Latitudinal dependence of UV background in Tatiana-2 measurements

Š. Mackovjak, P. Bobík, M. Putiš

Department of Space Physics, Institute of Experimental Physics, Slovak Academy of Sciences, Košice, Slovakia

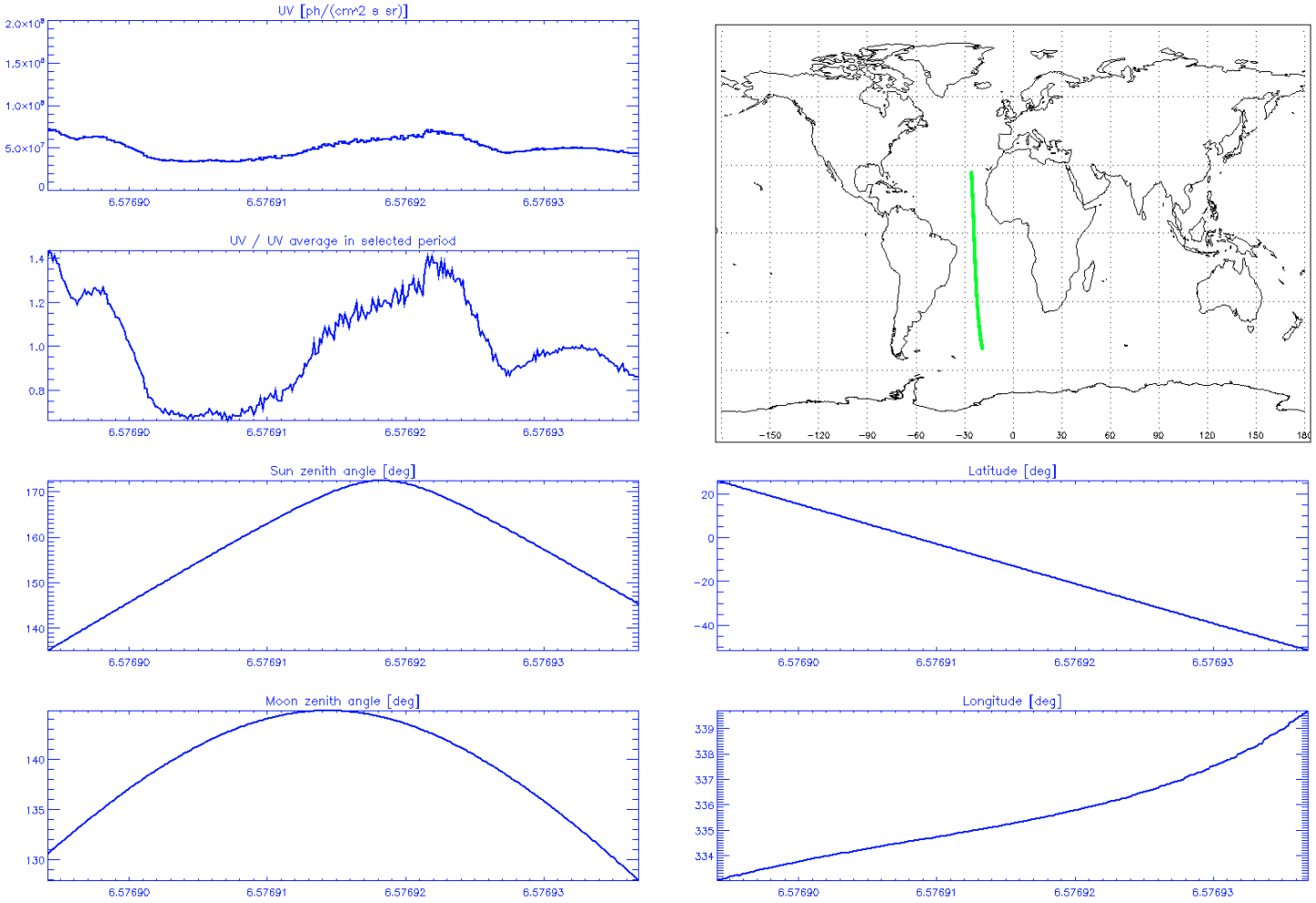
JEM-EUSO AMS and simulation meeting, Sofia, 7. - 10. October 2013

Motivation

- the systematic study of UV background is essential for the estimation of JEM-EUSO duty cycle and also for further data analysis
- In this preliminary analysis we focus partly on latitudinal dependence which is predicted by AURIC model
- Tatiana-1 data have been processed, but it does not offer sufficient data for latitudinal dependence analysis
- we handle with Tatiana-2 data and possible characteristic dependence will be shown in this presentation

Tatiana-1 data archive

Available on: http://space.saske.sk/JEM/tatiana.html (standard login & pwd)



Tatiana-2 data archive - in progress

Conditions of studied measurements:

- sun zenith angle $S_{ZA} > 132°$
- moon zenith angle $M_{ZA} > 90°$

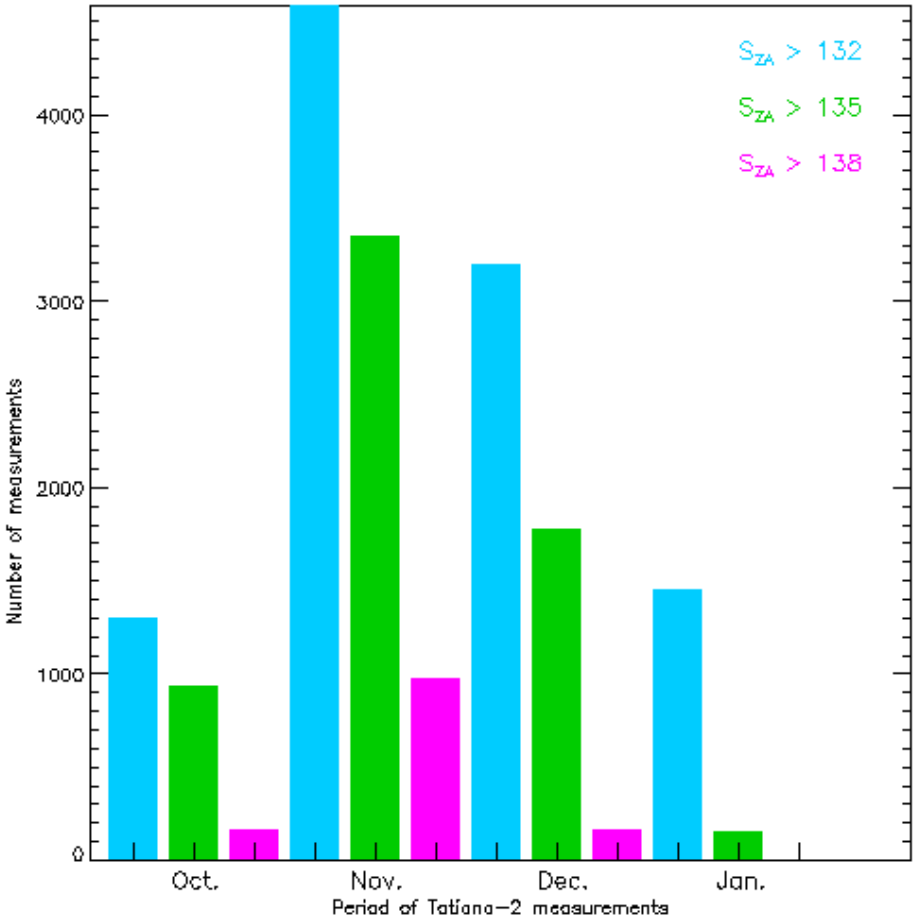
  => moon phase is not important
- satellite tracks over Atlantic and Pacific ocean
- unselected measurements of high peaks ~ TLE events

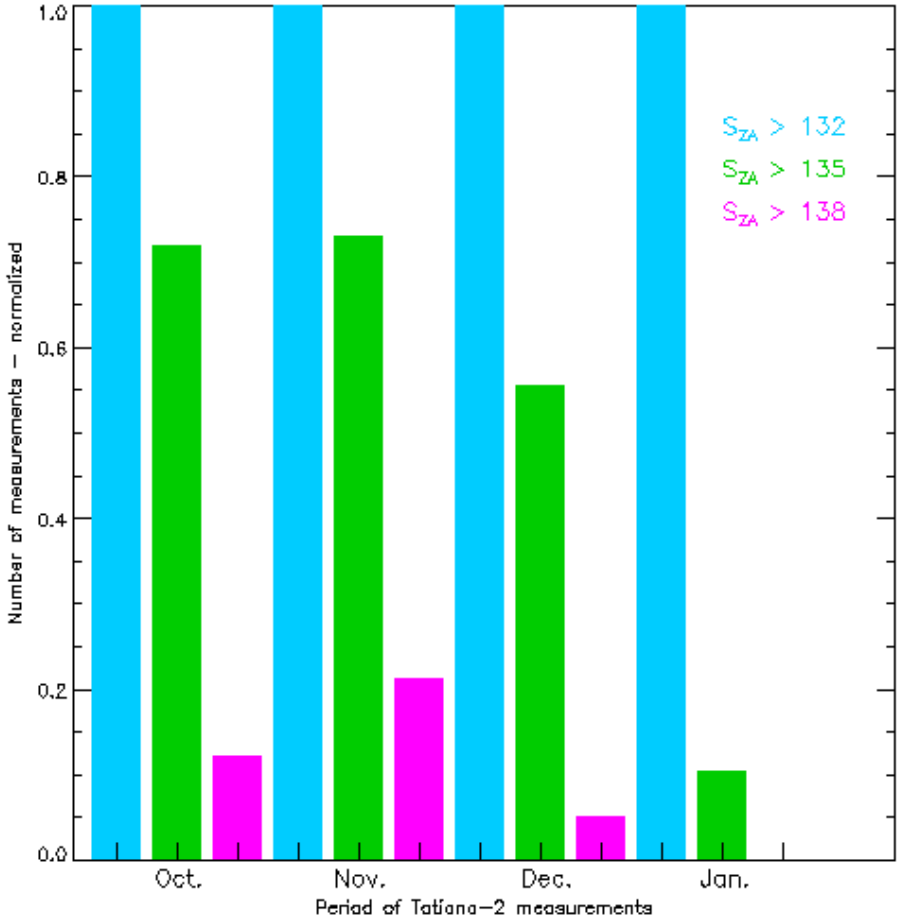
=> we try to find clear sky moonless situation -> low statistics

- index Kp < 2 for all presented data (solar minimum)

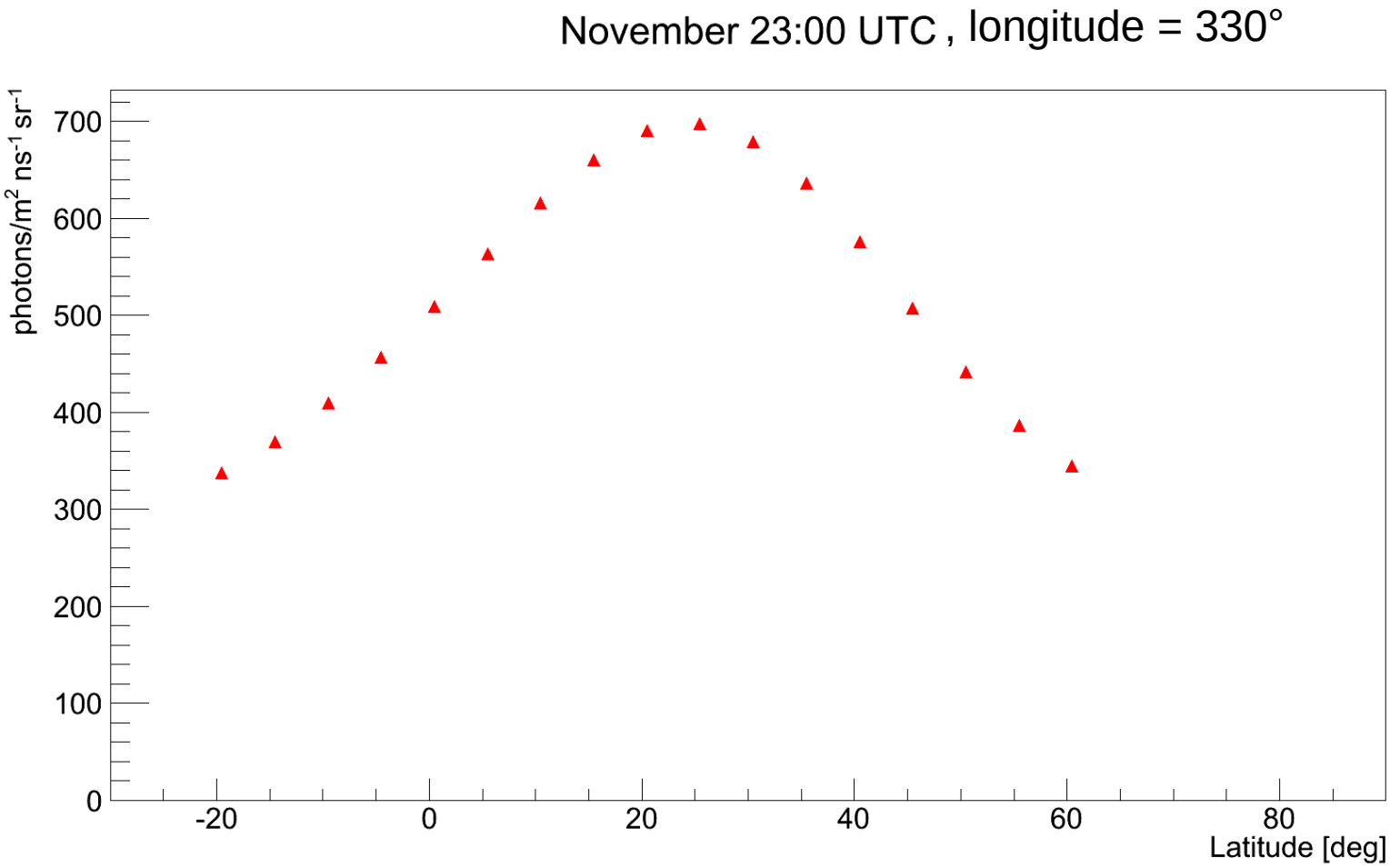
Literature: Sadovnichy et al. (2011, *SoSyR* 45, 3)
Garipov et al. (2011, arXiv:1112.0894)
Dmitriev et al. (2011, *P&SS* 59, 733)

Tatiana-2: night measurements - statistics

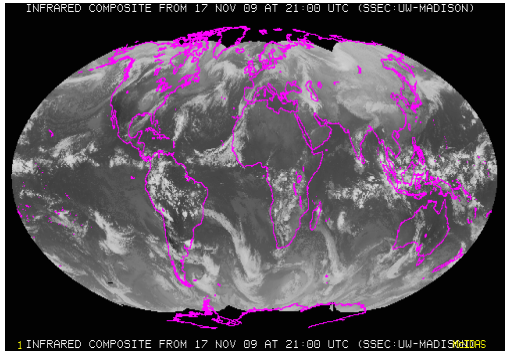


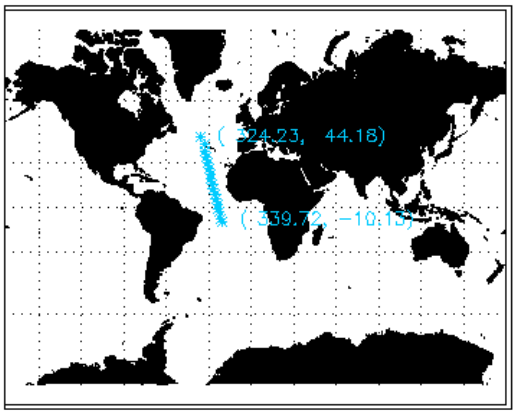


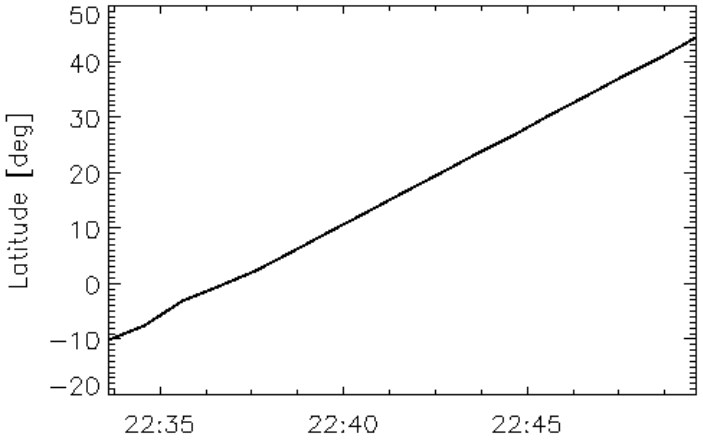
Prediction by AURIC

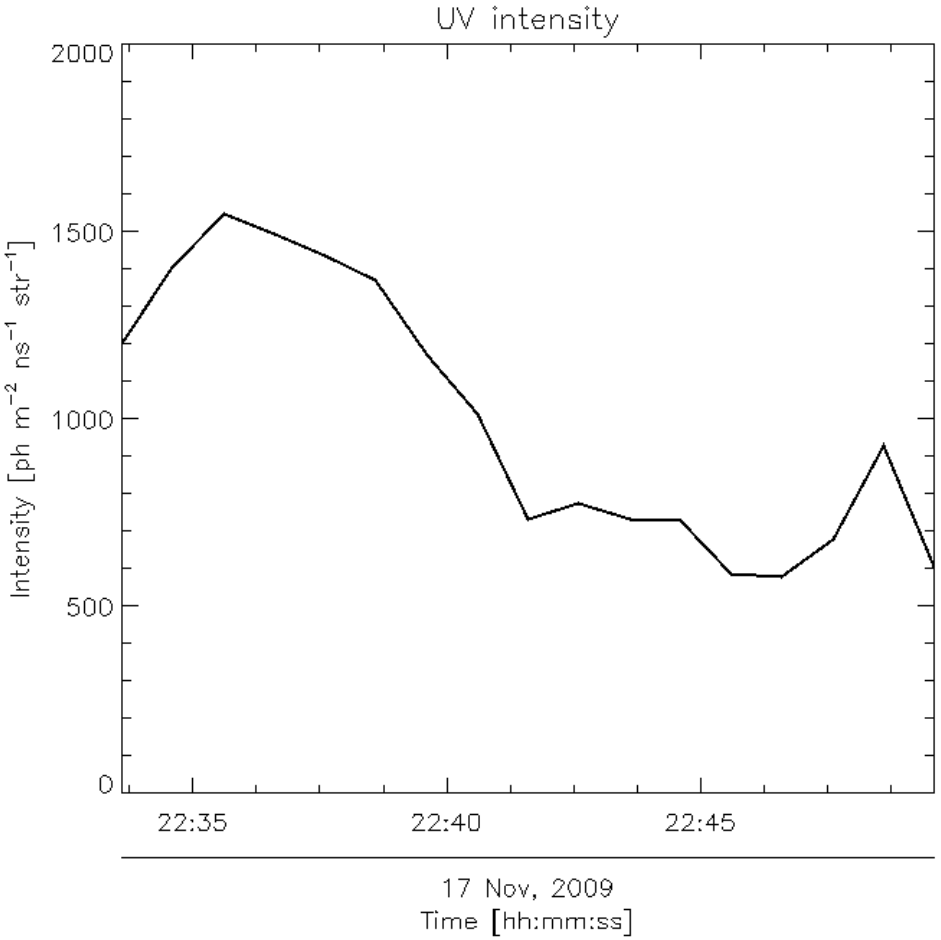


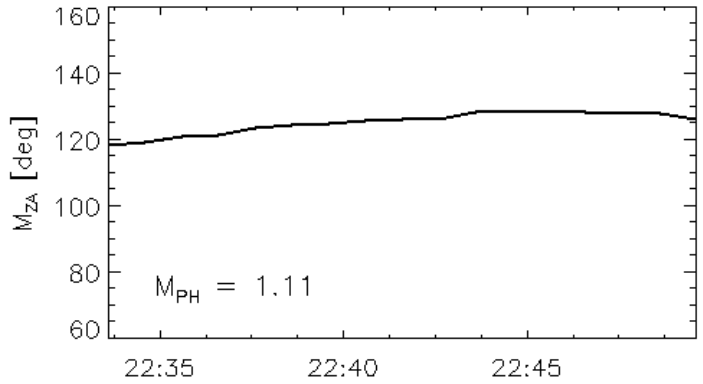
AURIC analysis report: http://goo.gl/ASIjG5

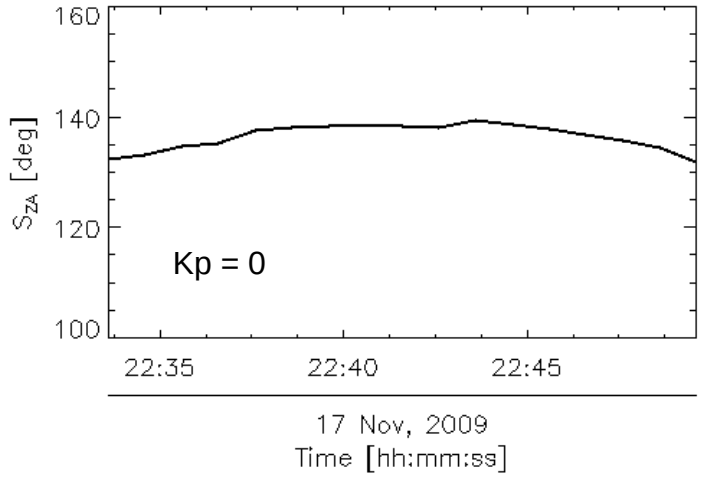

INFRARED COMPOSITE FROM 17 NOV 09 AT 21:00 UTC (SSEC:UW-MADISON)
1 INFRARED COMPOSITE FROM 17 NOV 09 AT 21:00 UTC (SSEC:UW-MADISON)

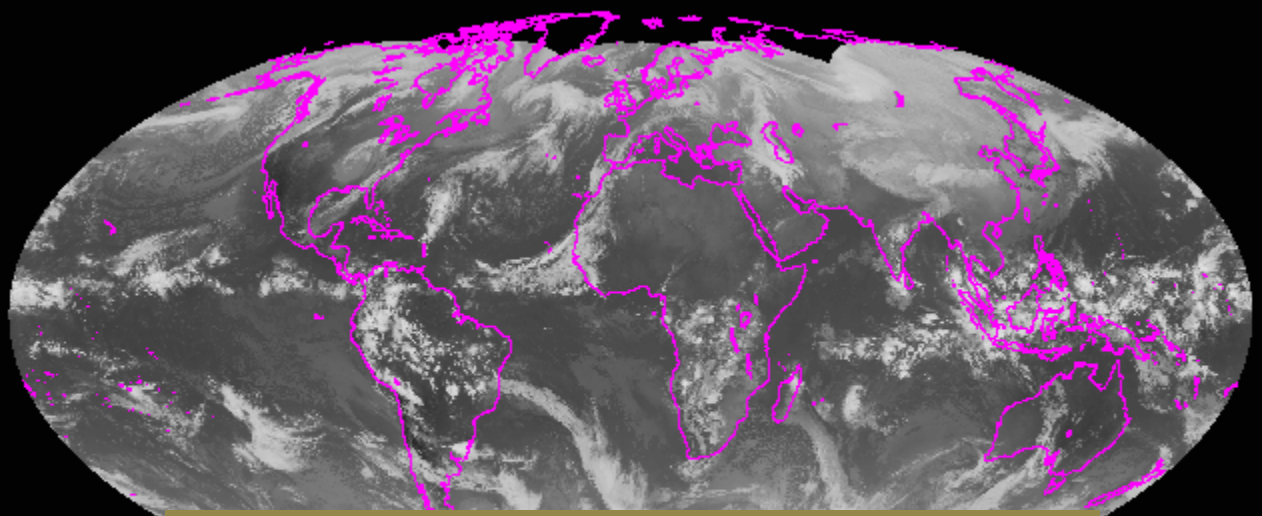

Tatiana 2 (longitude, latitude)
(324.23, 44.18)
(339.72, −10.15)


Latitude [deg]
50
40
30
20
10
0
−10
−20
22:35
22:40
22:45

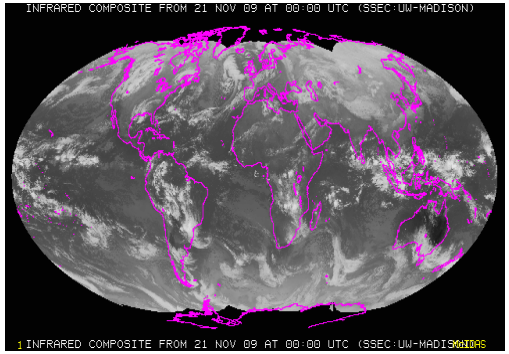

UV intensity
Intensity [ph m^{-2} ns^{-1} str^{-1}]
2000
1500
1000
500
0
22:35
22:40
22:45
17 Nov, 2009
Time [hh:mm:ss]

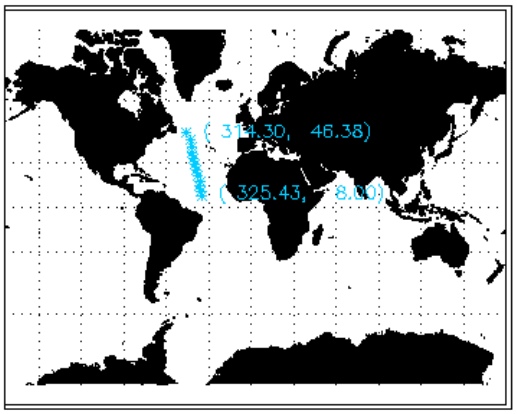

M_{ZA} [deg]
160
140
120
100
80
60
M_{PH} = 1.11
22:35
22:40
22:45

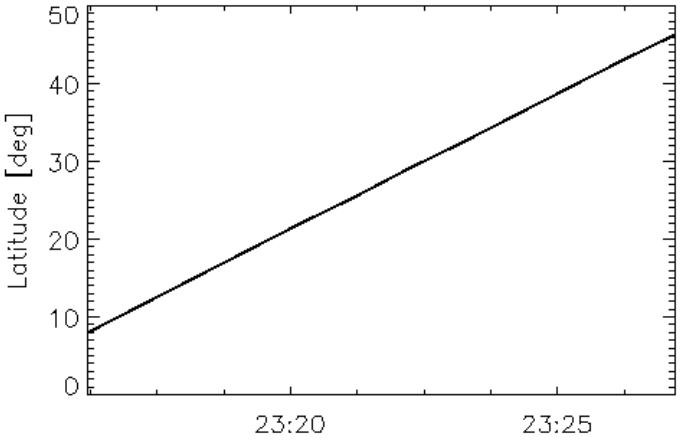

S_{ZA} [deg]
160
140
120
100
Kp = 0
22:35
22:40
22:45
17 Nov, 2009
Time [hh:mm:ss]

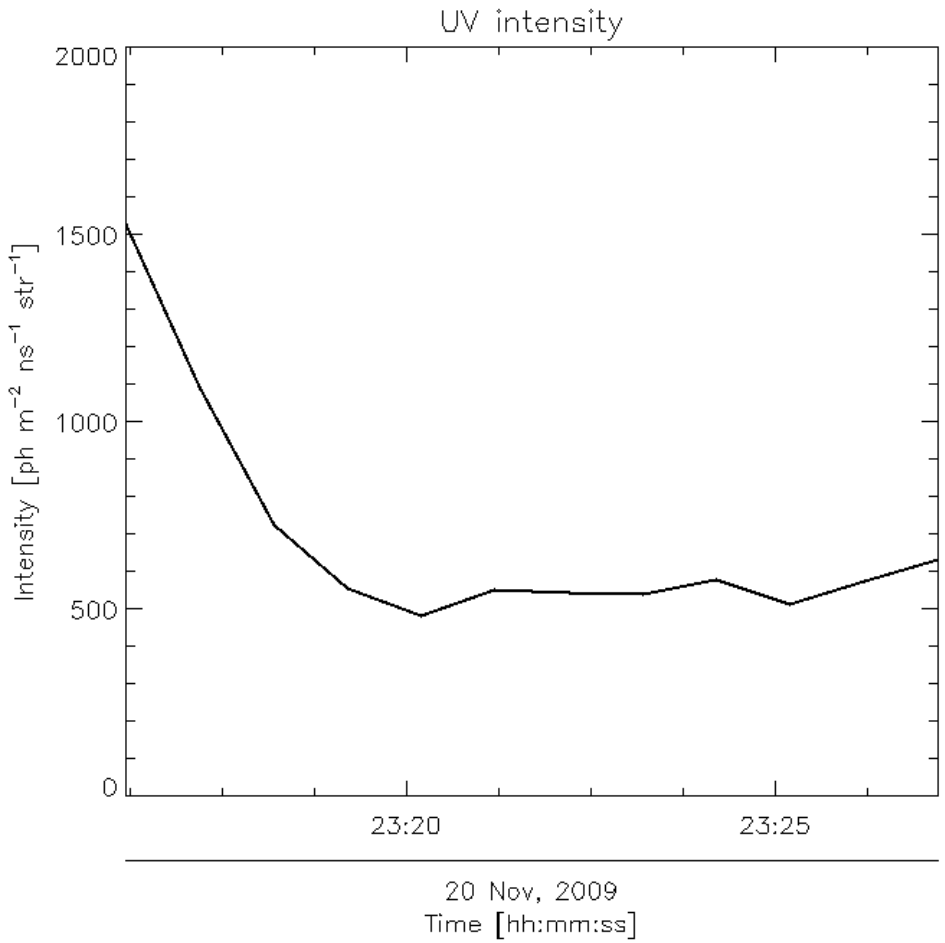

INFRARED COMPOSITE FROM 17 NOV 09 AT 21:00 UTC (SSEC:UW-MADISON)
http://www.ssec.wisc.edu/data/comp/ir/

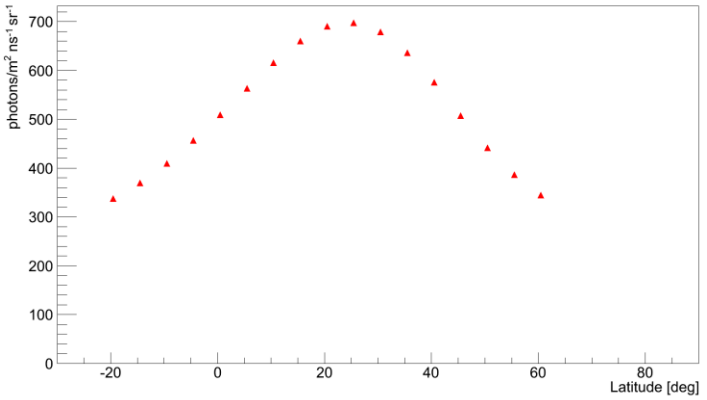

1 INFRARED COMPOSITE FROM 17 NOV 09 AT 21:00 UTC (SSEC:UW-MADISON)
MIDAS
http://www.wunderground.com/wundermap/?sat=1

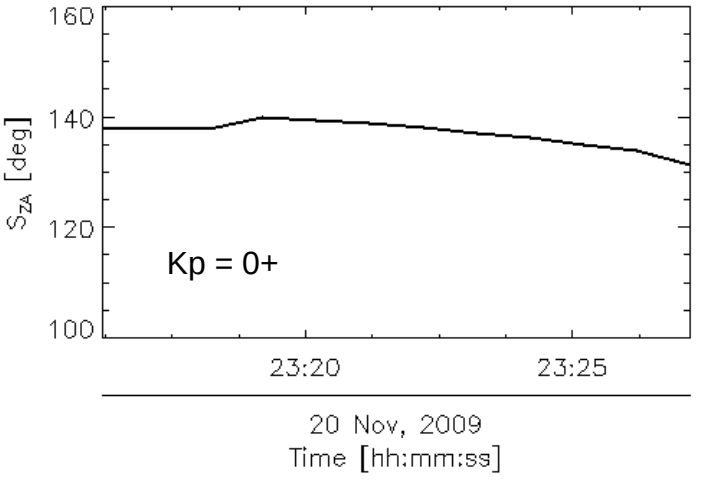

INFRARED COMPOSITE FROM 21 NOV 09 AT 00:00 UTC (SSEC:UW-MADISON)
1 INFRARED COMPOSITE FROM 21 NOV 09 AT 00:00 UTC (SSEC:UW-MADISON)

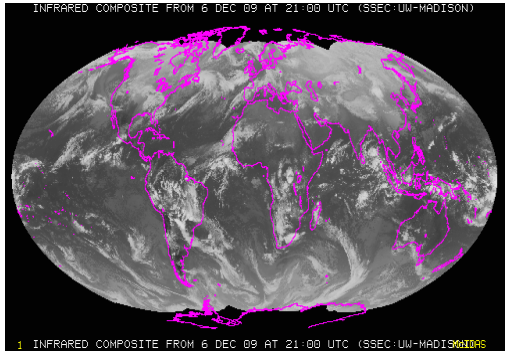

Tatiana 2 (longitude, latitude)
(314.30, 46.38)
(325.43, -8.00)


Latitude [deg]
50
40
30
20
10
0
23:20
23:25

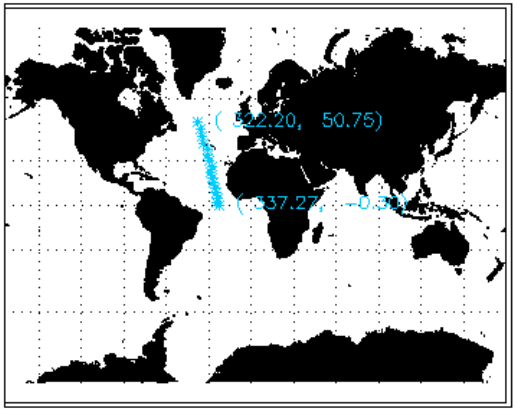

UV intensity
Intensity [ph m^{-2} ns^{-1} str^{-1}]
2000
1500
1000
500
0
23:20
23:25
20 Nov, 2009
Time [hh:mm:ss]

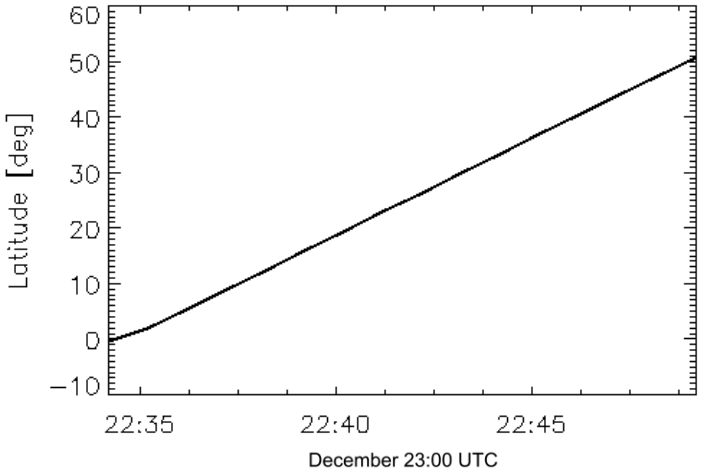

November 23:00 UTC
photons/m^2 ns^{-1} sr^{-1}
700
600
500
400
300
200
100
0
-20
0
20
40
60
80
Latitude [deg]


S_{ZA} [deg]
160
140
120
100
Kp = 0+
23:20
23:25
20 Nov, 2009
Time [hh:mm:ss]

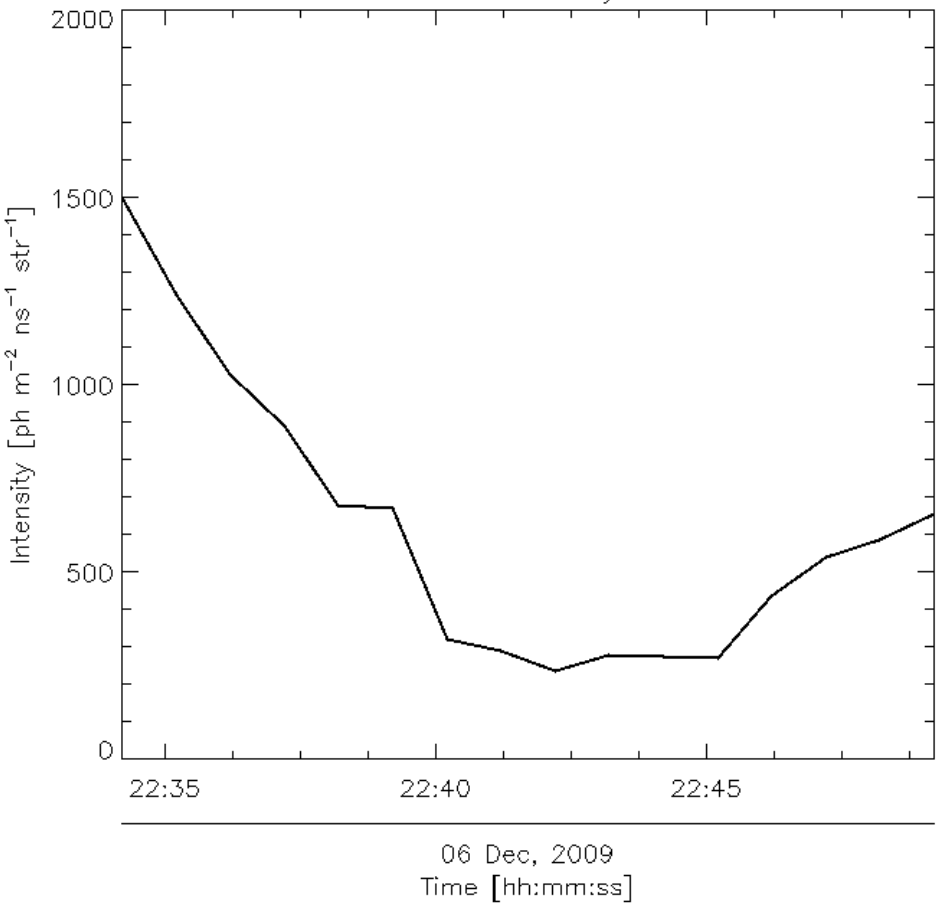


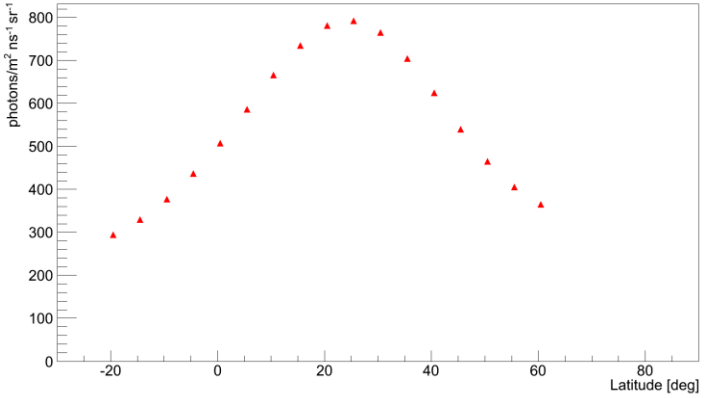
Tatiana 2 (longitude, latitude)

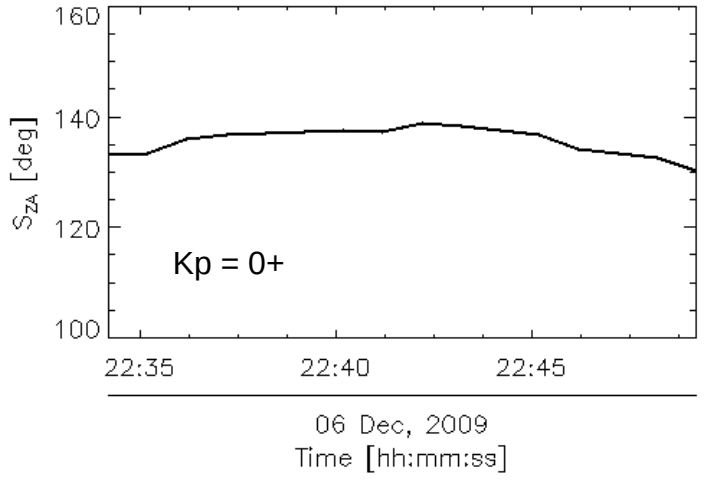


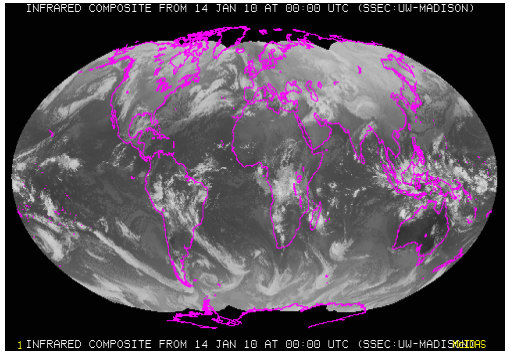


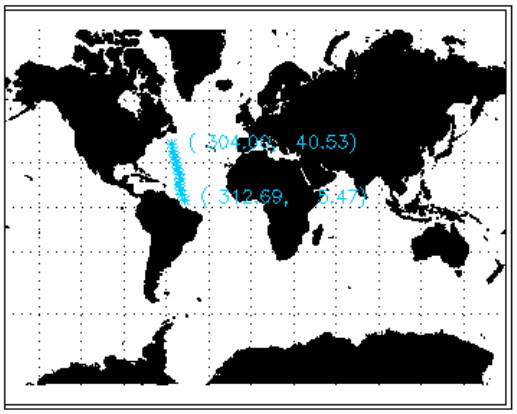
UV intensity

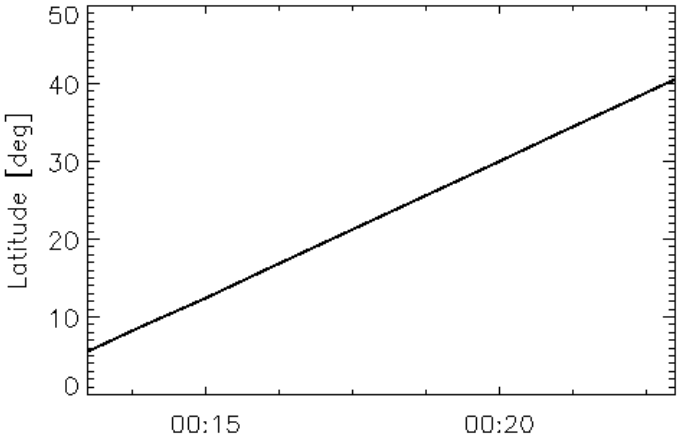




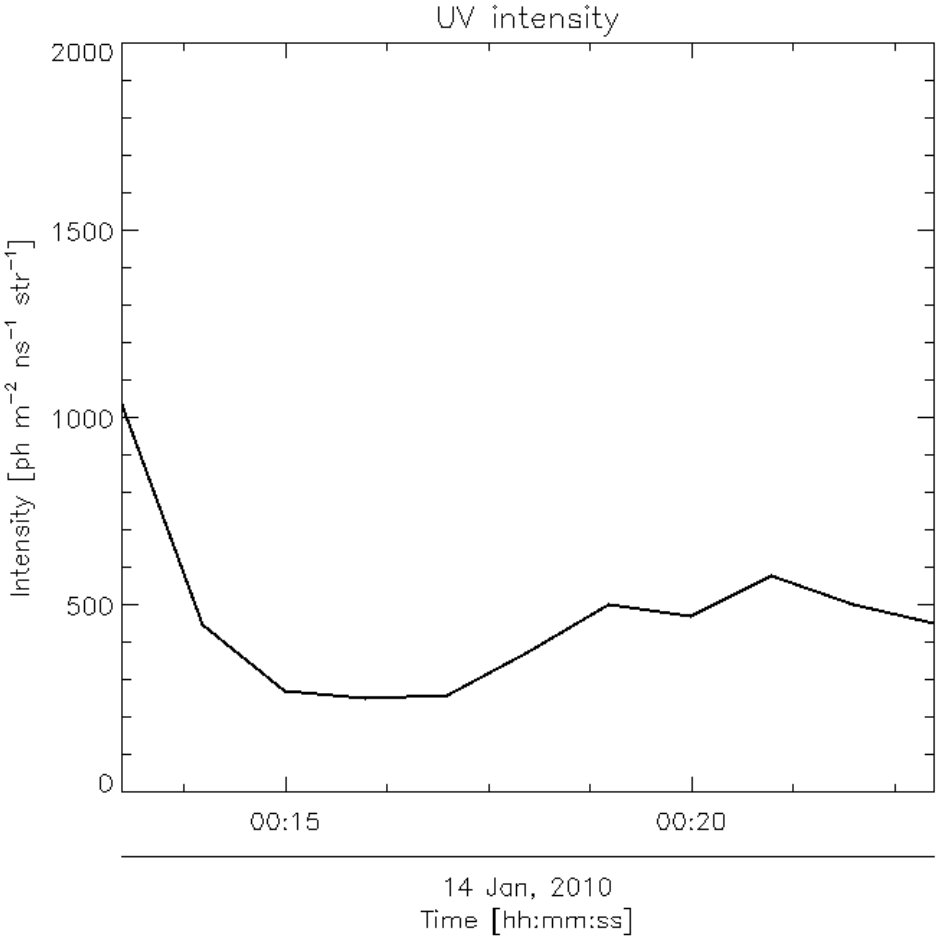


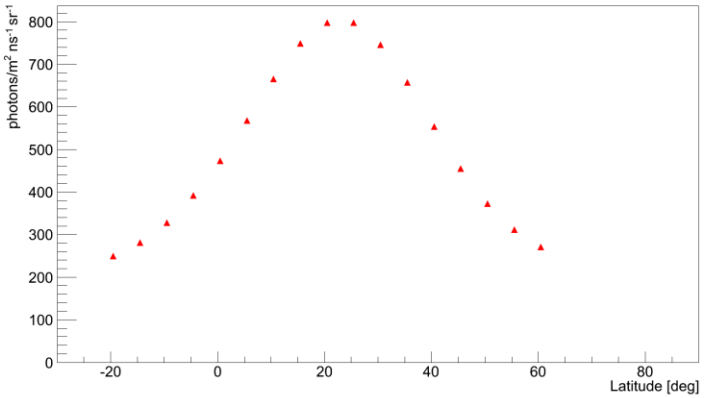


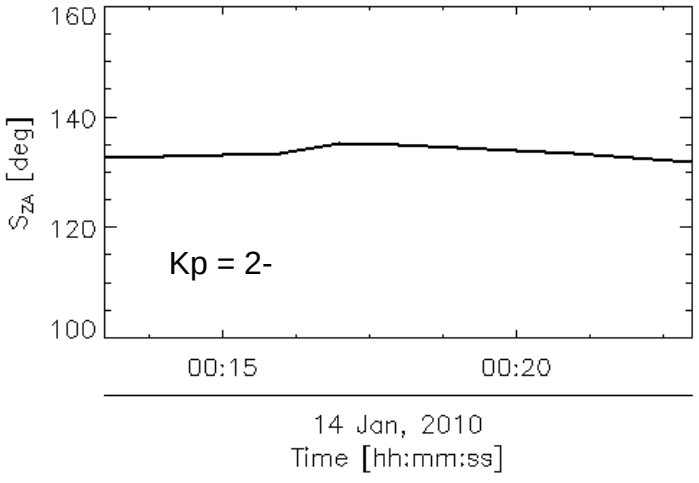


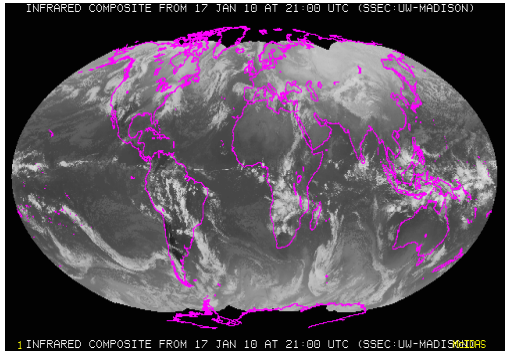


Longitude 315, 1987-01-14, 00:00 UTC

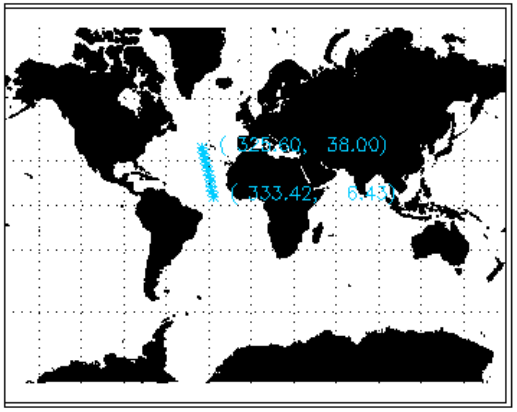


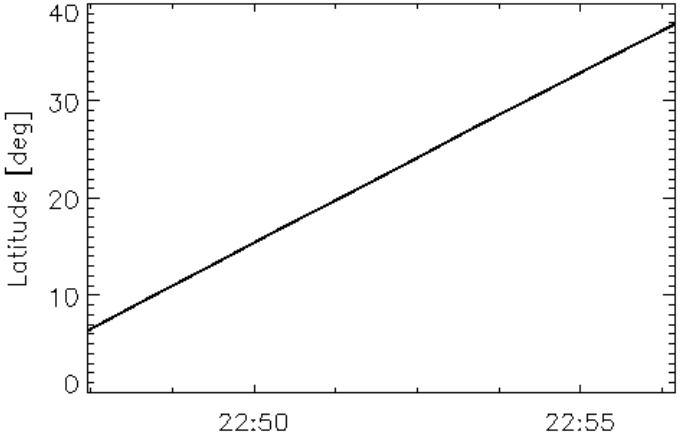




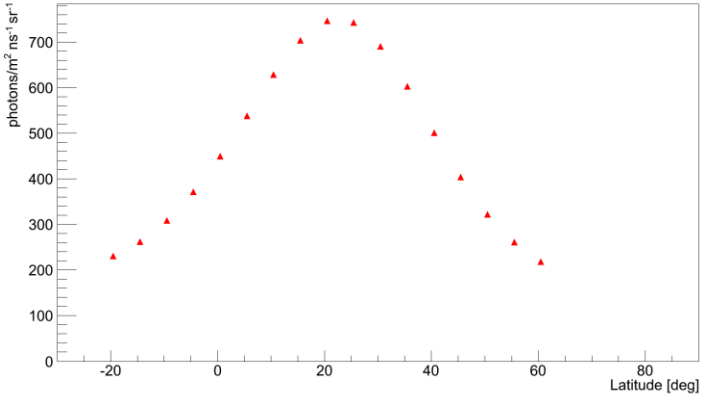


Tatiana 2 (longitude, latitude)

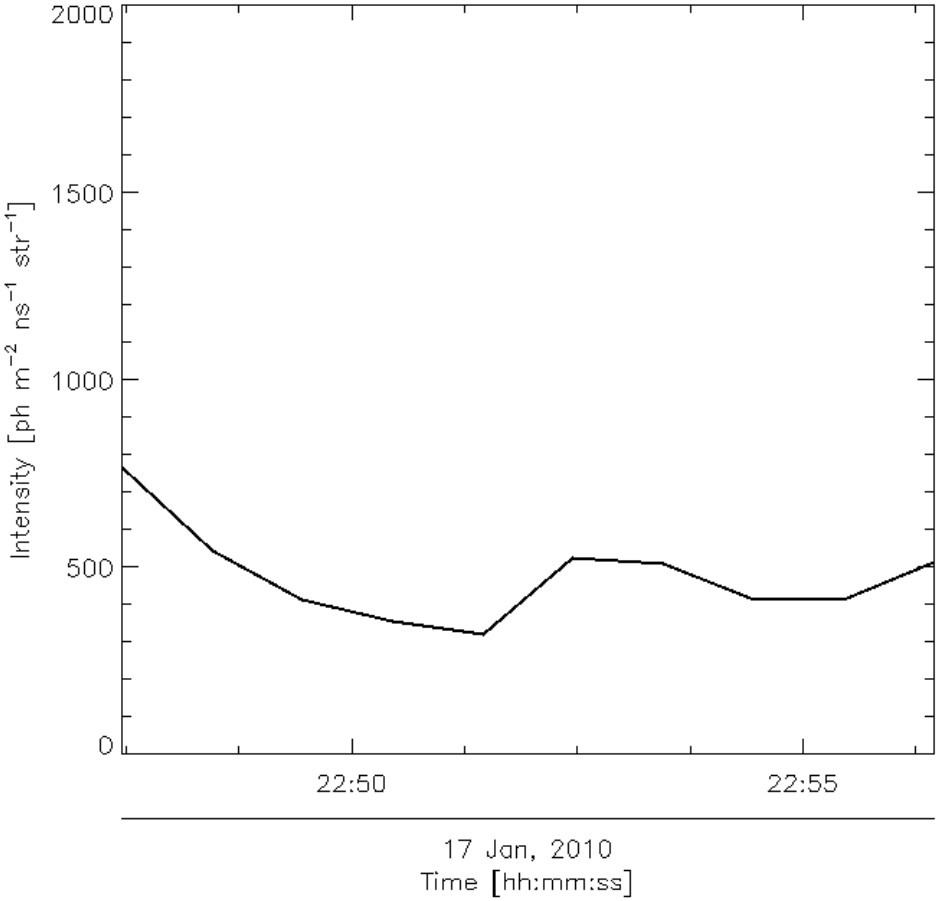


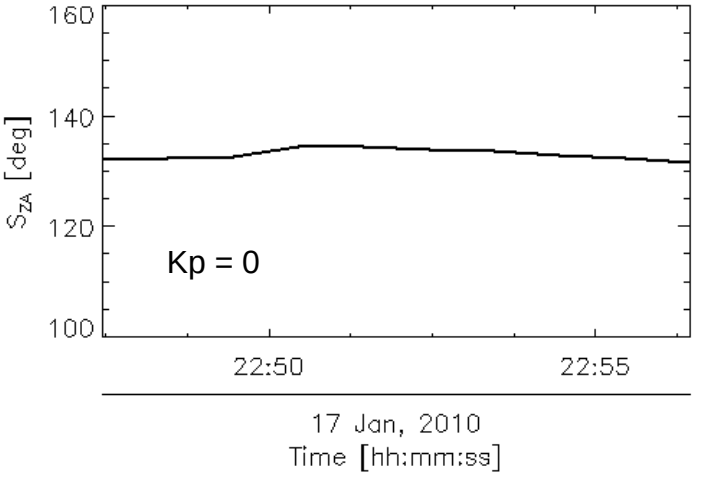


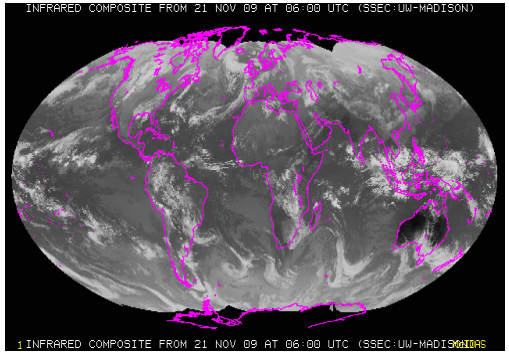
January 23:00 UTC



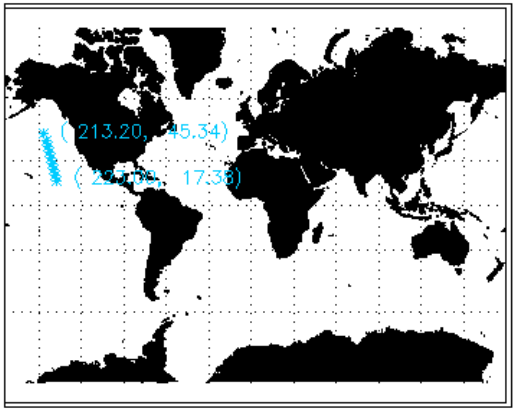
UV intensity

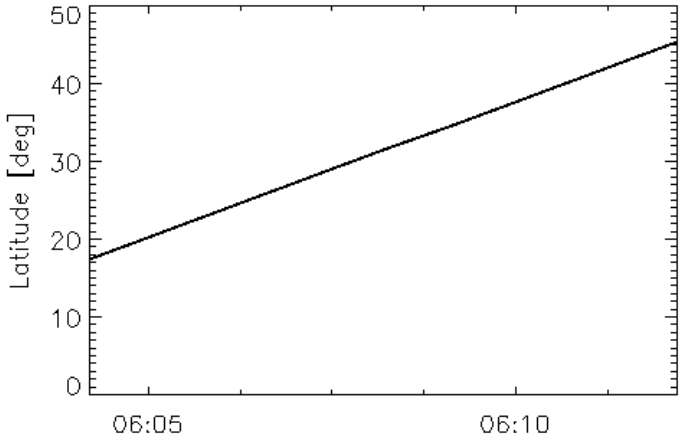




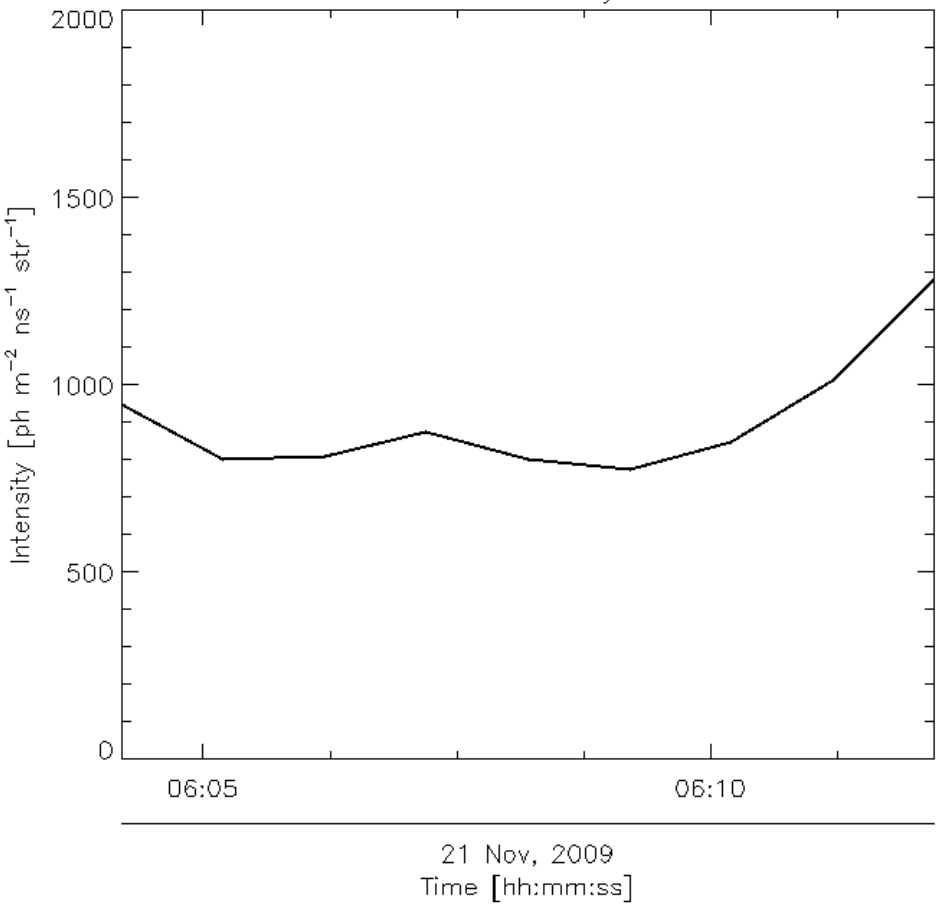


Tatiana 2 (longitude, latitude)

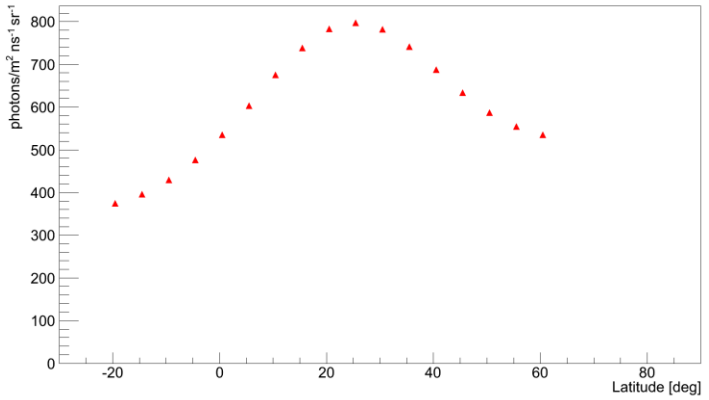


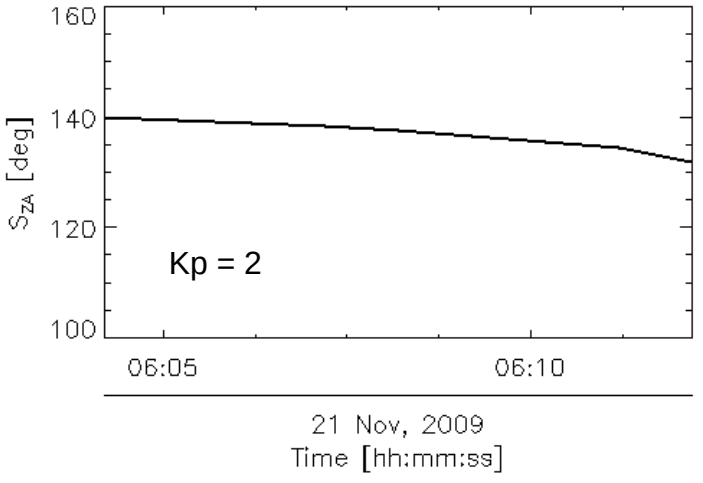


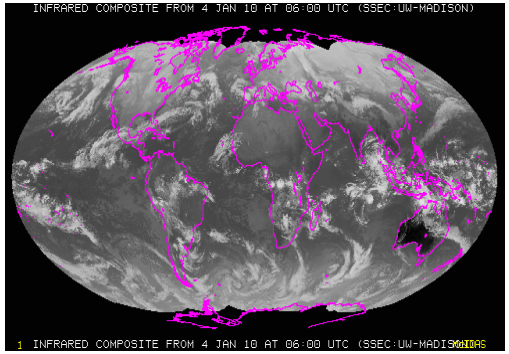
UV intensity



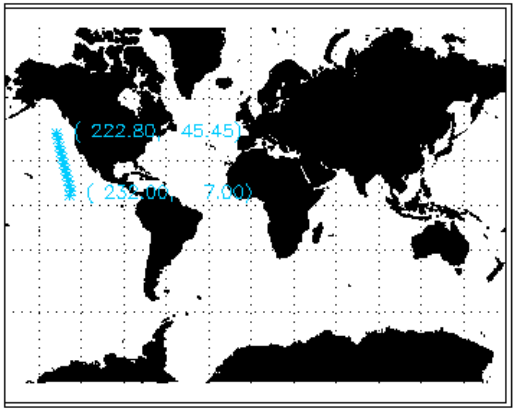
Longitude 225, 1986-11-21, 06:00 UTC

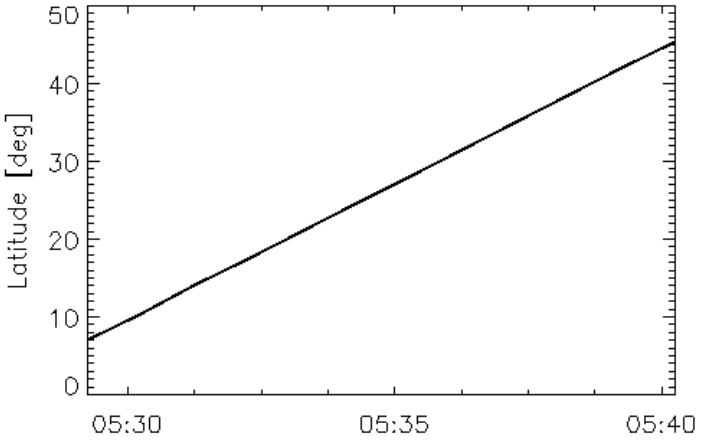




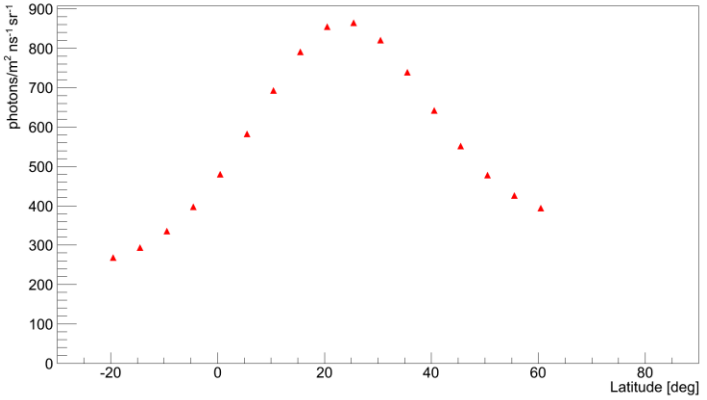


Tatiana 2 (longitude, latitude)

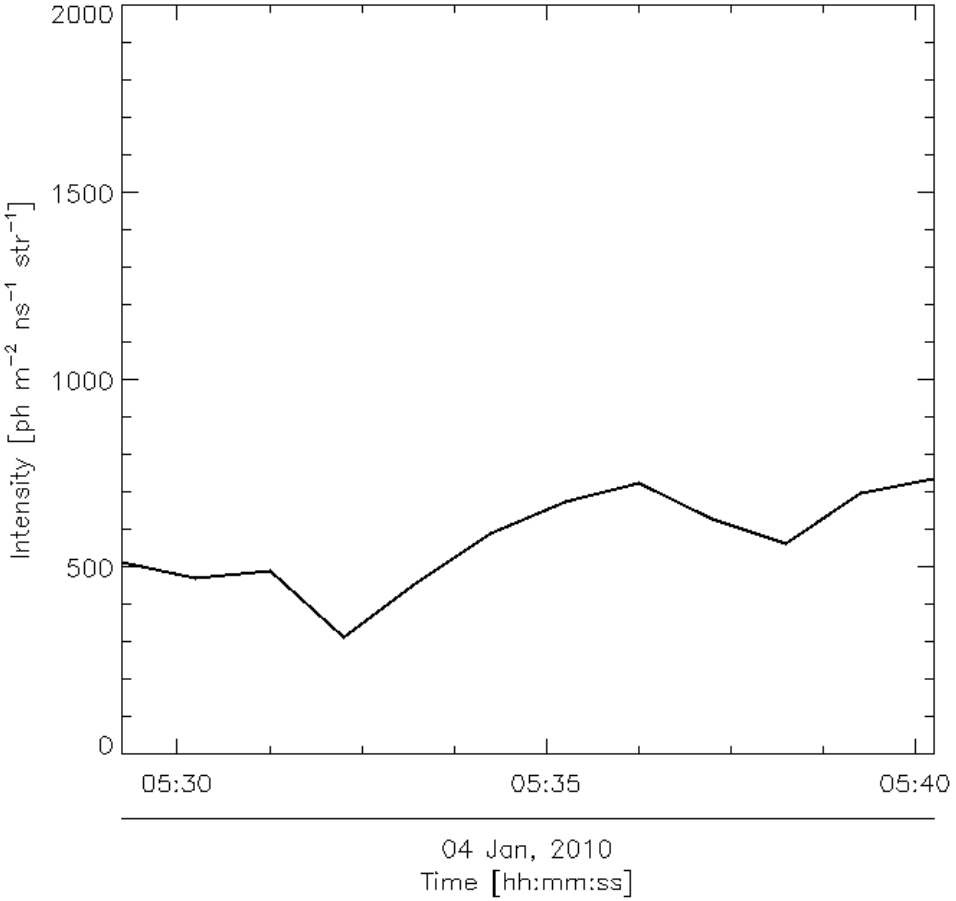


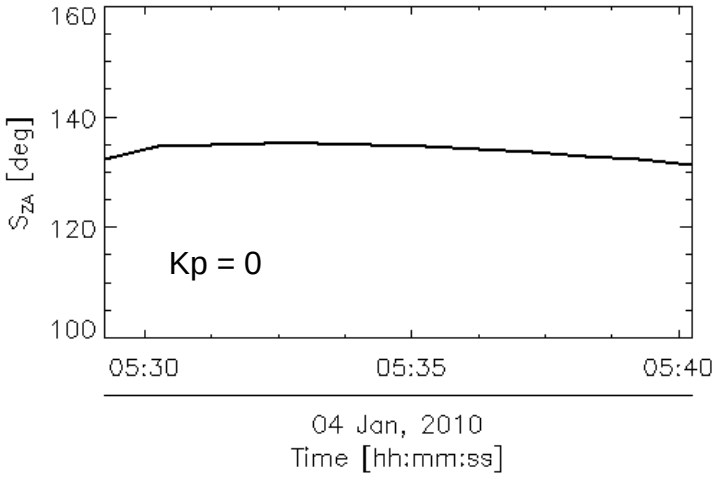


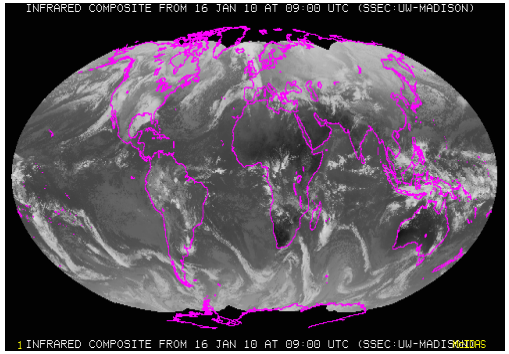
Longitude 225, 1987-01-04, 06:00 UTC



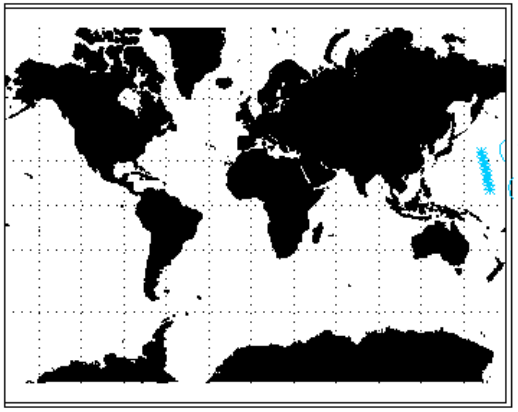
UV intensity

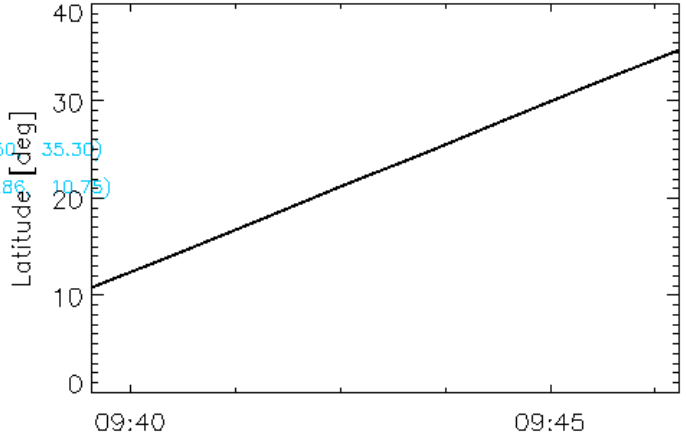




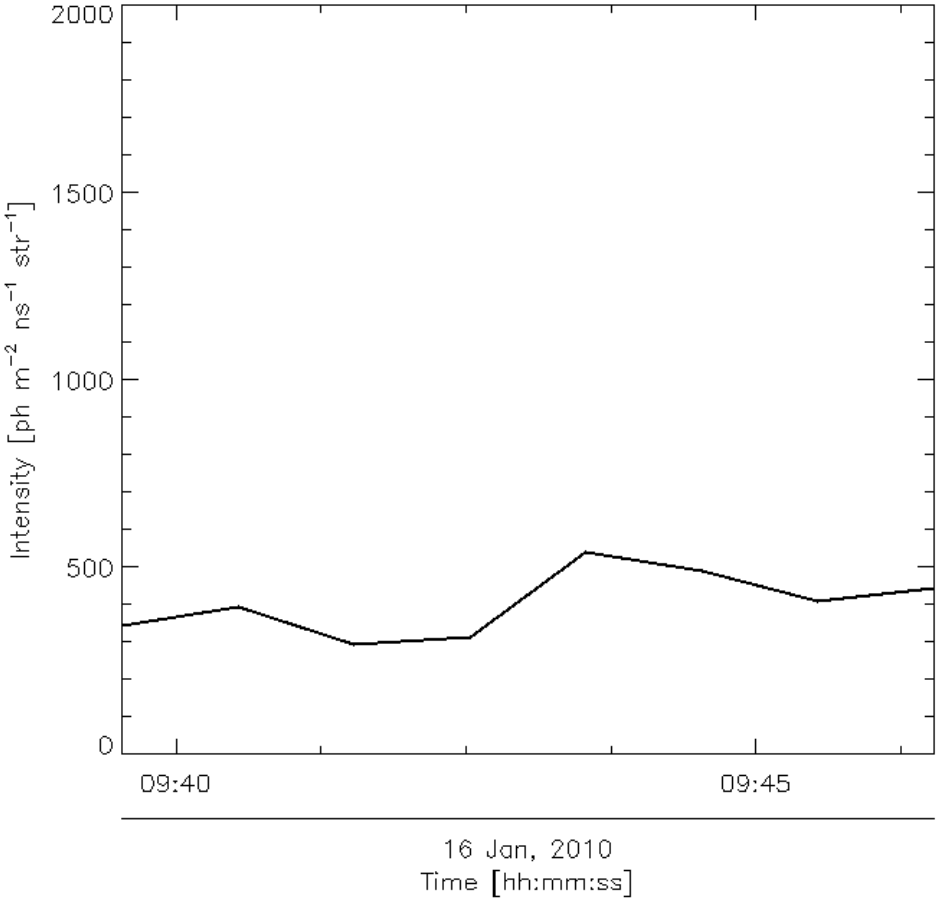


Tatiana 2 (longitude, latitude)

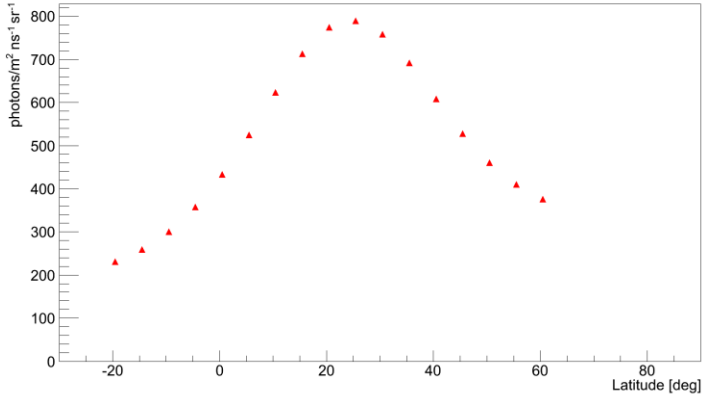


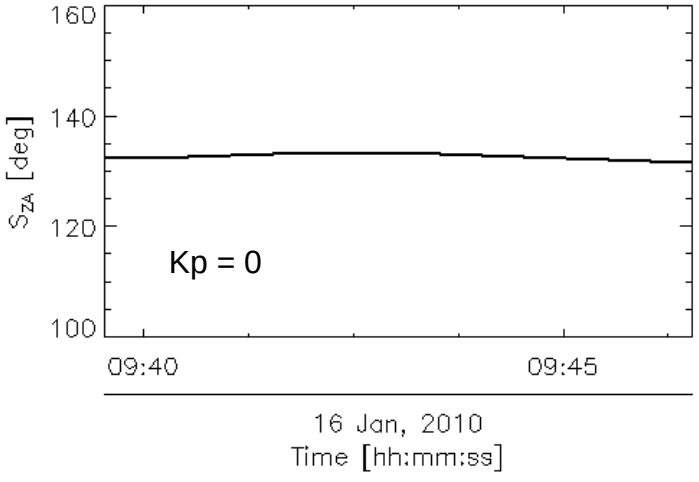


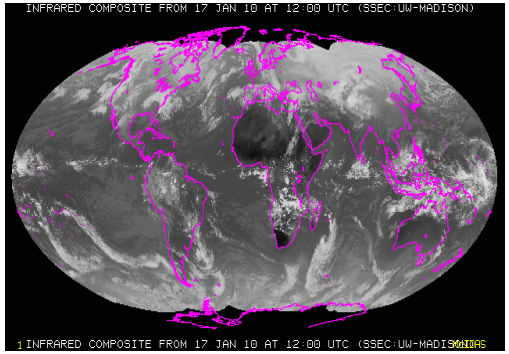
UV intensity

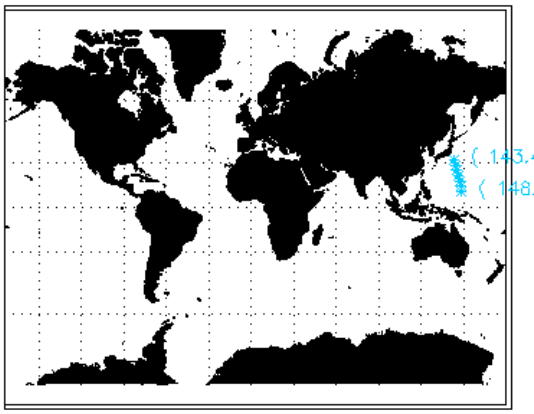


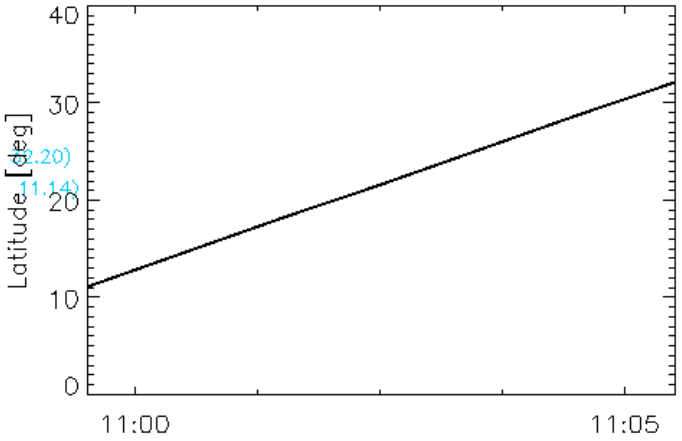
Longitude 165, 1987-01-16, 10:00 UTC

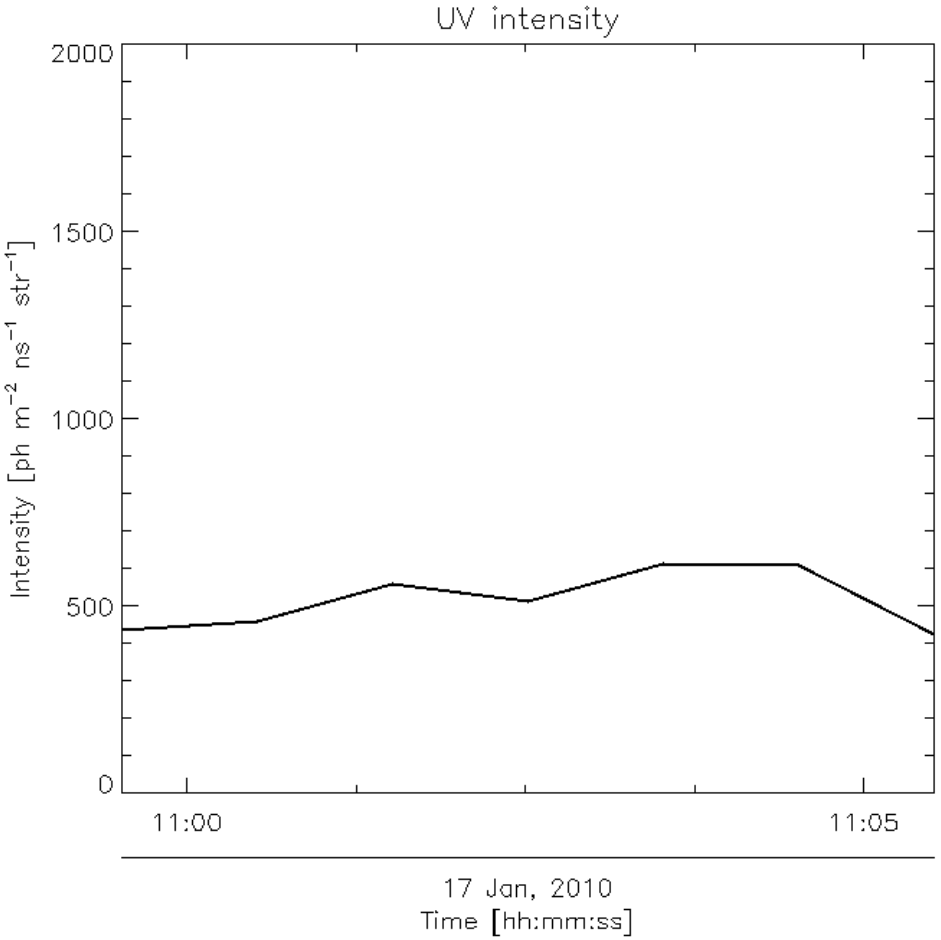


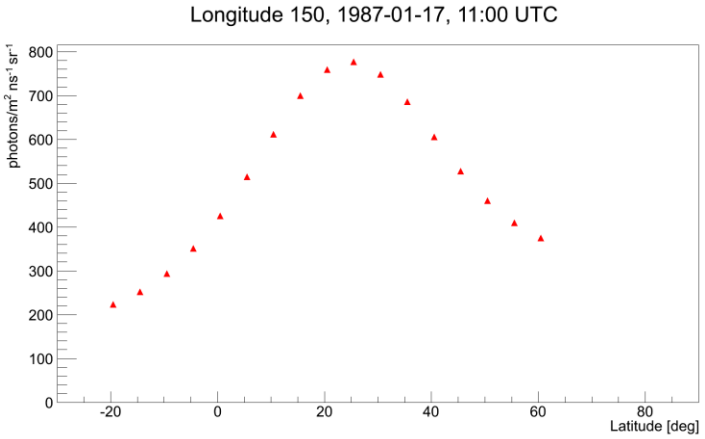


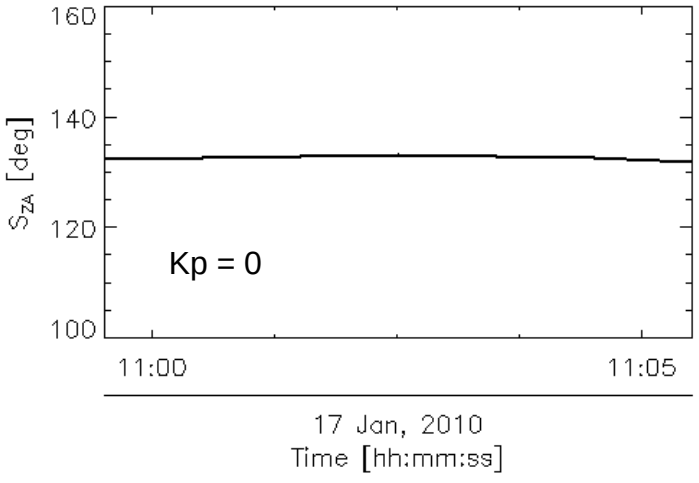

INFRARED COMPOSITE FROM 17 JAN 10 AT 12:00 UTC (SSEC:UW-MADISON)
1 INFRARED COMPOSITE FROM 17 JAN 10 AT 12:00 UTC (SSEC:UW-MADIS


Tatiana 2 (longitude, latitude)
(143.47,
(148.81,


Latitude [deg]
11:00
11:05


UV intensity
Intensity [ph m^{-2} ns^{-1} str^{-1}]
11:00
11:05
17 Jan, 2010
Time [hh:mm:ss]


Longitude 150, 1987-01-17, 11:00 UTC
photons/m^2 ns^{-1} sr^{-1}
Latitude [deg]

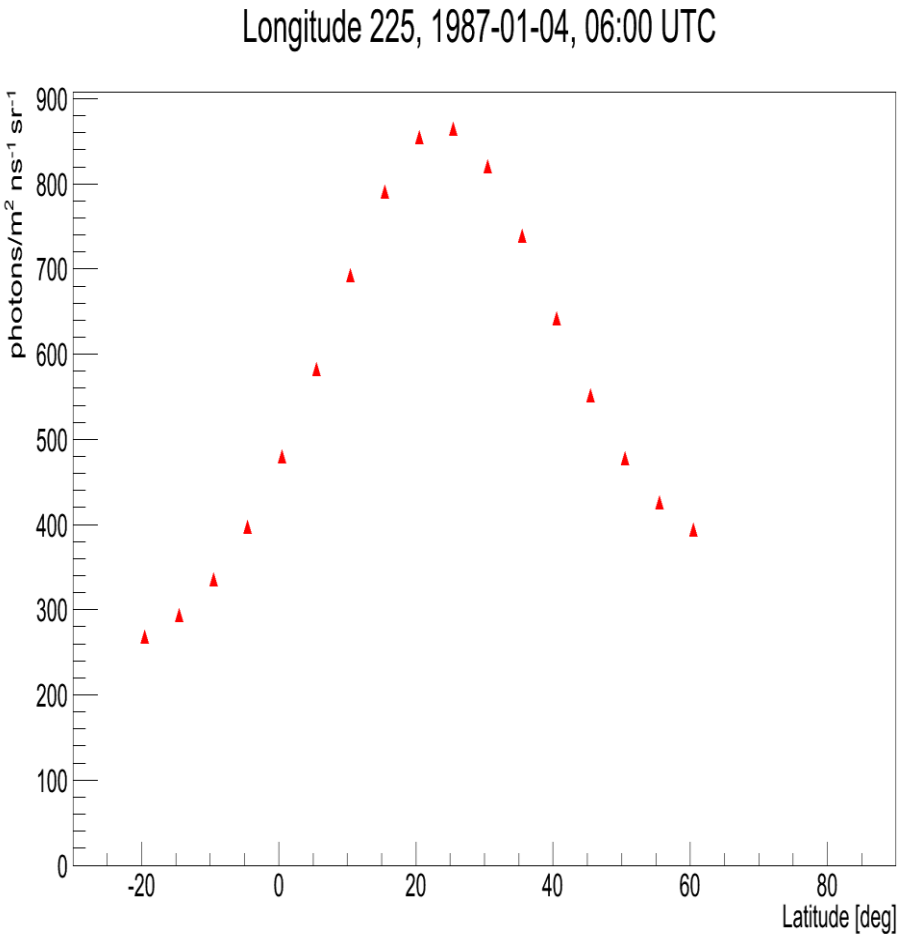

S_{ZA} [deg]
Kp = 0
11:00
11:05
17 Jan, 2010
Time [hh:mm:ss]

ISUAL

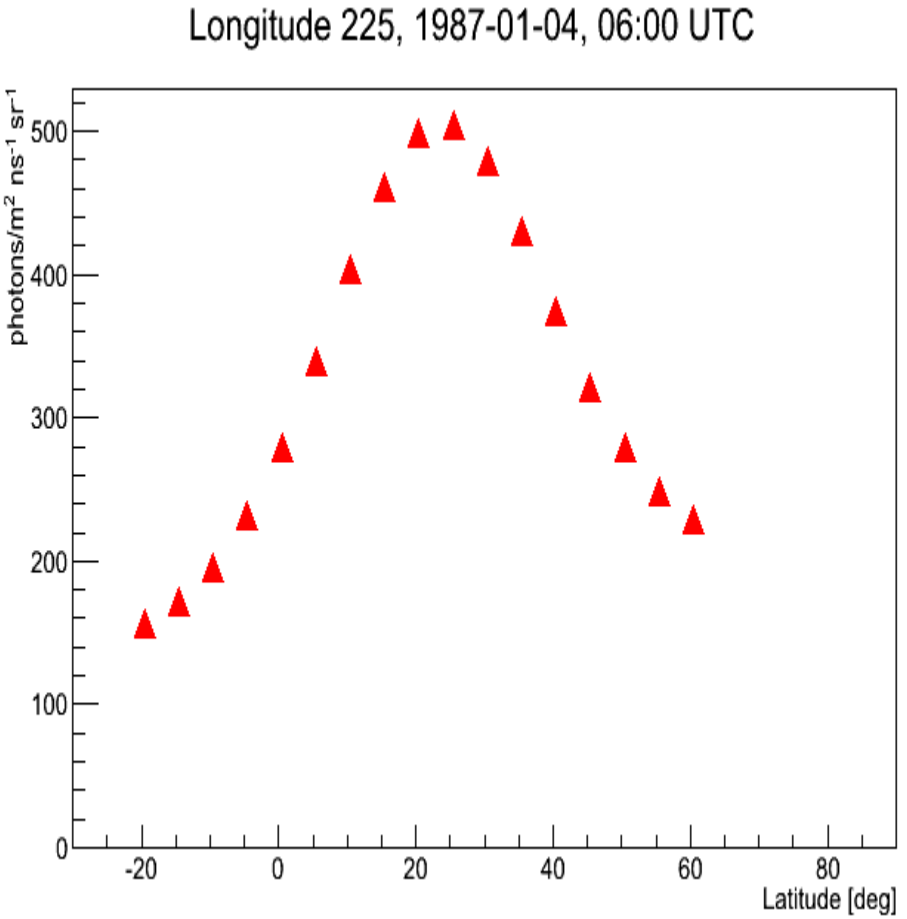
- Imager of Sprites and Upper Atmospheric Lightning
- Onboard Formosat-2 - satellite from Taiwan
- One of mission objective: To investigate the global distribution of the airglow intensity as a function of altitude
- Spectrophotometer with broadband UV filter 250-390 nm
- Aurora and airglow operation mode
- Available data since 06/2004 – now
- High statistical opportunity

- http://sprite.phys.ncku.edu.tw/En/Eindex.html
- Chern et al. (2003), Chen et al. (2008), Rejesh et al. (2009), Adachi et al. (2010), …

AURIC model needs accurate parameters



Oxygen density scale factor is **1**



Oxygen density scale factor is **0.75**

Conclusions & Future work

- archive of Tatiana-2 measurements was established
- interpretation of the UV BG sources is in progress
- first preliminary analysis of Tatiana 2 data do not show clear pattern (characteristic latitudinal dependence) – the result will be concluded latter
- Tatiana-2 data offer low statistics -> using of ISUAL data is ongoing
- accurate data (from JEM-EUSO precursor missions) are really welcomed

Acknowledgements

Authors are grateful to Tatiana 2 team from D.V. Skobeltsyn Institute of Nuclear Physics of M.V. Lomonosov Moscow State University for UV data.