Cosmic ray's Effect on Ionospheric Critical Frequencies and Heights

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with

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OUTLINE

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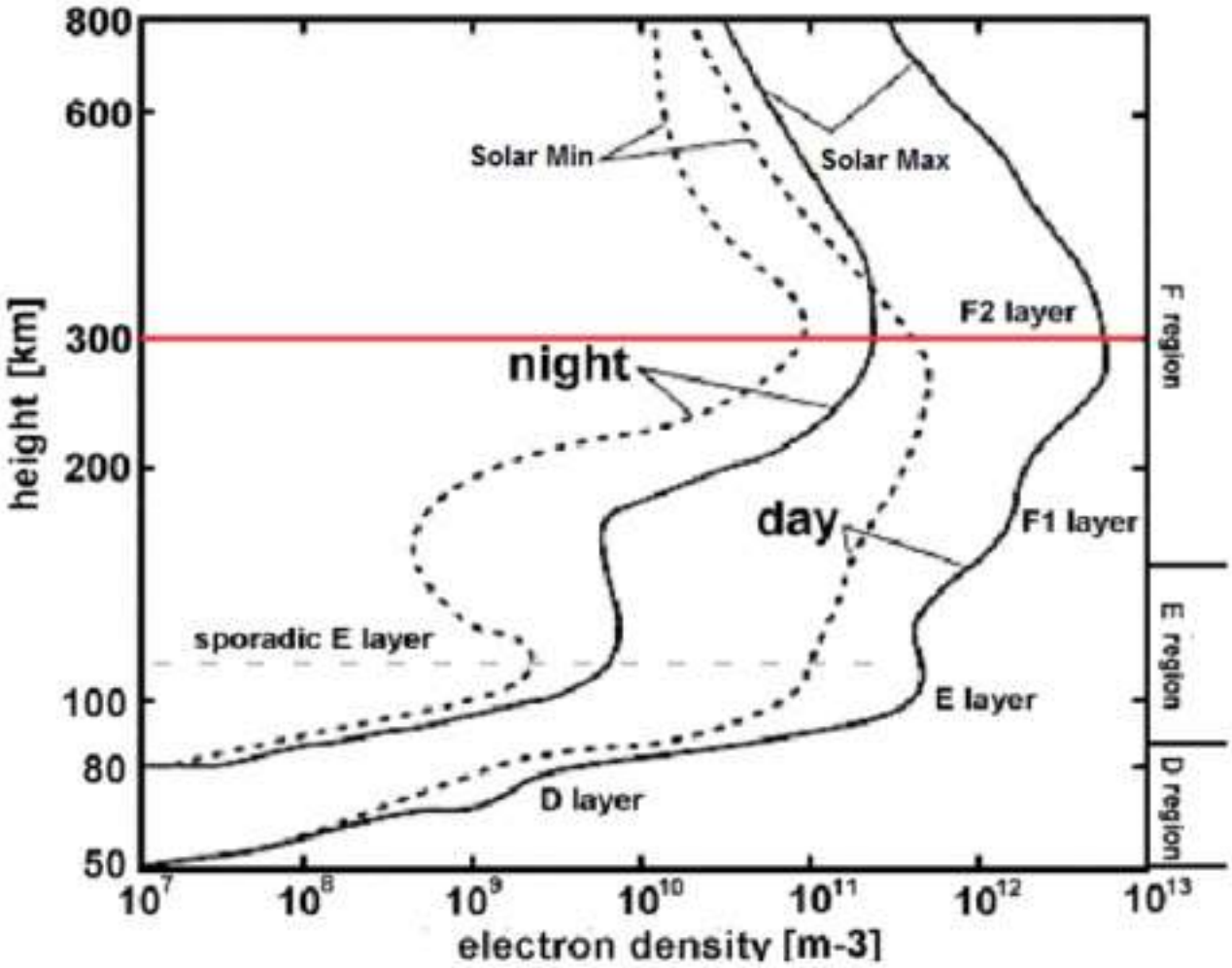
Ionospheric Layers

The ionosphere is the ionized component of the Earth's upper atmosphere.

Ionospheric Layers	Ionospheric Heights (km)
D	50-90
E	90-140
Es	90-140
F	140-600

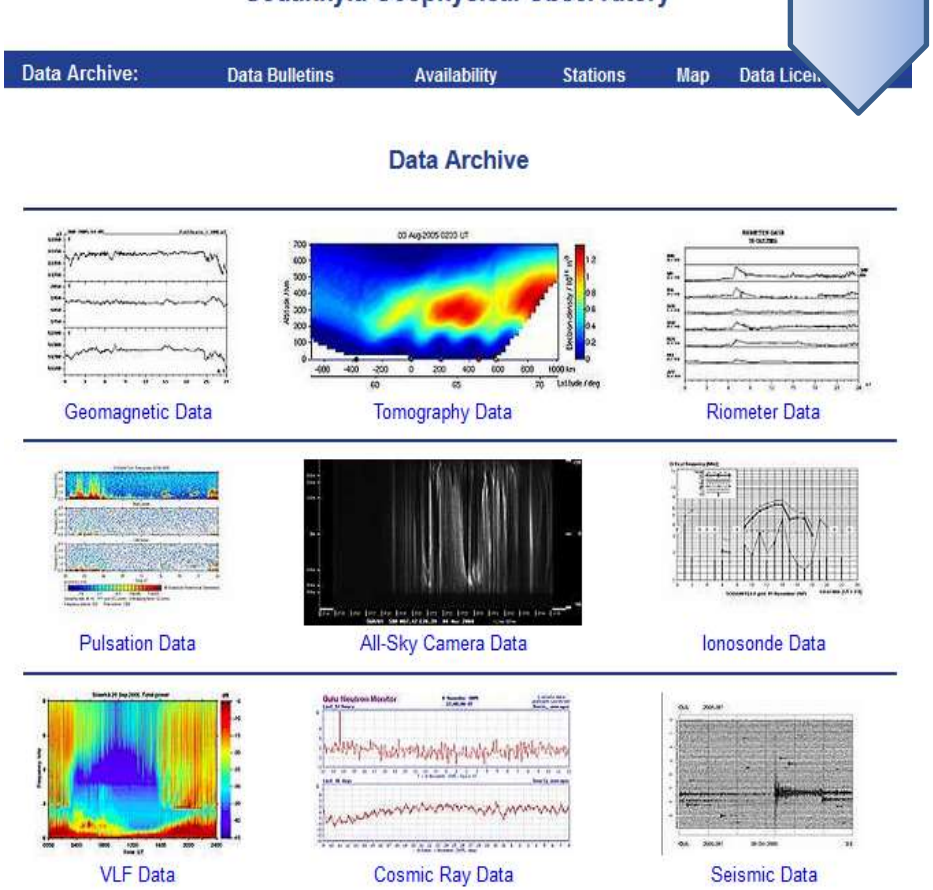
Ionospheric Layers



Solar activiy anti-correlate with the cosmic rays (Atac, 2009).

Electron density as a function of altitude, and various ionospheric layers

Data



➡ The ionospheric critical frequency and heights data sets are taken from the Sodankylä Geophysical Observatory at 14:00 for each day.

➡ Cosmic ray data are also taken from the same station

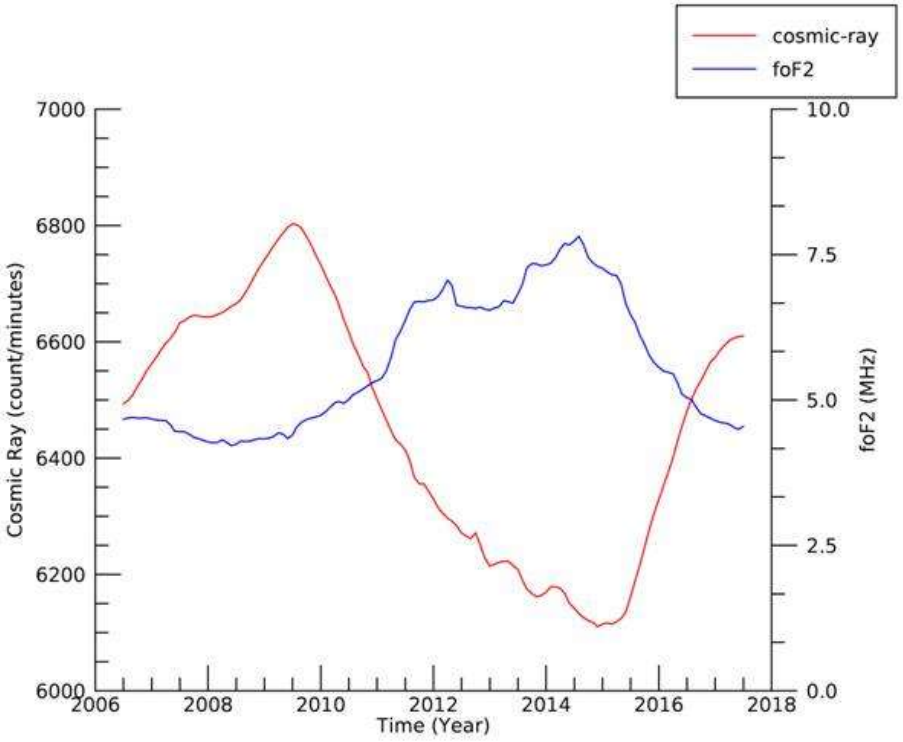
The investigated time interval covers from January 2006 to December 2017

Method

- Monthly median values of each ionospheric layer data was calculated.
- The temporal variations of the critical frequencies and heights of each ionospheric layer compared with cosmic ray count.
- To investigate possible relation between these data sets correlation analysis was applied.
- Fisher test was also applied to determine to confidence intervals of obtained correlation coefficients.

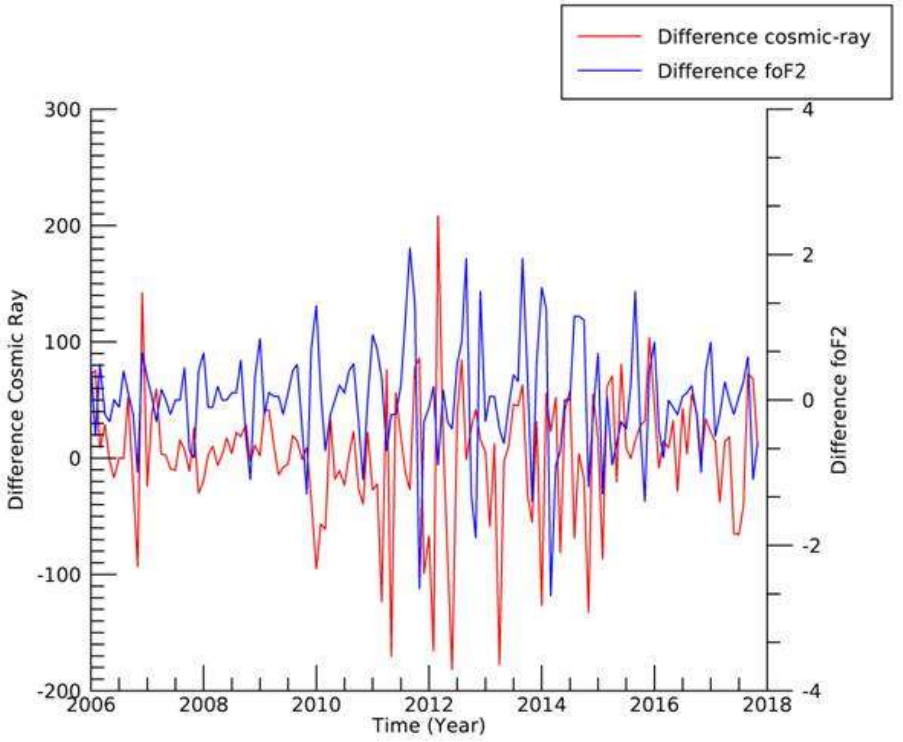
Cosmic-Ray & foF2

Correlation Coefficient: -0.74



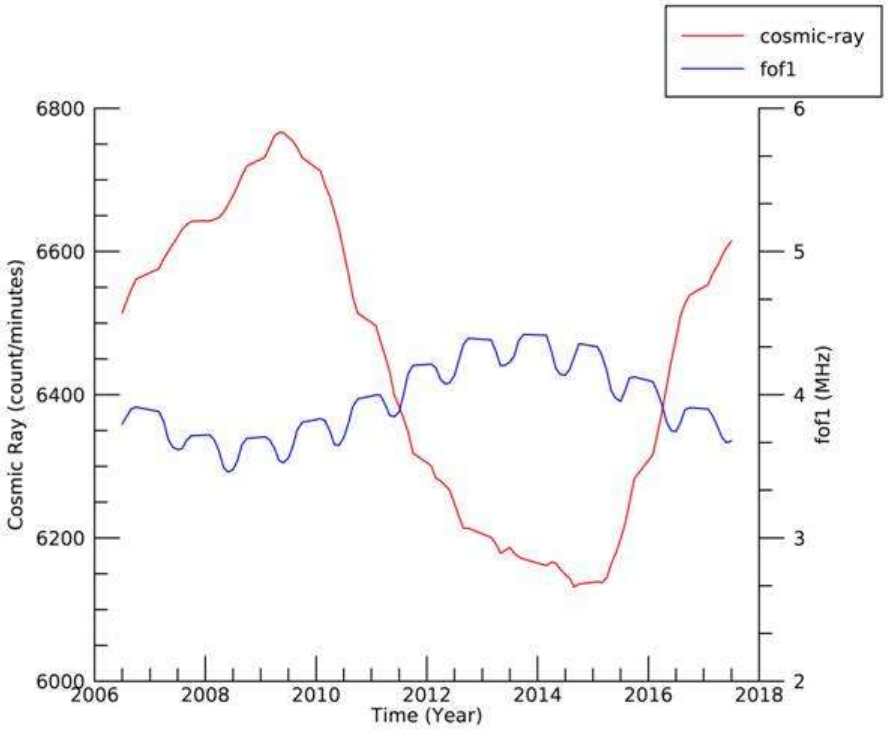
Difference Cosmic-Ray & foF2

Correlation Coefficient: -0.005



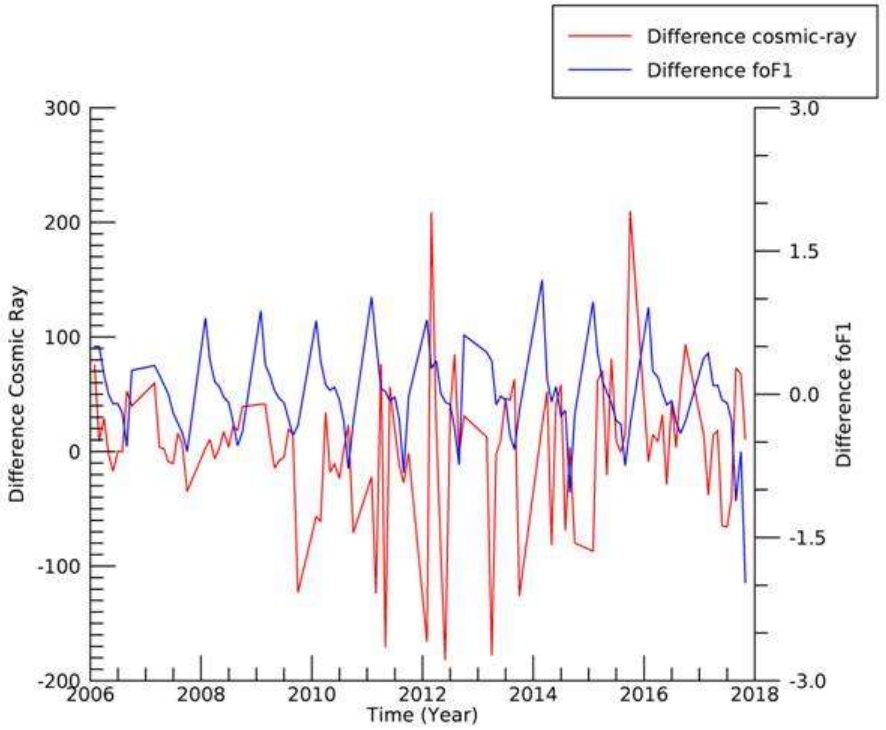
Cosmic-Ray & foF1

Correlation Coefficient: -0.45



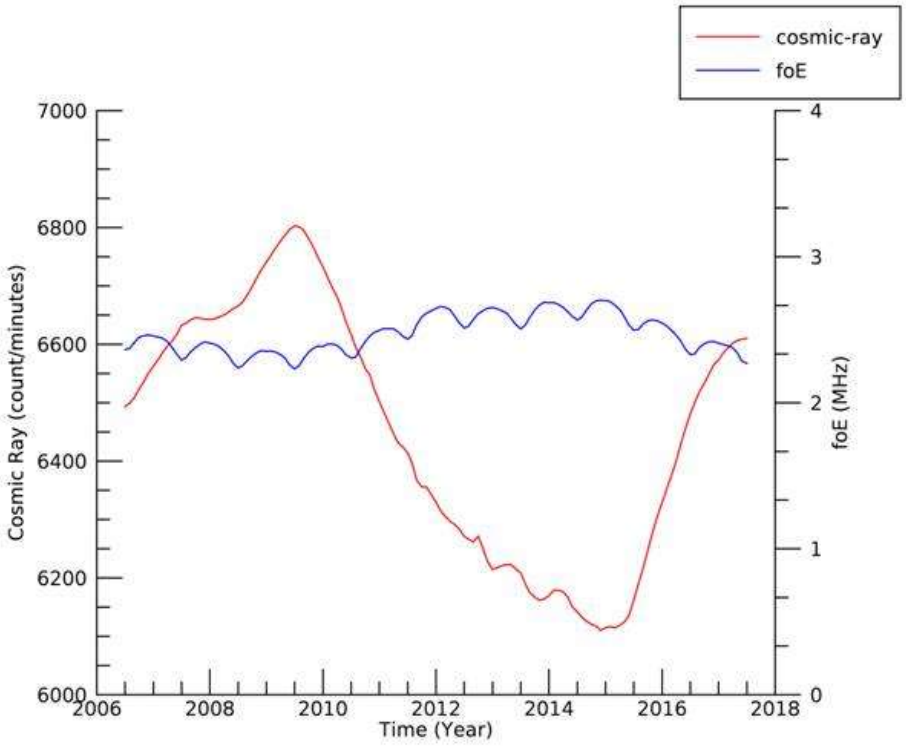
Difference Cosmic-Ray & foF1

Correlation Coefficient: -0.14



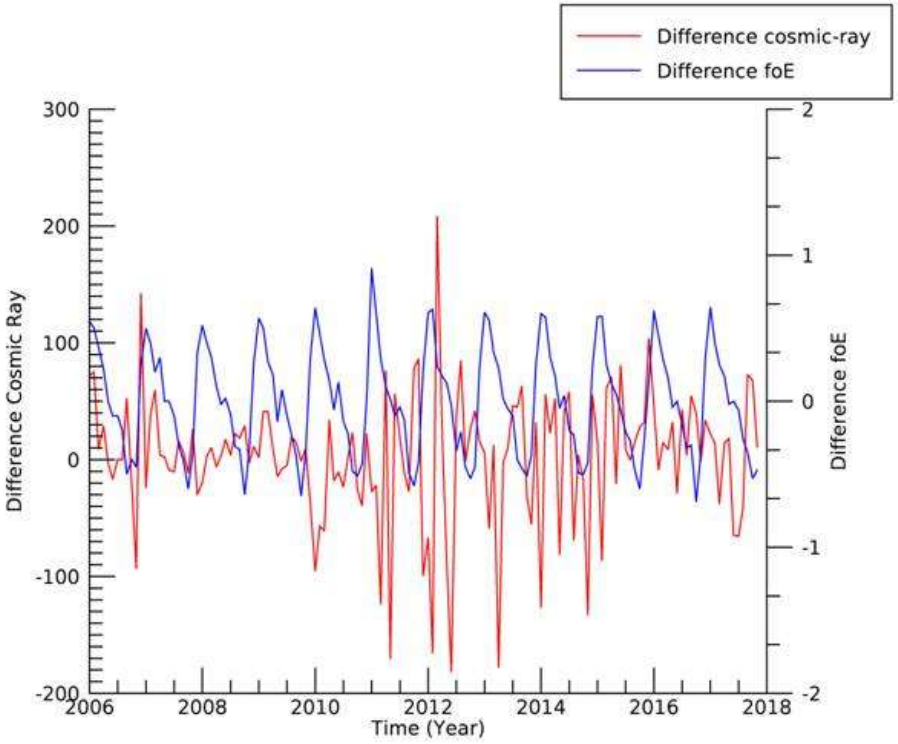
Cosmic-Ray & foE

Correlation Coefficient: -0.23



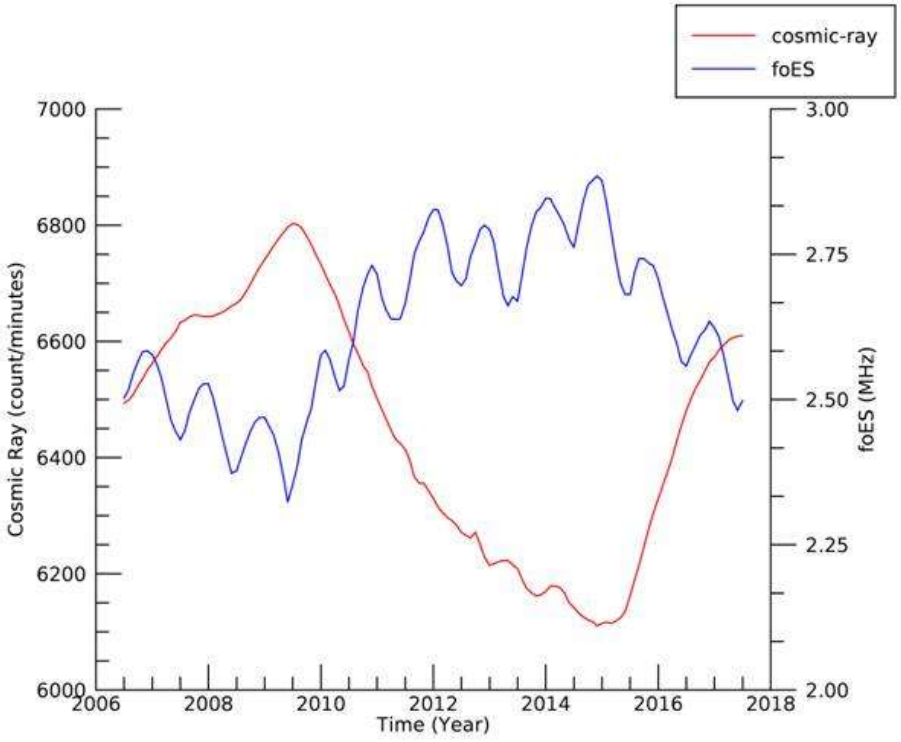
Difference Cosmic-Ray & foE

Correlation Coefficient: -0.12



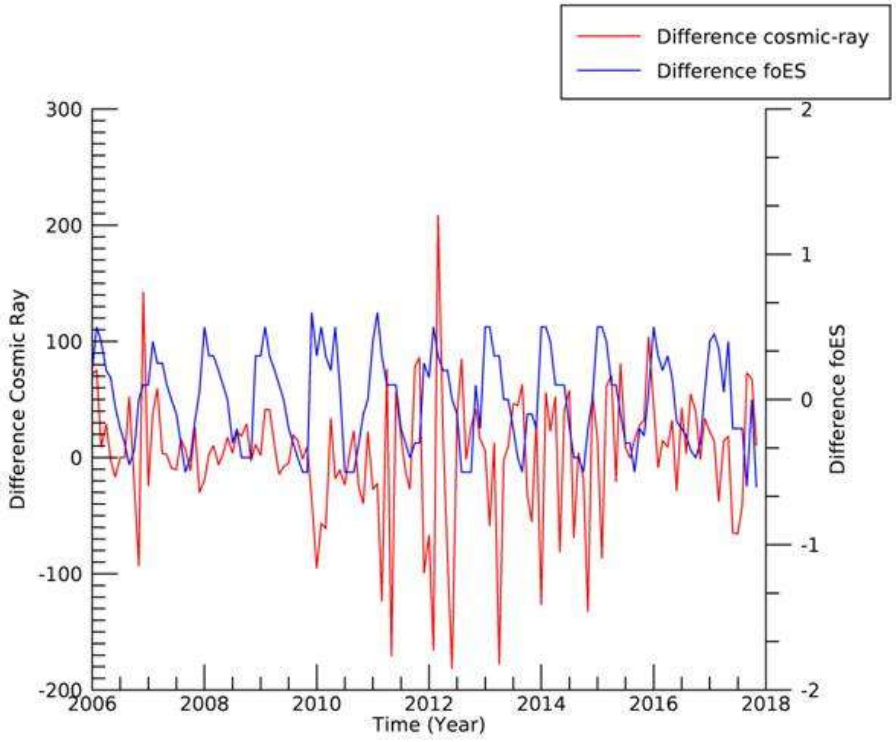
Cosmic-Ray & foEs

Correlation Coefficient: -0.26



Difference Cosmic-Ray & foEs

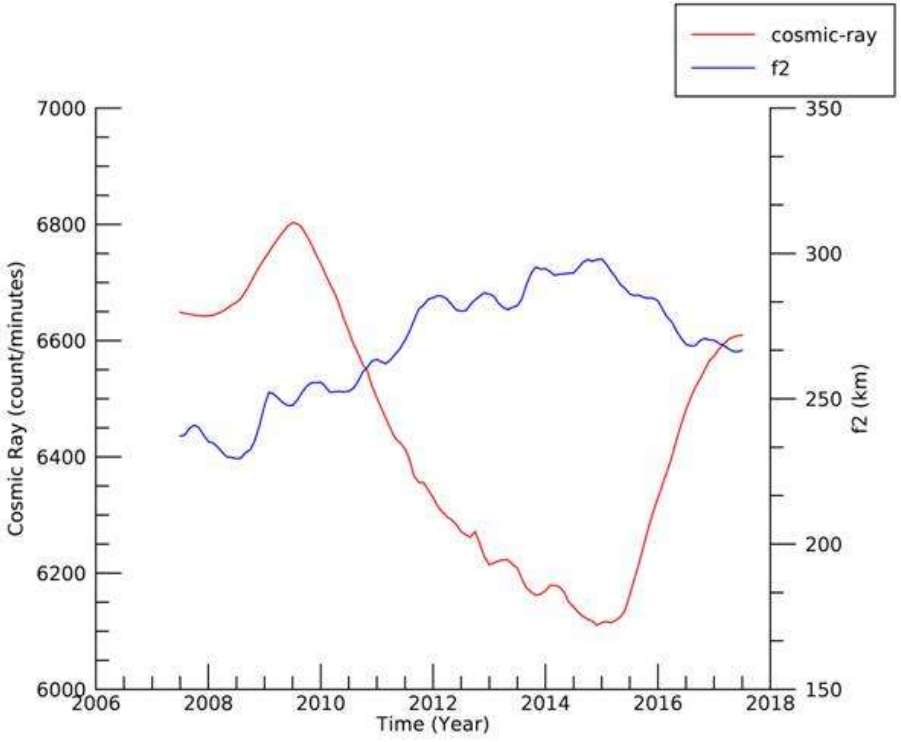
Correlation Coefficient: -0.15



PART 2

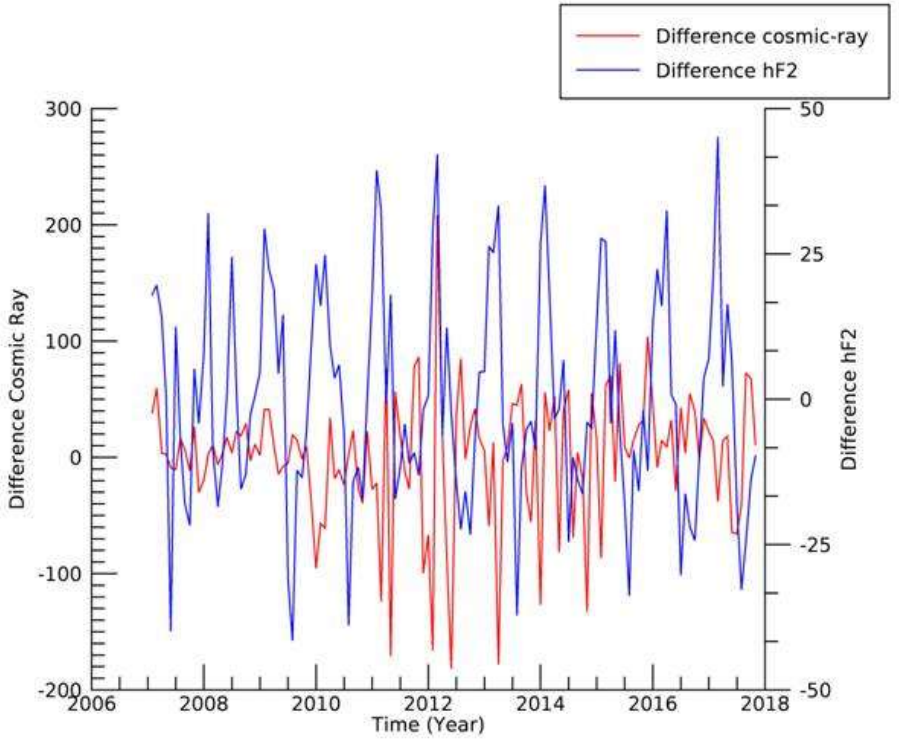
Cosmic-Ray & hF2

Correlation Coefficient: -0.53



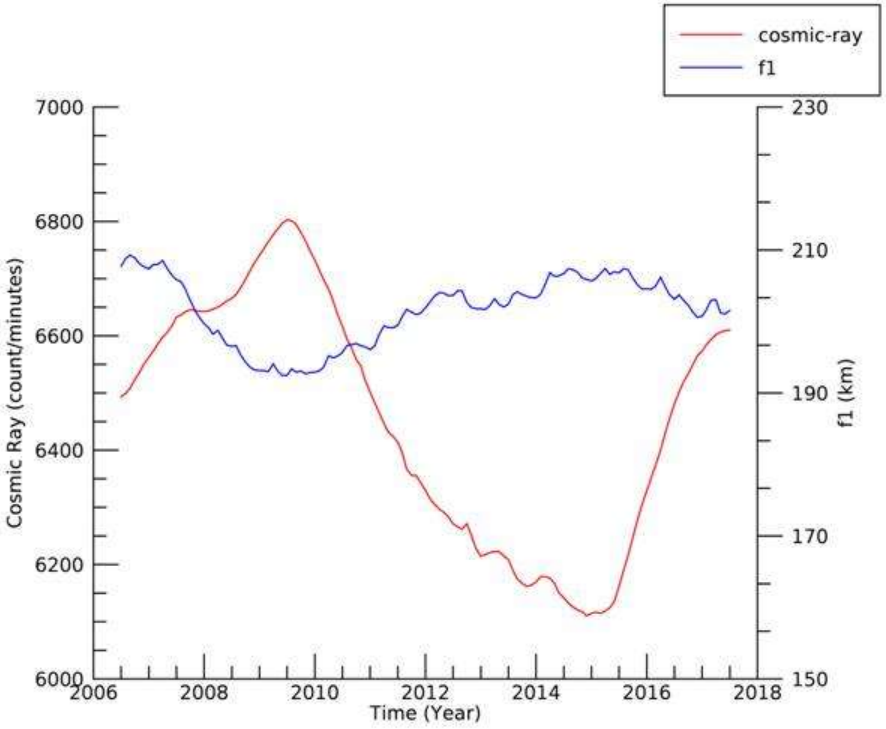
Difference Cosmic-Ray & hF2

Correlation Coefficient: -0.22



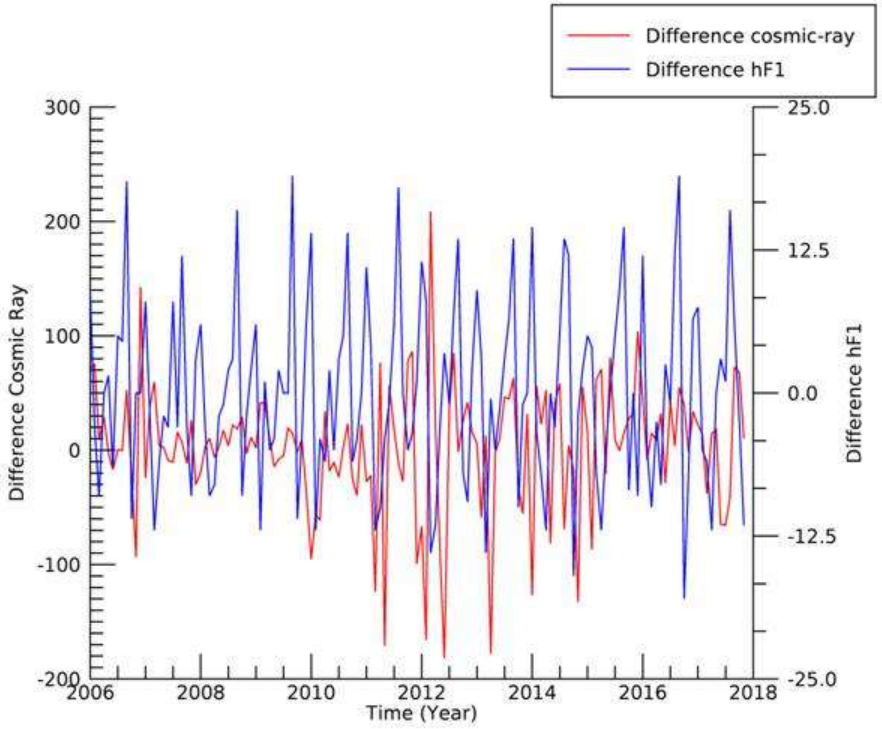
Cosmic-Ray & hF1

Correlation Coefficient: -0.31



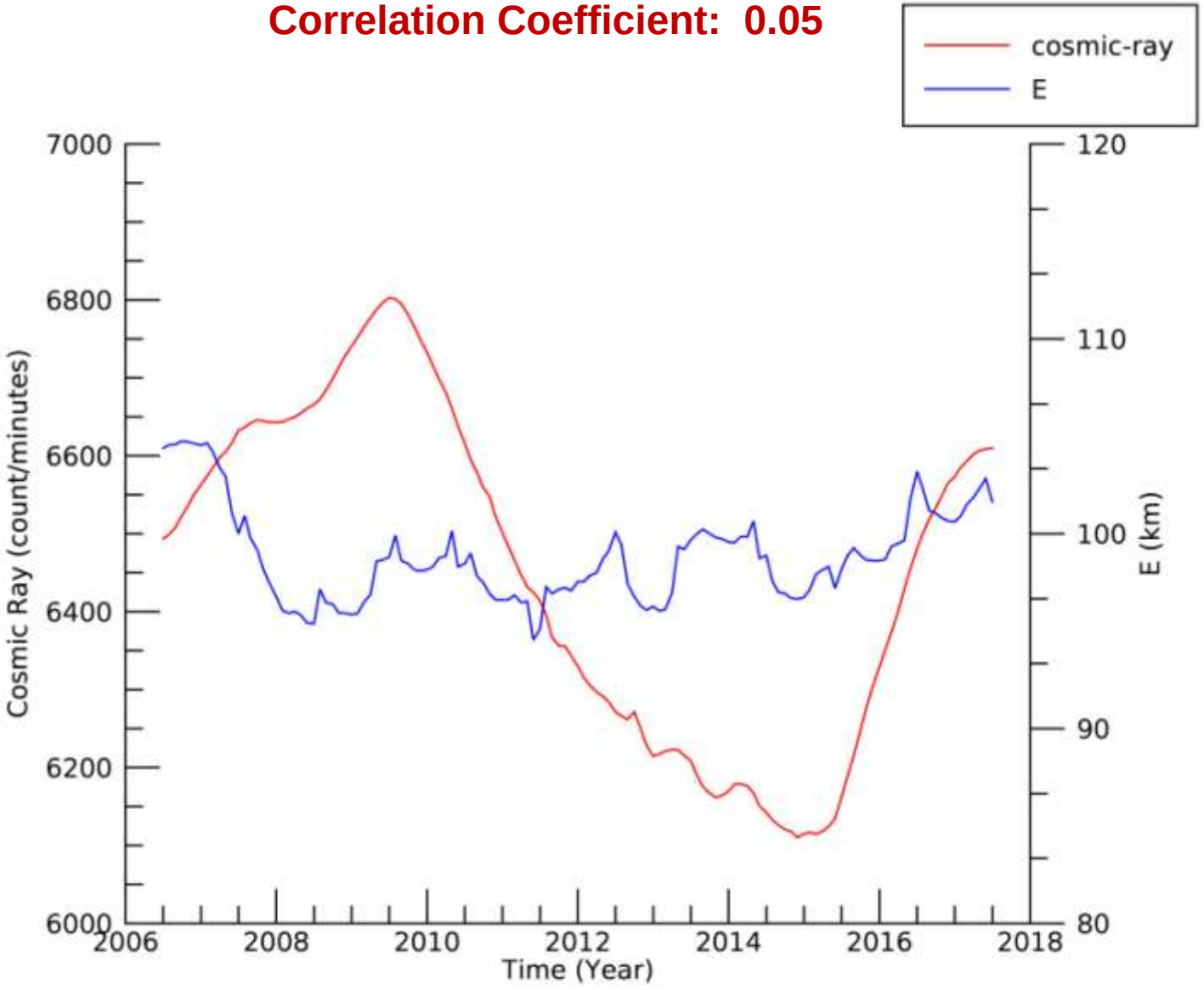
Difference Cosmic-Ray & hF1

Correlation Coefficient: -0.14



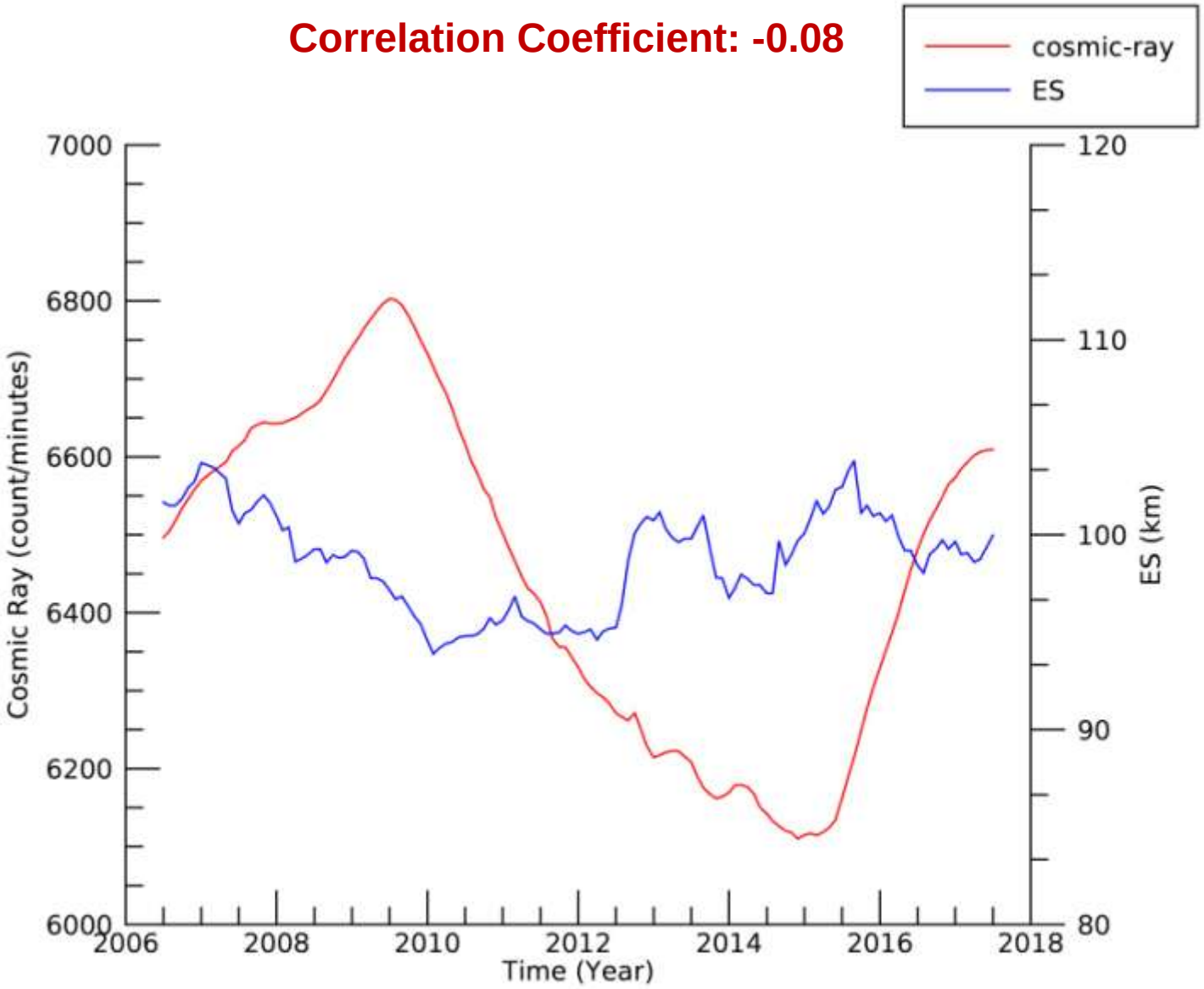
Cosmic-ray & hE

Correlation Coefficient: 0.05



Cosmic-ray & hES

Correlation Coefficient: -0.08



Correlation C.	foF1	foF2	foE	foEs
Cosmic Rays	-0.45	-0.73	-0.23	-0.26
Confidence Intervals	± 0.09	± 0.17	± 0.17	± 0.17
Correlation C.	Detrend-foF1	Detrend-foF2	Detrend-foE	Detrend-foEs
Cosmic Rays	-0.14	-0.005	-0.12	-0.15

Correlation C.	hF1	hF2	hE	hEs
Cosmic Rays	-0.31	-0.53	0.05	-0.08
Confidence Intervals	± 0.14	± 0.16	± 0.17	± 0.17
Correlation C.	Detrend-hF1	Detrend-hF2	Detrend-hE	Detrend-hEs
Cosmic Rays	-0.22	-0.14		

Summary and Conclusion

•We investigated the possible relation between cosmic rays and ionospheric critical frequencies and heights.

•We may conclude that correlations between these data sets mainly come from the general trend.

Thank You…

Study is in still progress..