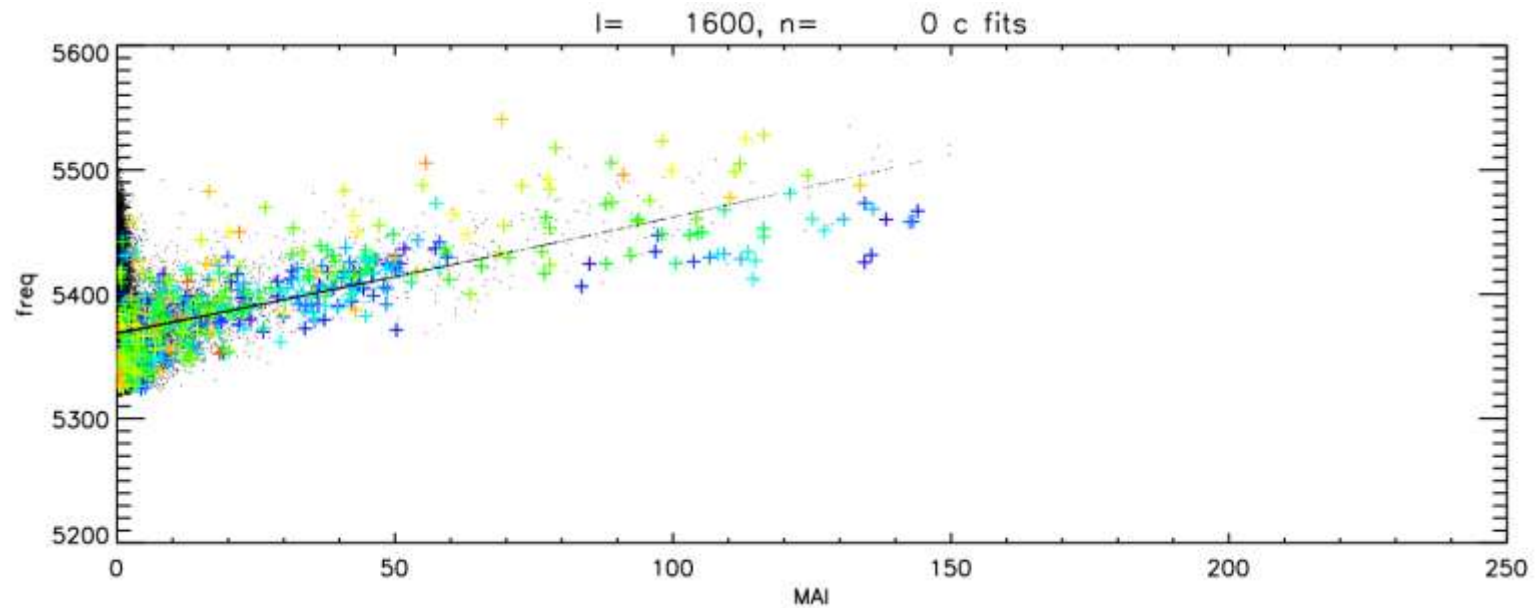
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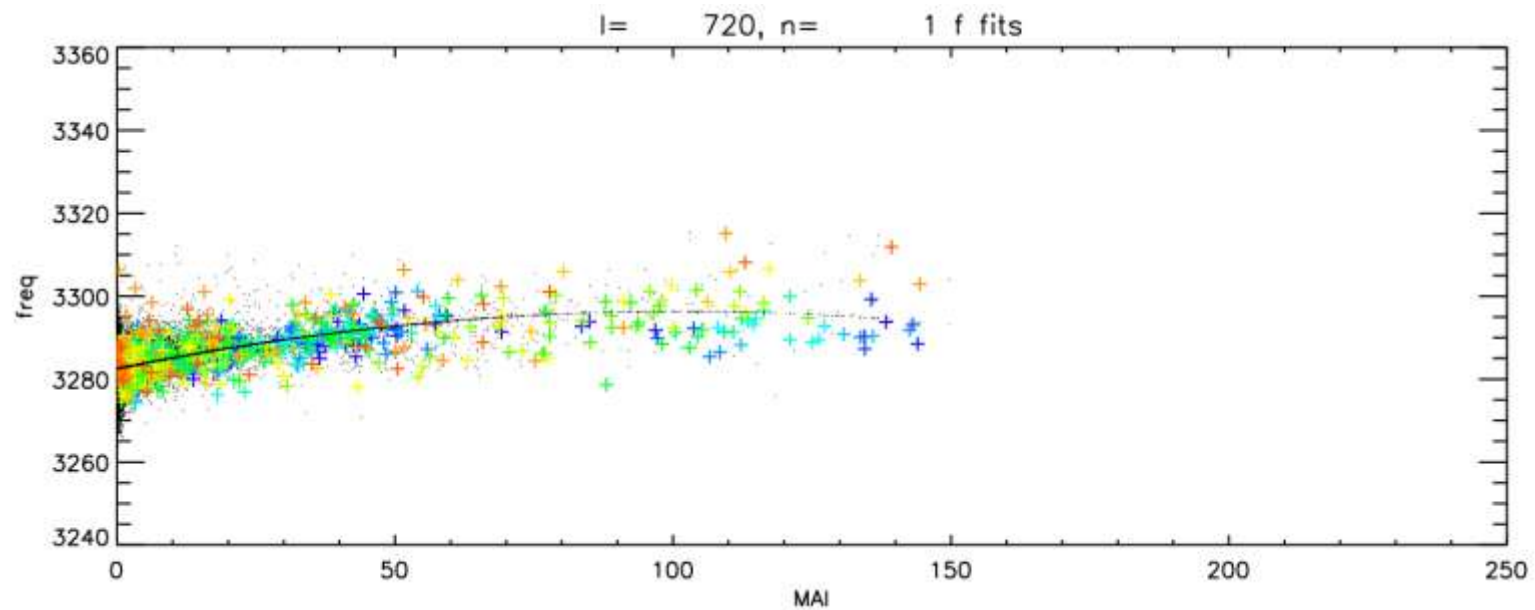- IF time is short, jump to conclusions here!
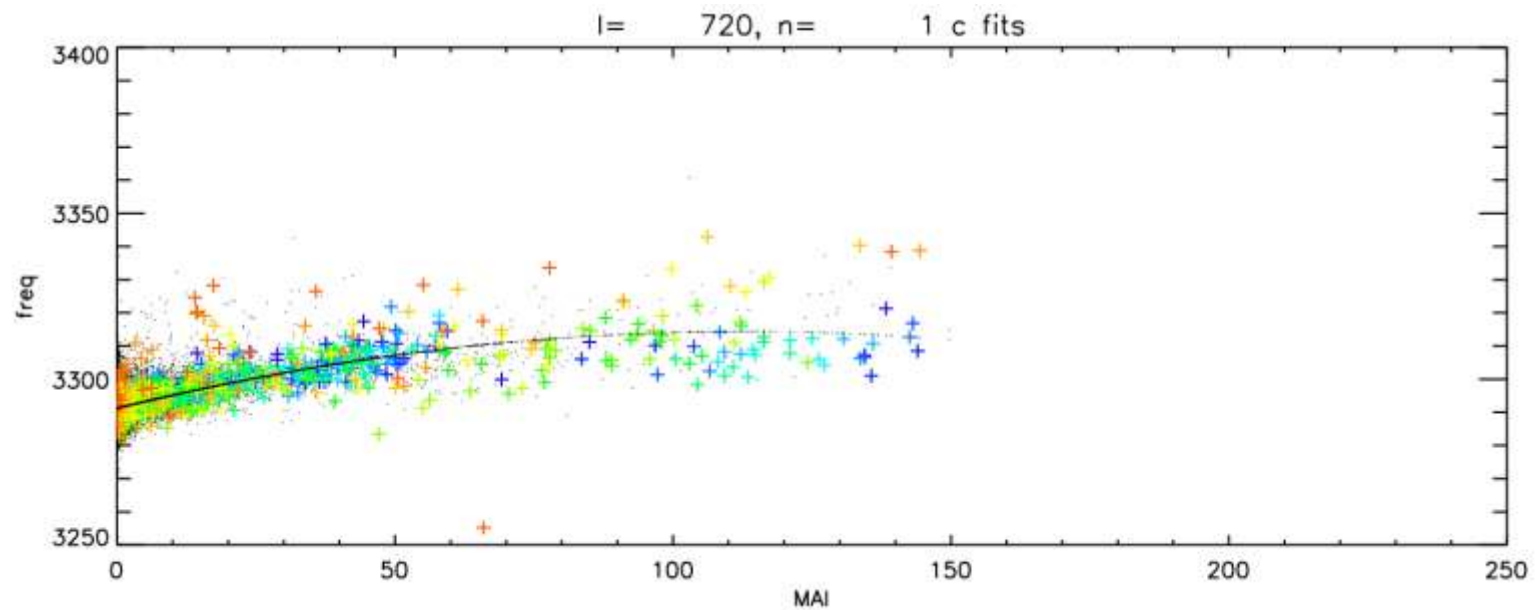- ELSE continue with AR 11093

11093 L=1600 N=0 F FITS

11093 L=1600 N=0 C FITS

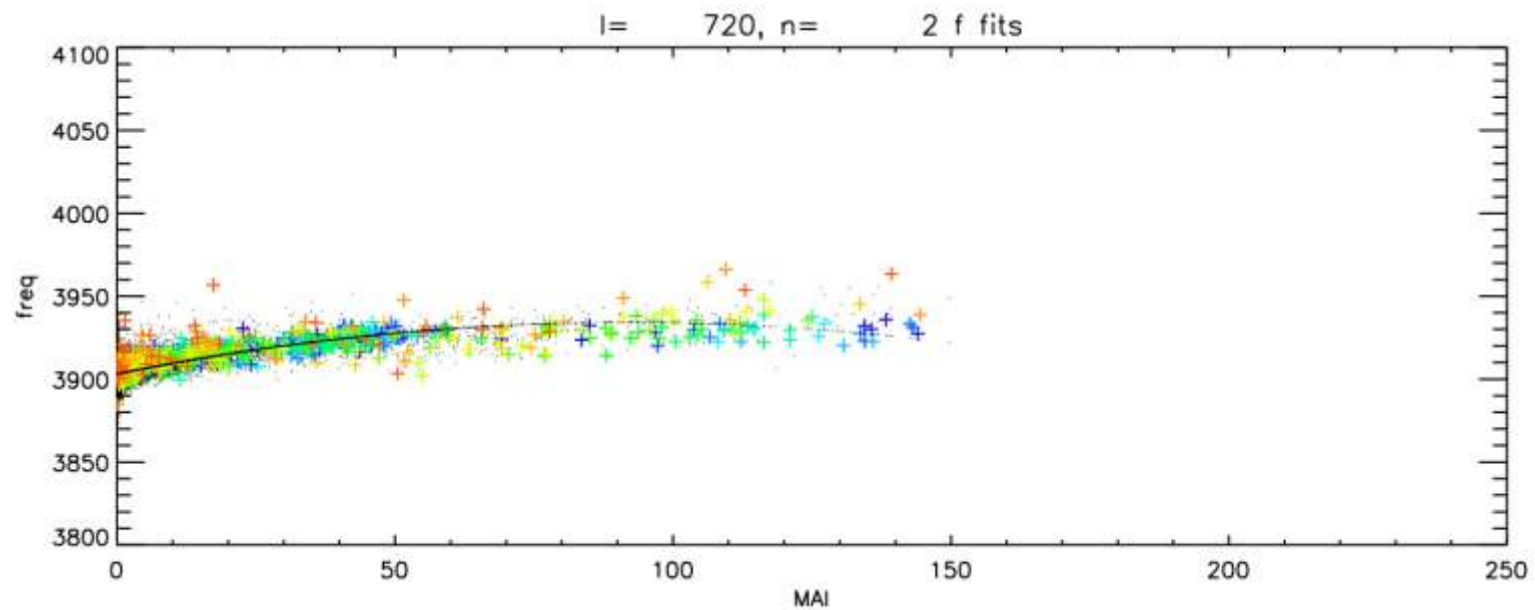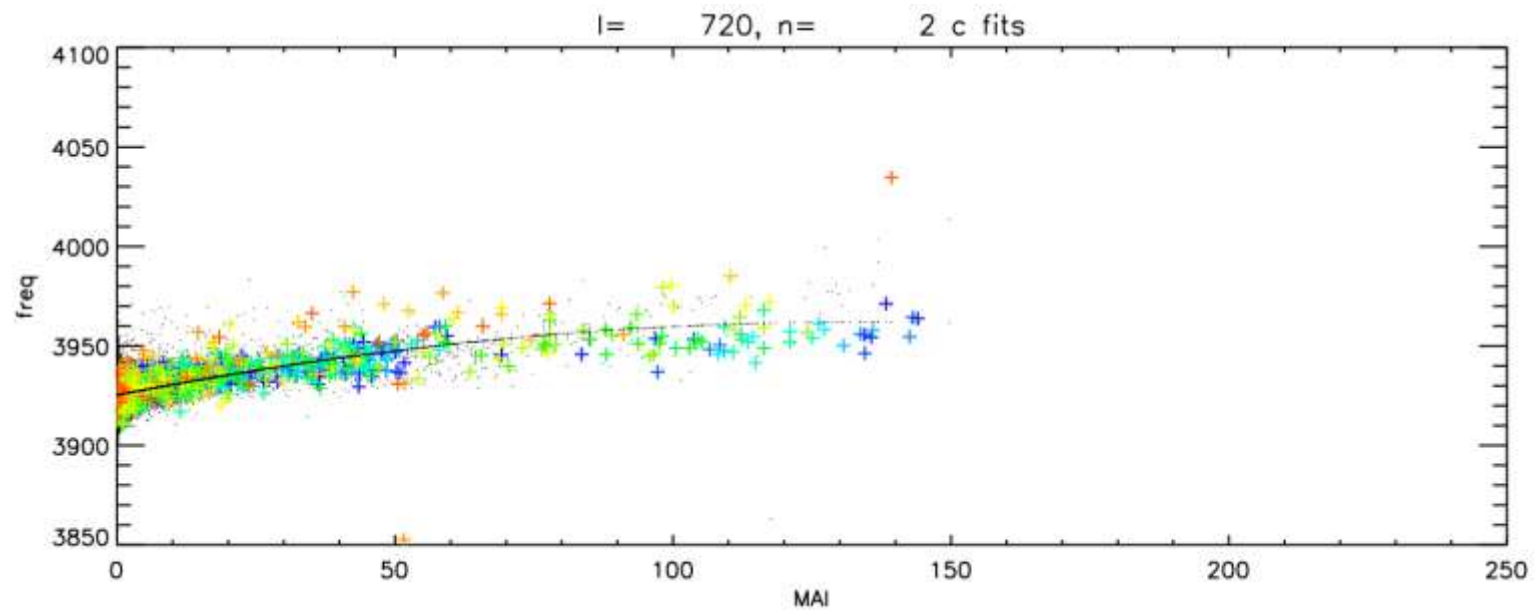l=   1600, n=   0 c fits

11093 L=720 N=1 F FITS

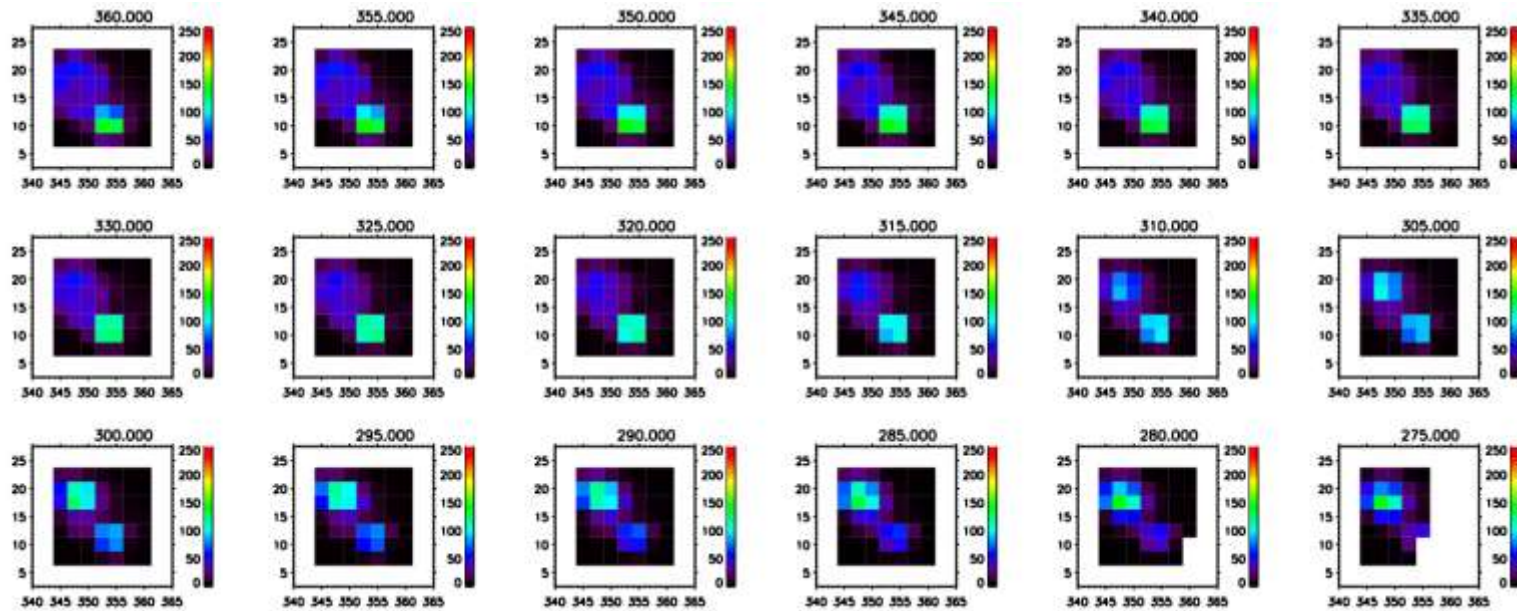# 11093 L=720 N=1 C FITS

I= 720, n= 1 c fits

11093 L=720 N=2 F FITS

I=   720, n=   2 f fits

11093 L=720 N=2 C FITS

l=   720, n=   2 c fits

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11093 MAIs

11093 L=1600 N=0 F FITS

11093 L=0 N=1600 C FITS

11093 L=720 N=1 F FITS
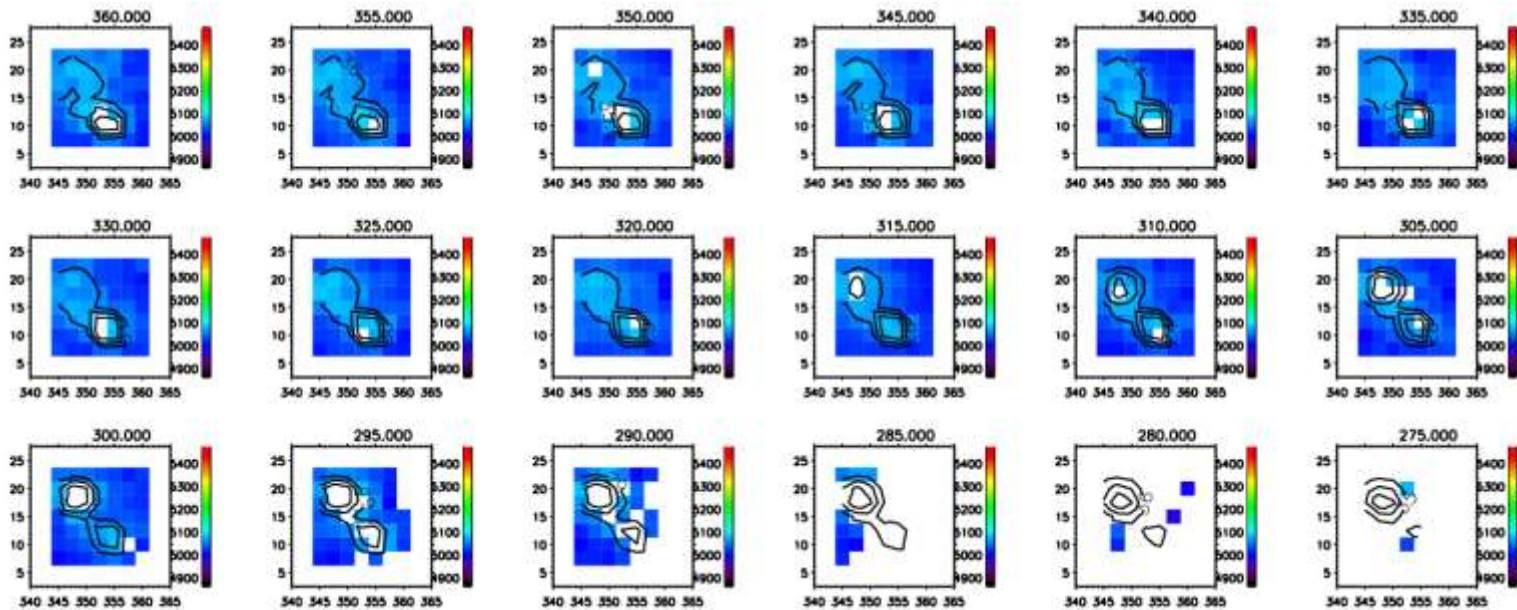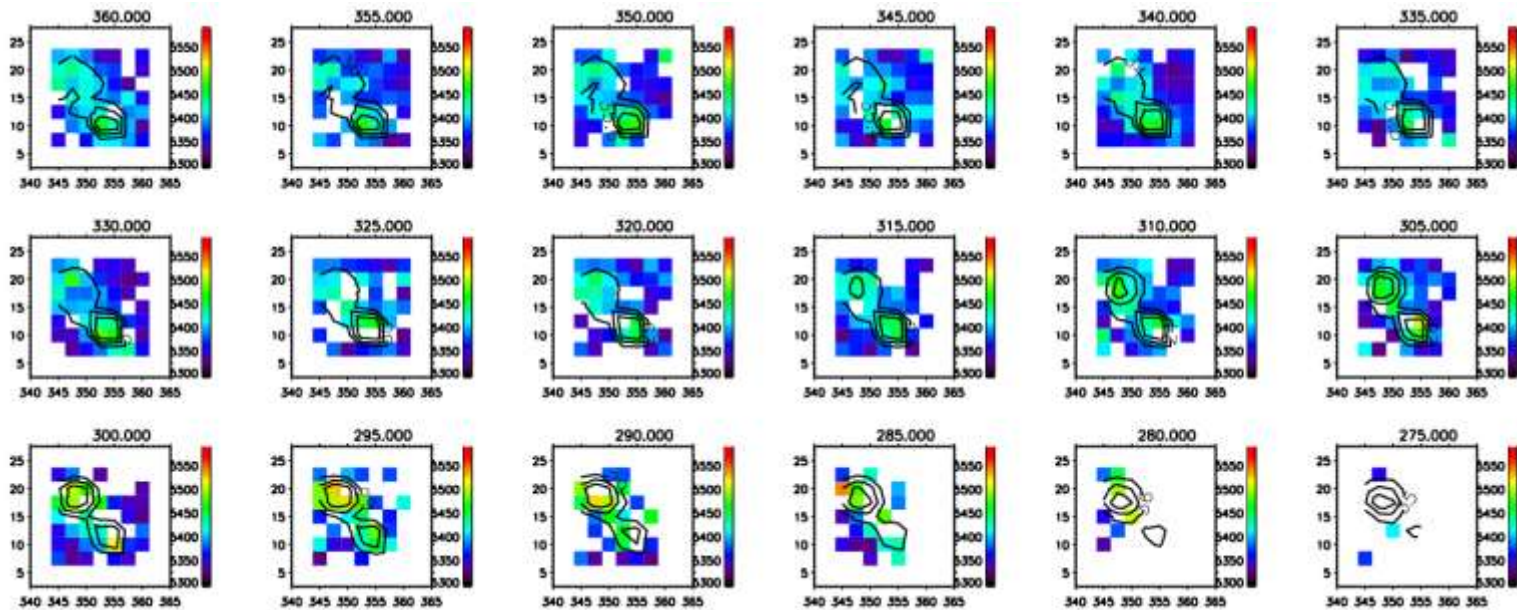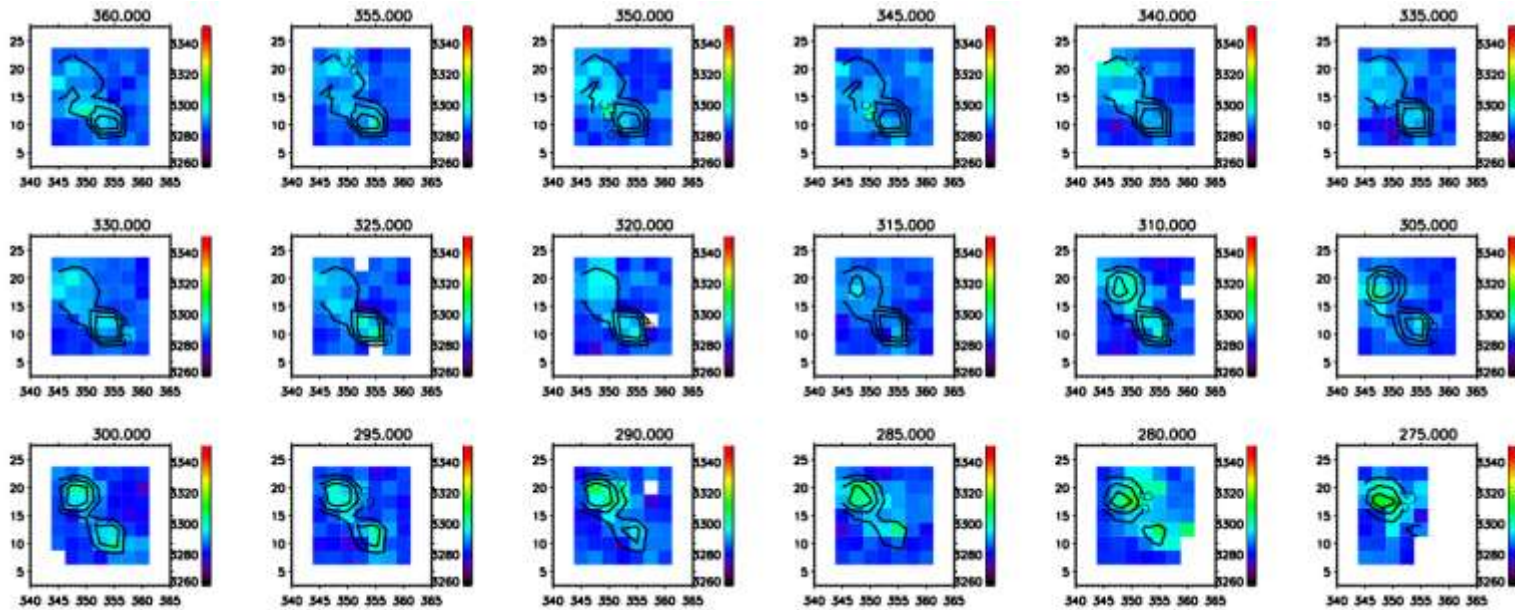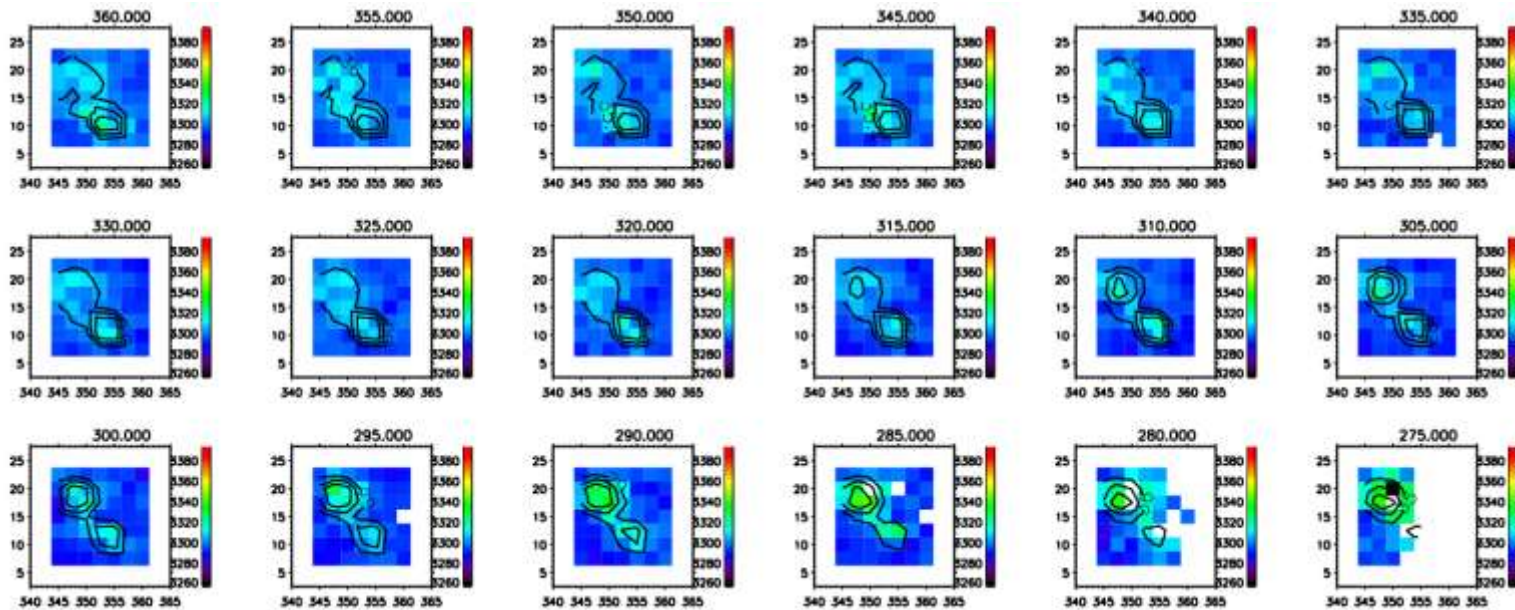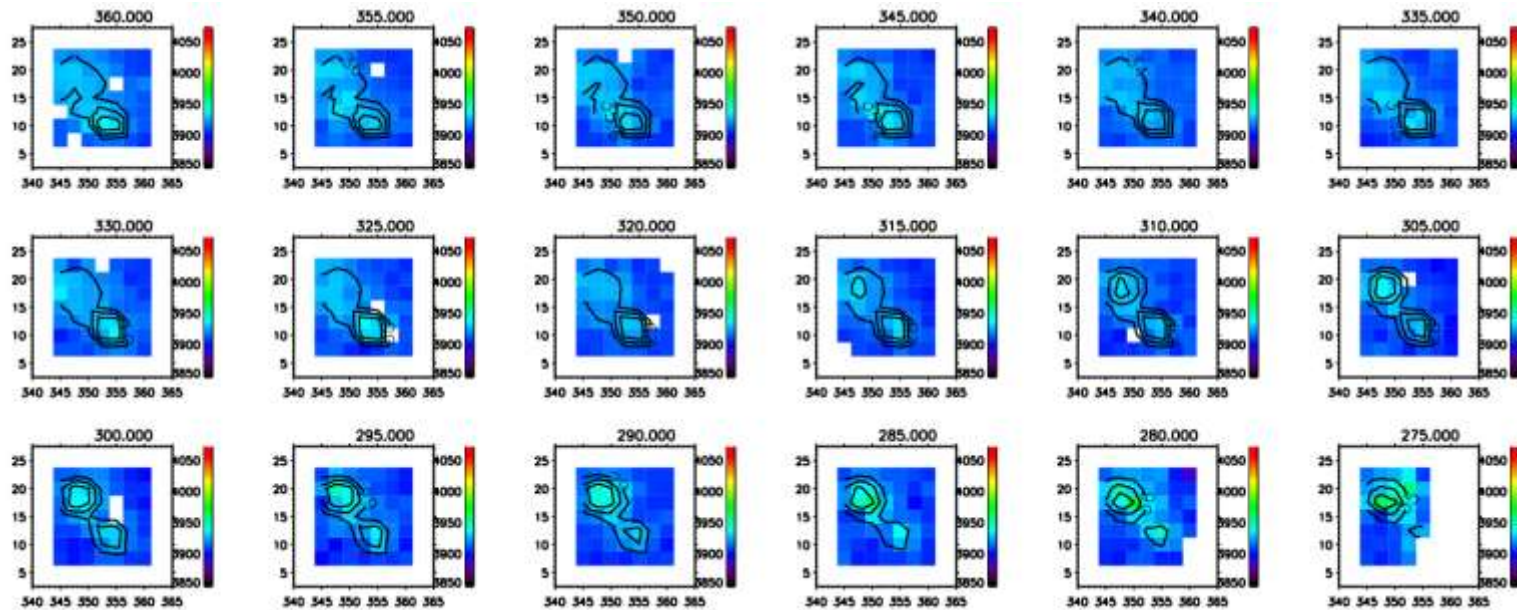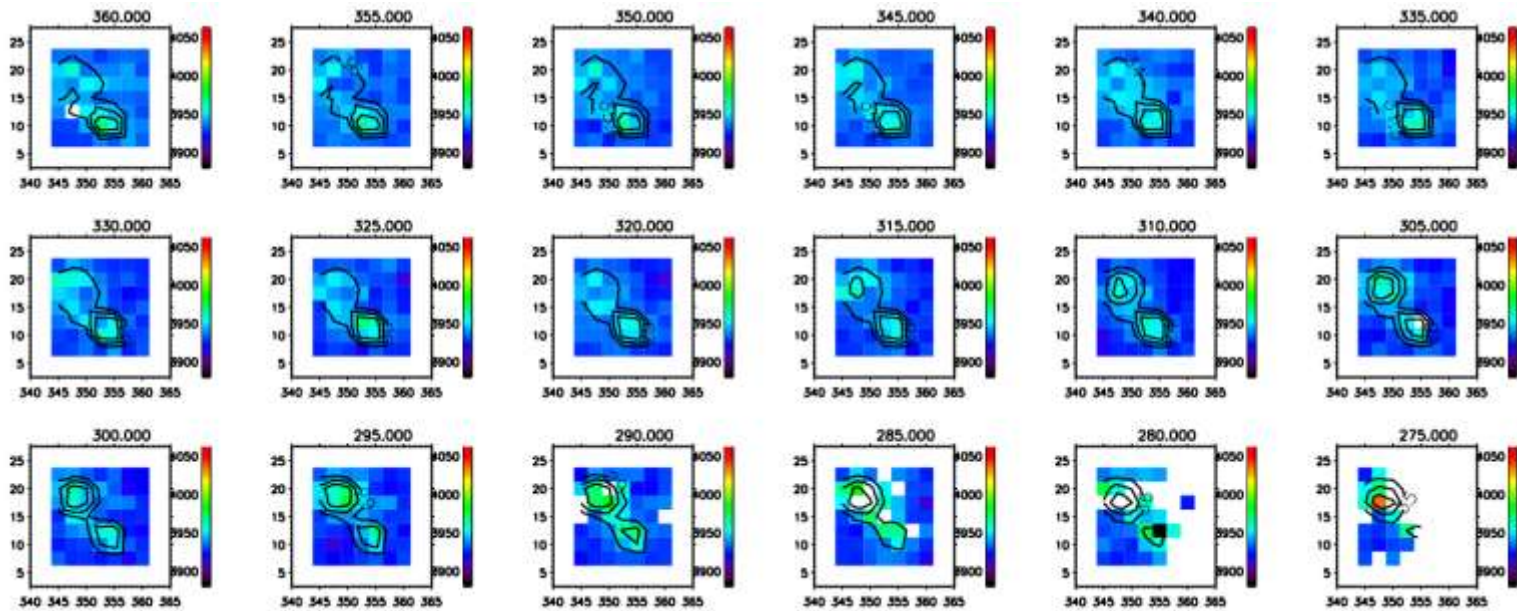
11093 L=720 N=1 C FITS

11093 L=720 N=2 F FITS

11093 L=720 N=2 C FITS

DISCUSSION

- Saturation and scatter make it hard to conclude anything from detail of frequency changes in strong active regions
- Can see elevated frequency tracking activity locations even on 5-degree scale.