Features of Earth's Local Magnetic Field in Different Locations

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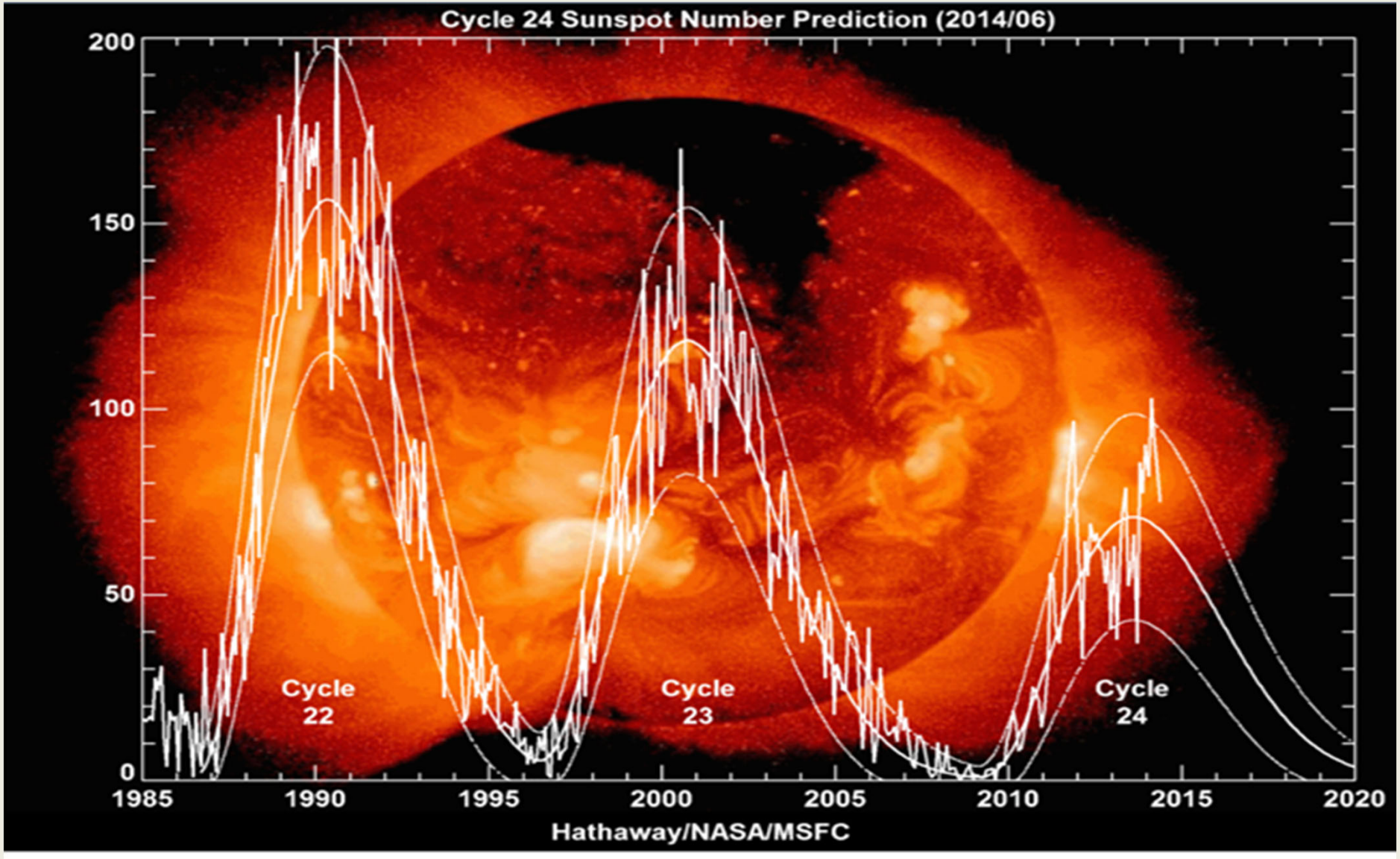
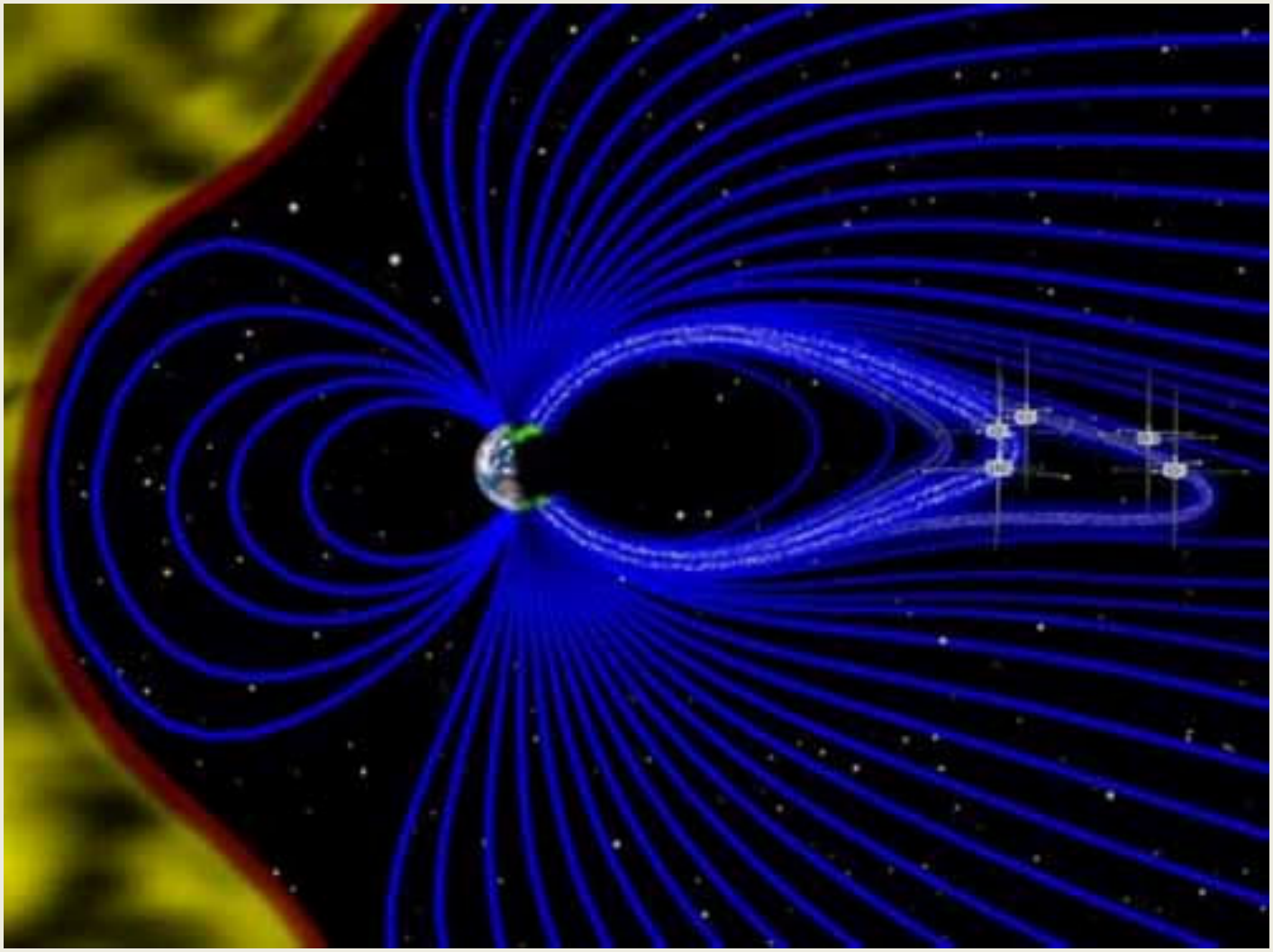
King of Organs – 2019

Sun activity in last, 24-th cycle



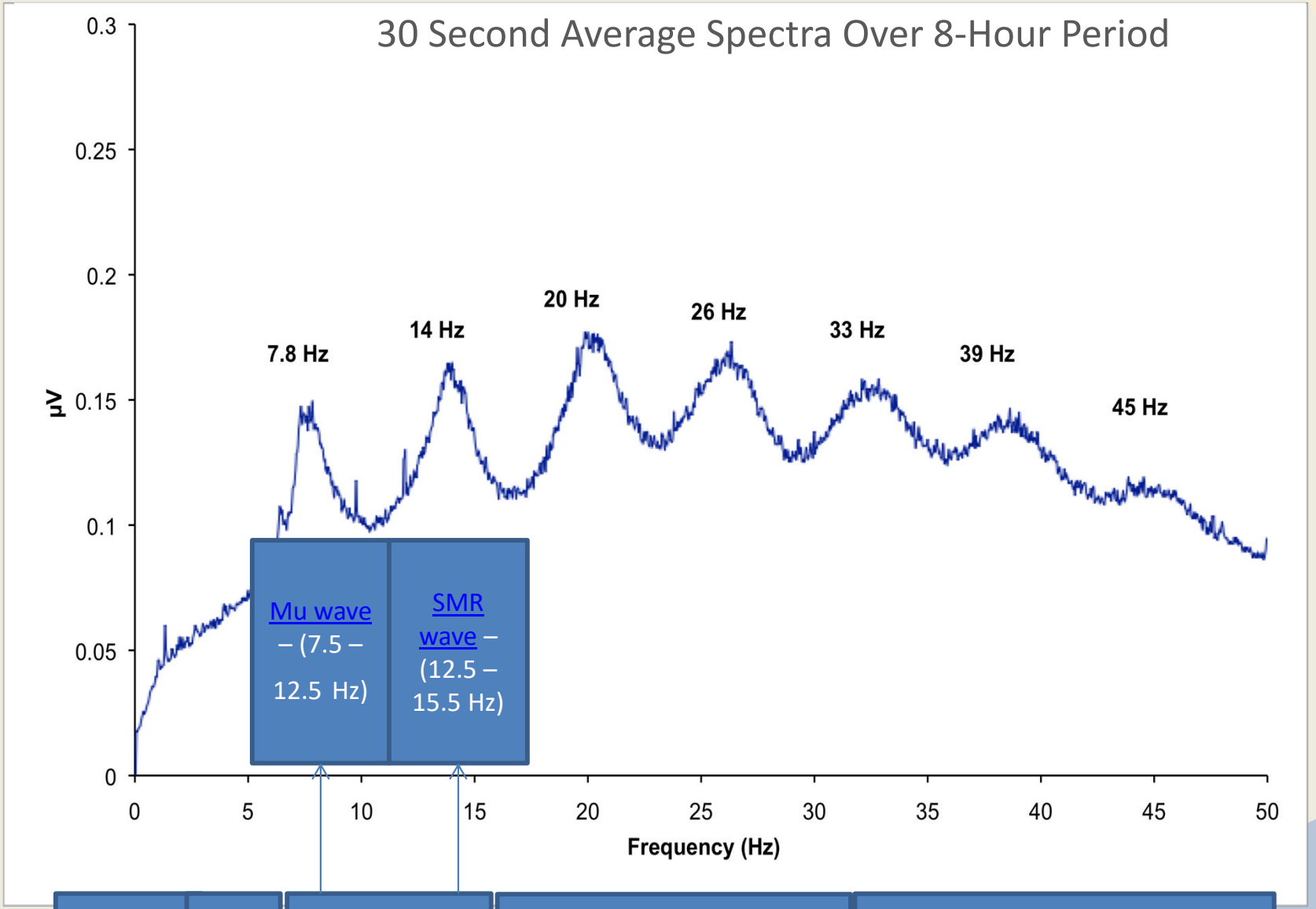
Solar effect on Earth MF



Aurora borealis activity in Norway

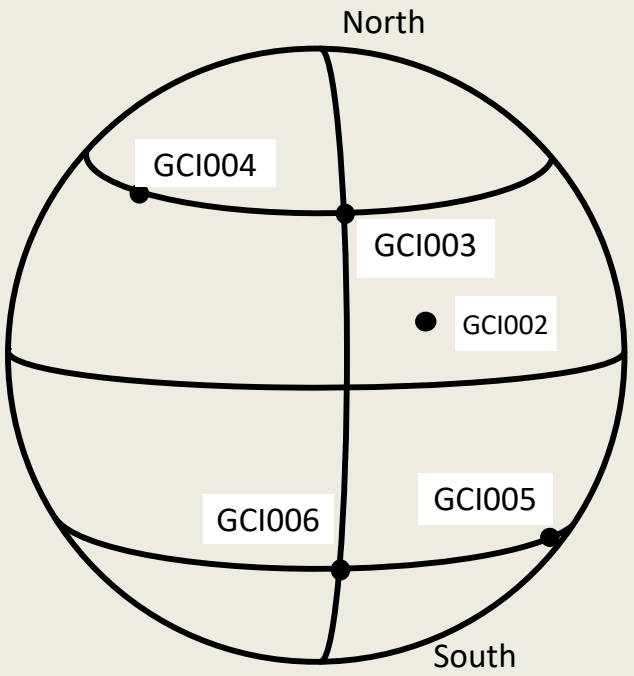
In 1952, German physicist and professor W.O. Schumann hypothesized there were measurable electromagnetic waves in the atmosphere that existed in the cavity (or space) between the surface of the earth and the ionosphere

Schuman Resonances



Location of magnetometers

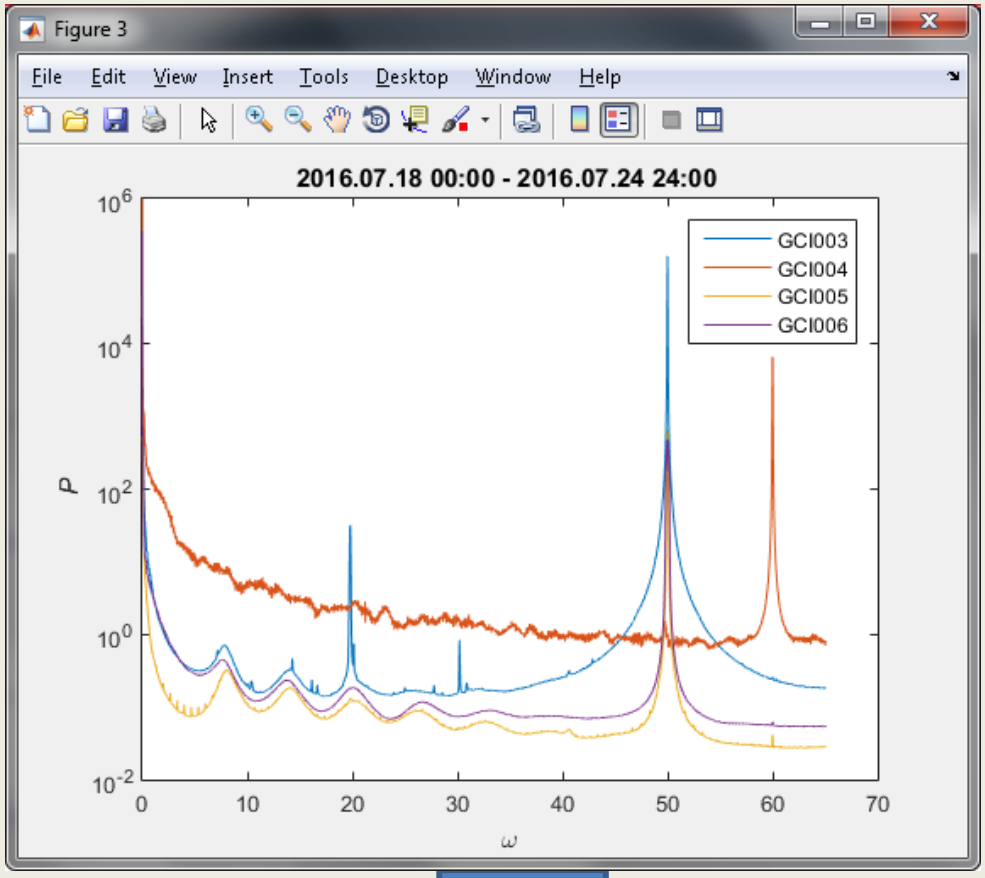
- GCI002 Saudi Arabia;
- GCI003 Lithuania;
- GCI004 Canada;
- GCI005 New Zealand;
- GCI006 South Africa.



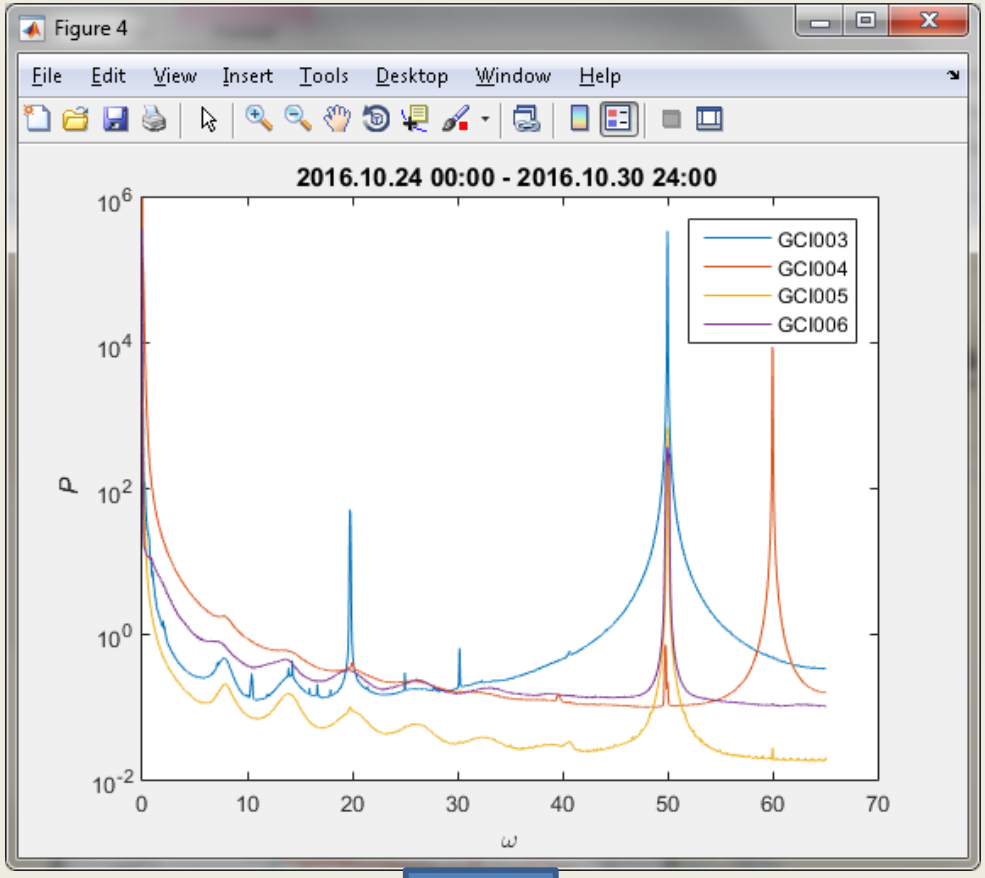
Discrete Fourier Transform

- Signal vector $\{I_t\}_{t=0}^{N-1}$
- DFT $f(\omega) = \sum_{t=0}^{N-1} I_t \cdot e^{\frac{-2\pi i t \omega}{N}}$
- STFT $F(\tau, \omega) = \sum_{t=-\infty}^{\infty} I_t \cdot \xi(t - \tau) \cdot e^{-it\omega}$
- Power spectral density $S(\tau, \omega) = |F(\tau, \omega)|^2$
- Averaging at the time interval $S(\omega_j) = \frac{1}{\tau_2 - \tau_1} \sum_{i=\tau_1}^{\tau_2} S(i, \omega_j)$
- Power at the frequency range $P = \sum_{j=\omega_1}^{\omega_2} S^{(\tau_1, \tau_2)}(j)$

Spectra of Magnetometer Signals



A



B

Powers of frequencies calculated in 30 seconds interval and averaged per week, in Summer (A) and in Autumn (B)

Magnetic Field Frequency Bands Matching EEG Bands

- Delta we divided it into two intervals:

Delta 1 till 0,01 Hz and Delta 2 from 0,01 to 3,5 Hz

(delta-waves are the predominant wave forms of infants, NREM sleep)

Theta from 3,5 to 7 Hz, (Hippocampus activation, REM sleep, attention)

Alpha from 7 to 15 Hz, (gauge the attention level, creativity)

Beta from 15 to 32 Hz,

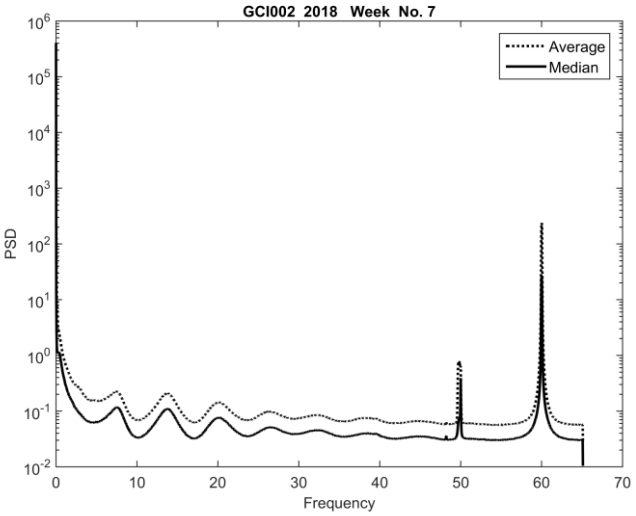
(Beta states are the states associated with normal waking consciousness).

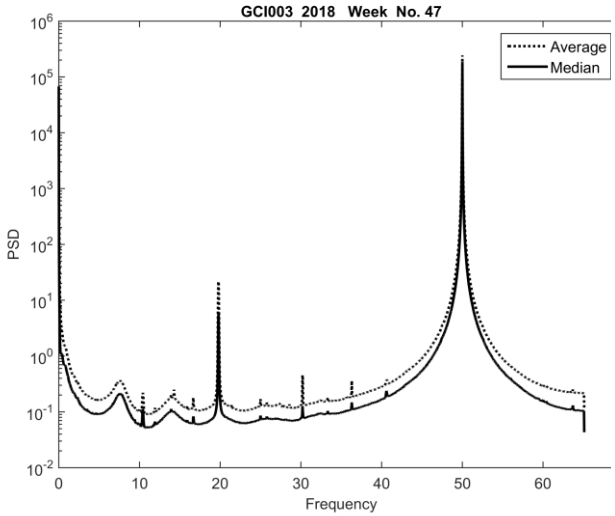
Gamma from 32 to 66 Hz, (implicated in creating the unity of conscious perception, coherence, short effect – positive, long effect – negative, inducing stress state)

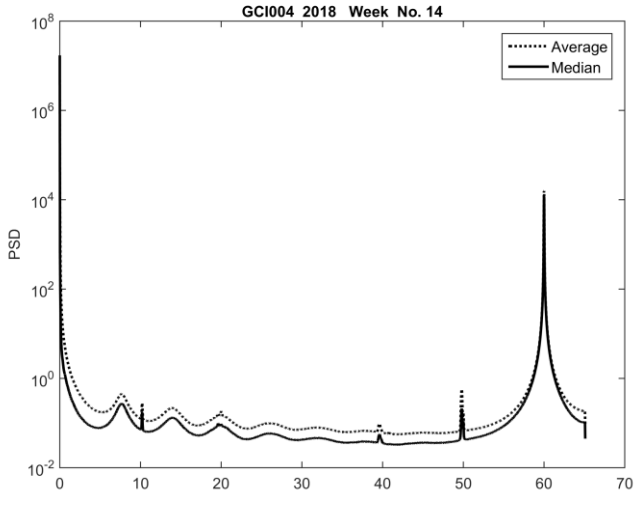
Each frequency band has different physiologic effects on human organism. As they are closely related to Schumann frequencies – we are in permanent relation to Earth MF fluctuations.

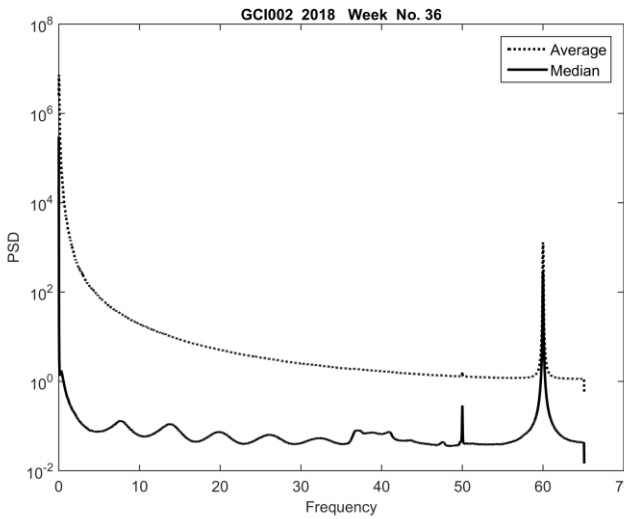
Their changes have direct influence on our health, emotions, behavior.

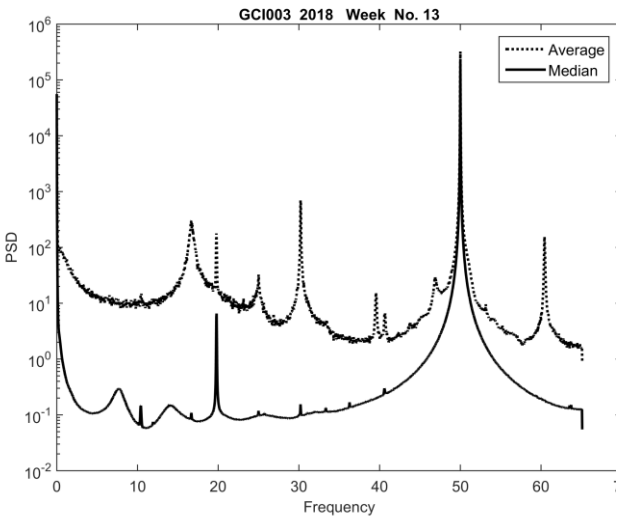
Spectra for Saudi Arabia, Lithuania, & Canada
Upper line – quiet weeks in year, bottom line – “active” weeks for year 2018

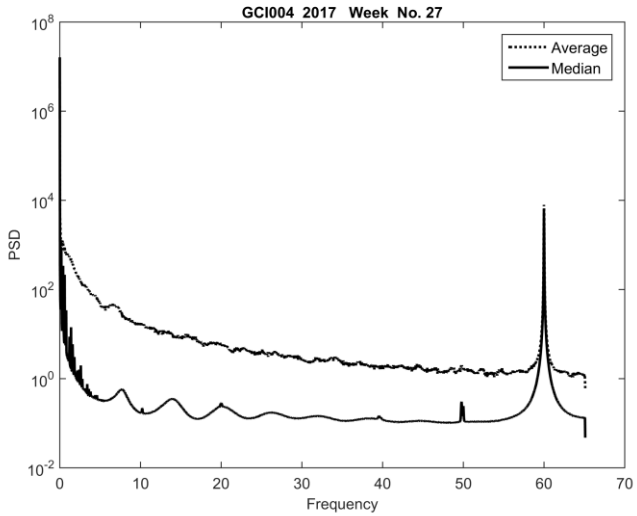










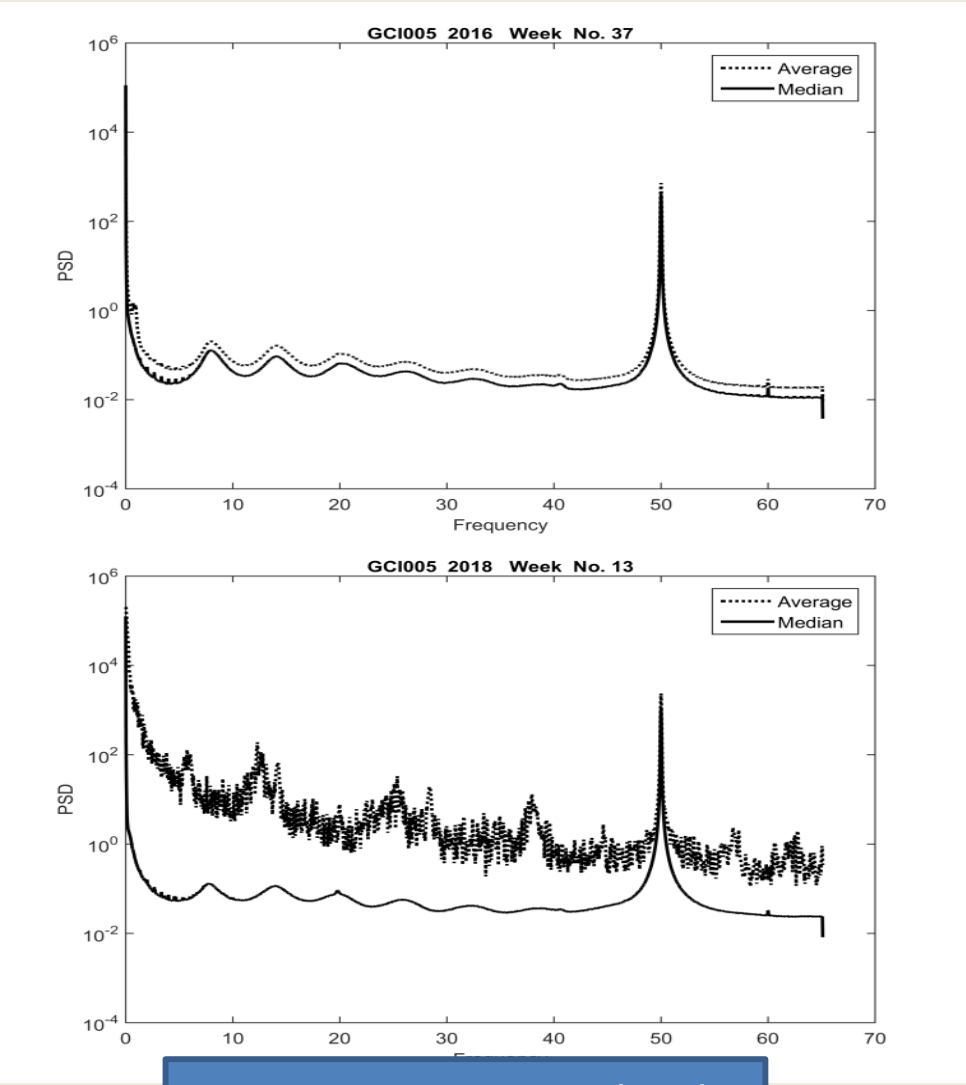


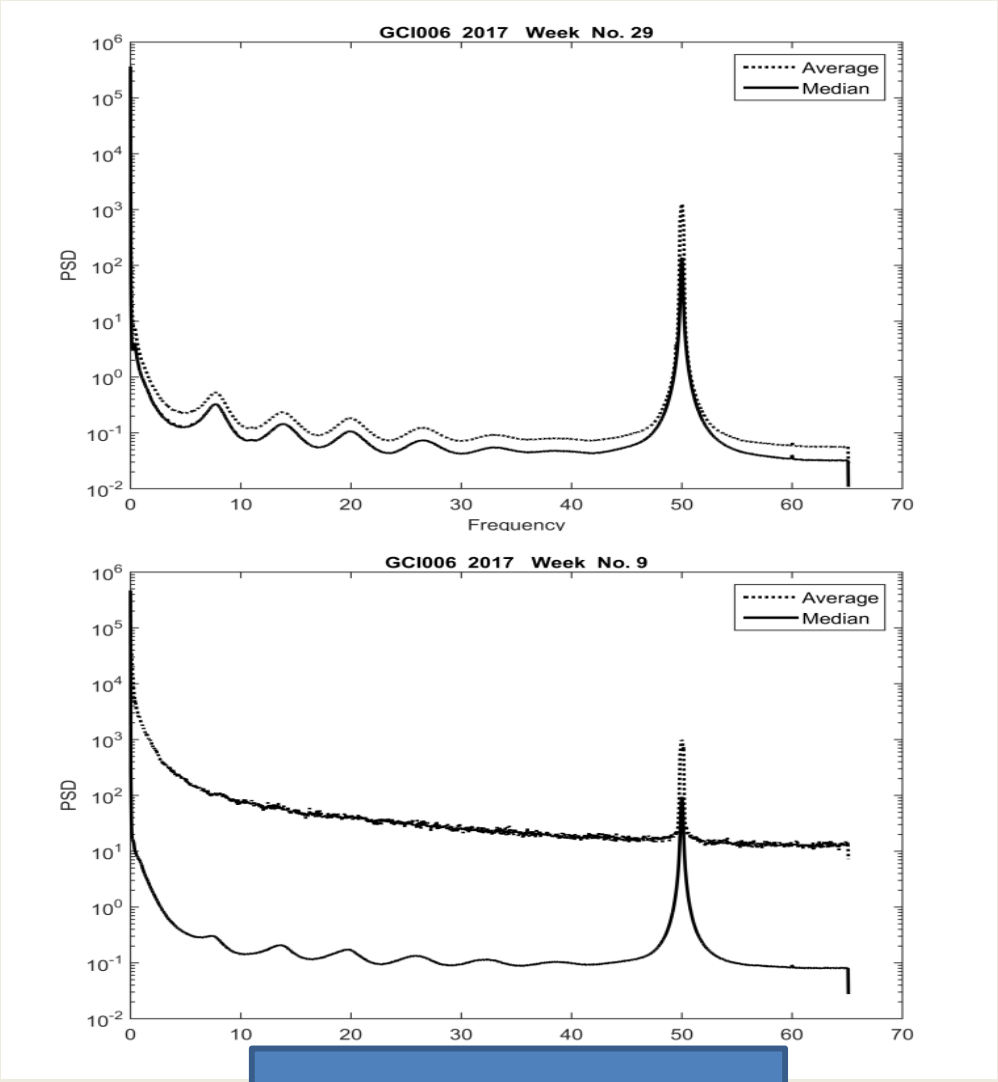
GCI002 – Saudi Arabia, GCI003 - Lithuania, GCI004 – Canada

Difference between average value and median, shows the intensity of noises.

Spectra for New Zealand, & South Africa

Upper line – quiet weeks in year, bottom line – “active” weeks in the year



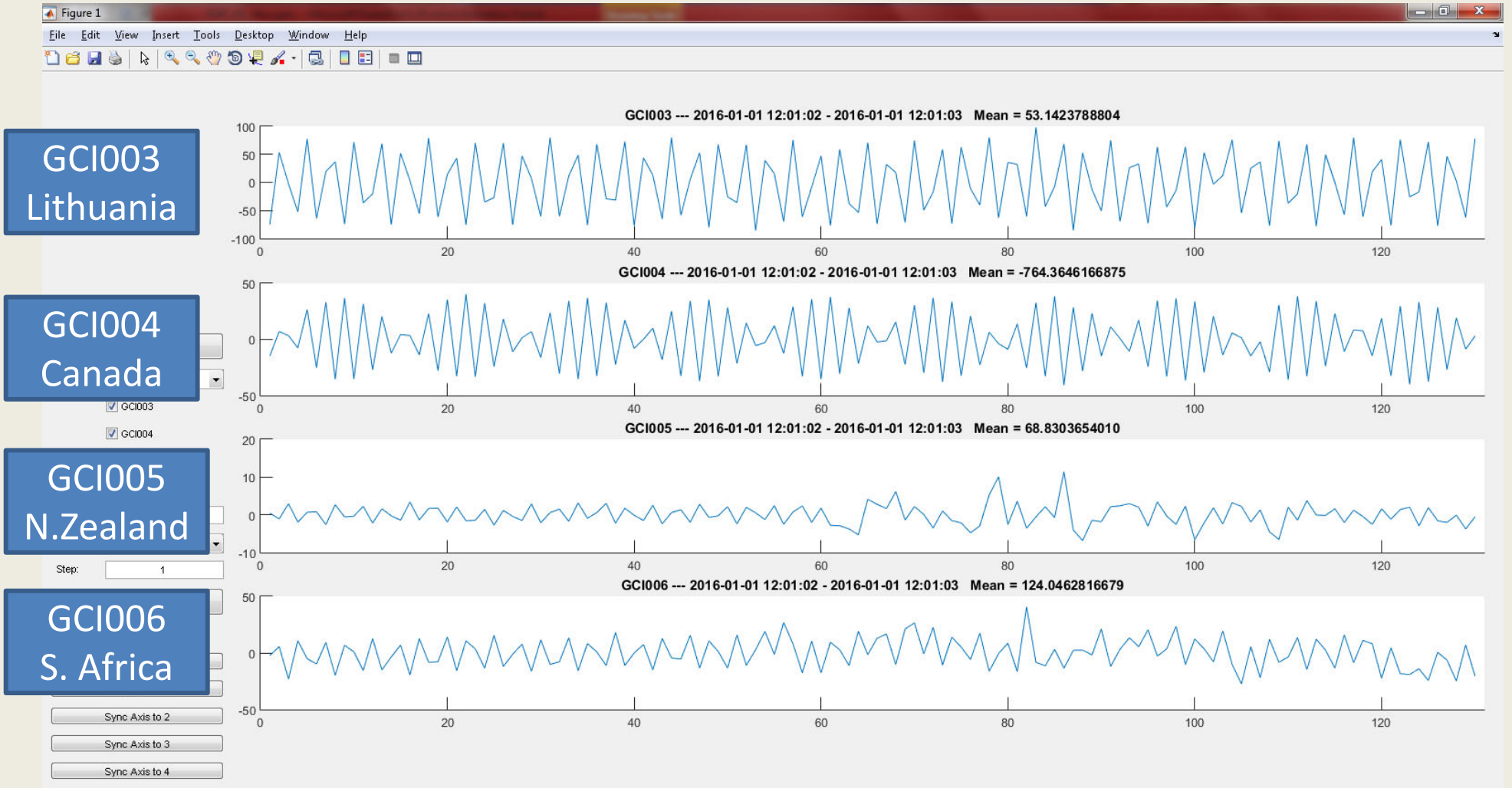


GCI005 – New Zealand

GCI006 – South Africa

Difference between average value and median, shows the intensity of noises.

Noises in Signals (1 sec. interval), at Different Sites. There are large differences in noise levels



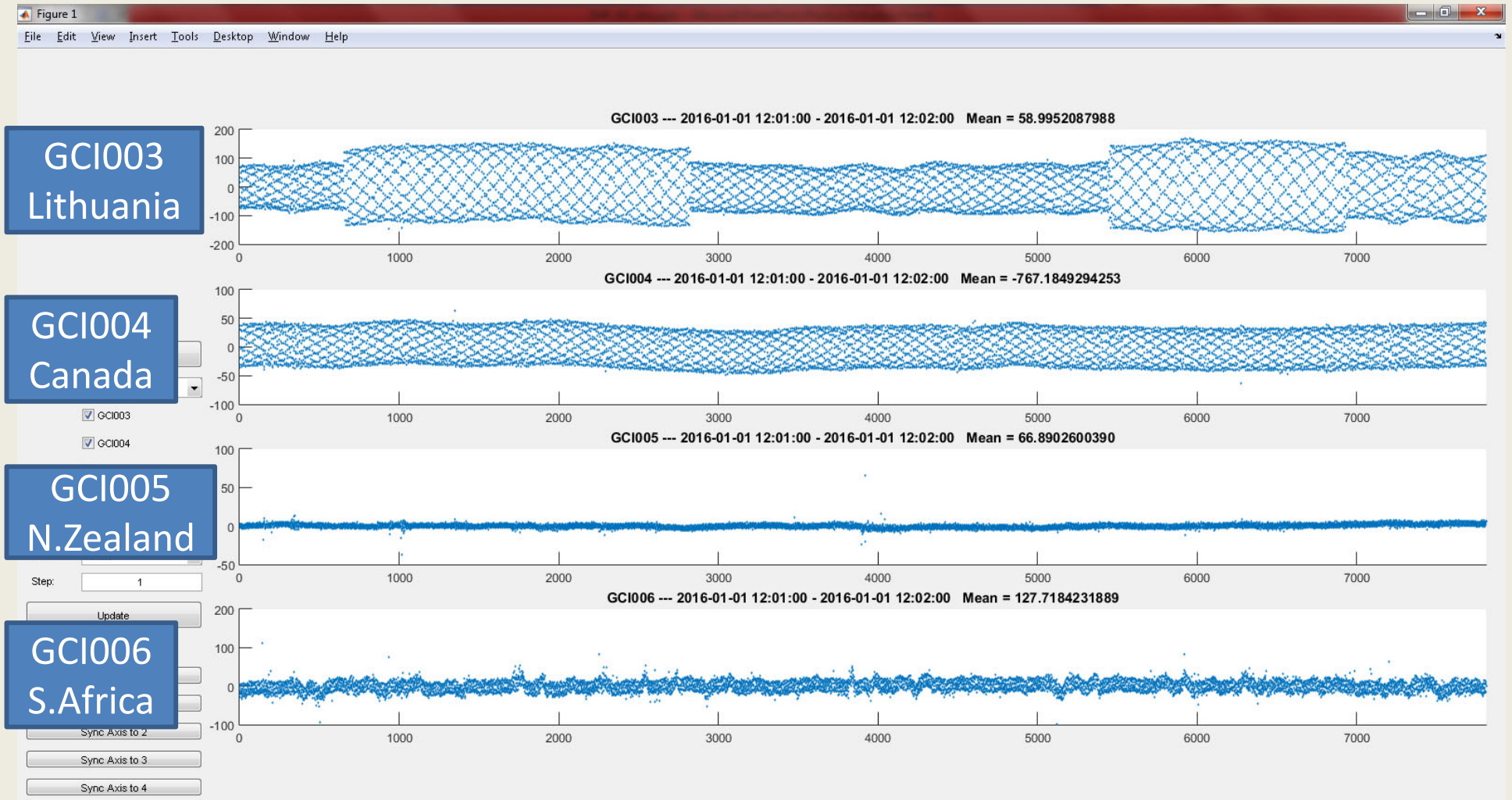
GCI003 Lithuania

GCI004 Canada

GCI005 N.Zealand

GCI006 S. Africa

Noise in Signals (1 min. interval), at Different Sites. There are differences in noise type.



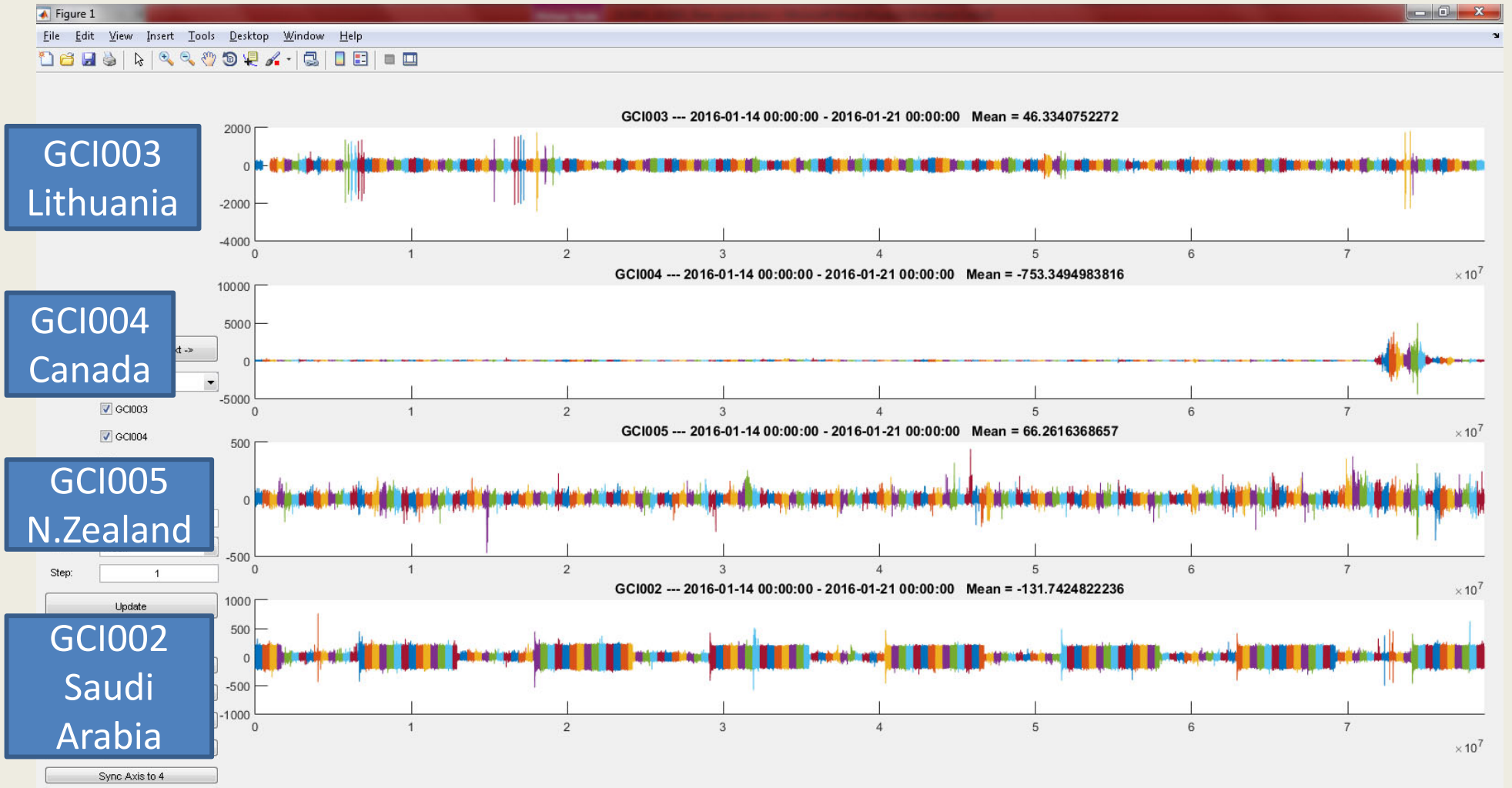
GCI003 Lithuania

GCI004 Canada

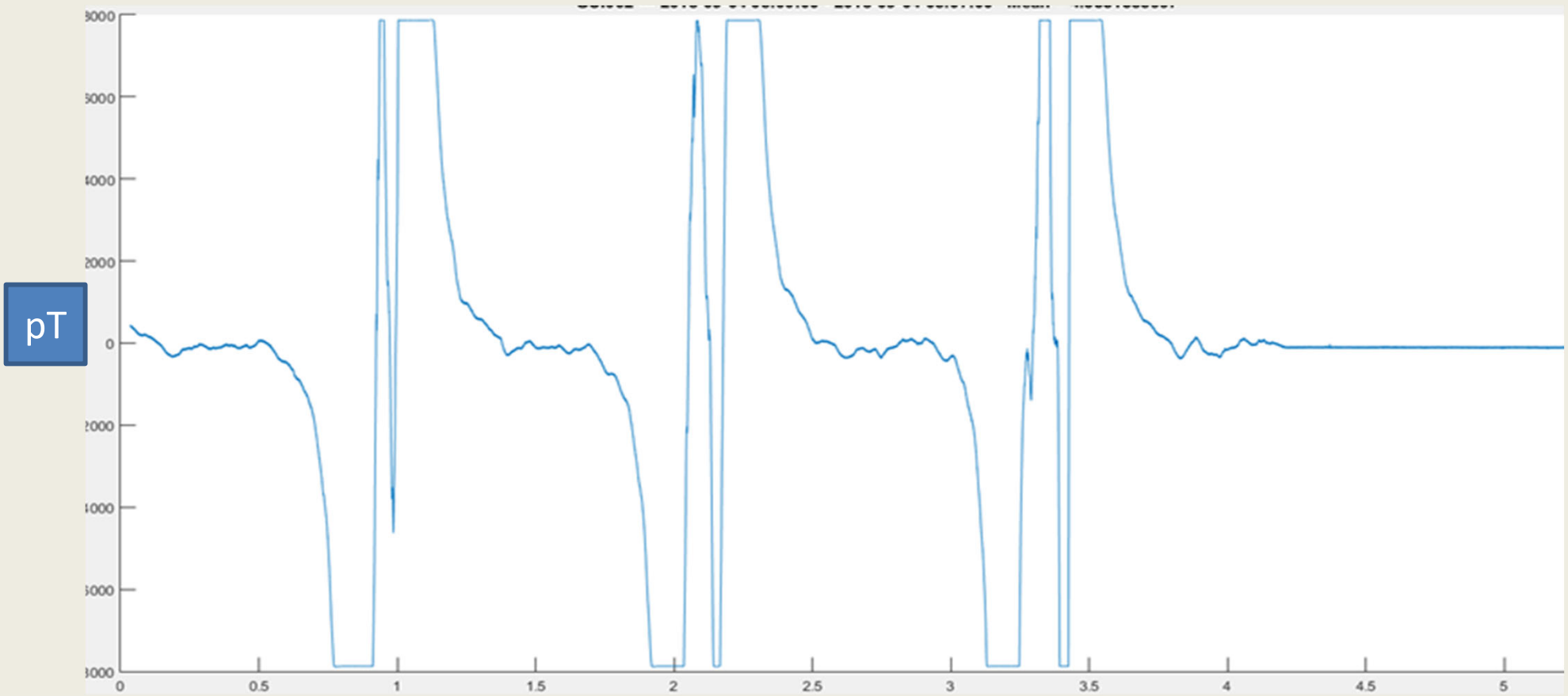
GCI005 N.Zealand

GCI006 S.Africa

Noise in Signals (1 week interval), at Different Sites. There are differences in noise type.



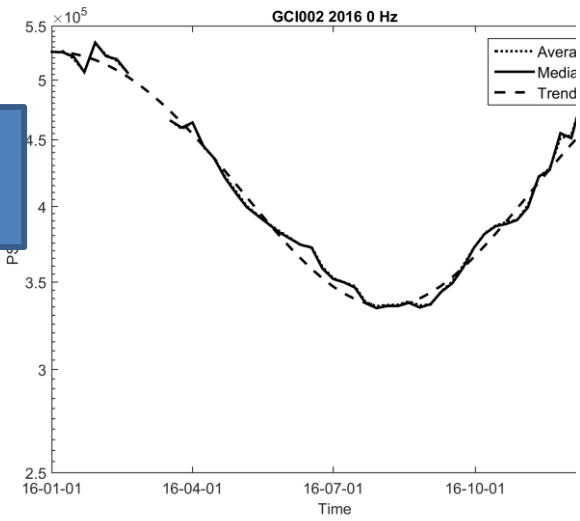
Signals in Saudi Arabia. Seven minutes interval, unclear type of noise – short (~1 min.) spikes, but very strong power.

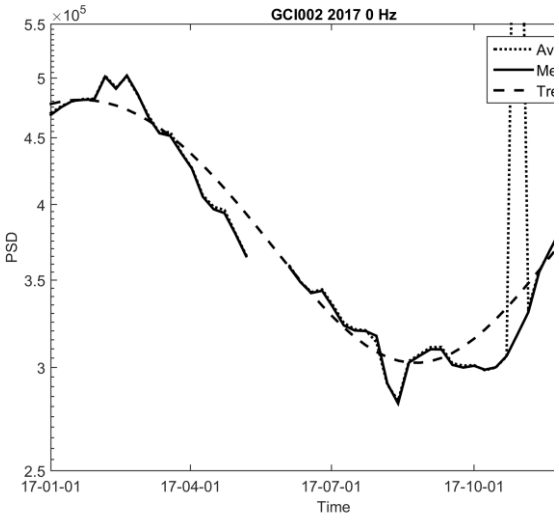


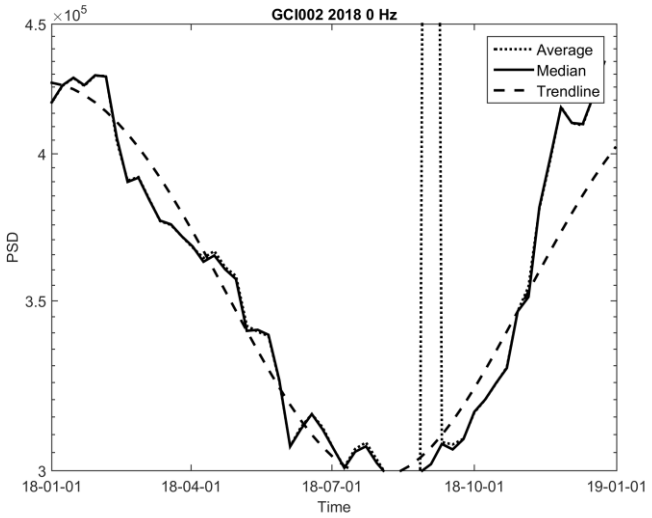
Conclusion about noise: At every site we have different type of noise, varying in duration, amplitude, frequencies and vary in seasons.
Difference between average value and median, shows the intensity of noises.

Delta 1(till ~0,01Hz) Power Changes in Saudi Arabia & Lithuania - Years 2016 – 2017 - 2018

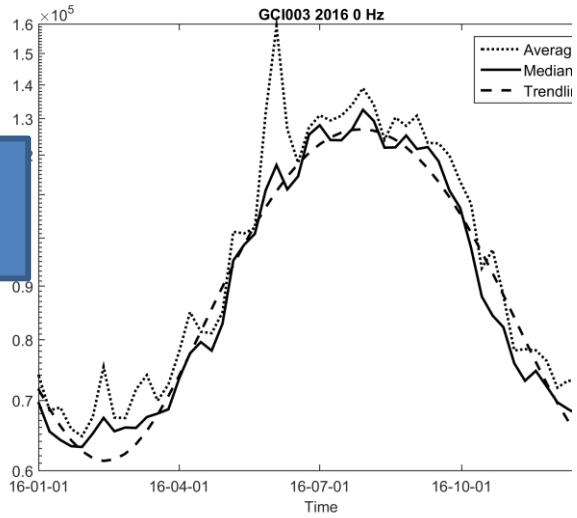
GCI002 S.Arabia

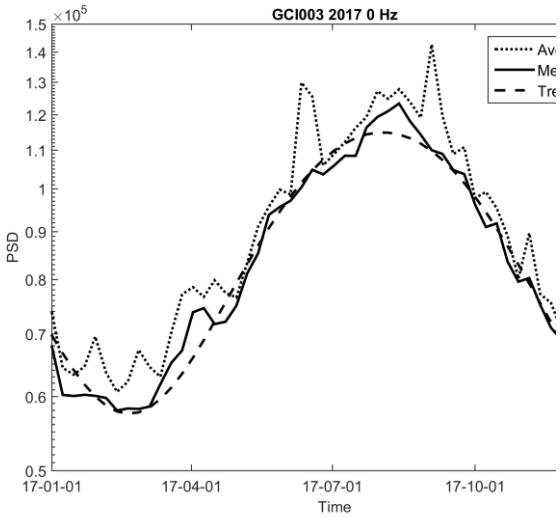


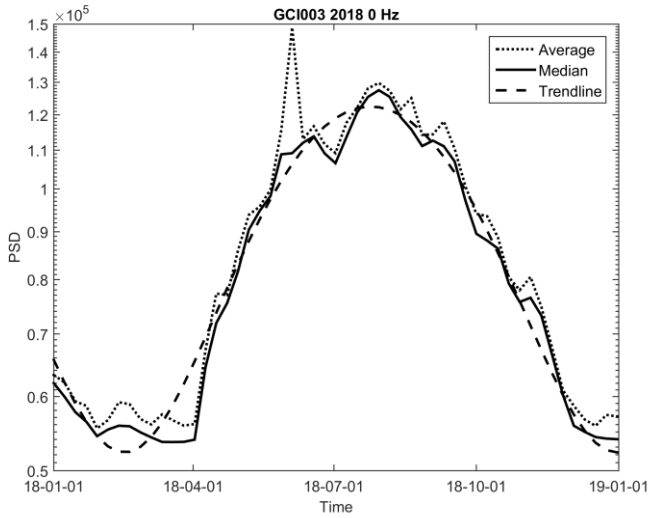




GCI003 Lithuania





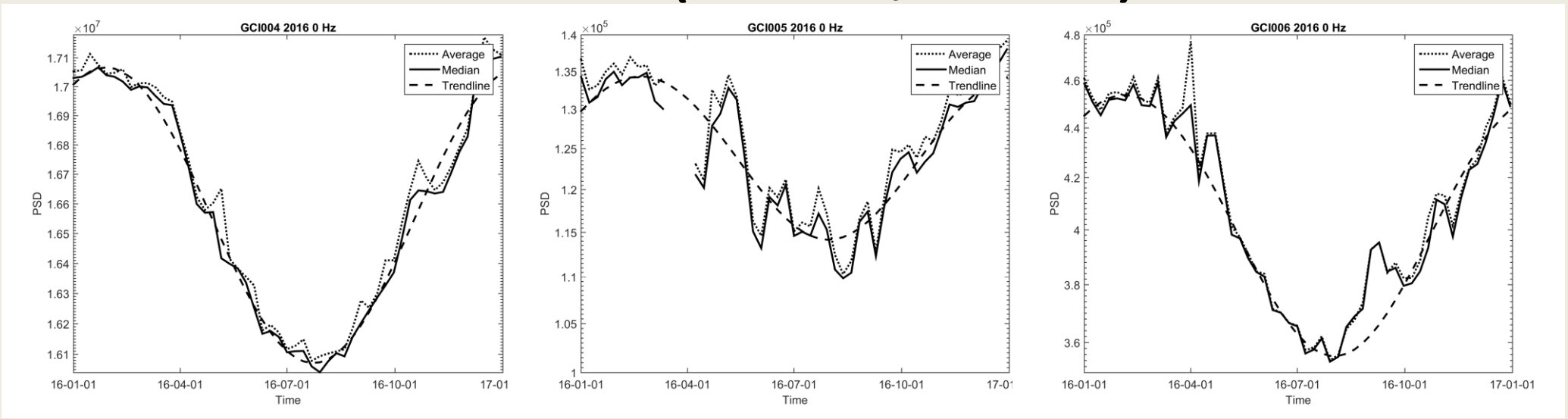


2016

2017

2018

2016y., GCI004, GCI005, GCI006, Delta1(till ~0,01 Hz)



GCI004, Canada

GCI005, N.Zealand

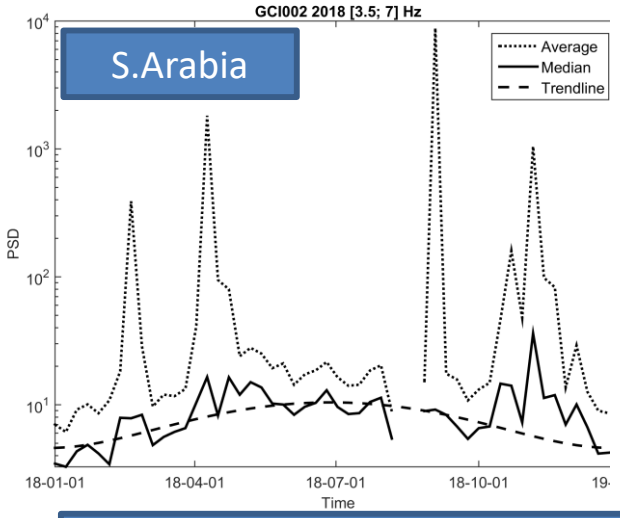
GCI006, S.Africa

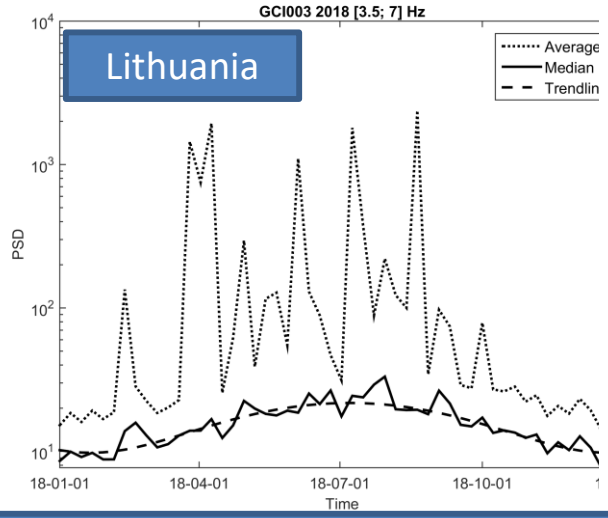
Equation for Trend line approximation

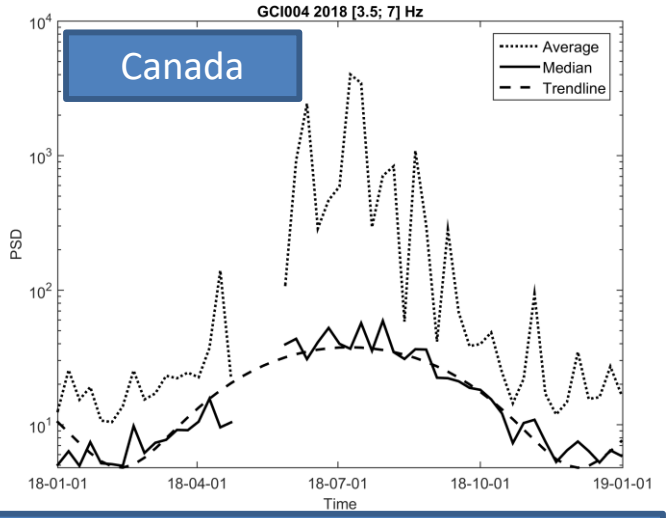
$$PSD = 497660 \cdot sin\left(2\pi \cdot \frac{t+7.6940}{50.531}\right) + 1656900; \quad -\boldsymbol{GCI004, Canada}$$

$$PSD = A \sin\left(2\pi \cdot \frac{t+\psi}{T}\right) + B$$

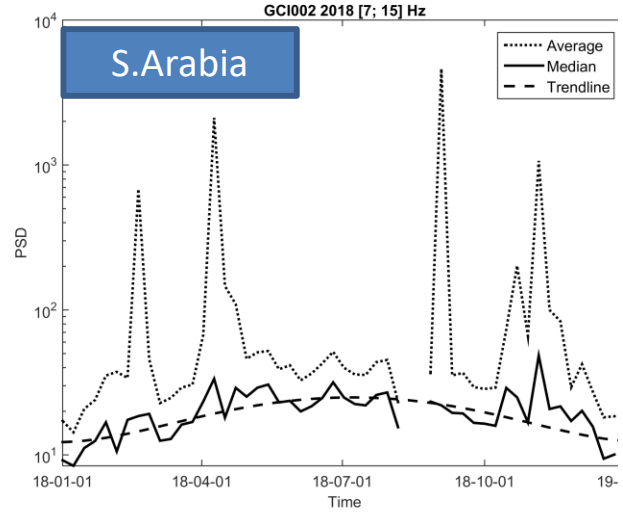
2018 y., S. Arabia, Lithuania, Canada in Theta (3,5 – 7 Hz) and Alpha (7 – 15 Hz) frequencies

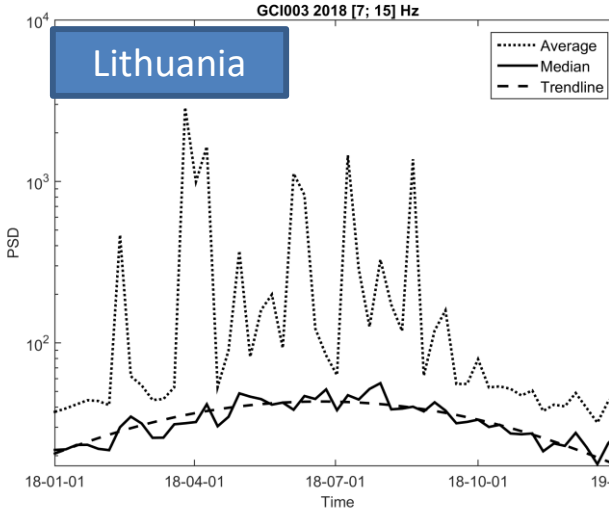


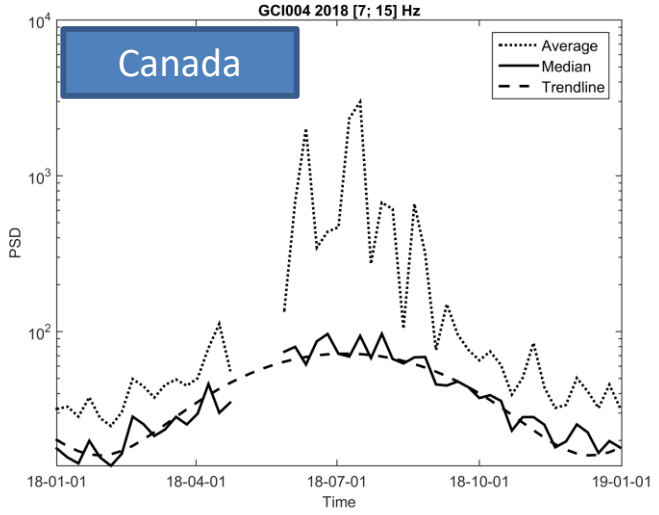




GCI002 Theta (3,5 – 7 Hz), GCI003 Theta, (3,5 – 7 Hz), GCI004 Theta, (3,5 – 7Hz),

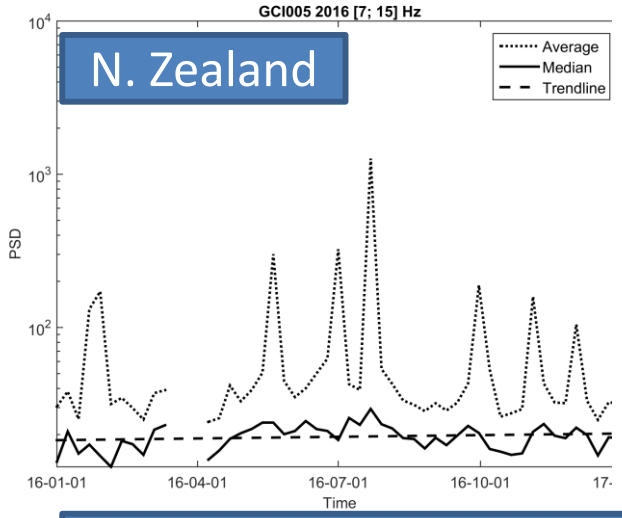




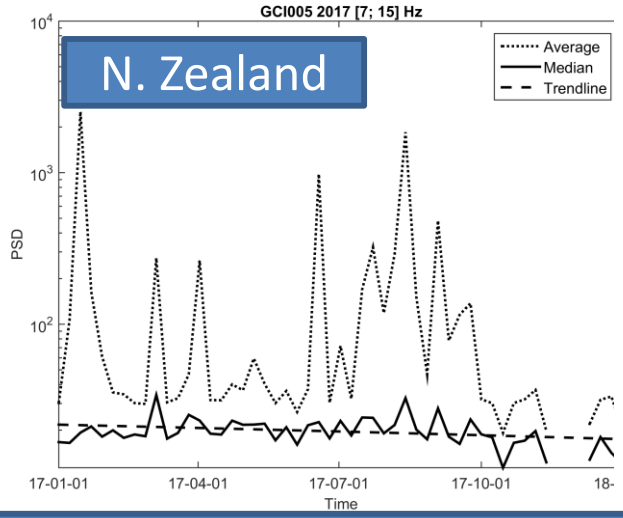


GCI002 Alpha (7 – 15 Hz), GCI003 Alpha, (7 – 15 Hz) GCI004, (7 – 15 Hz)

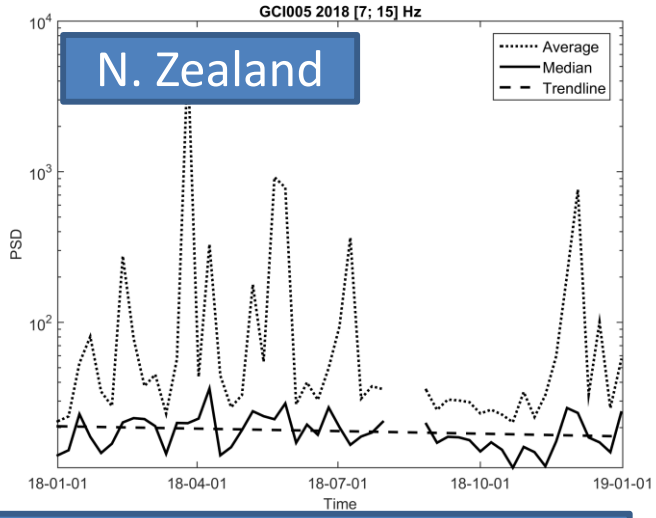
Power of N. Zealand, S. Africa spectra in Alpha (7 – 15 Hz) Frequencies Interval, Years 2016, 2017, 2018



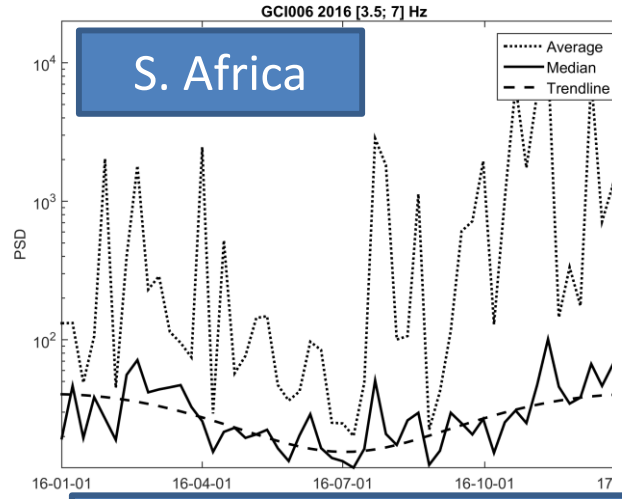
GCI005, Alpha, 2016



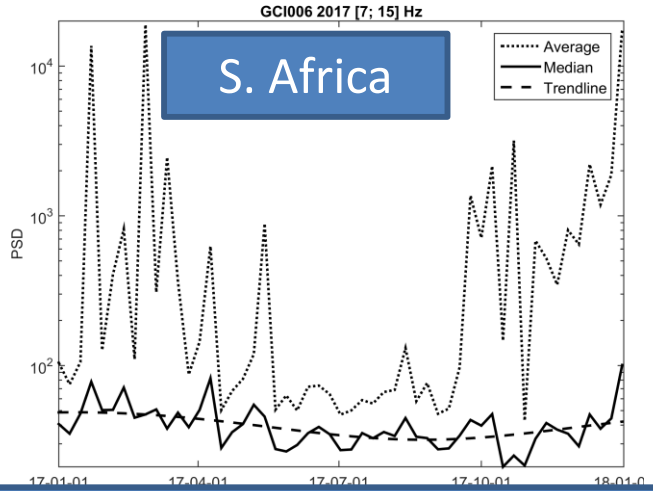
GCI005, Alpha, 2017



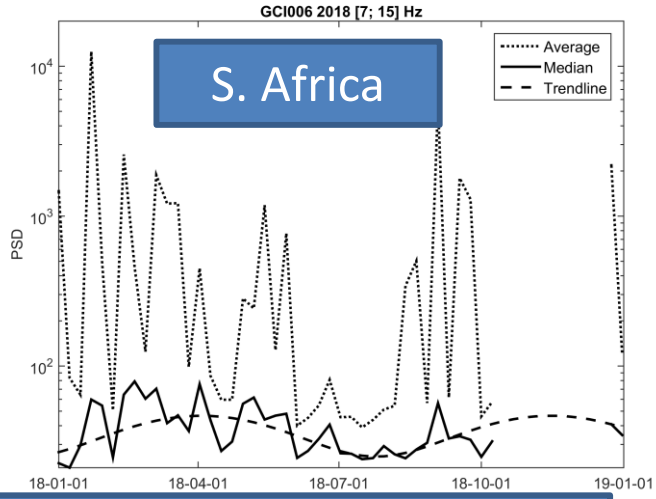
GCI005, Alpha, 2018



GCI006, Alpha, 2016

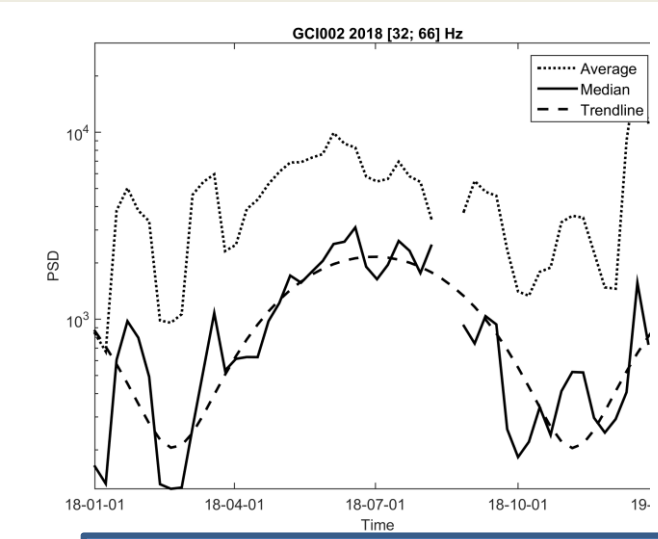


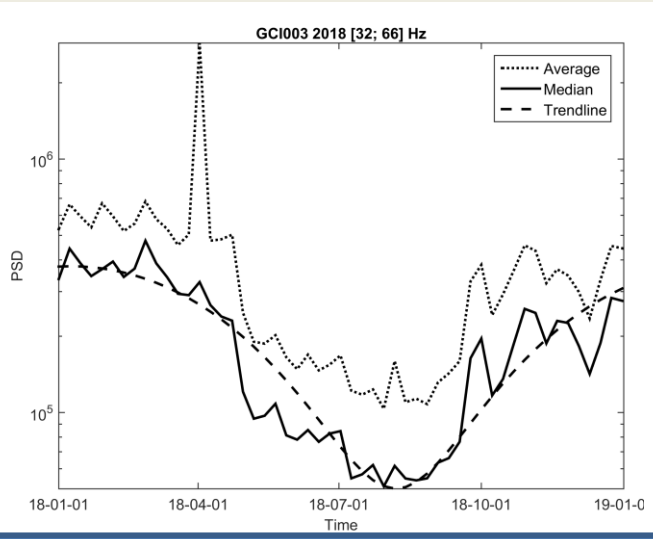
GCI006, Alpha, 2017

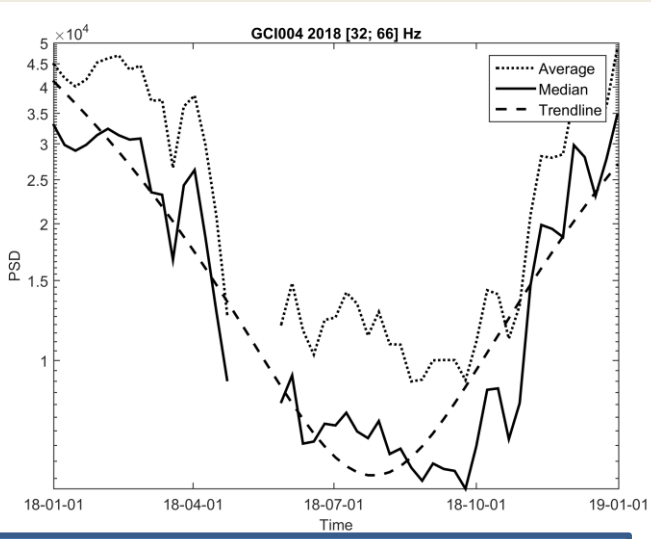


GCI006, Alpha, 2018

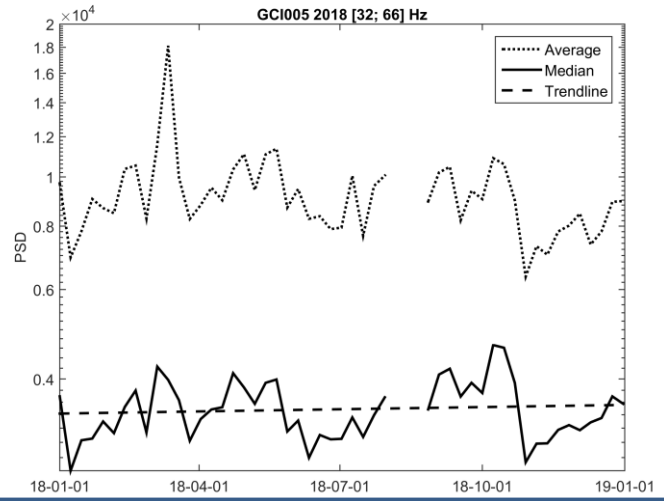
Gamma(32 – 66 Hz) activity changes in 2018 year

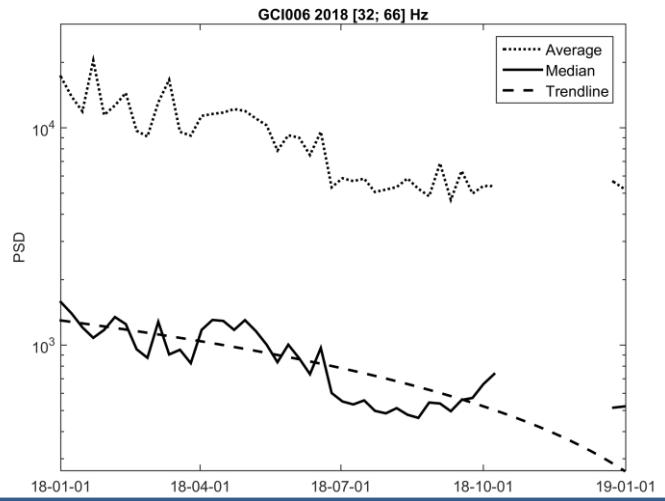






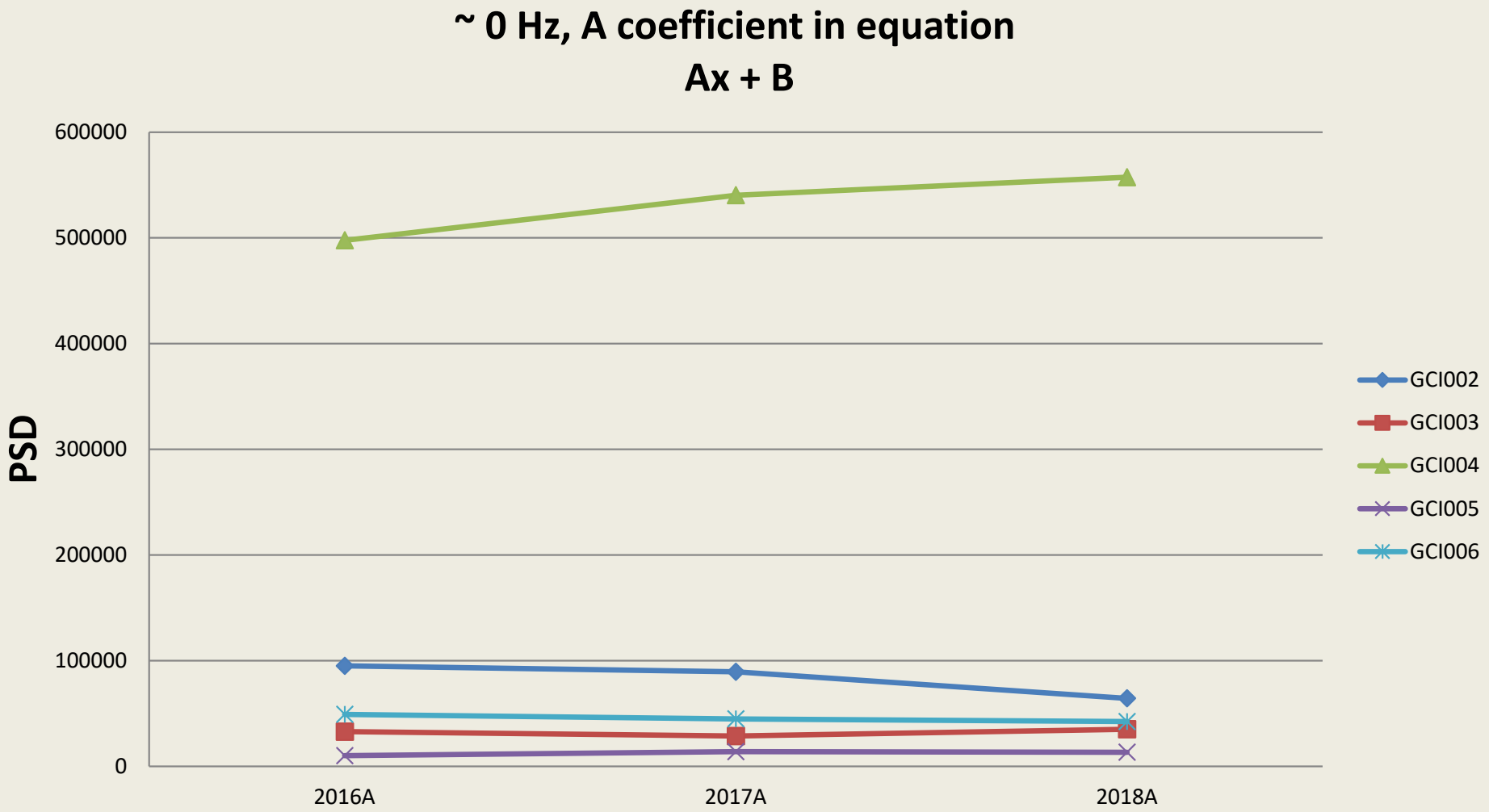
GCI002 – Saudi Arabia GCI003 – Lithuania GCI004 - Canada



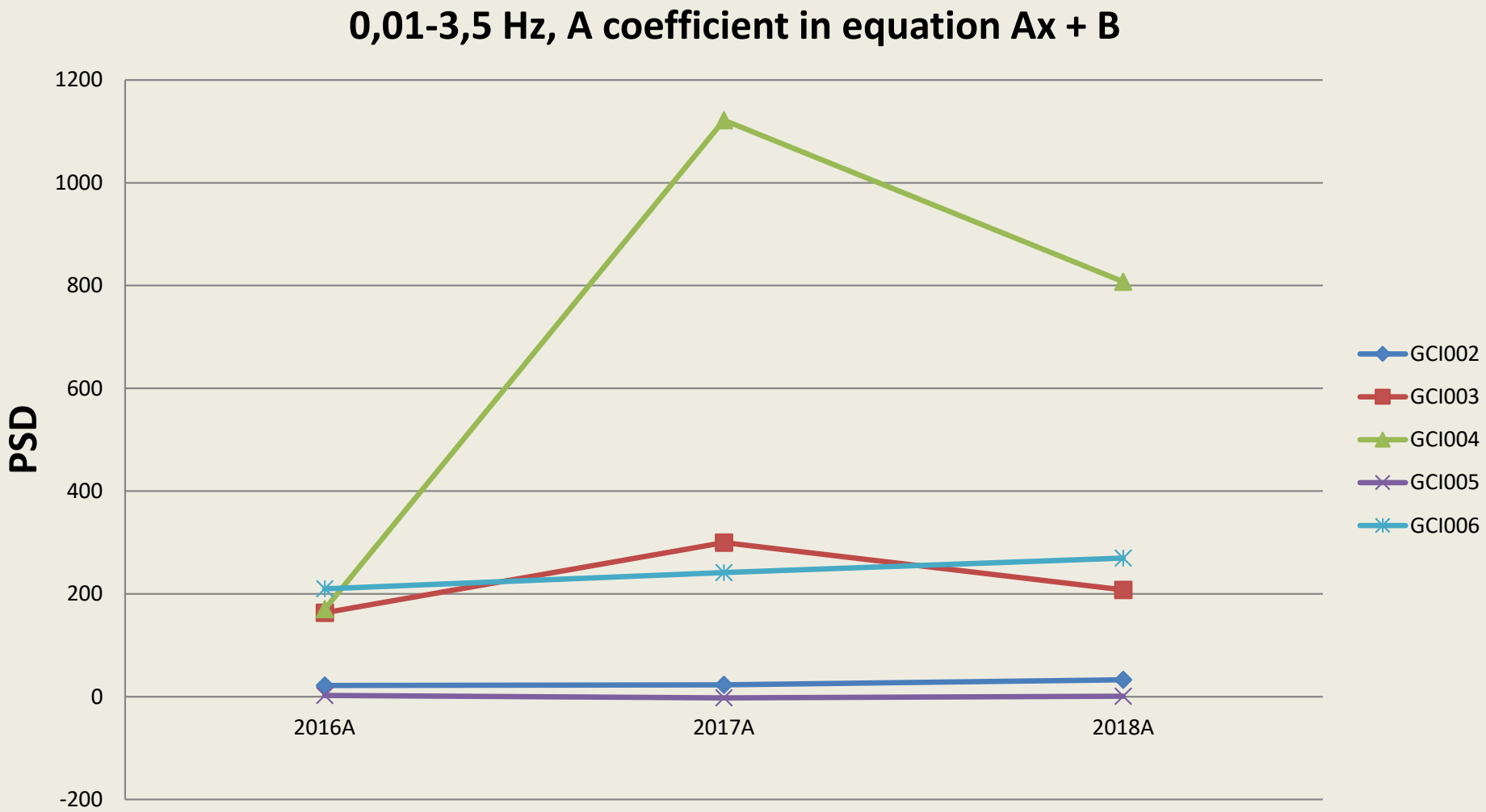


GCI005 – New Zealand GCI006 – South Africa

PSD changes in Saudi Arabia, Lithuania, Canada, New Zealand, South Africa in Delta 1 (~0,01 Hz) Frequency Interval. Amplitude of fluctuation.

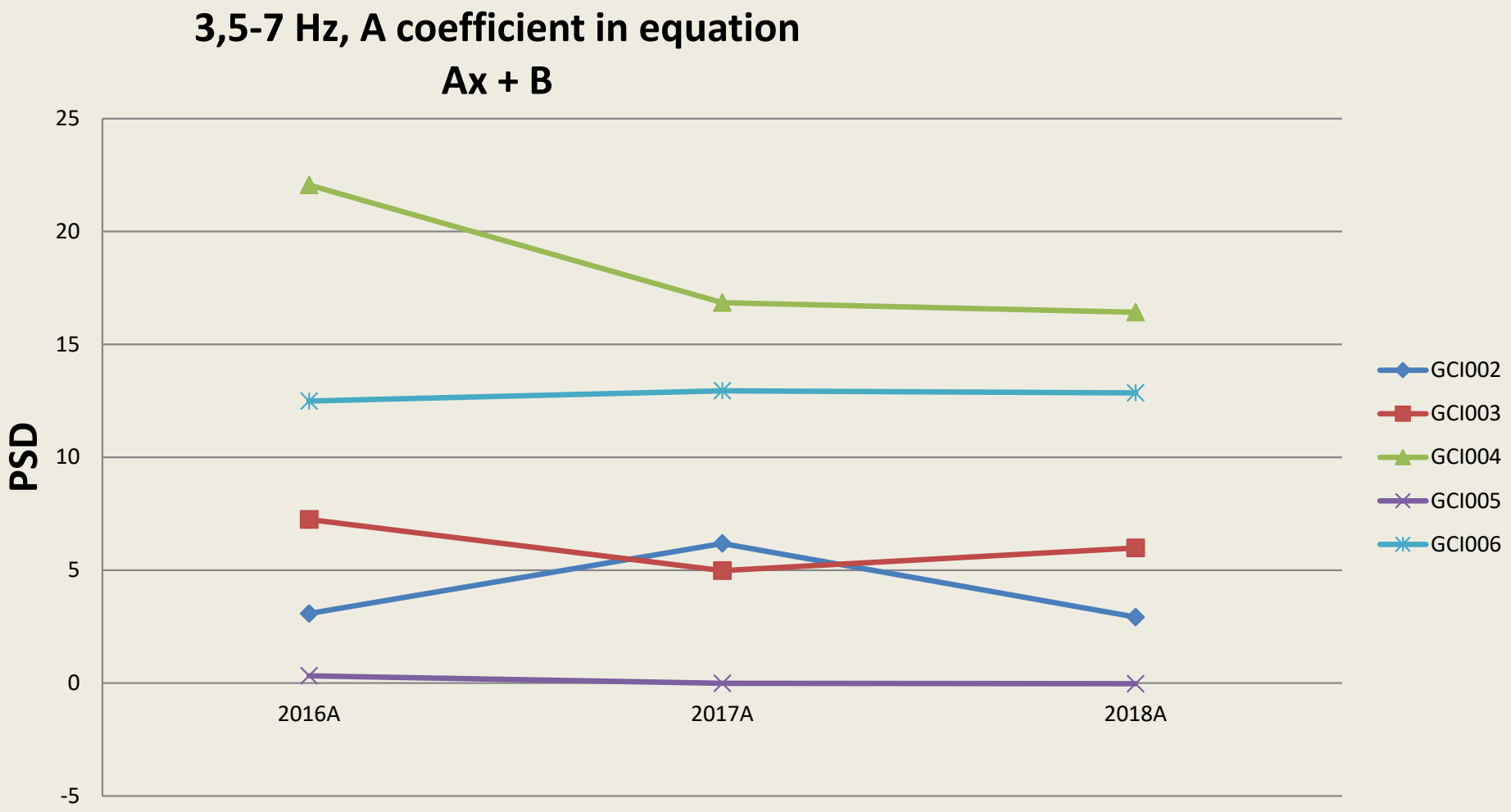


PSD changes in Saudi Arabia, Lithuania, Canada, New Zealand, South Africa in Delta 2 (0,01-3,5 Hz) Frequency Interval Amplitude of fluctuation

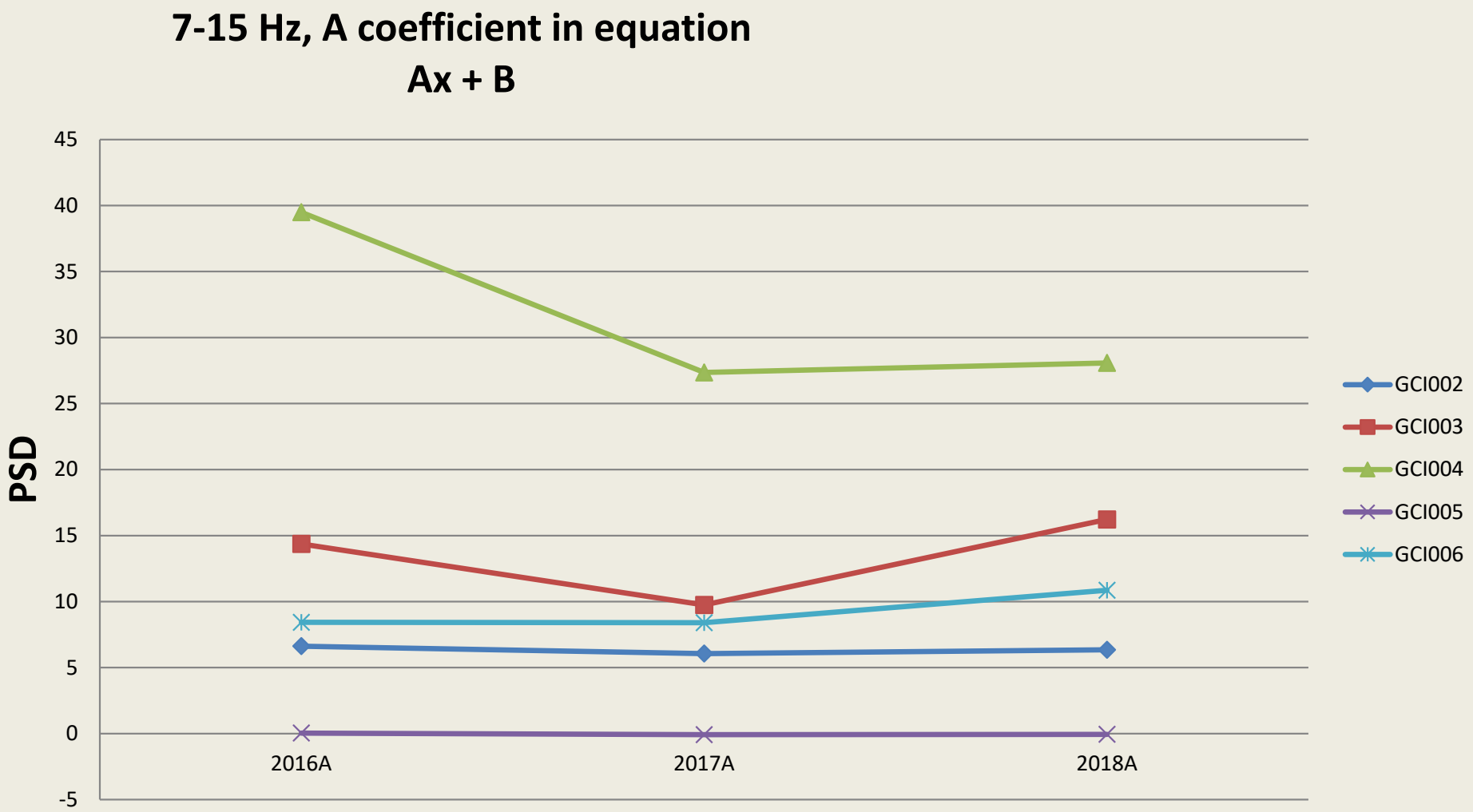


PSD changes in Saudi Arabia, Lithuania, Canada, New Zealand, South Africa in Theta (3,5-7 Hz) Frequency Interval

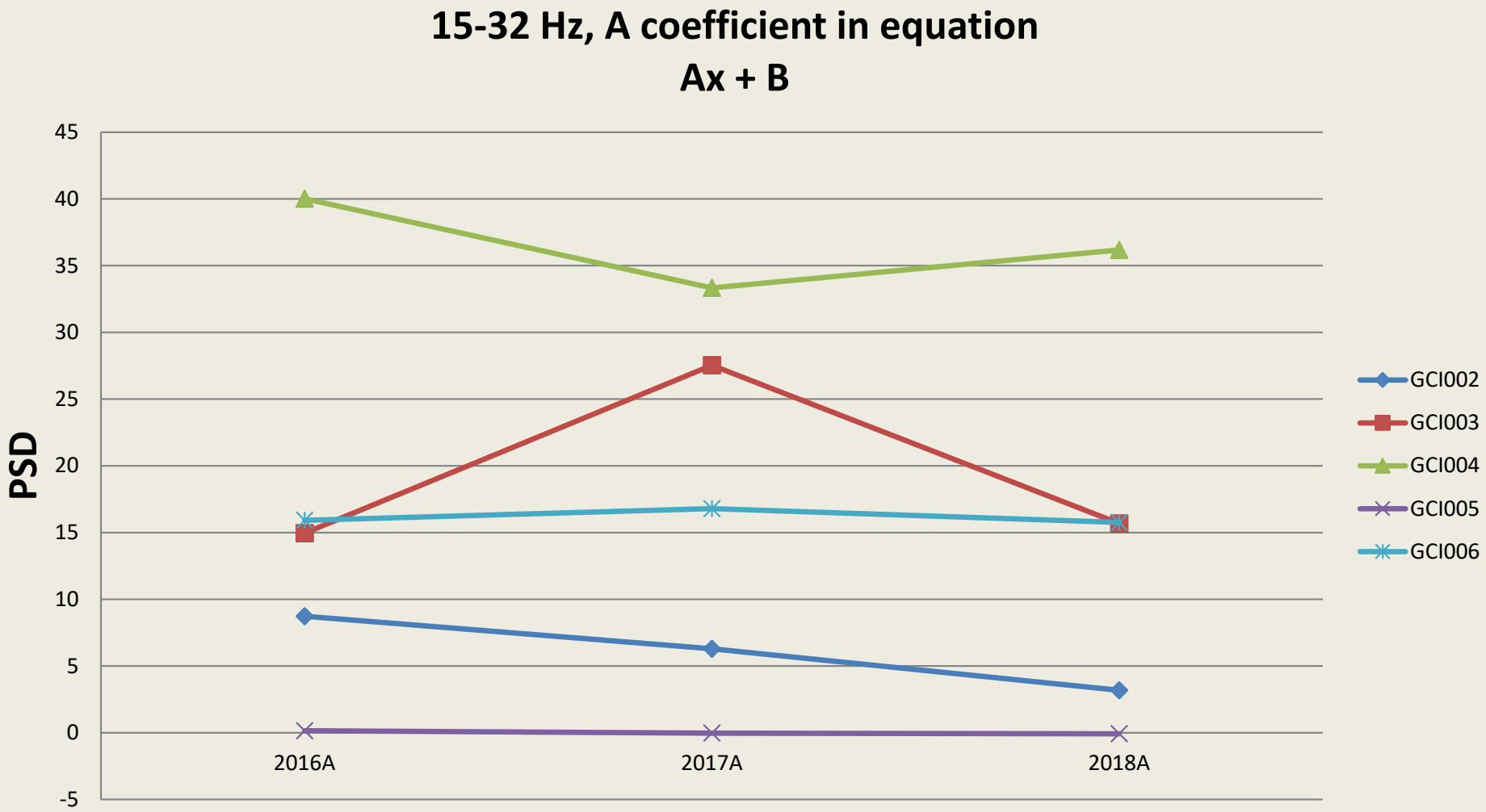
Amplitude of fluctuation



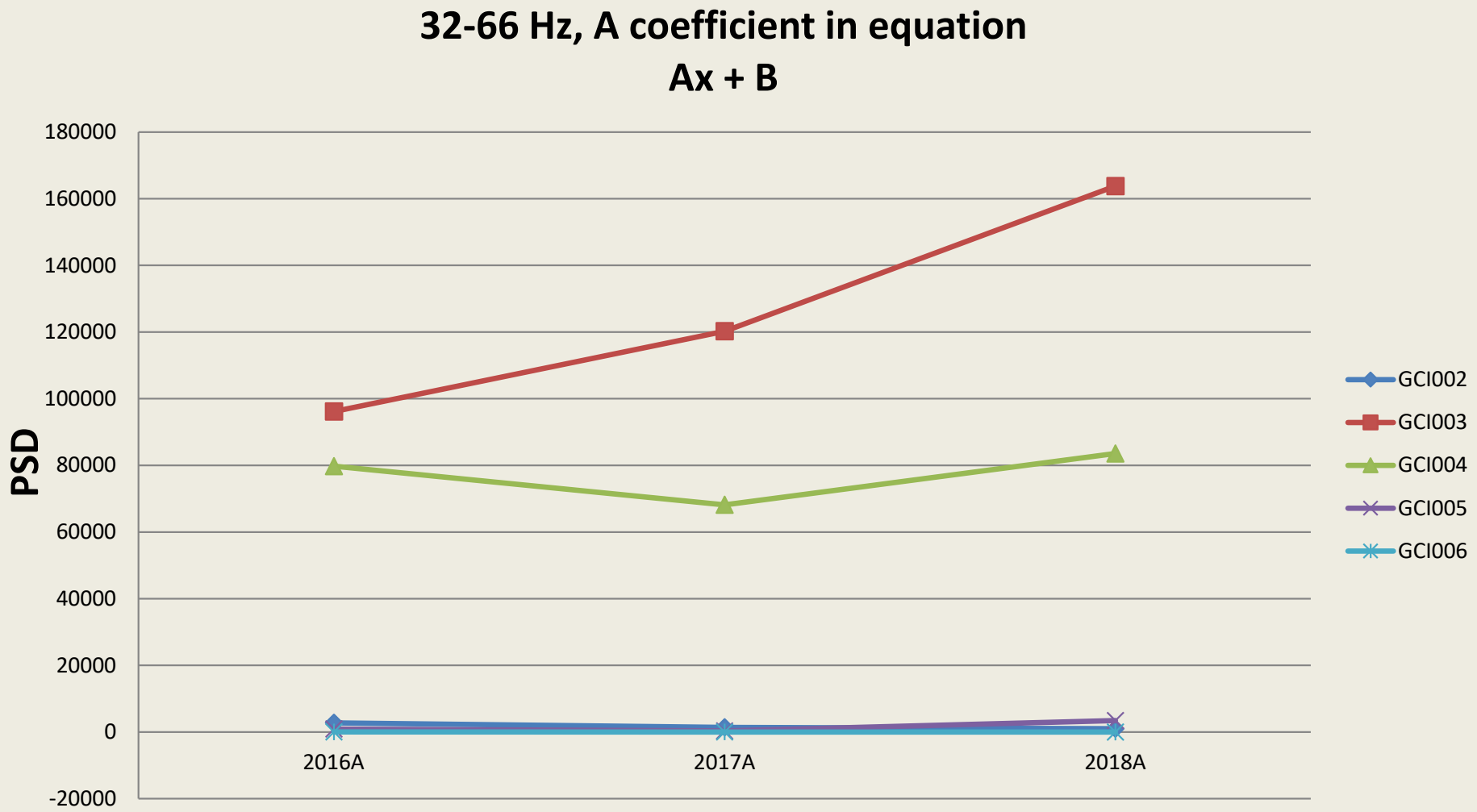
PSD changes in Saudi Arabia, Lithuania, Canada, New Zealand, South Africa in Alpha (7-15 Hz) Frequency Interval Amplitude of fluctuation



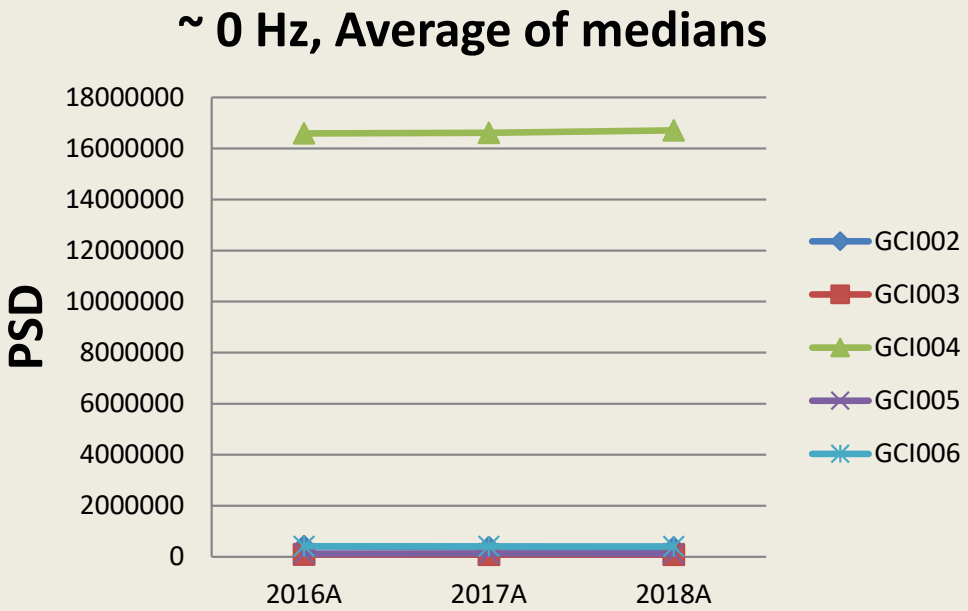
PSD changes in Saudi Arabia, Lithuania, Canada, New Zealand, South Africa in Beta (15-32 Hz) Frequency Interval Amplitude of fluctuation



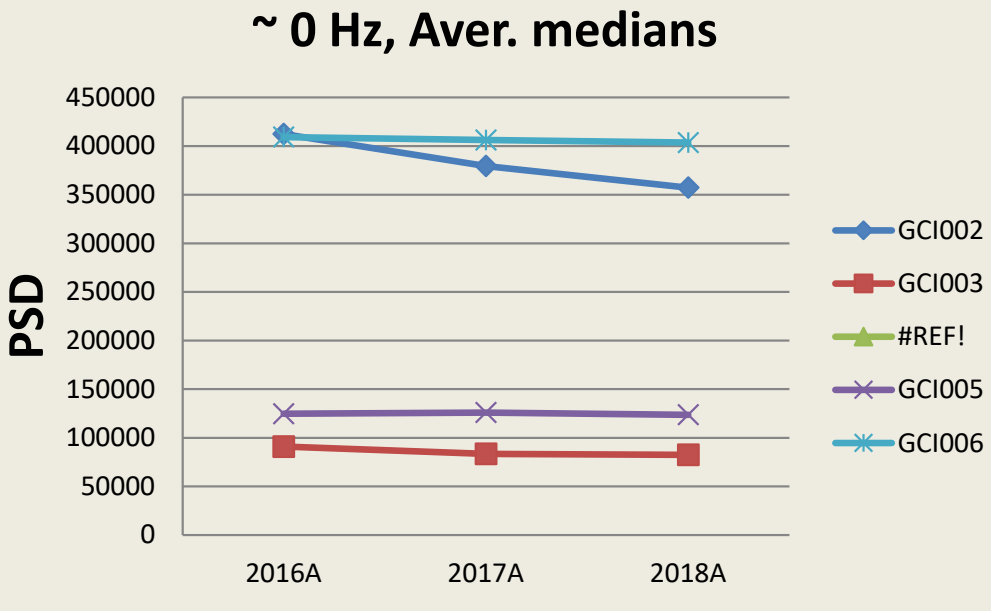
PSD changes in Saudi Arabia, Lithuania, Canada, New Zealand –, South Africa in Gamma (32-66 Hz) Frequency Interval Amplitude of fluctuation



Average level of PSD in Saudi Arabia, Lithuania, Canada, New Zealand, South Africa in Delta 1 Frequency Interval Average level of median in year

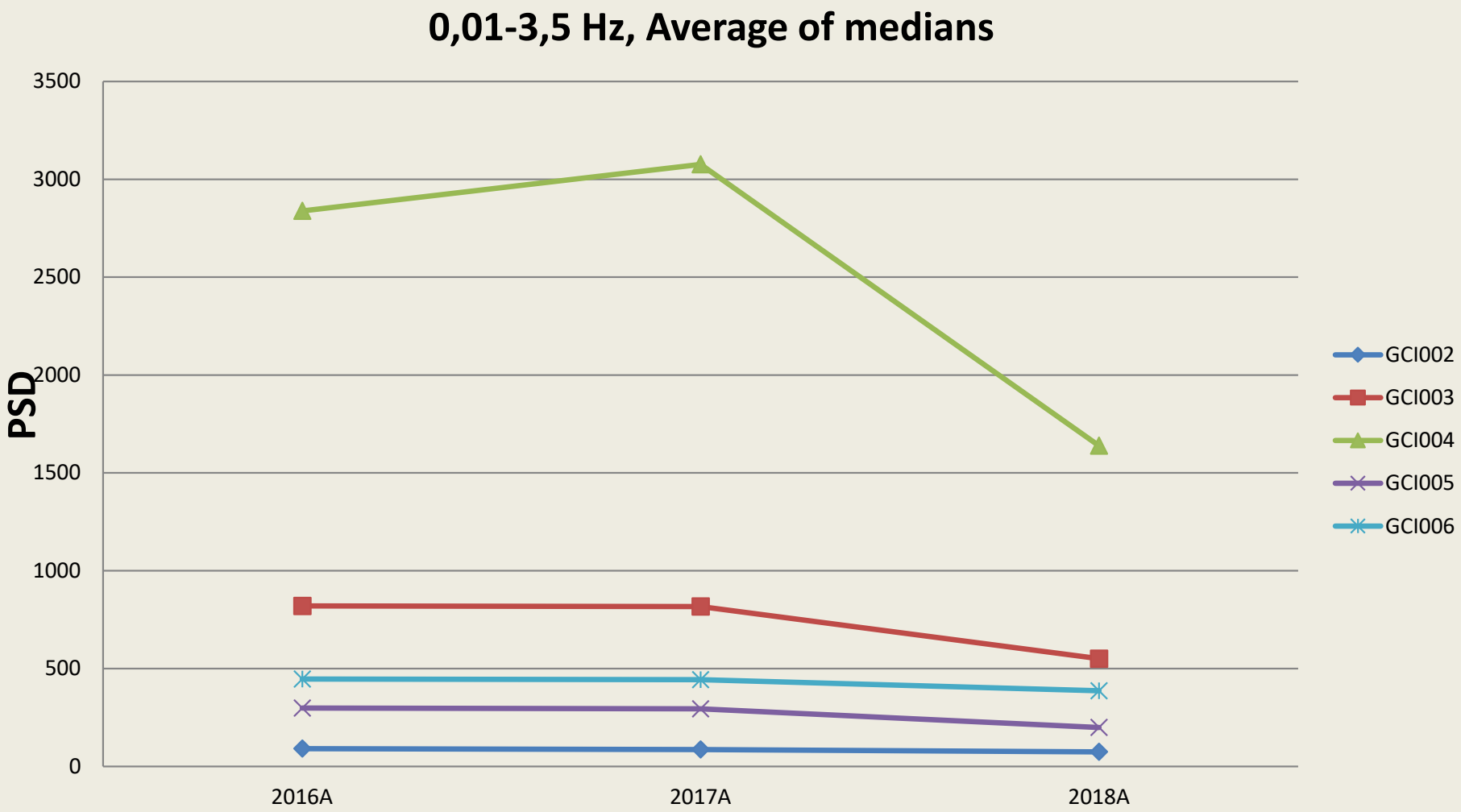


All studied sites

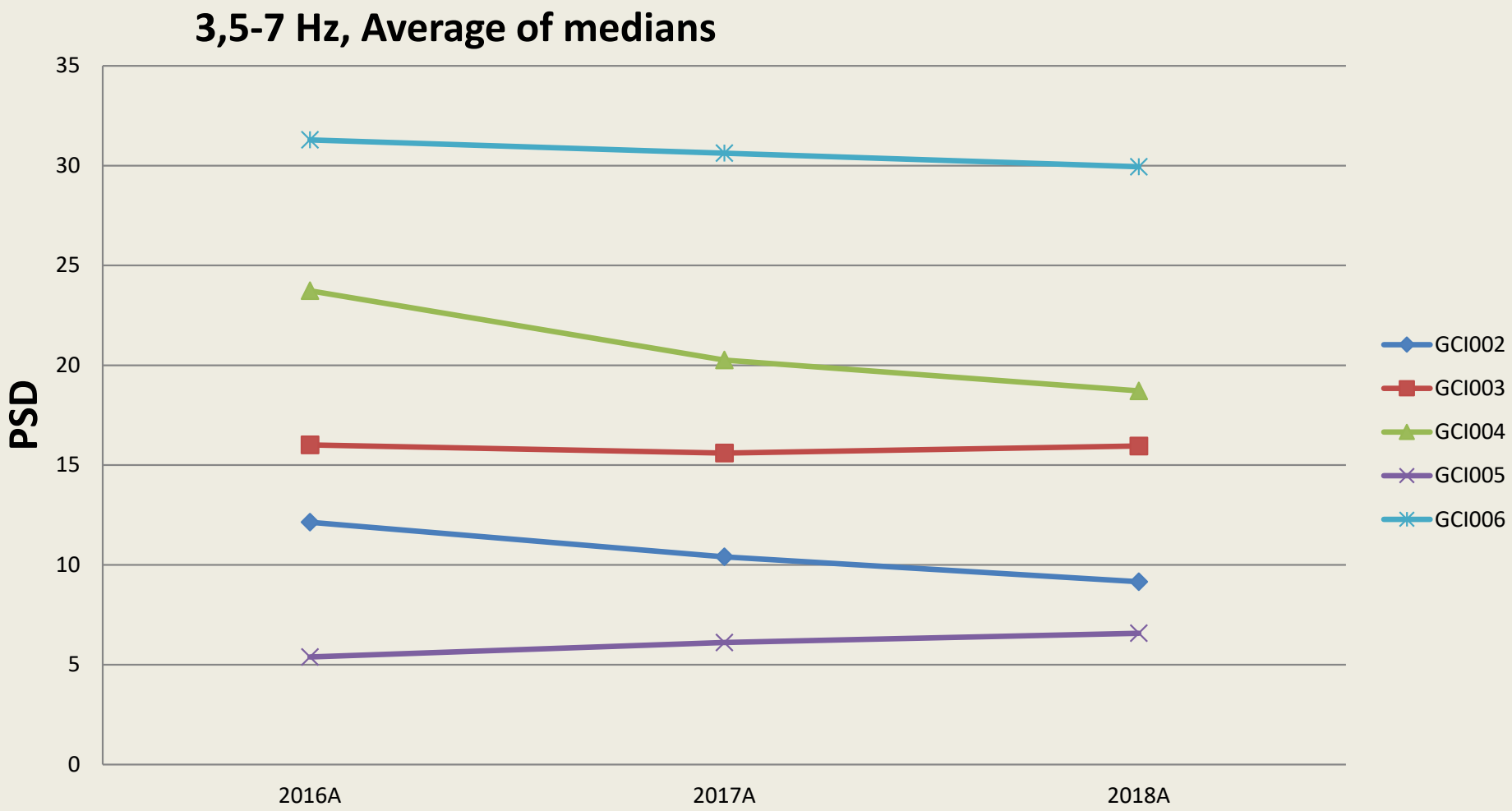


Studied sites without Canada – GCI004

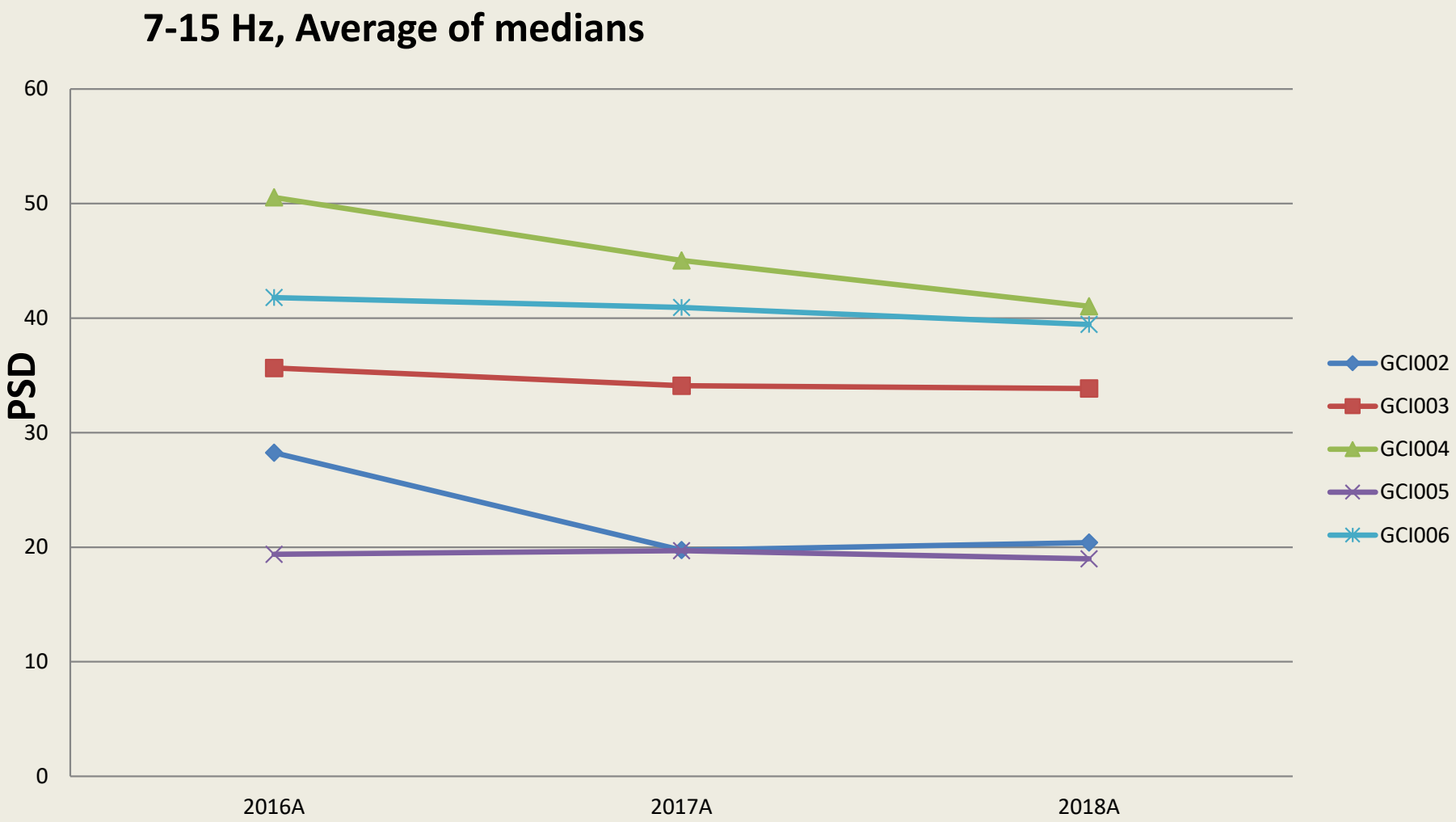
Average level of PSD in Saudi Arabia, Lithuania, Canada, New Zealand, South Africa in Delta 2 (0,01-3,5 Hz) Frequency Interval Average level of median in year



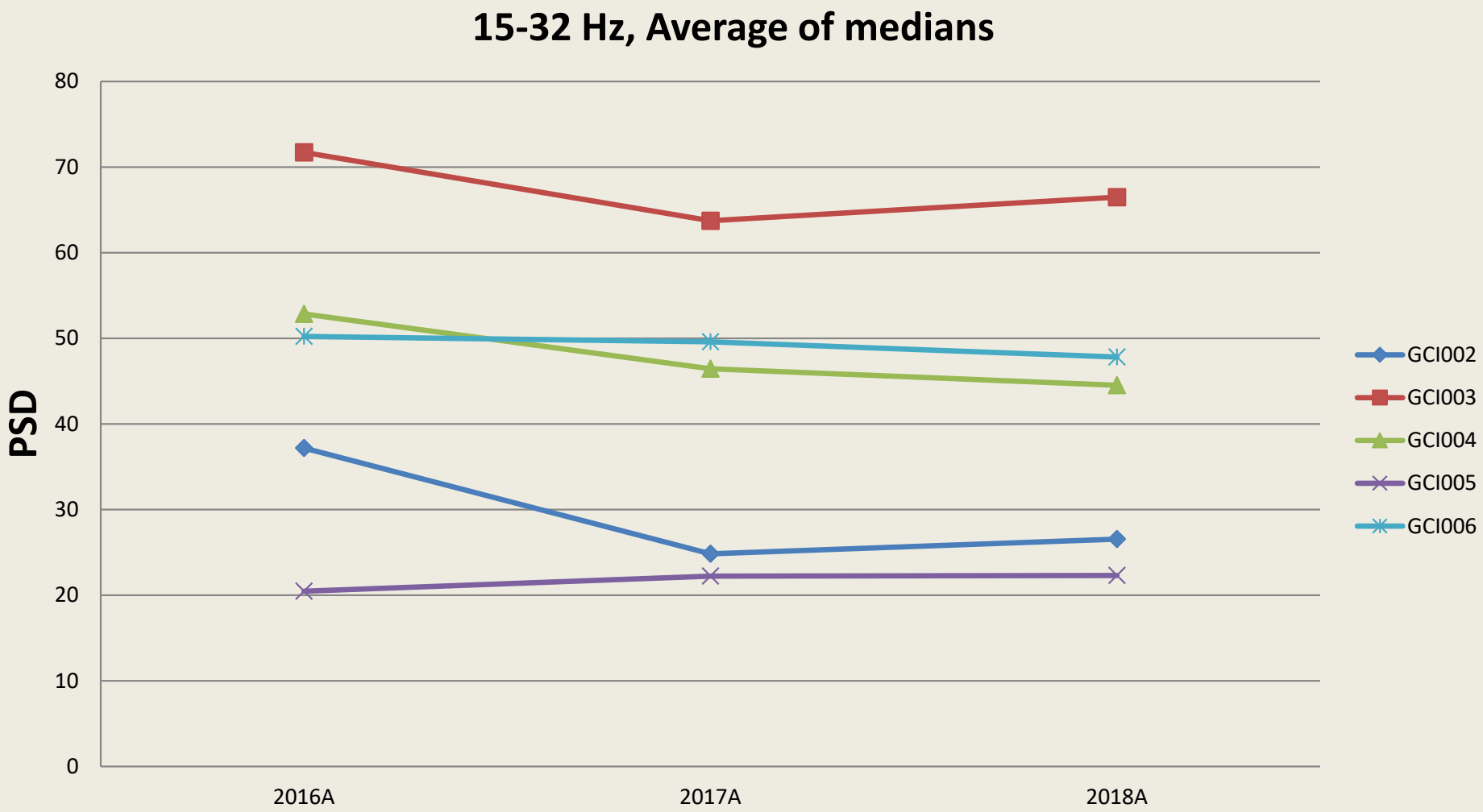
Average level of PSD in Saudi Arabia, Lithuania, Canada, New Zealand, South Africa in Theta (3,5-7 Hz) Frequency Interval Average level of median in year



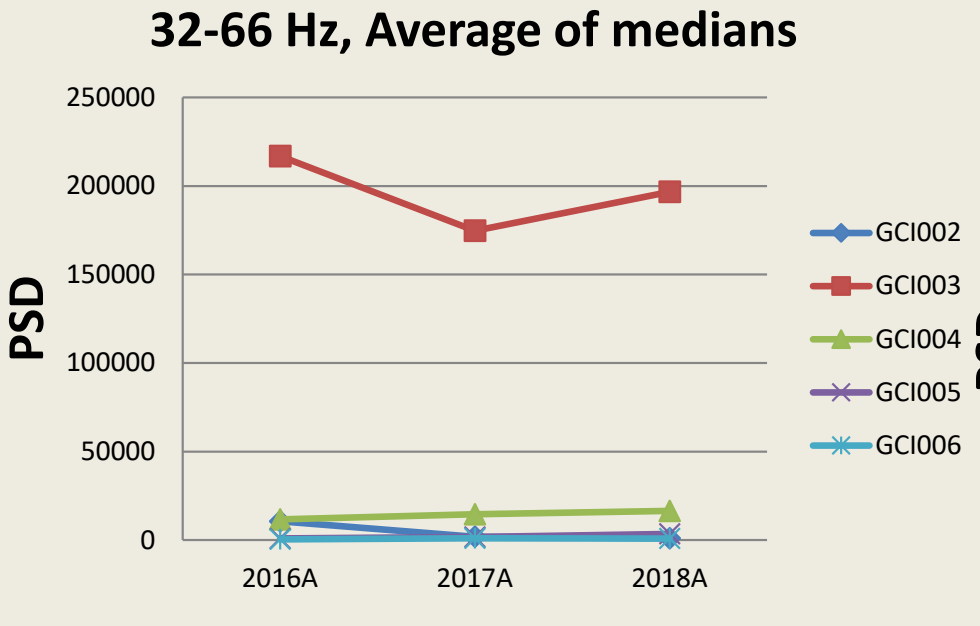
Average level of PSD in Saudi Arabia, Lithuania, Canada, New Zealand, South Africa in Alpha (7-15 Hz) Frequency Interval Average level of median in year



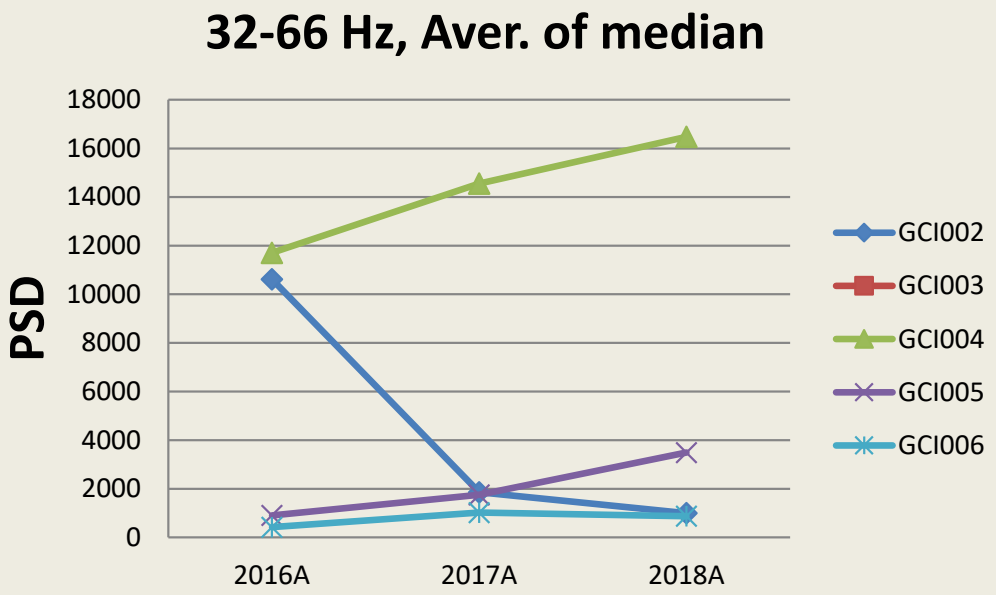
Average level of PSD in Saudi Arabia, Lithuania, Canada, New Zealand, South Africa in Beta (15 – 32 Hz) Frequency Interval Average level of median in year



Average level of PSD in Saudi Arabia, Lithuania, Canada, New Zealand, South Africa in Gamma (32 – 66 Hz) Frequency Interval Average level of median in year



All studied sites



Studied sites without Lithuania – GCI003

Conclusions

- Measurements in five different countries are different;
- High variation observed in all frequency bands, localizations and time-scales;
- The changes of the Earth MF in all frequency bands are related to human health features and this interconnection need to be studied in different continents and regions more carefully;
- Observed variability of specific seasonal patterns - maximum power MF is monitored in summer, but not in N. Zealand.
- Large powers of Earth MF observed at delta 1(~ 0,01 Hz) frequencies in all locations. The power in Canada compared to other localizations exceeds others by more than 40 times.
- Large powers of Earth MF observed at gamma frequencies in all locations. This power in Lithuania compared to other localizations exceeds by more than 100 times. It can cause many physical disorders in human beings.

- Questions – what is optimal intensity of MF in different frequency bands to keep human organism in optimal functional state?

Thank You for Attention!

Saudi Arabia, King of Organs 2019