

Aggiornamenti sull'analisi dei rate a Ny Ålesund

Luigi Ghezzer, Francesco Nozzoli, Ombretta Pinazza

22/2/2024

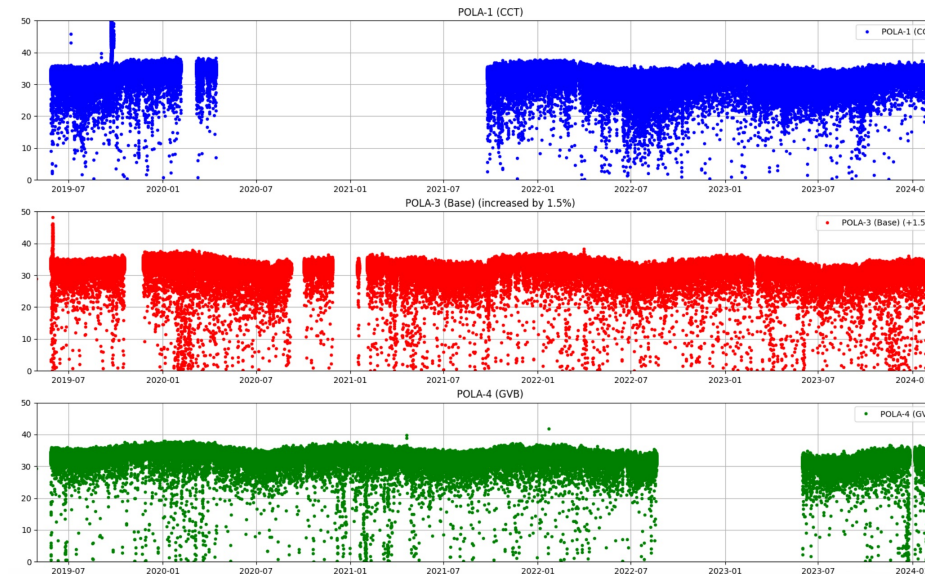
1. Definizione della serie temporale
2. Analisi della periodicità annuale
3. Confronto con rate di neutroni (WIP)

Convalida dei dati

- Nuova ricostruzione realizzata da Francesco Noferini:
 - file root disponibili fino al 8/2/2024
 - rate con frequenza di 1 minuto,
 - ogni evento ha un indice di qualità (status)
 - sono riportate tutte le letture dei sensori

Tutti i rate con status = 0
e almeno un valore di
pressione disponibile:

POLA-1 82.0%
POLA-3 82.9%
POLA-4 70.9%



/home/eee/analisi/polarRates/outPOLA-0x.root

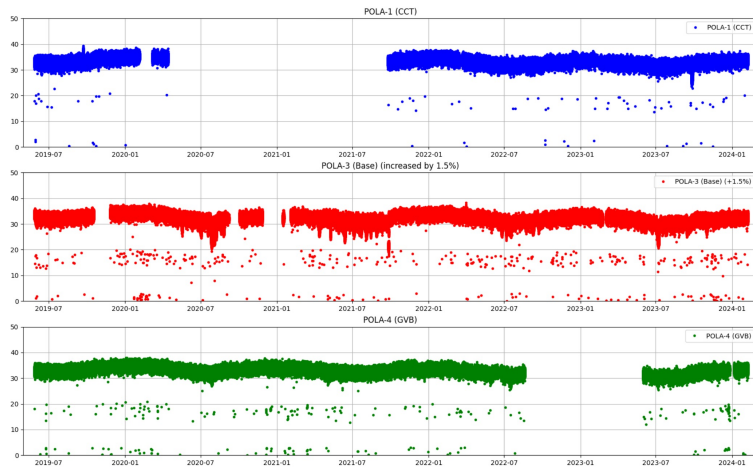
Rate:

rate
rate4c
rateDir (9 elem)
ratePair (16 elem)
ratePair4c (16)
ratePairAND1 (16)
ratePairAND2 (16)
rateRaw
rx1
rx2

Sensori

temp = Sensehat
temp2 = Sensehat
temp3 = DS18B20
temp4 = BMO055 (only POLA 1-2, not on 3-4)
temp5 = BME280
humi = Semsehat
pres = Sensehat
humi1 = BME280
pres1 = BME280

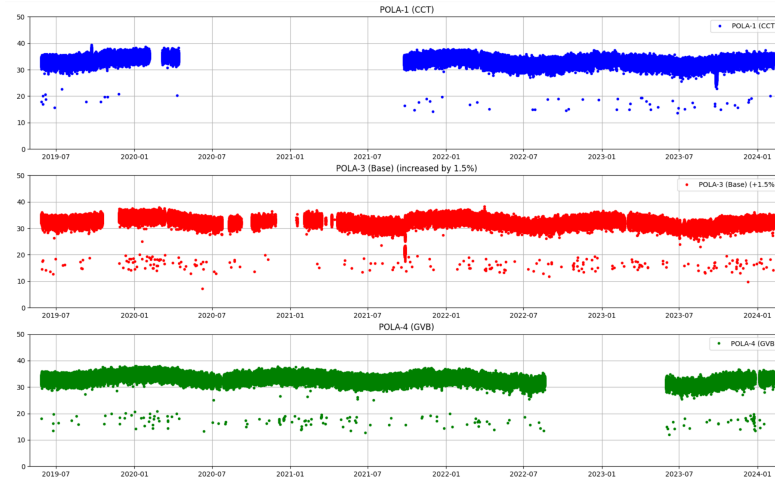
Prove con tagli diversi



Rate validi:

- rate con status == 0
- almeno un valore di pressione disponibile
- 4 valori di rate non differiscono di più di 3 Hz

POLA-1 67.5%
POLA-3 68.7%
POLA-4 68.8%

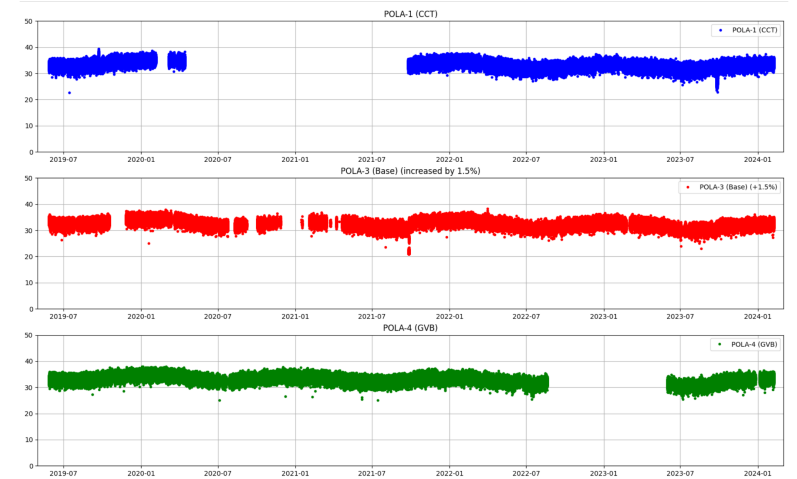


Rate validi:

- rate con status == 0
- almeno un valore di pressione disponibile
- 4 valori di rate non differiscono di più di 3 Hz
- Temperatura interna $\leq 40^{\circ}\text{C}$
- Rate $> 5\text{ Hz}$

POLA-1 66.5%
POLA-3 55.6%
POLA-4 66.9%

(scartati in particolare dati di POLA-3)



Rate validi:

- rate con status == 0
- almeno un valore di pressione disponibile
- 4 valori di rate non differiscono di più di 3 Hz
- Temperatura interna $\leq 40^{\circ}\text{C}$
- Rate $> 20\text{ Hz}$

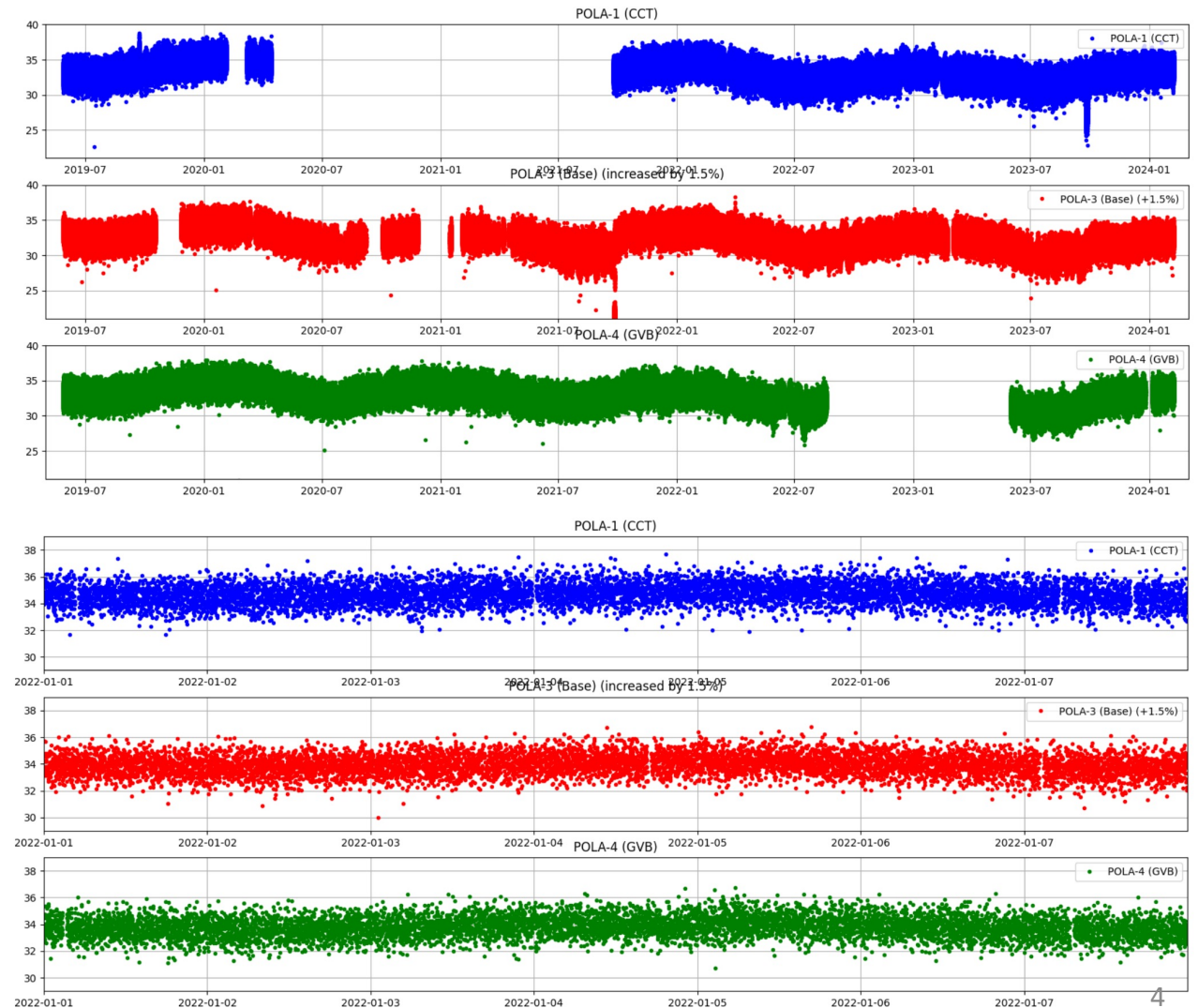
POLA-1 66.5%
POLA-3 55.5%
POLA-4 66.9%

(scartate poche decine di eventi)

Riassunto: effetto dei tagli

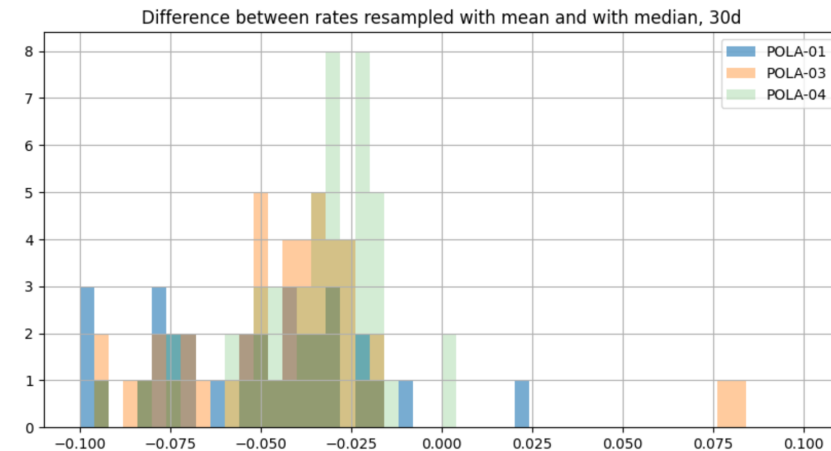
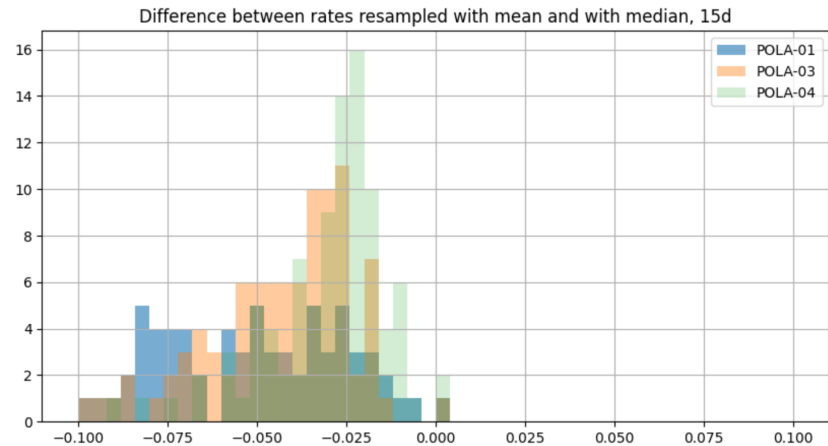
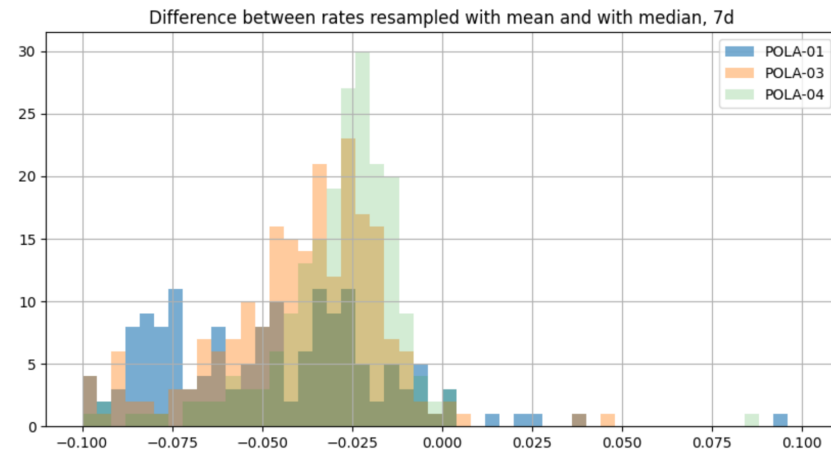
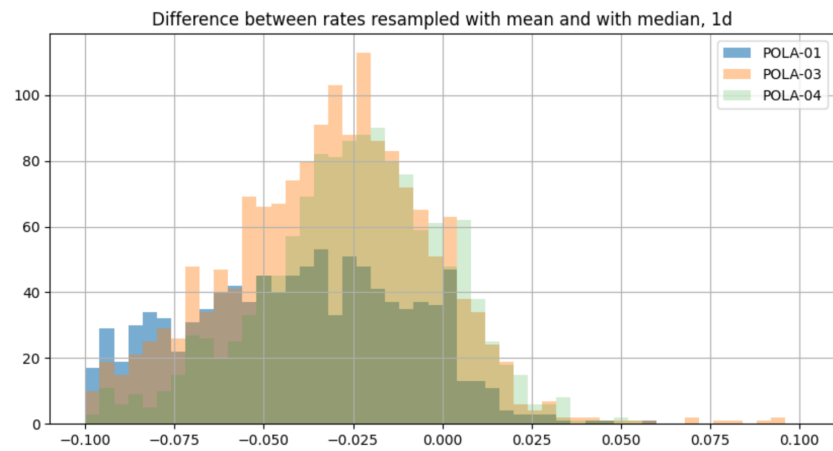
values	POLA-1	POLA-3	POLA-4
tot events	1847035	2544087	2254835
Valid values	1230634	1416057	1511198
Valid %	66.5	55.6	66.9
Cut status>0	328161	430849	653094
Cut press na	4704	4433	4643
Cut diff>3	269079	361345	46270
Cut diff>2.5	285814	389458	65882
Cut temp>41	10762	187926	26972
Cut temp>40	19120	335784	44184
Cut rate<=1	41	52	89
Cut rate<=5	69	125	172
Cut rate<=20	112	364	279

Zoom:



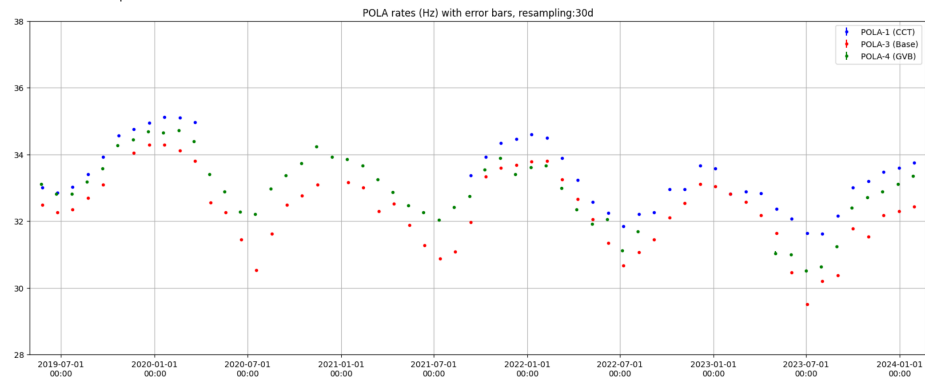
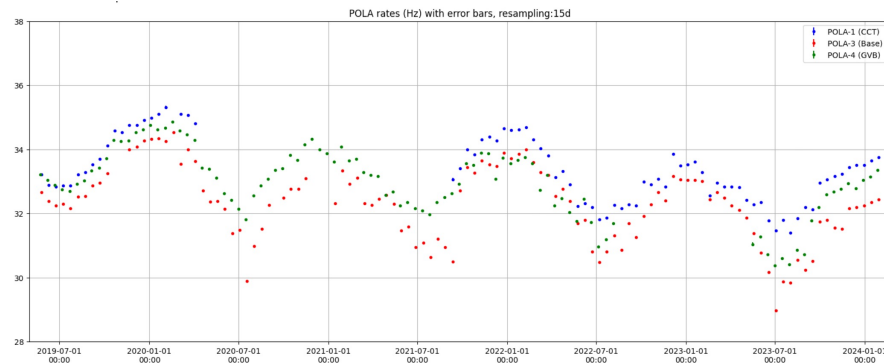
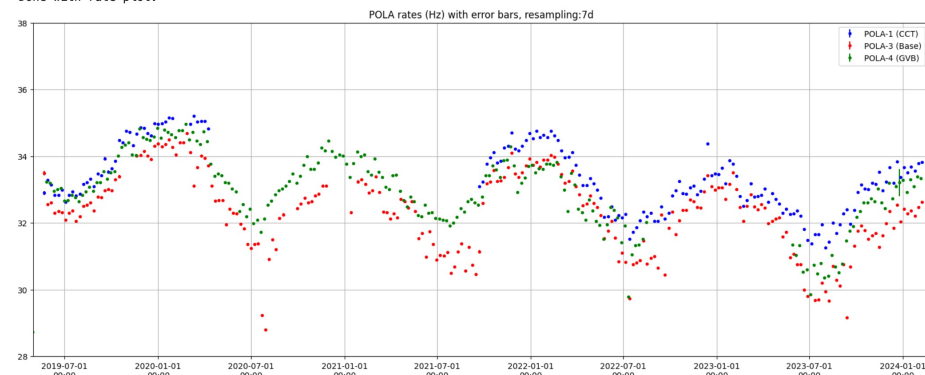
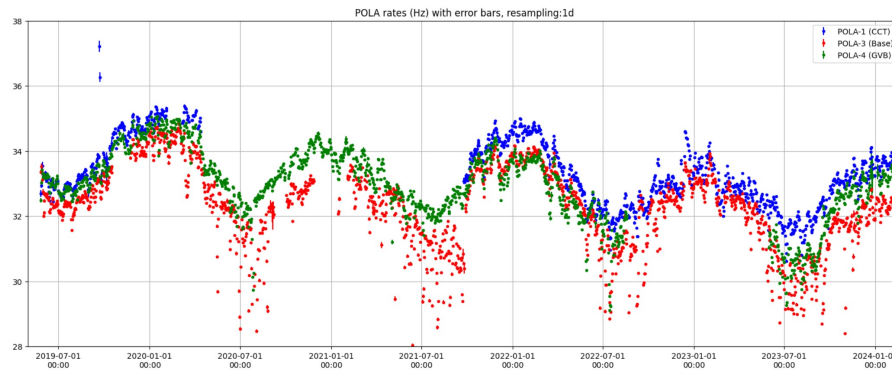
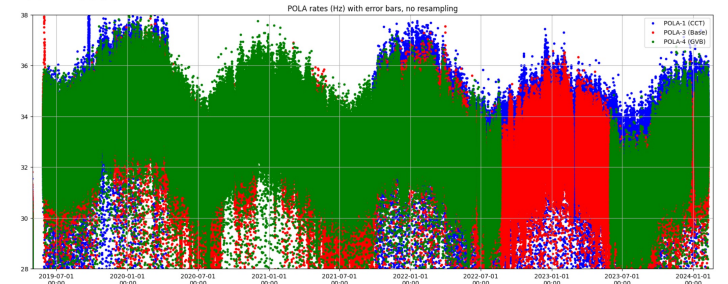
Ricampionamento tramite media e mediana

- Resampling dei rate ‘non tagliati’
 - Confronto media e mediana per 1d, 7d, 15d, 30d



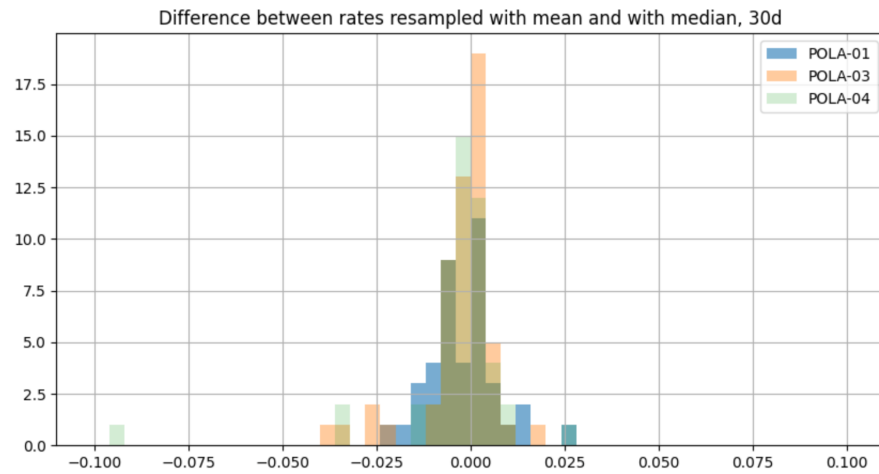
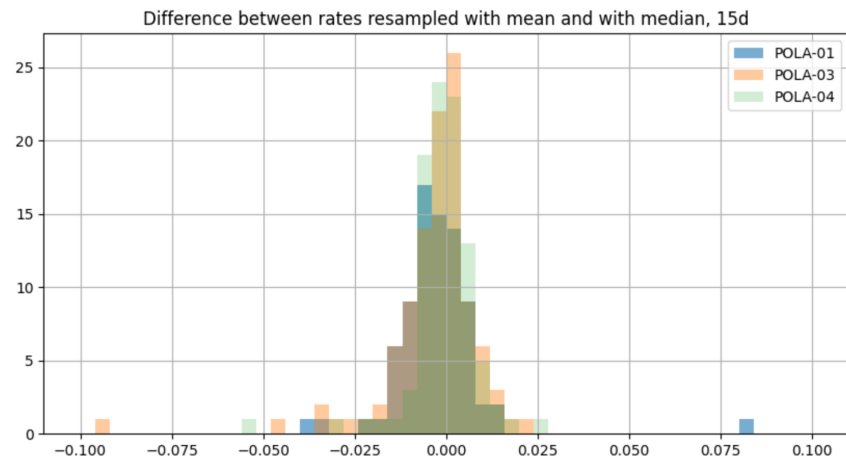
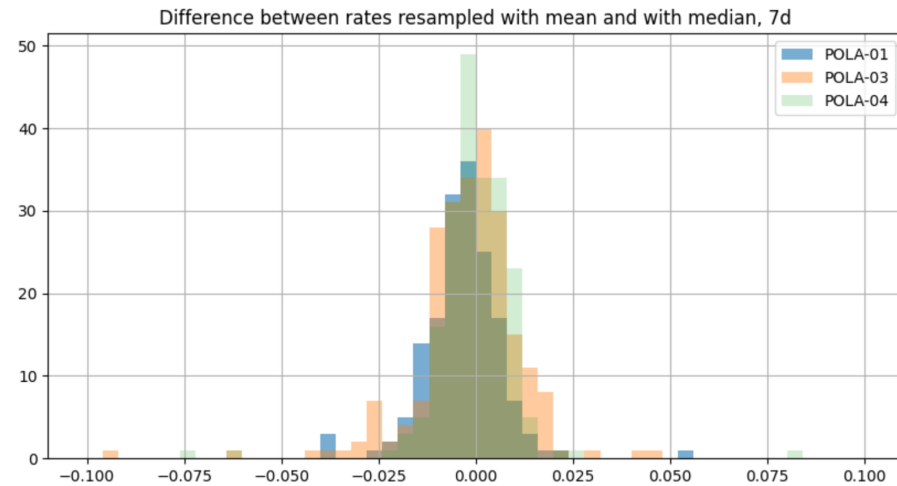
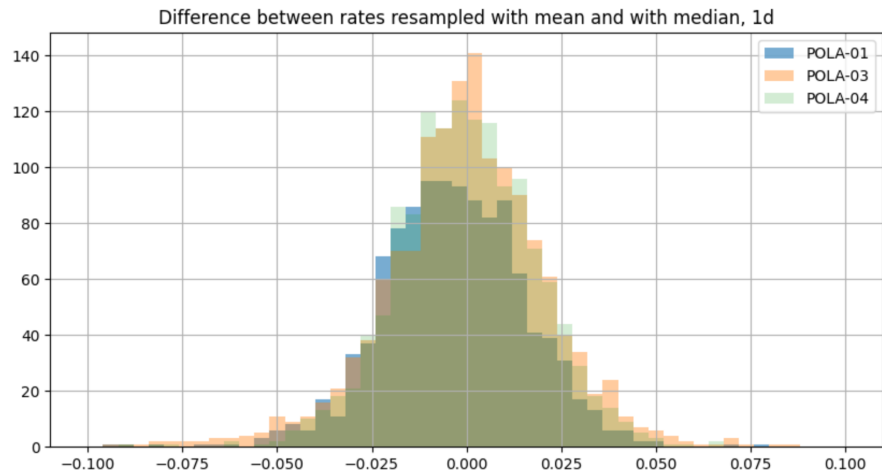
Ricampionamento tramite mediana

- Resampling dei rate ‘non tagliati’
 - Rate ricampionati con mediana per 1d, 7d, 15d, 30d



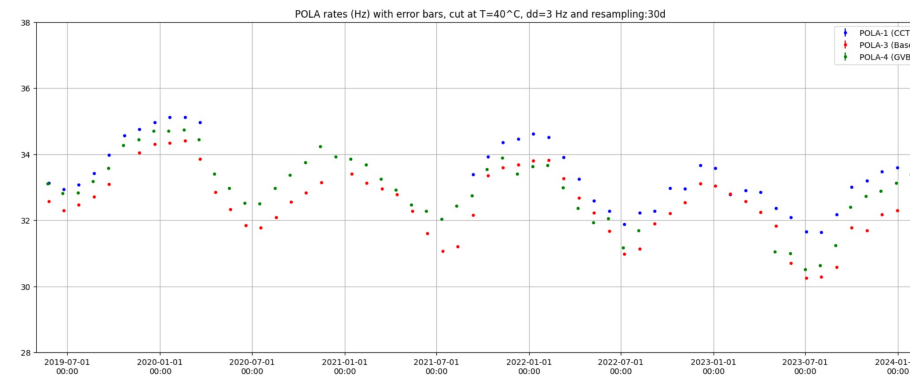
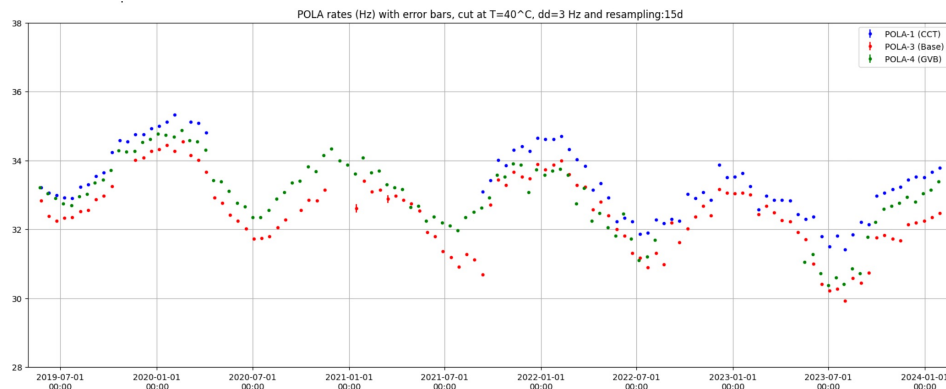
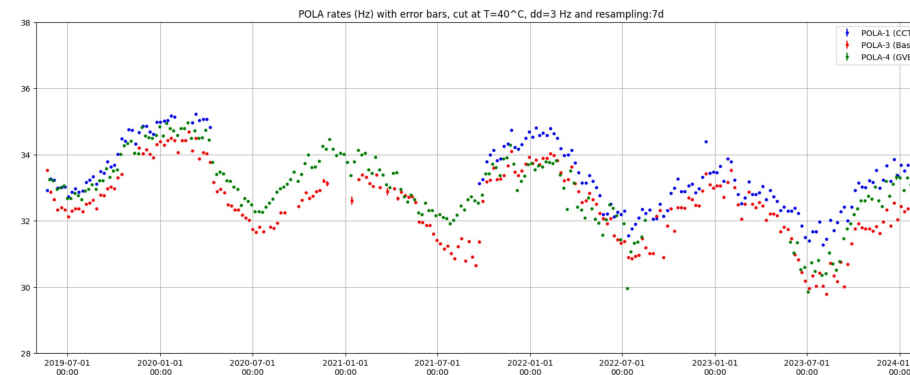
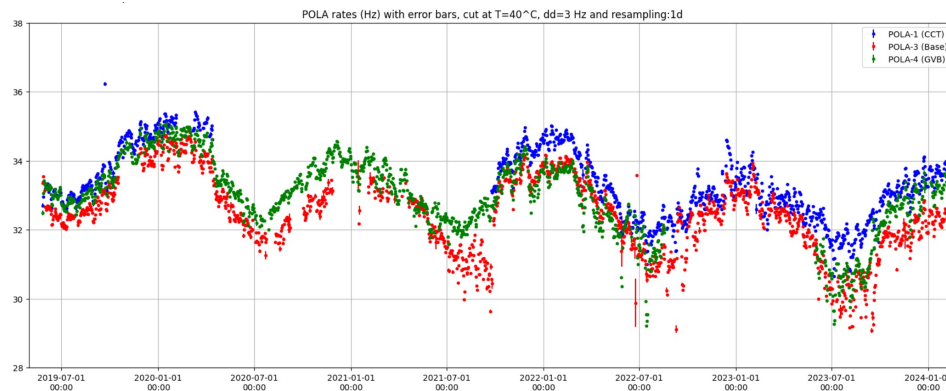
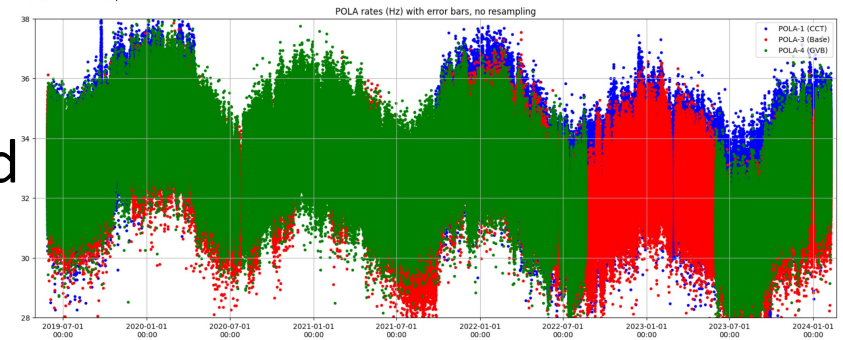
Ricampionamento tramite media e mediana

- Resampling dei rate già tagliati
 - Confronto media e mediana per 1d, 7d, 15d, 30d

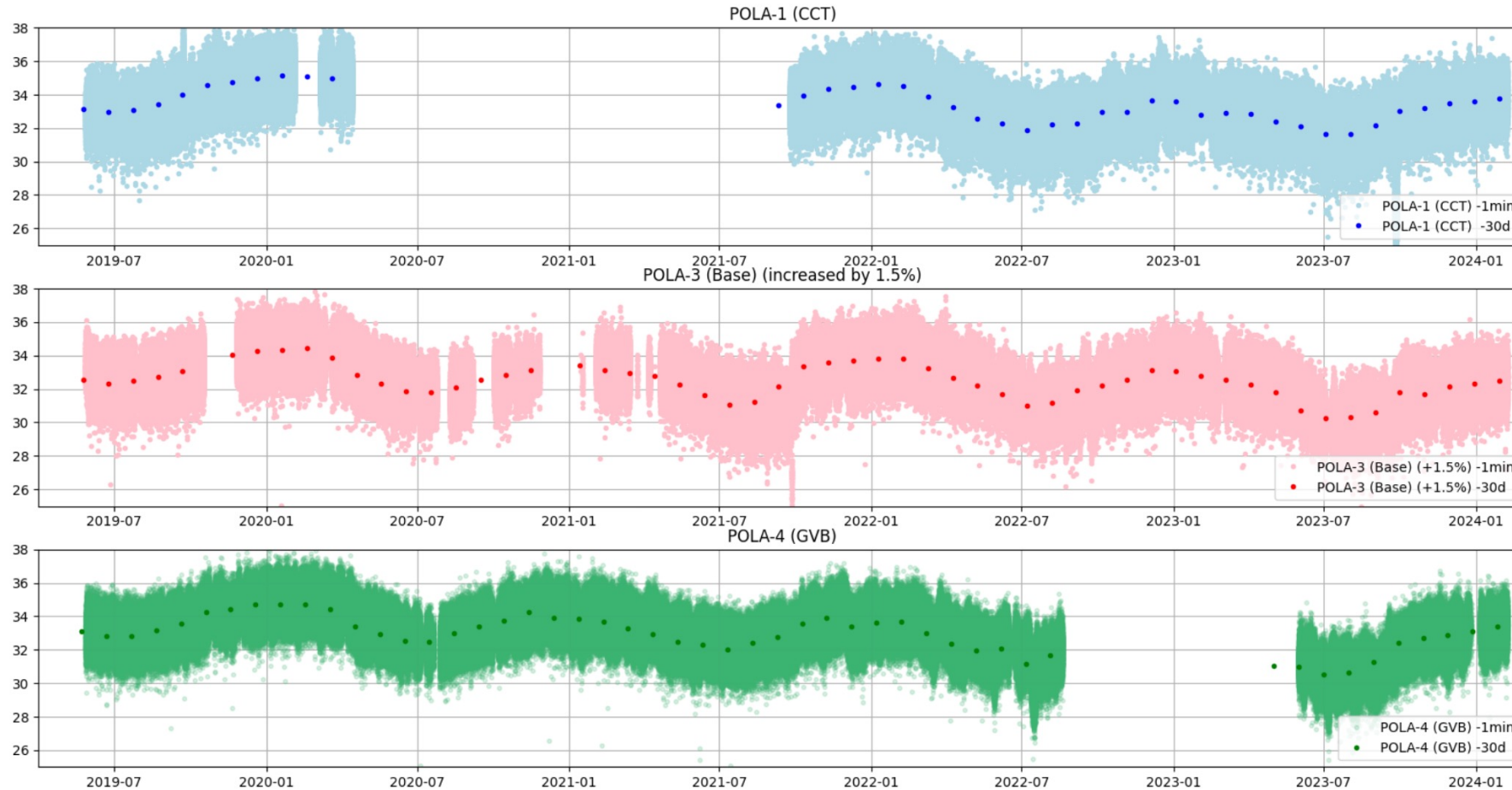


Ricampionamento tramite mediana

- Resampling dei rate già tagliati
 - Rate ricampionati con mediana per 1d, 7d, 15d, 30d



Valori dei rate a 1min e 30d

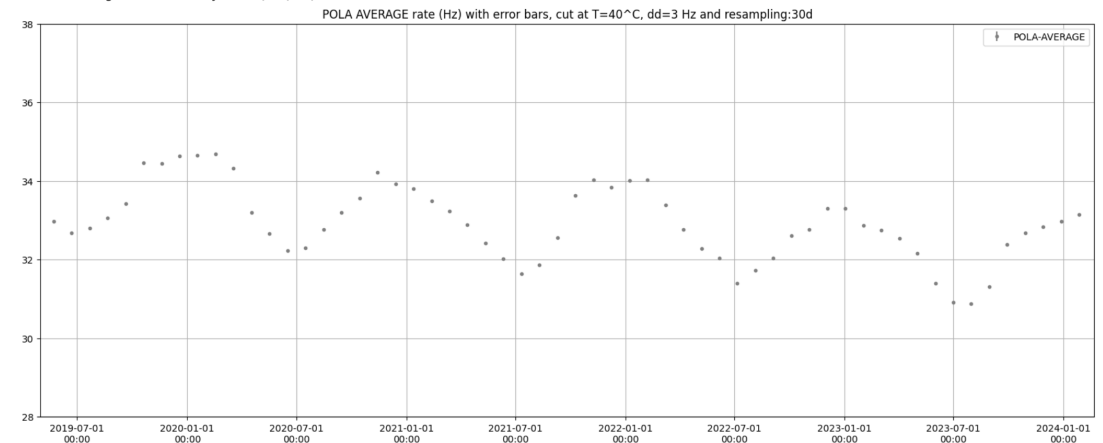
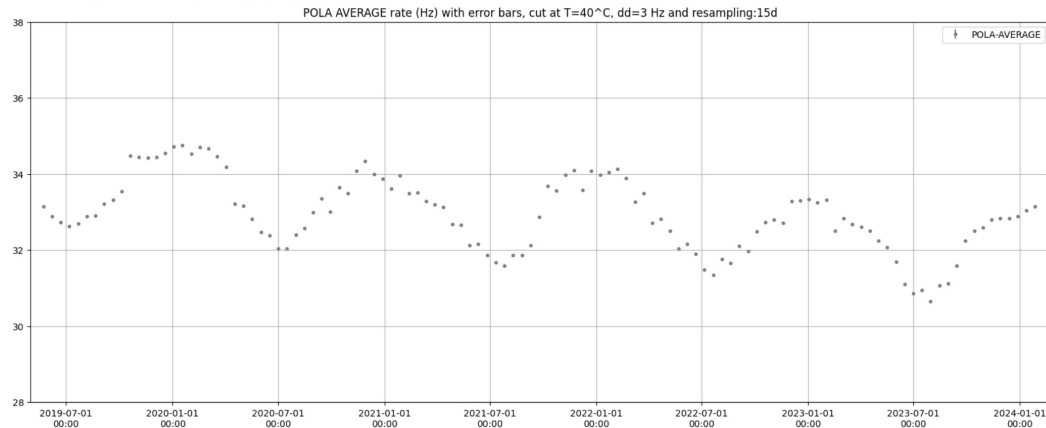
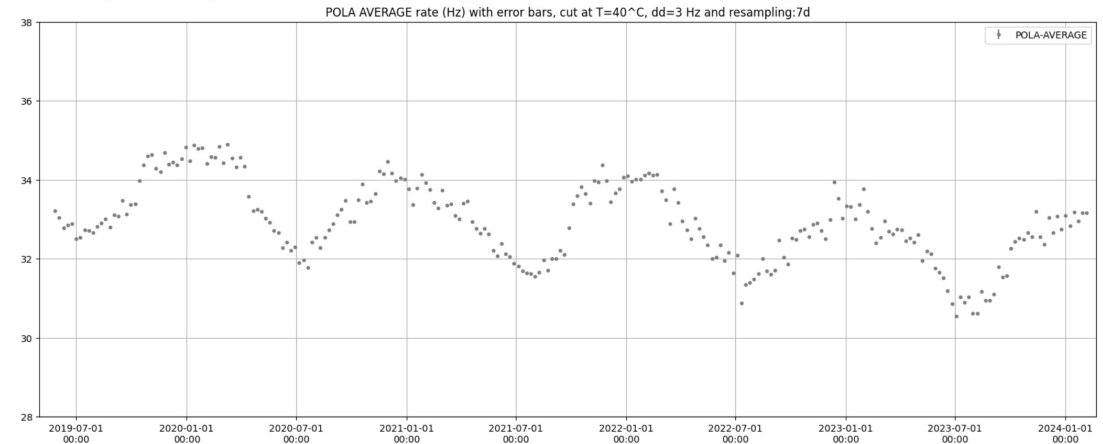
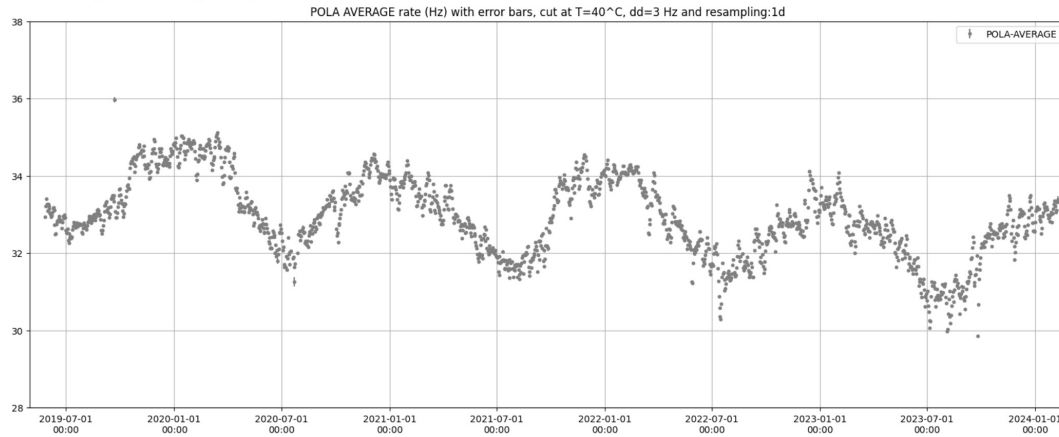


Det	1min	1day	15days	30days
POLA-1	1230634	2081	139	70
POLA-3	1416057	2081	139	70
POLA-4	1511198	2083	139	70

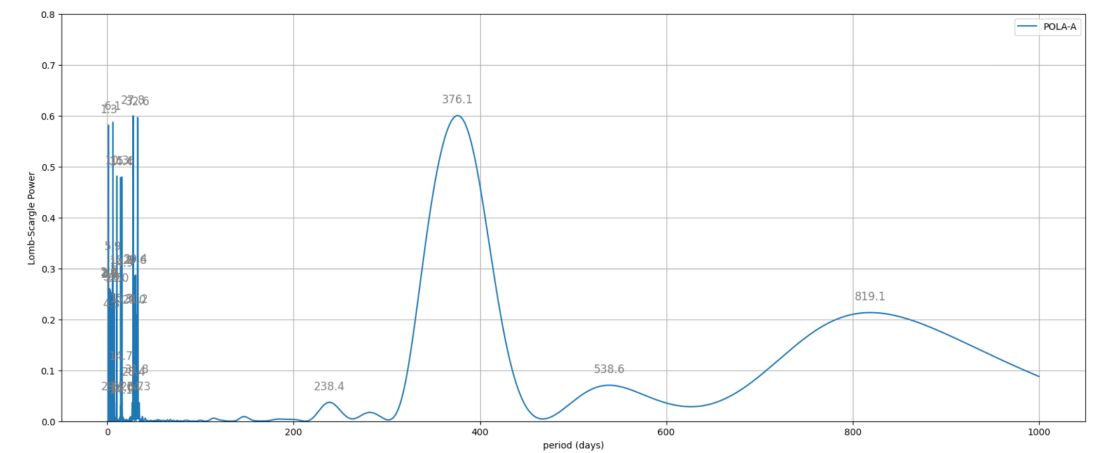
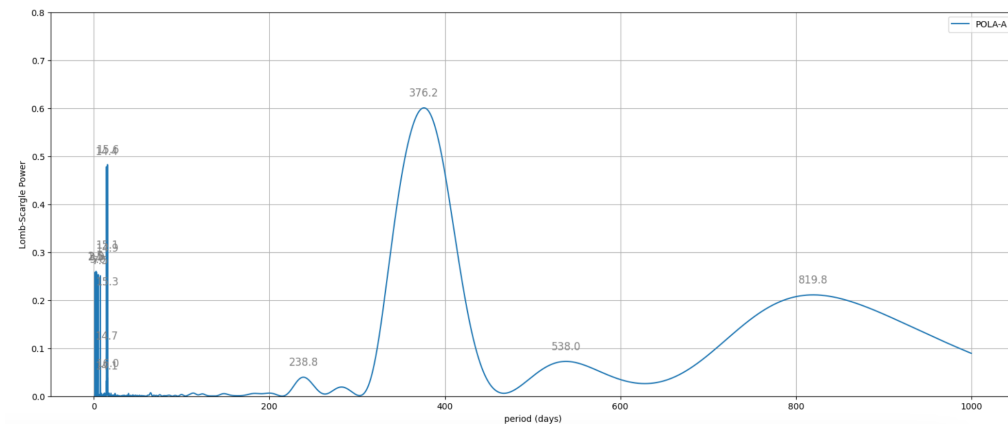
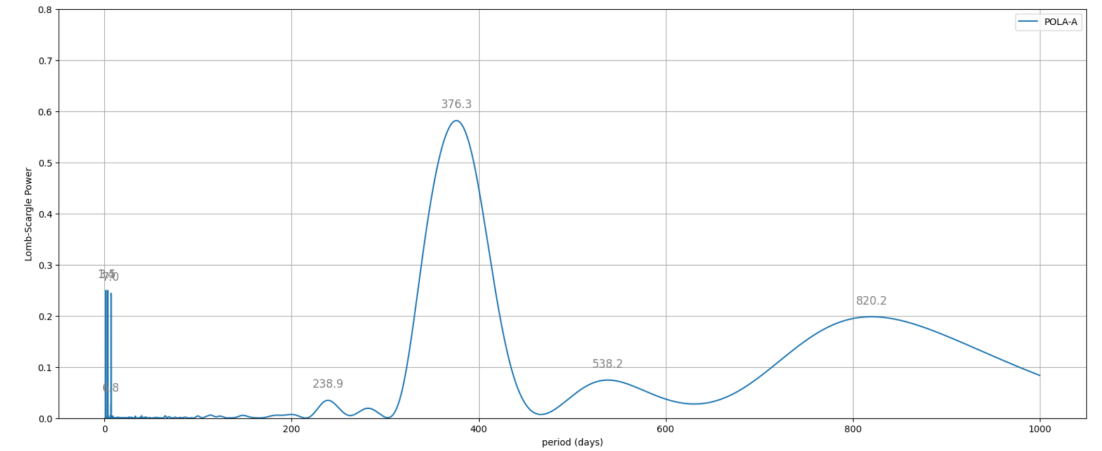
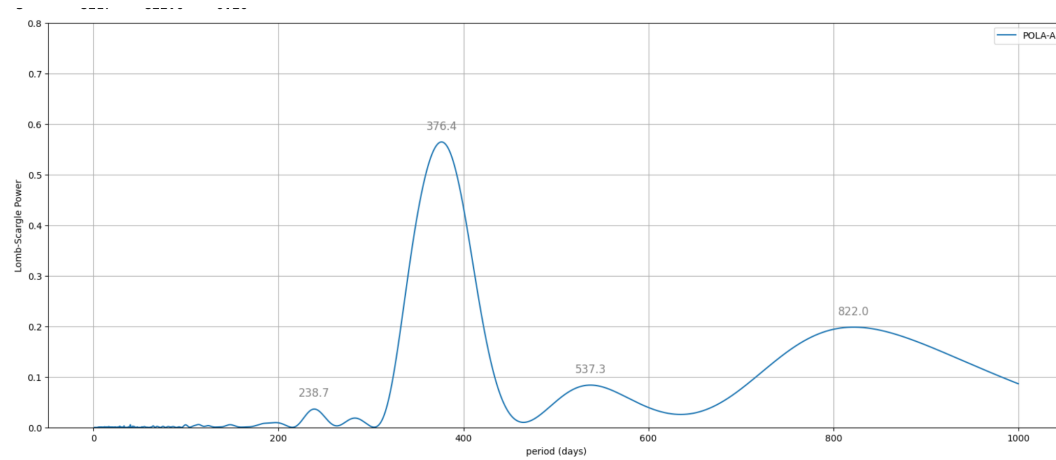
Rate 'accettato', rate medio delle 3 POLA

Tagli, più ricampionamento tramite mediana

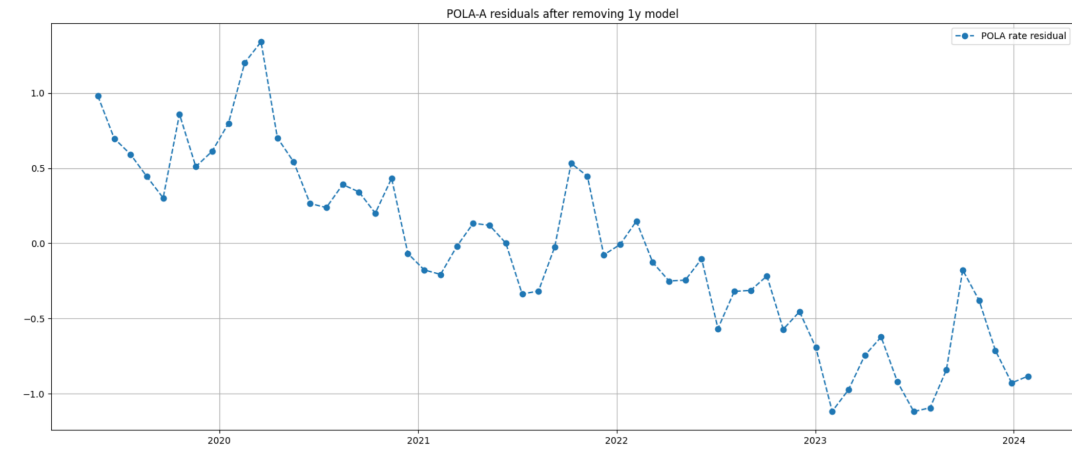
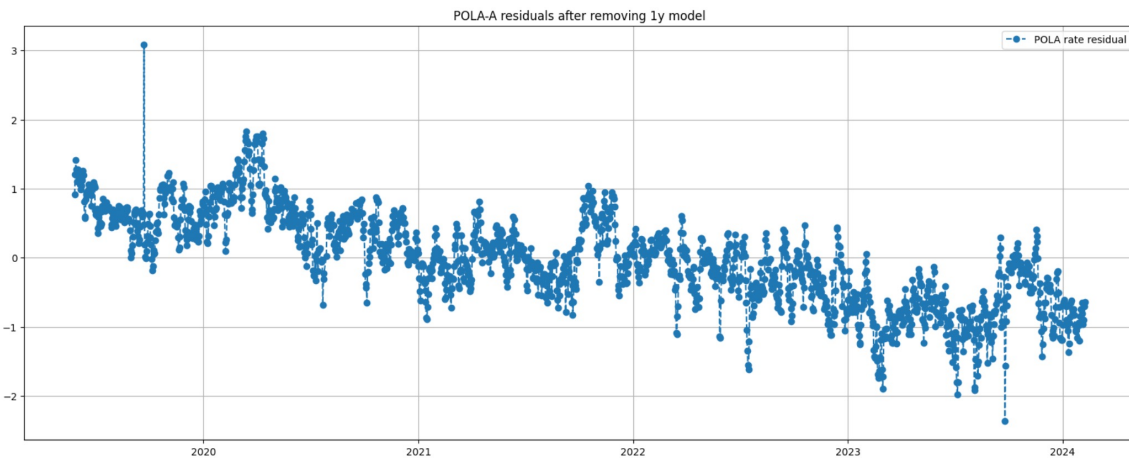
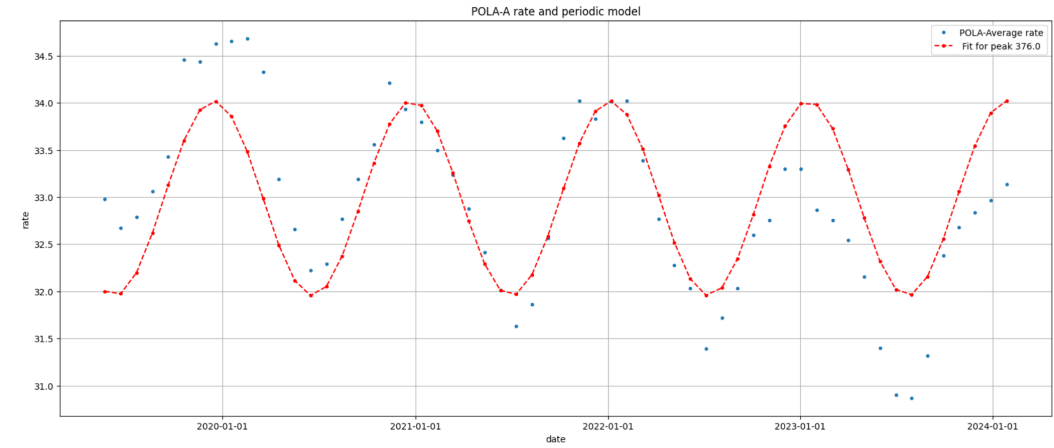
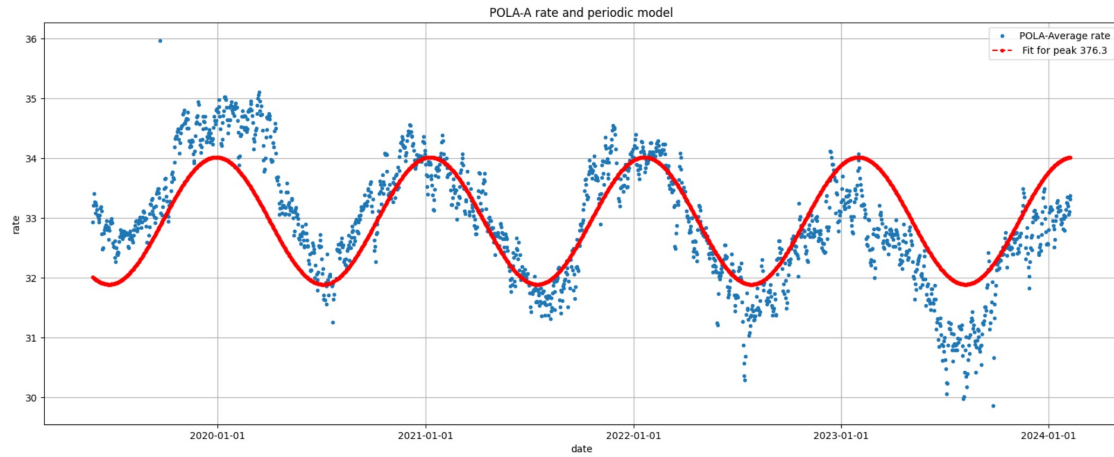
1d: 1710
7d: 246
15d: 115
30d: 58



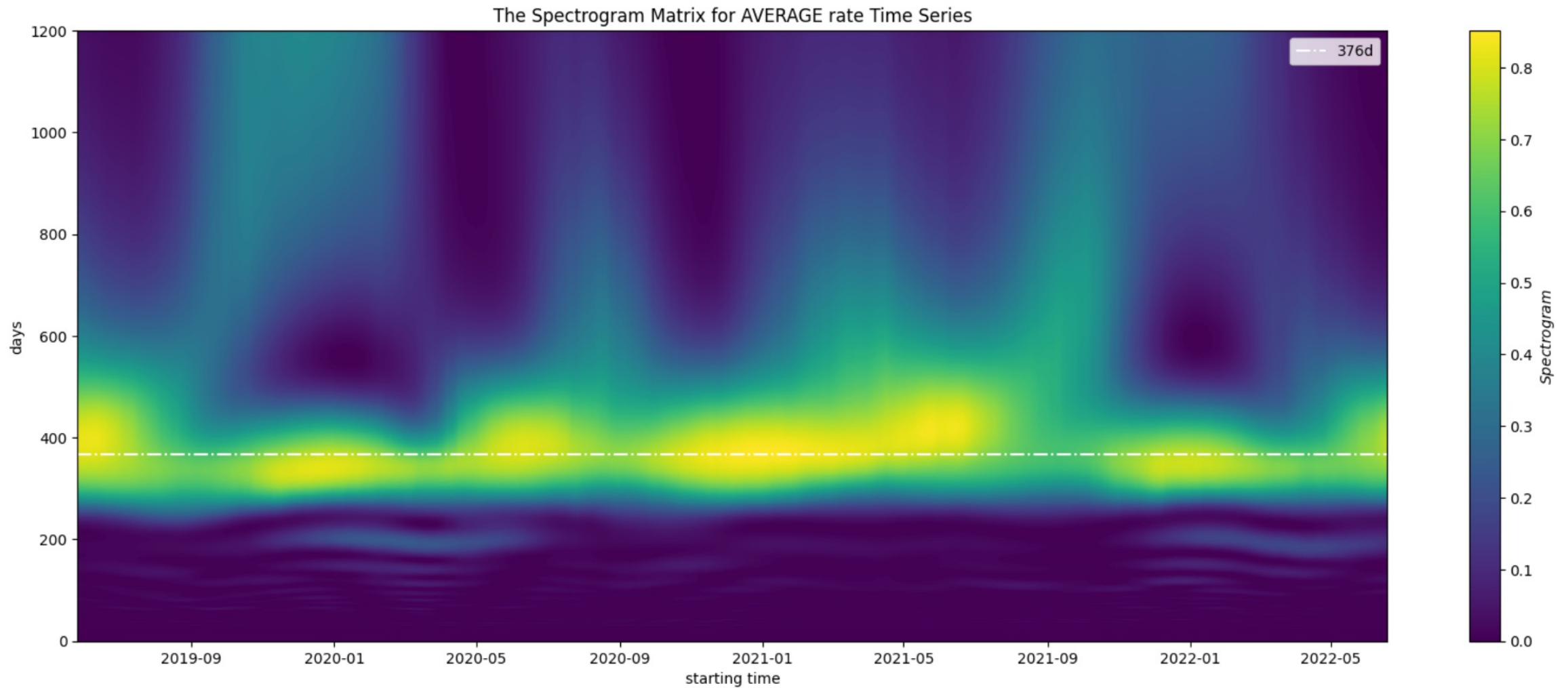
Periodogram POLA-A (1d, 7d, 15d, 30d)



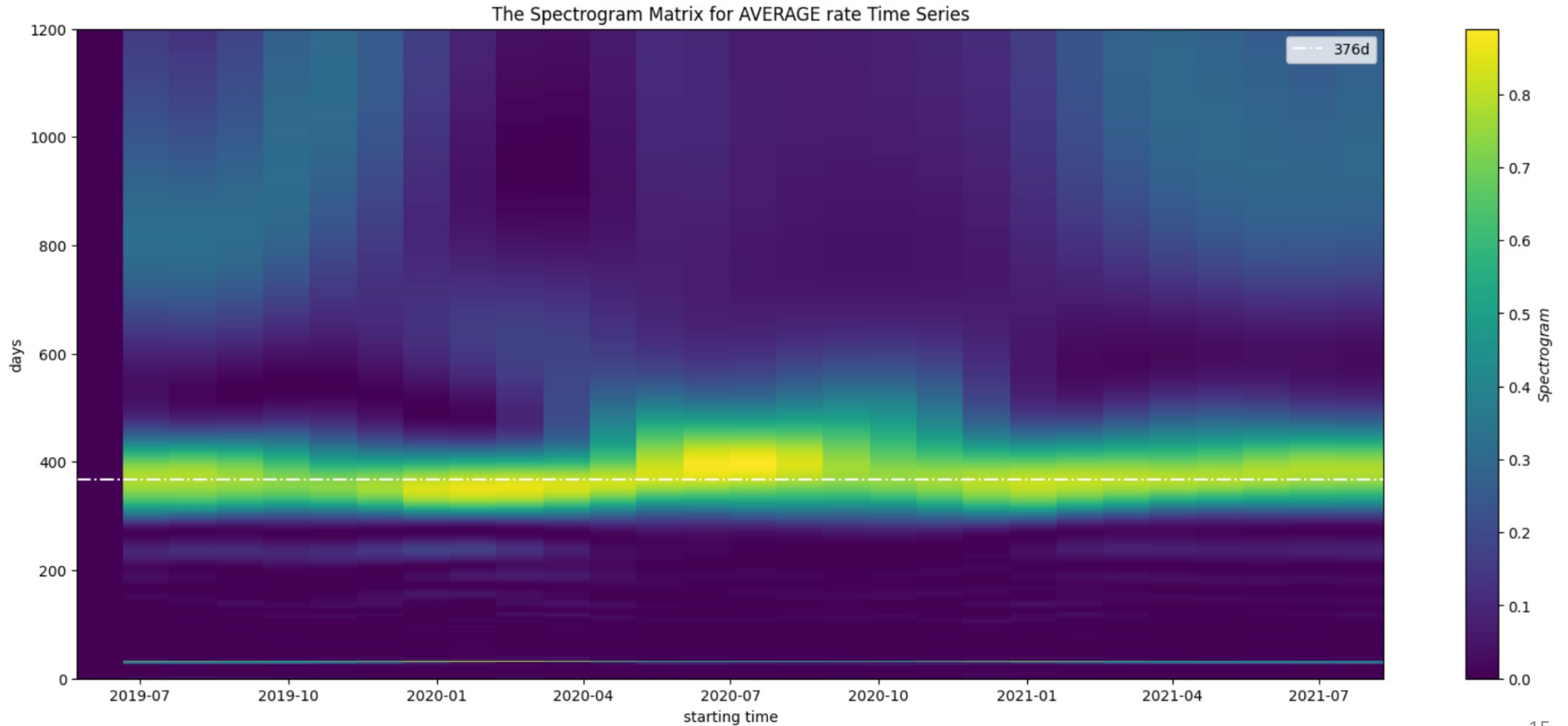
Residui (plot con resampling 1d – 30d)



Running periodogram (1d)

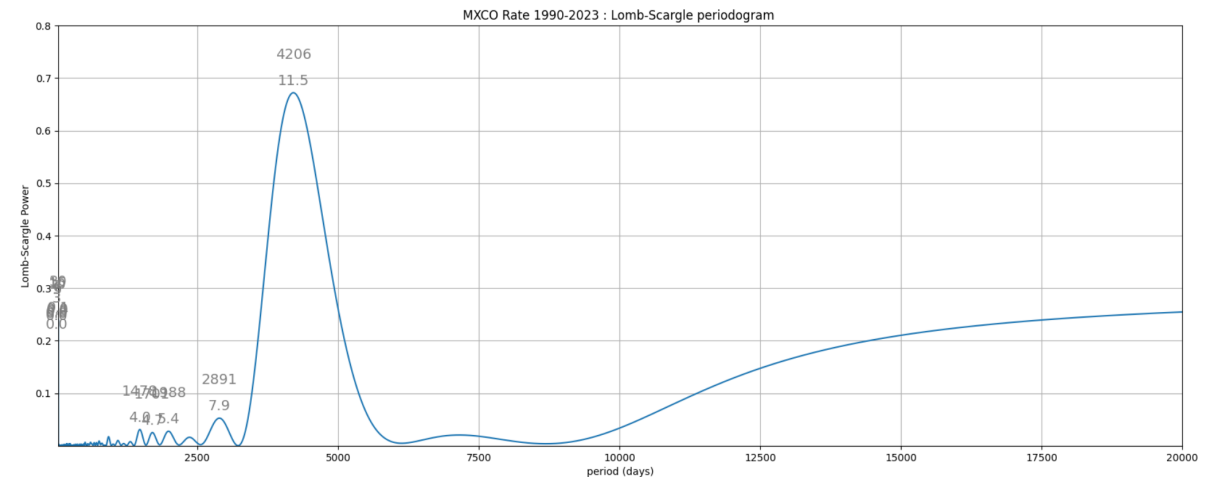
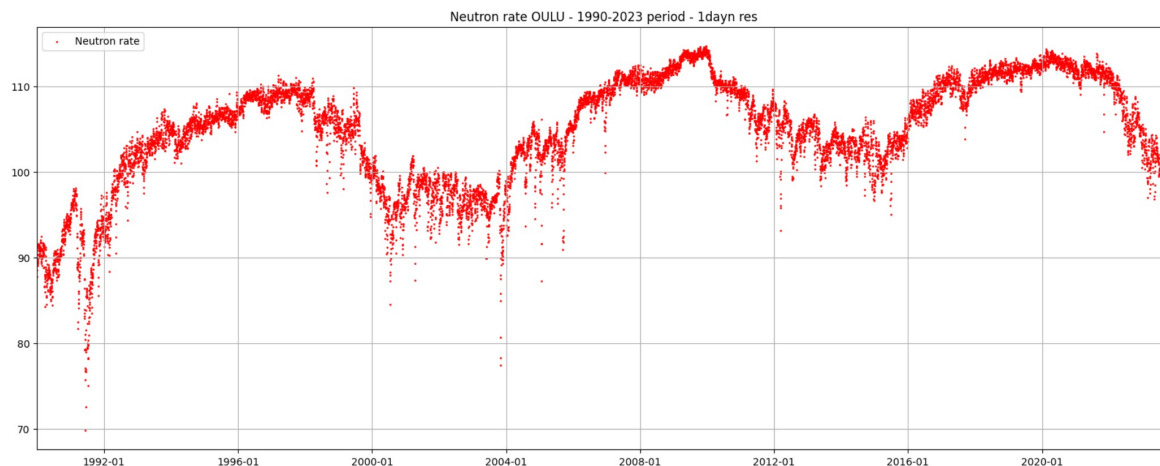


Running periodogram (30d)



Periodogramma di rate di neutroni

- WIP
- Il periodogramma di OULU (e di altri telescopi per neutroni) mostra chiaramente la componente dovuta al ciclo solare (11 anni)
- verificare se questo trend giustifica l'andamento 'calante' dei residui



Punti da chiarire

- Definizione della serie 'ufficiale':
 - Meglio i tagli o il ricampionamento, o entrambi?
 - Errore statistico si ottiene automaticamente dal ricampionamento: ok?
- Periodogramma
 - Il periodo è 376d, non un anno esatto, e sembra stabile nel tempo
 - Come stimare l'errore sul periodo?
 - I residui hanno un andamento calante: come modellizzarlo?
- Confronto con rate di neutroni
 - Come utilizzare il periodogramma dei neutroni per i nostri dati, che coprono solo 4.5 anni?