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Trapped proton fluxes observed by LEO satellites in 23d solar cycle

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Coronas-F 8 2001-5 2005

Orbit 500 km 82.5 deg
(2004-400 km)

Proton energy channels

1-5 MeV
14-26 MeV
26-50 MeV
50-90 MeV

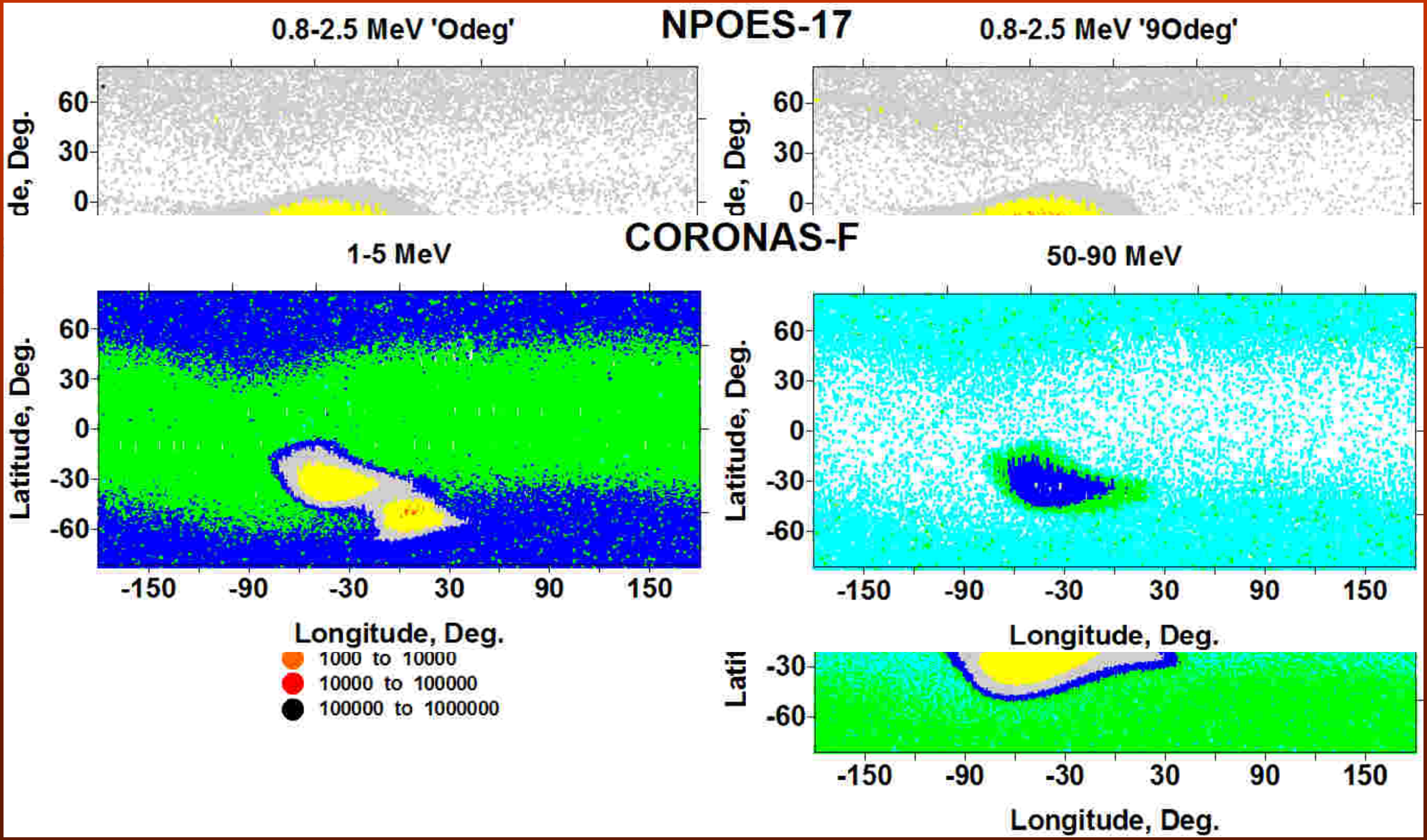
NPOES-15 07.1998
NPOES-17 07.2002

Orbit 820 km, 98 deg

Proton energy channels

'0deg detector'	'90deg detector'	
30-80 keV	30-80 keV	16-35 MeV
80-240 keV	80-240 keV	35-70 MeV
240-800 keV	240-800 keV	70-140 MeV
0.8-2.5 MeV	0.8-2.5 MeV	>140 MeV
2.5-6.9 MeV	2.5-6.9 MeV	
>6.9 MeV	>6.9 MeV	

Geographical position



Data Analysis Procedure

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In order to compare the trapped proton fluxes measured during the 23d solar cycle with the AP8 model data the directional flux of trapped protons with energy 0.8-2.5 MeV was recalculated to omnidirectional flux $\Phi_L(\alpha_0)$ using formula:

$$\Phi_L(\alpha_0)/4\pi = \int_0^{\pi/2} F_L(\alpha_0)\sin\alpha_0 d\alpha_0$$

where $F_L(\alpha_0)$ is the pitch-angular α_0 ($\sin\alpha_0 = (B0/B)^{1/2}$) dependence. Omnidirectional flux for the detectors with wide field of view (70-140 MeV) was calculated by multiplying $F_L(B/B0)$ by 4π.

Trapped proton fluxes
(energies from 80 keV to 6.9 MeV
and >6.9 MeV) observed by NPOES-17 in April 2005
depending on the L-shell compared with the AP8 model prediction (green dots)

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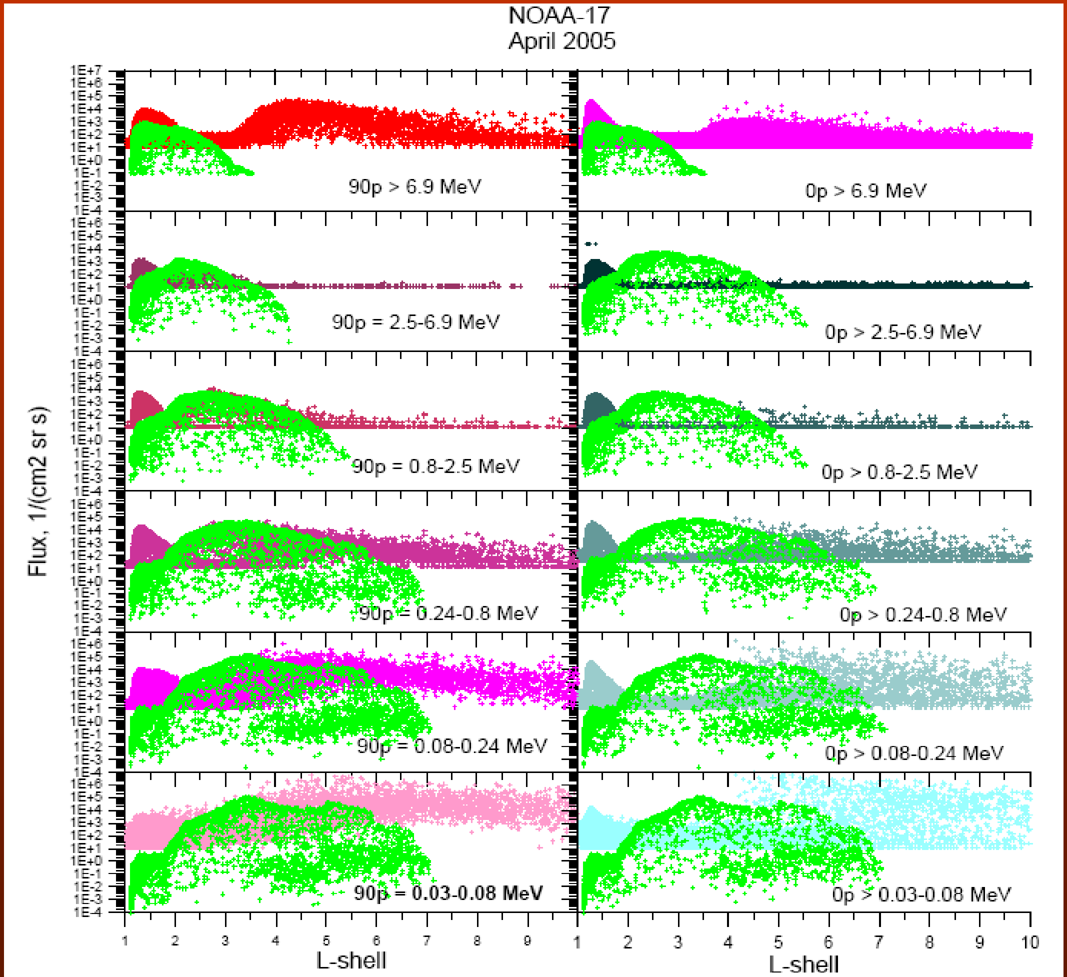

Trapped proton fluxes
(energies from 35-140 MeV
NPOES-17; 14-90 MeV Coronas-F) observed in April 2005 depending on the L-shell compared with the AP8 model prediction (green dots for NPOES 16 and blue for Coronas-F)

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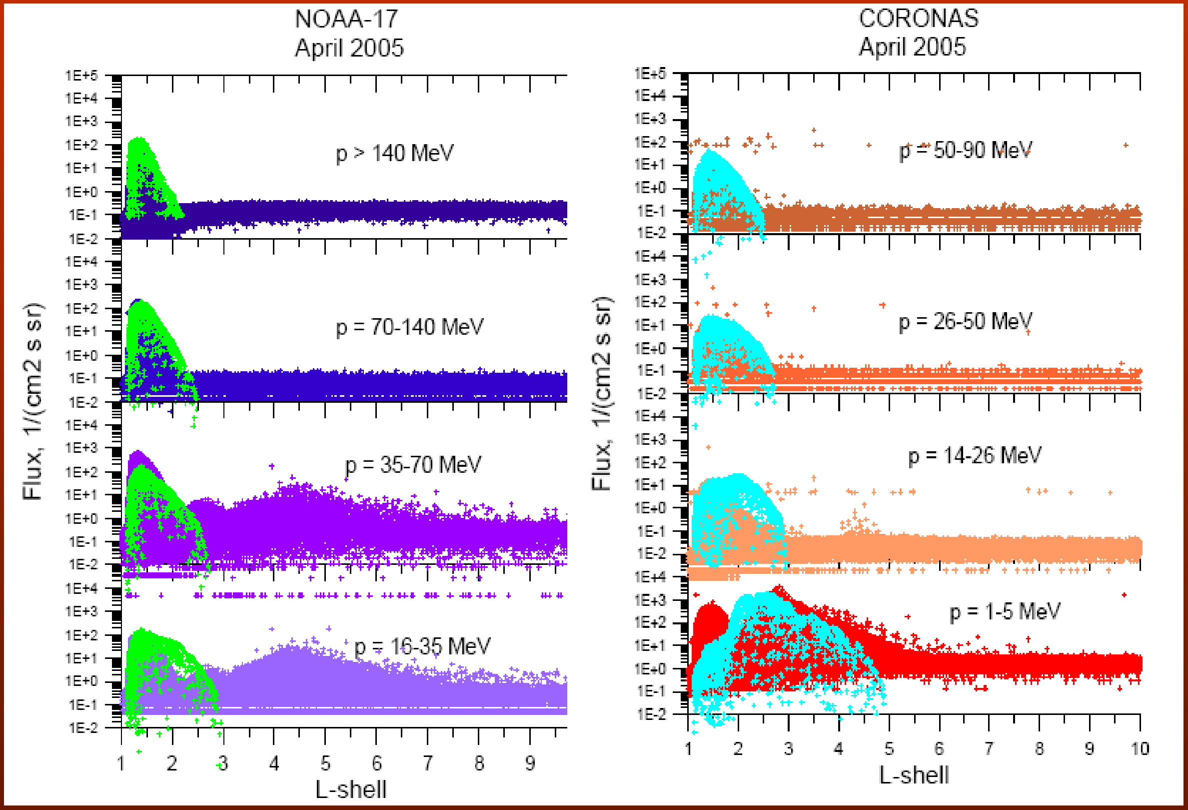

Trapped proton fluxes observed by NPOES-17 satellite in solar maximum and solar minimum L=1.2 in comparison with the AP8 model

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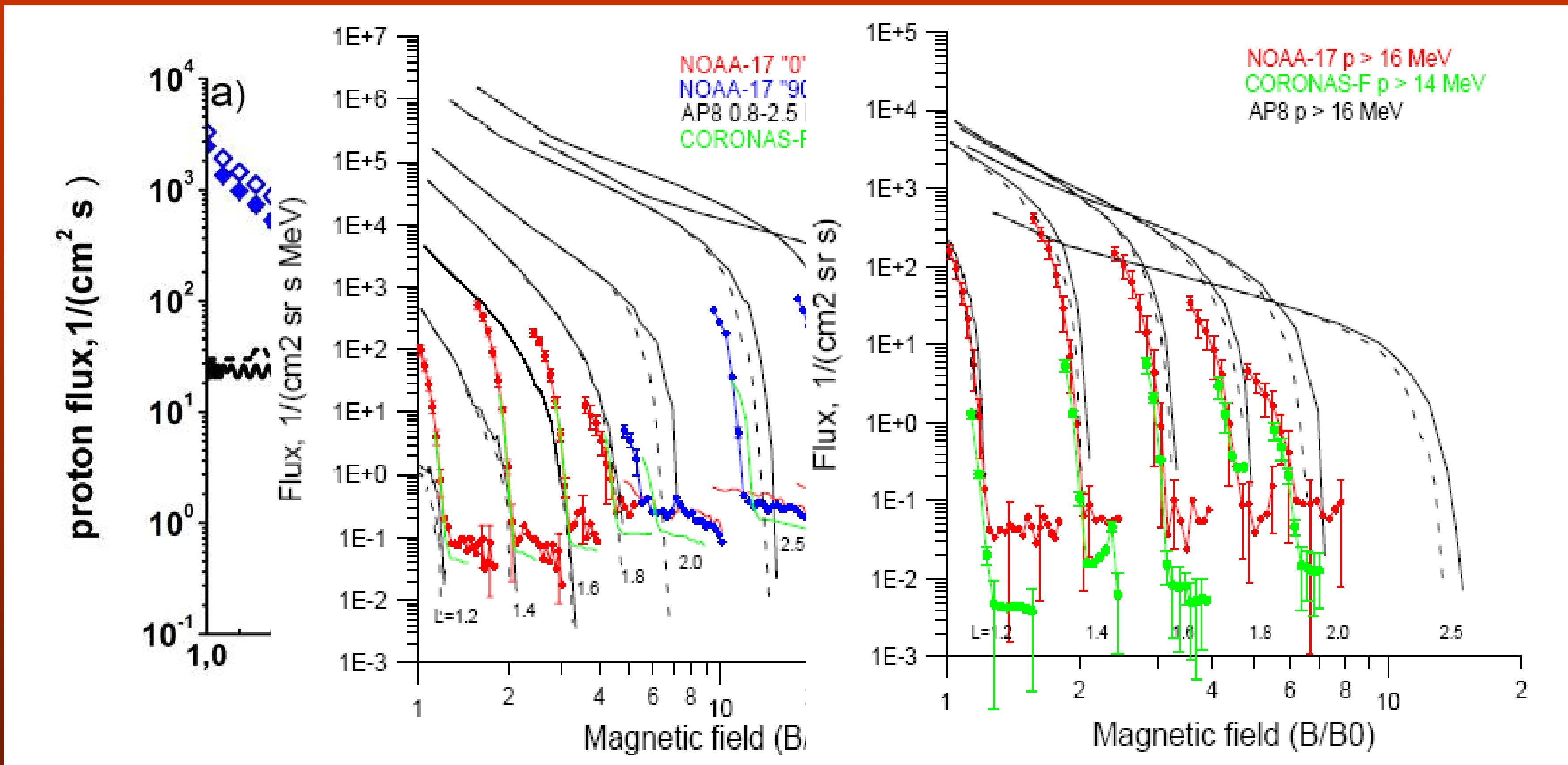

Low energy trapped protons fluxes measured by considered satellites are underestimated by the model at L< 1.4-1.6 coincide with the model at L~1.8 and overestimated by the AP8 model at L>1.8.

High energy trapped proton fluxes coincide satisfactory with the model at L<1.8.

Trapped proton fluxes observed by NPOES-17 satellite in solar maximum and solar minimum

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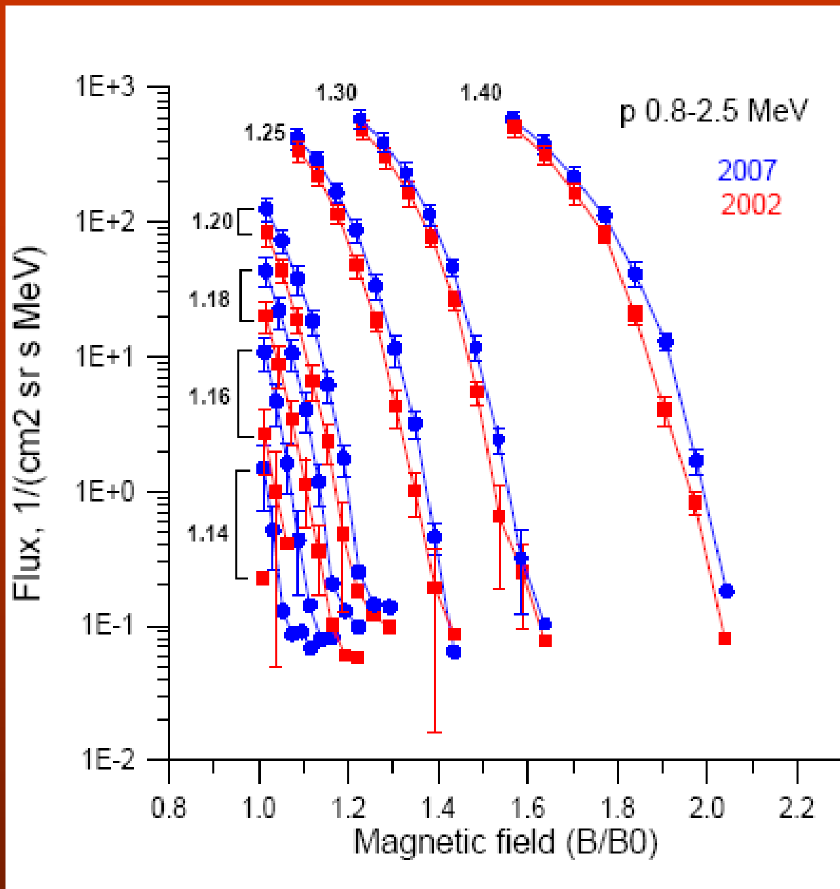
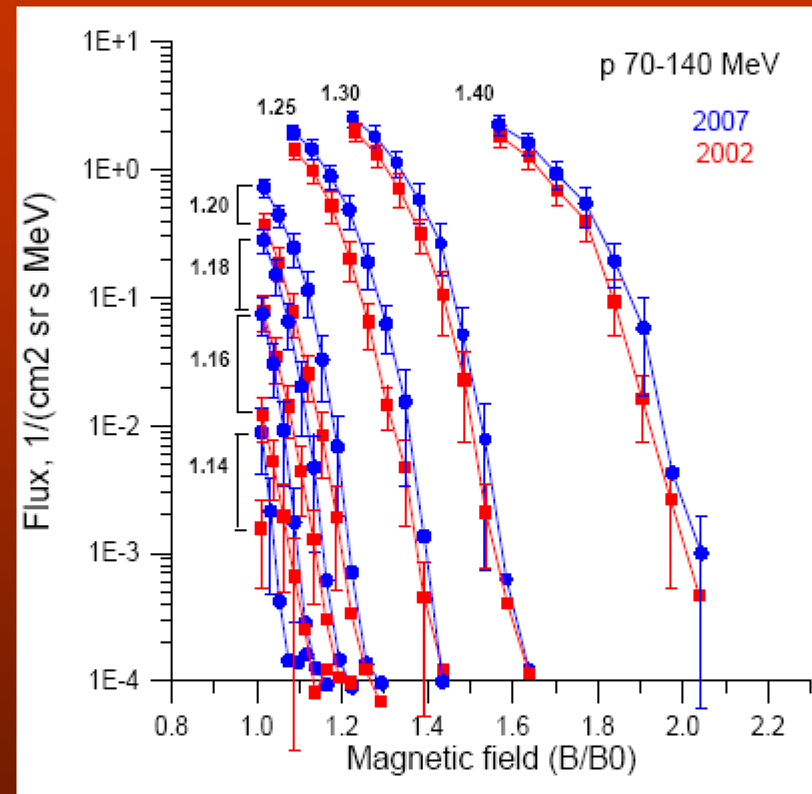
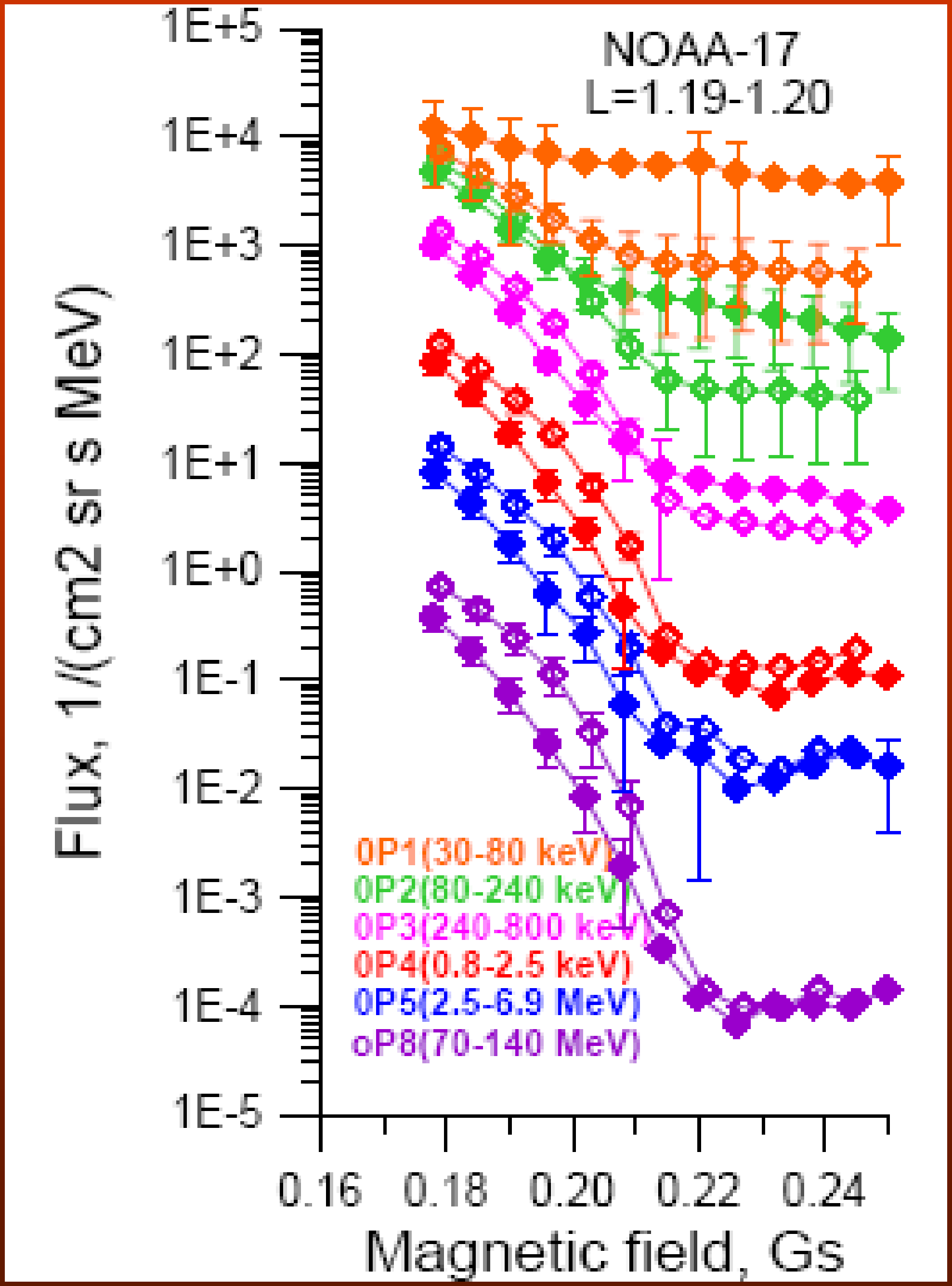




Trapped proton fluxes observed by NPOES-17 satellite in 2007(blue dots) and 2002(red dots) for different L-shells. Energy 0.8-2.5 MeV (left panel) 70-140 MeV (right panel)



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Trapped proton fluxes observed by NPOES- 17 at L=1.2 depending on B. in solar maximum (filled dots) and solar minimum for different energies

Solar cycle variation

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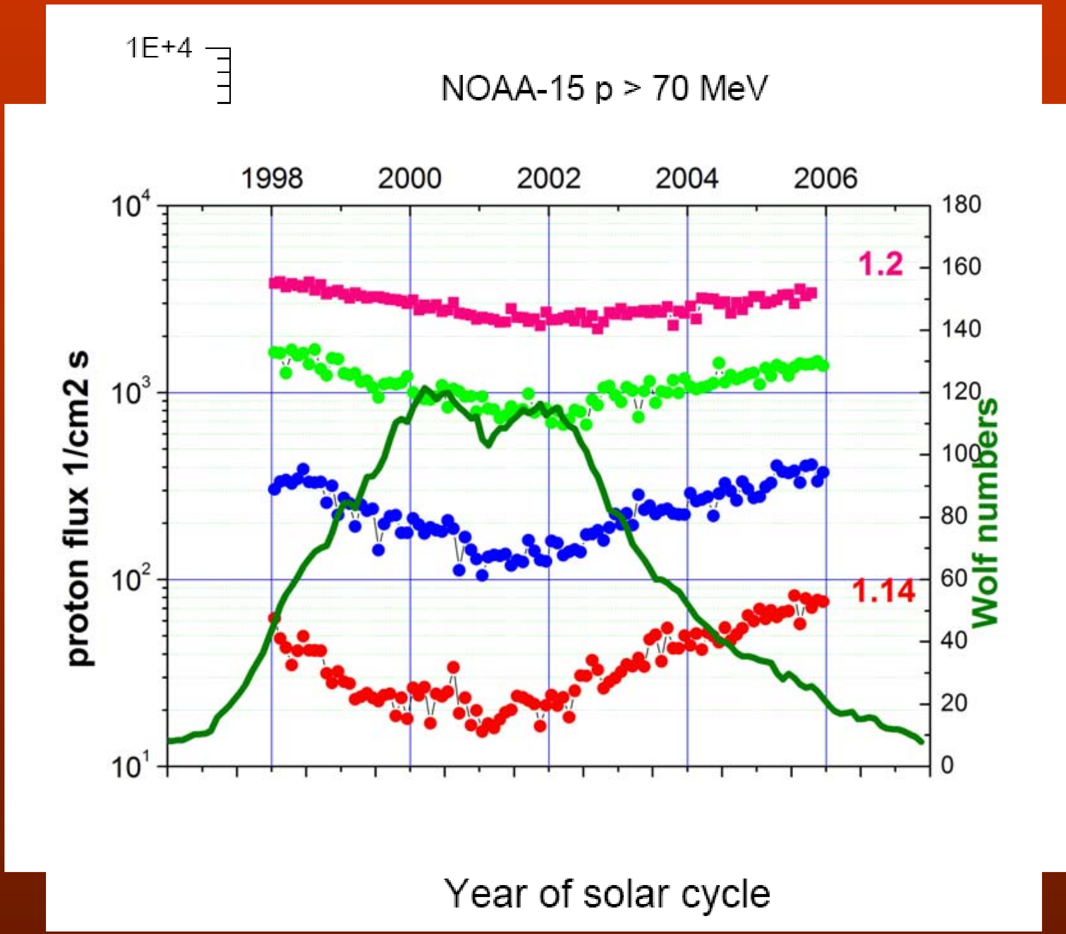

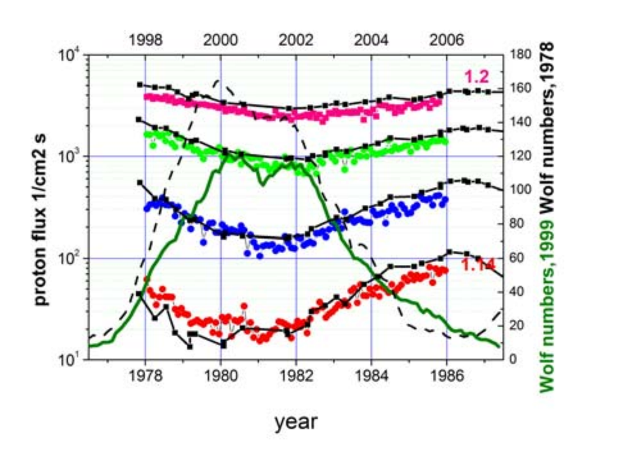

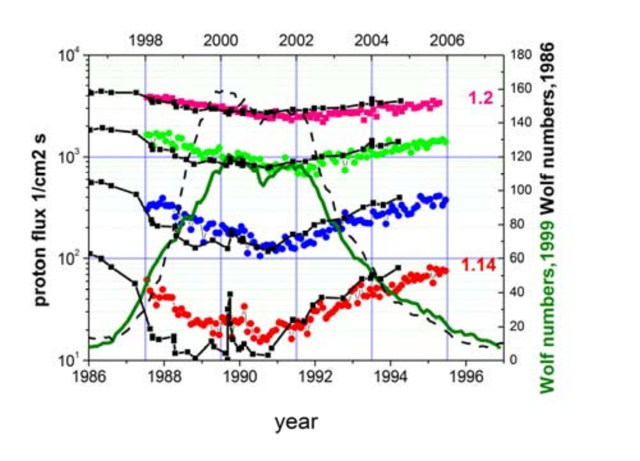

Trapped proton flux at geomagnetic equator for several L-shells observed in 21-23 solar cycle

Solar cycle variation

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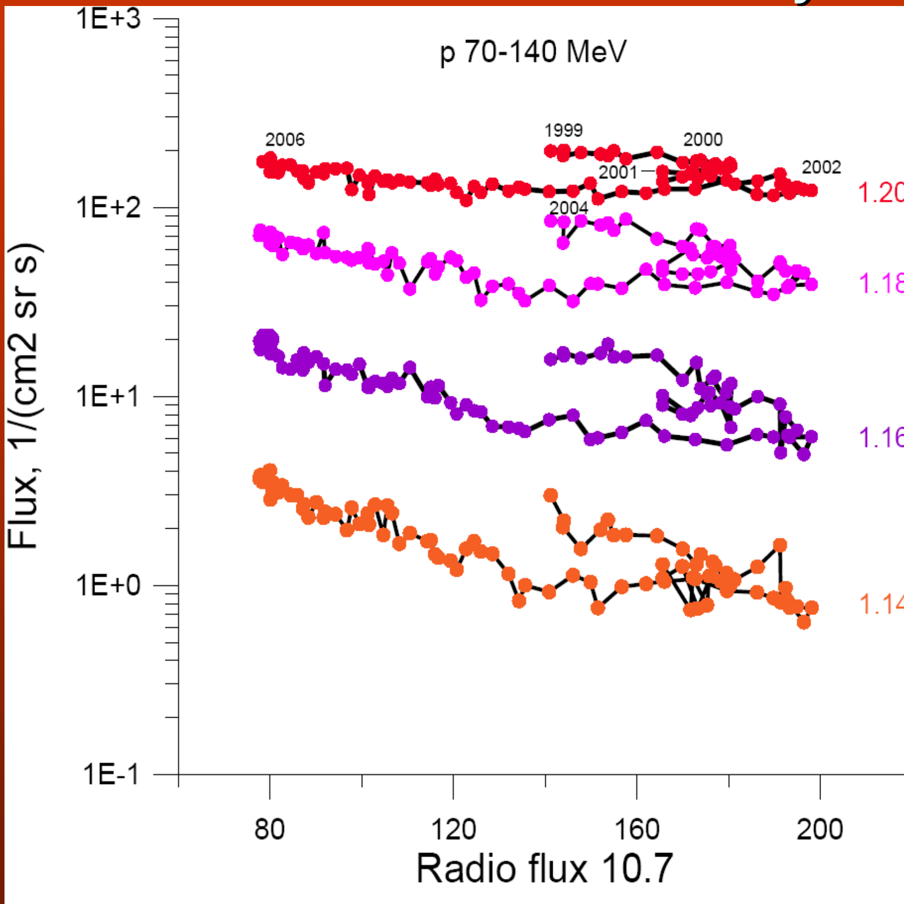
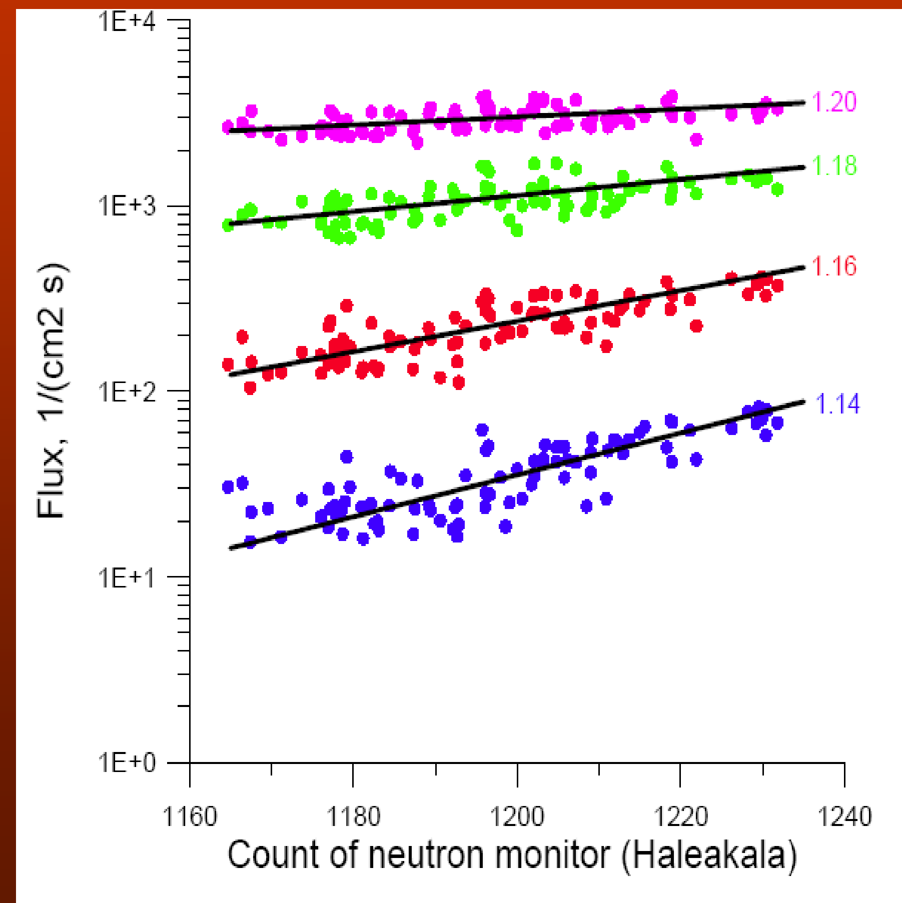
23d solar cycle



Comparison with solar radio flux

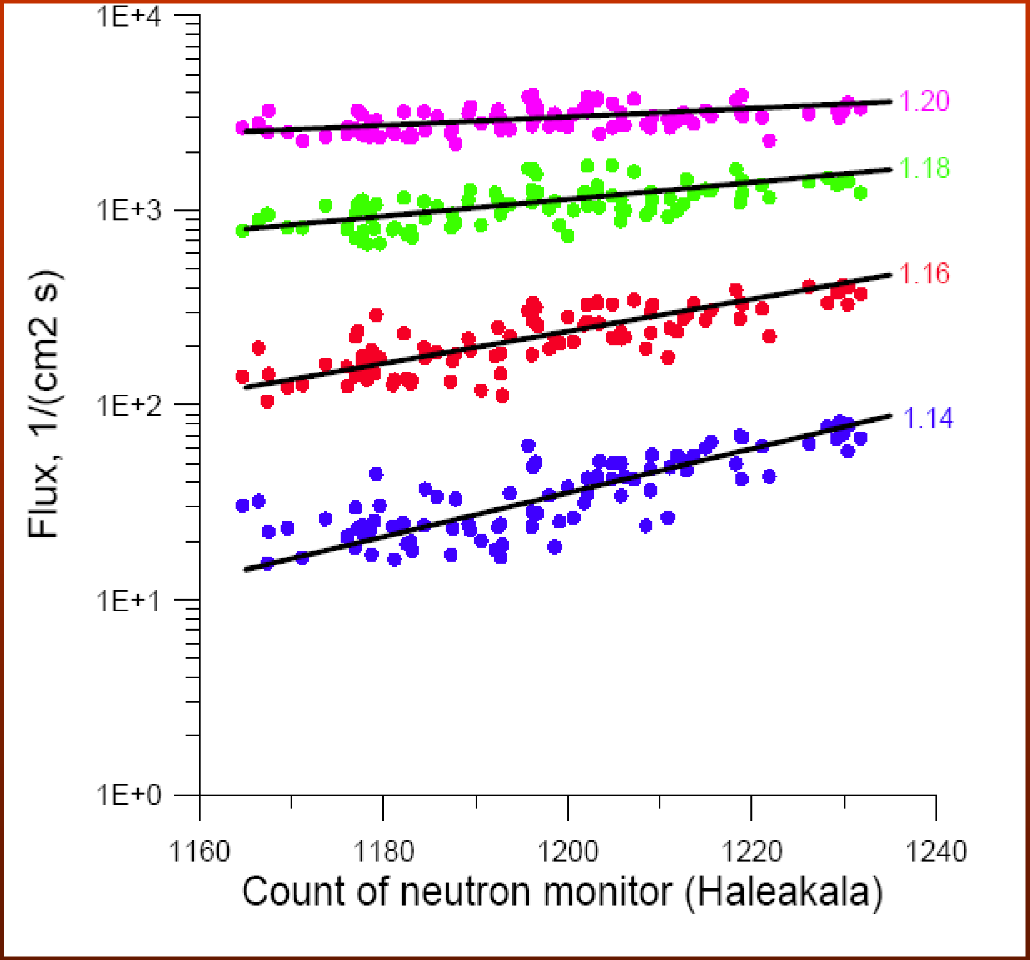
Comparison with neutron monitor count



Solar cycle variation

23d solar cycle

Comparison with neutron monitor count



Conclusions

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Trapped proton fluxes obtained during the 23d solar cycle were analyzed and were compared with the previous solar cycles. It was shown that for high energy proton flux dependence on the solar cycle is the same for 21-23 solar cycles

It is shown that trapped proton flux variation with the solar cycle is well correlated with the variation of the flux of galactic cosmic rays defined by the neutron monitor data

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Thank you for attention