Fifth Workshop "Solar influence on the magnetosphere, ionosphere and atmosphere"

SUBSTORMS AT HIGH LATITUDES AND SOLAR WIND CONDITIONS

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Abstract

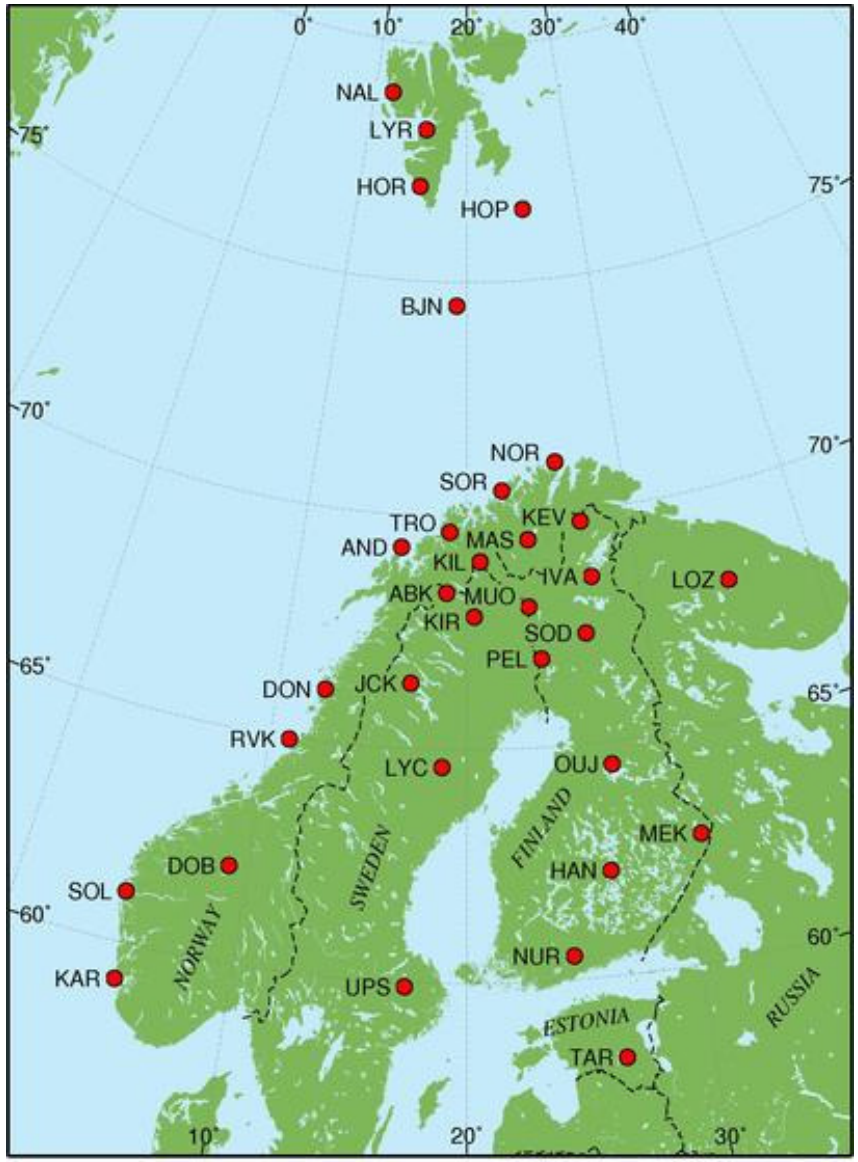
It is know that sometimes substorms are observed at very high latitudes (CGLat >75-80). Distinguished are 2 types of these substorms - "polar" and "high latitude" substorms. The first of them have the onset to be at higher than the 71^0 CGLAT, and a further poleward expansion is observed. These events are called "polar" substorms. The second type of substorms have an onset in the auroral zone, further the substorm propagates poleward, and a "centred" westward electrojet at high latitudes (CGLat $>75^0$) is observed. These substorms events are called "high-latitude" substorms. In our study compared the interplanetary and solar wind conditions for the development of "polar" and "high-latitude" substorms. For this purpose we used solar wind data from the OMNI database and ground-based data from the geomagnetic station network IMAGE and the system MIRACLE.

We analysed more than 100 substorm events during 1995, 2000, 2006 - 2011. It is shown that the "polar" substorm are observed after the passage of a solar wind high speed stream (when the velocity is reduced from high to low values), during late recovery phase of a storm. "High latitude" substorms, on the contrary, are observed during the high speed stream, at high speeds of the solar wind and small values of the B_Z component of the IMF.

IMAGE

International Monitor for Auroral Geomagnetic Effects

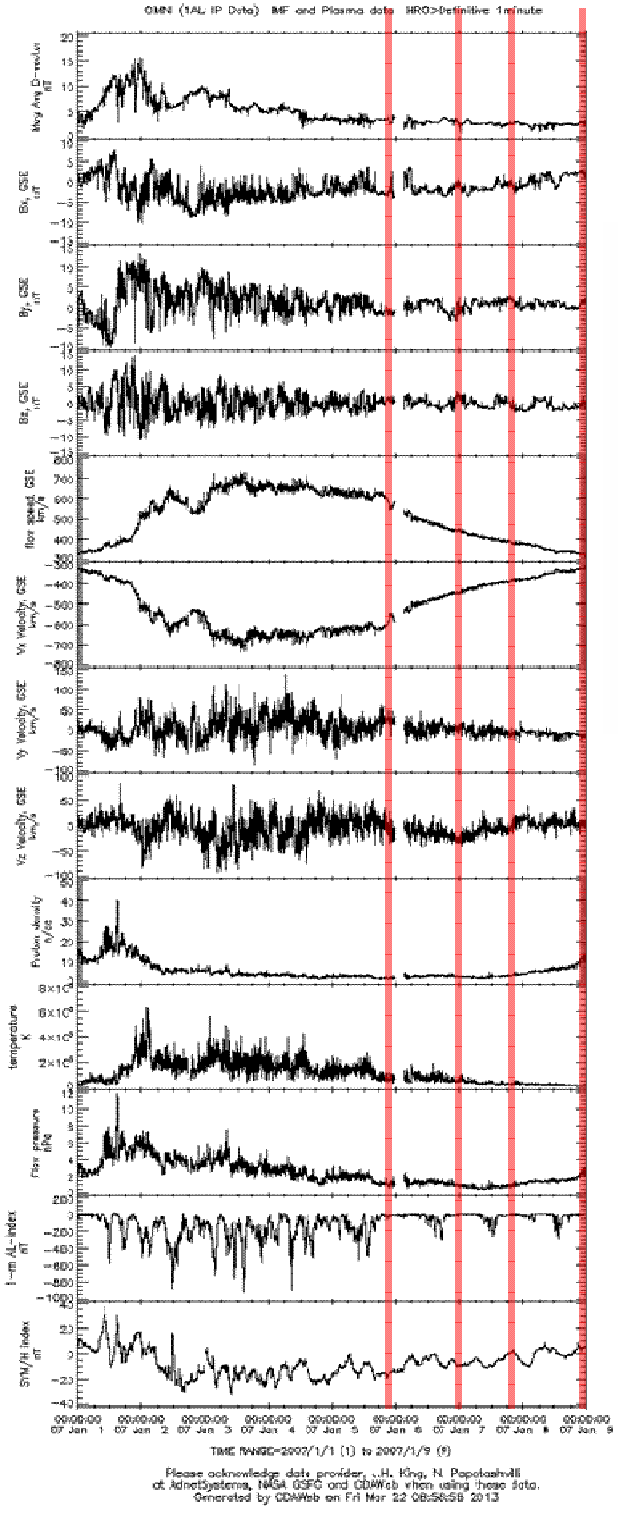
	Code	Name	Geogr. lat (°)	Geogr. lon (°)	CGM lat (°)	CGM lon (°)
1.	NAL	Ny Ålesund	78.92	11.95	75.25	112.08
2.	LYR	Longyearbyen	78.20	15.82	75.12	113.00
3.	HOR	Hornsund	77.00	15.60	74.13	109.59
4.	BJN	Bear Island	74.50	19.20	71.45	108.07
5.	SOR	Sørøya	70.54	22.22	67.34	106.17
6.	MAS	Masi	69.46	23.70	66.18	106.42
7.	MUO	Muonio	68.02	23.53	64.72	105.22
8.	PEL	Pello	66.90	24.08	63.55	104.92
9.	OUJ	Oulujärvi	64.52	27.23	60.99	106.14
10.	HAN	Hankasalmi	62.25	26.60	58.69	104.54
11.	NUR	Nurmijärvi	60.50	24.65	56.89	102.18
12.	TAR	Tartu	58.26	26.46	54.47	102.89



June 2011

1) Examples of "Polar" substorms

06 January 2007



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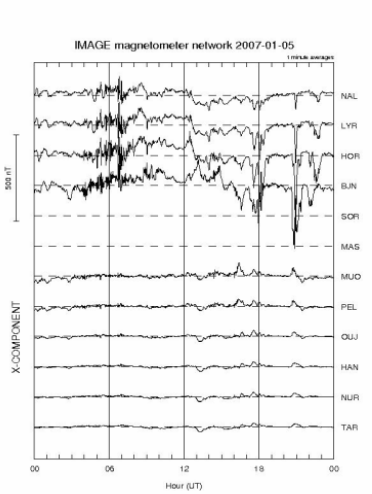

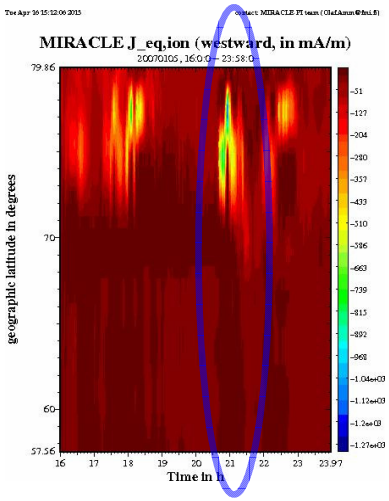

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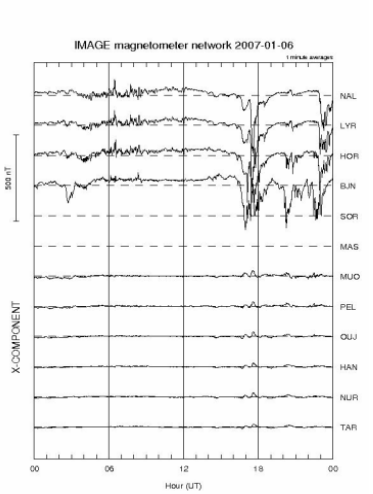

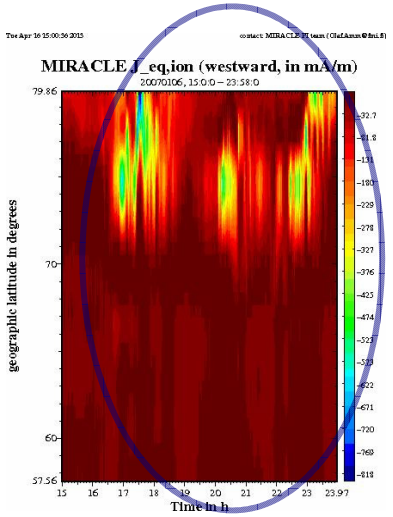

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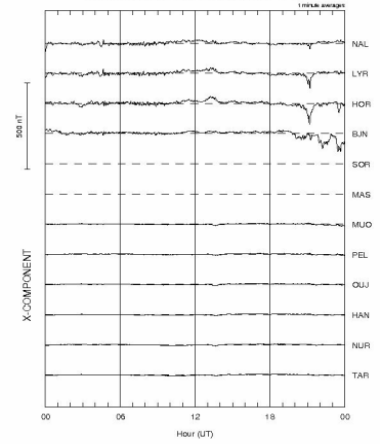

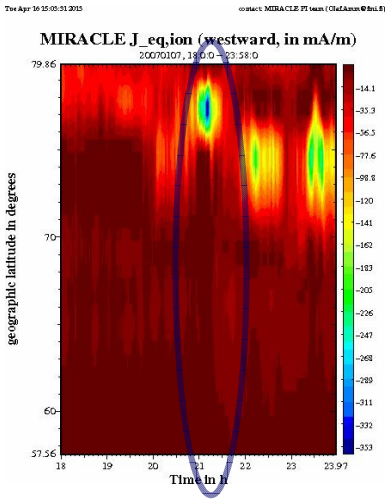

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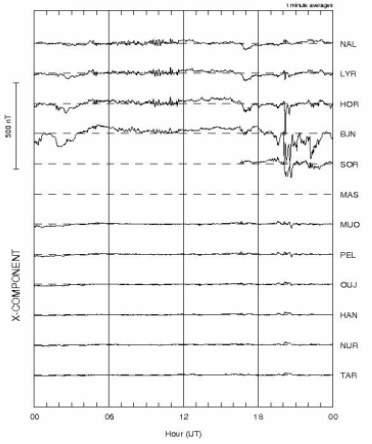

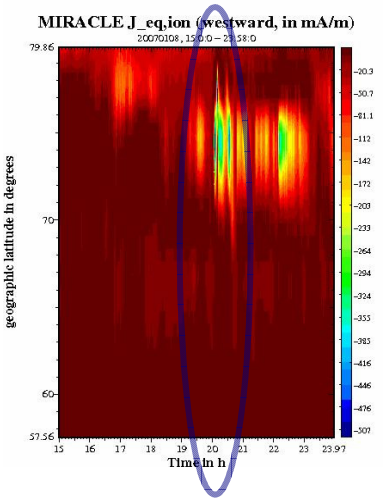

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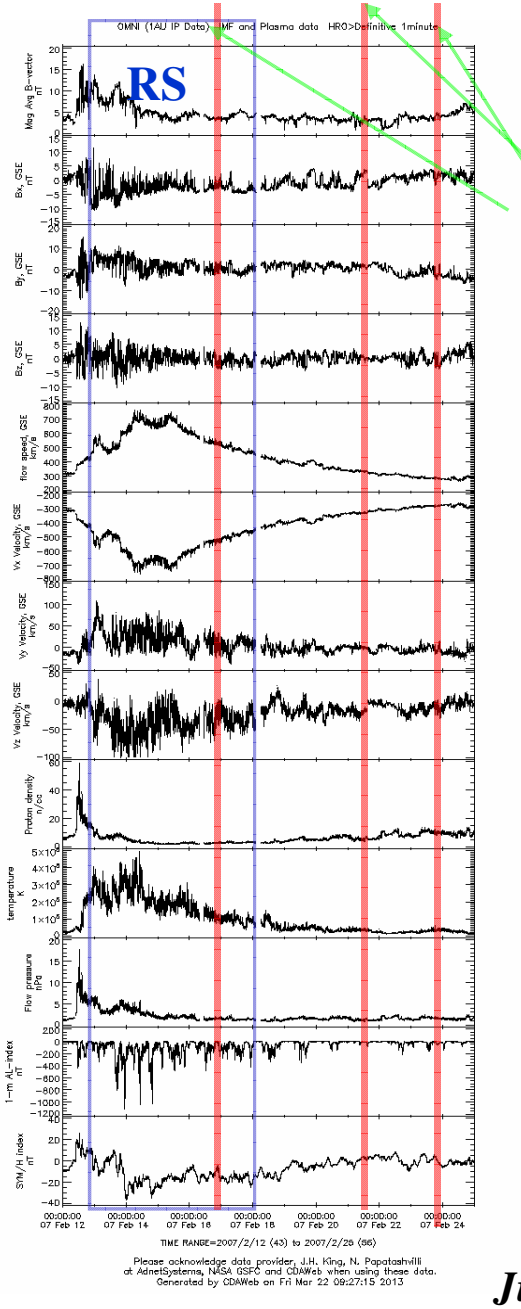
Solar wind conditions for “polar” substorms

1) First type



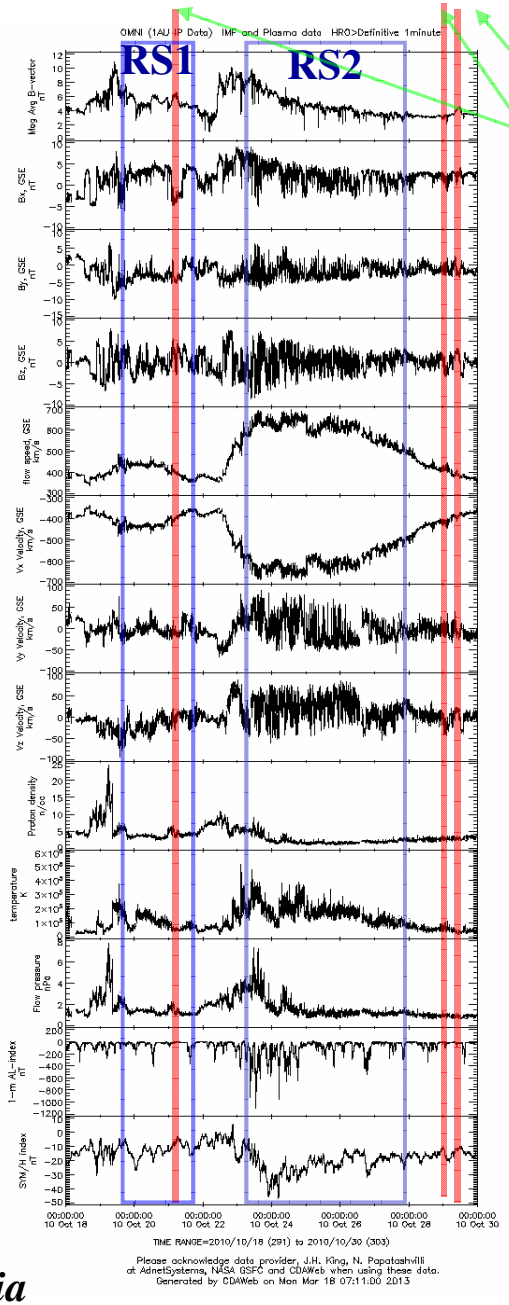
16 February 2007

Polar substorms

HSS: 12.02-18.02 (inside the blue rectangle)

Polar substorms - (red lines) - after the HSS, at the phase of the speed decrease

2) Second type



20 October 2010

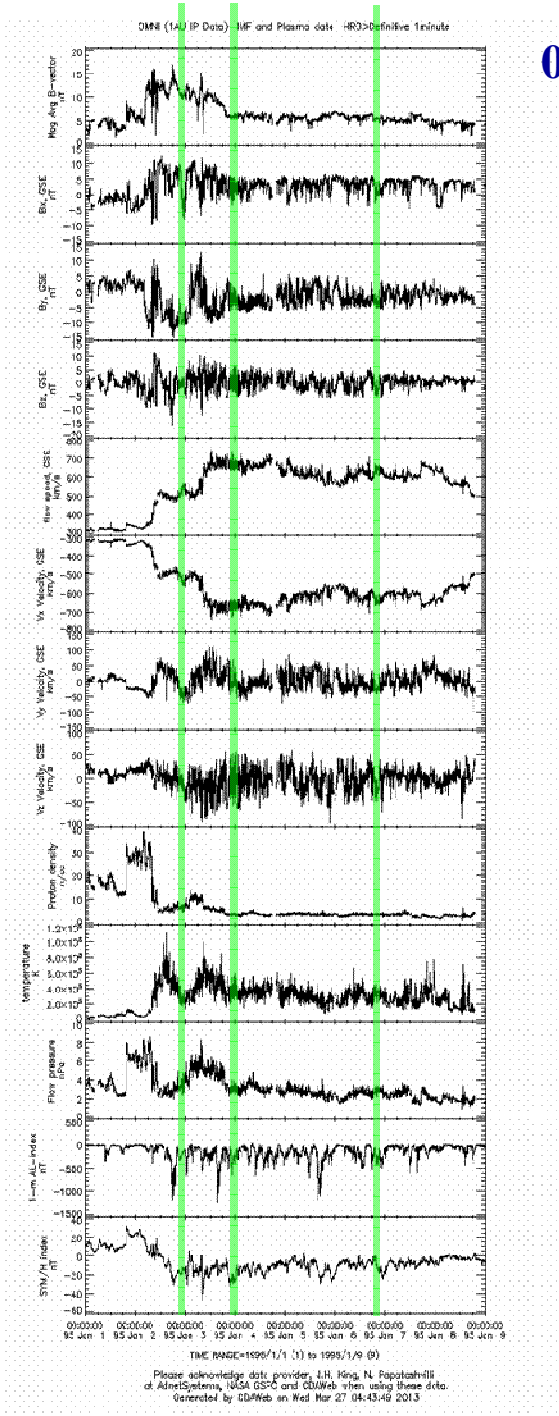
Polar substorms

HSS1: 19.01-21.01
HSS2: 22.01- 28.01 (inside the blue rectangleS)

Polar substorms – before the increase of SW speed and at the phase of the speed decrease

2) Examples of "high-latitude" substorms

02 January 1995



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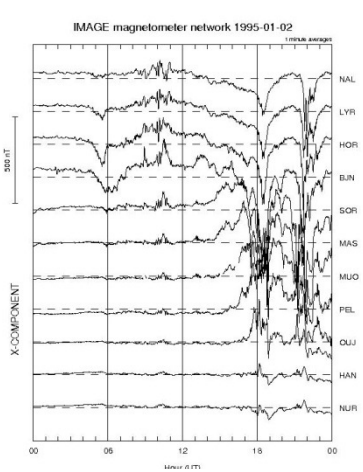

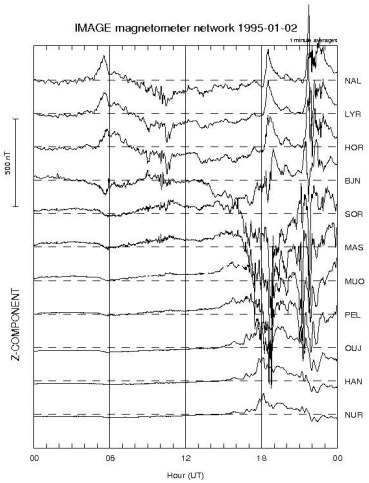

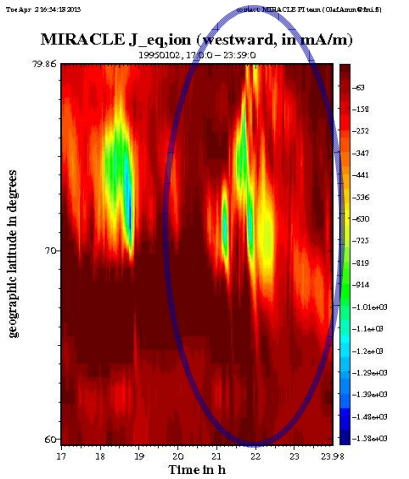

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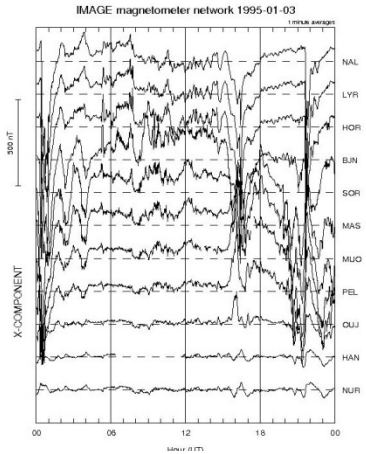

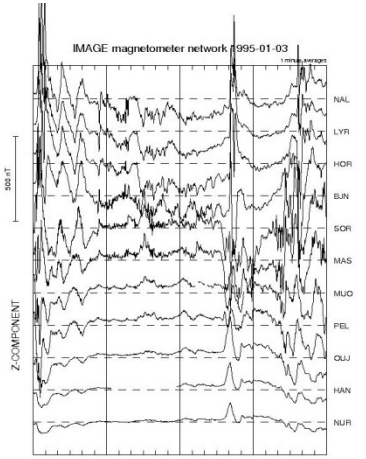

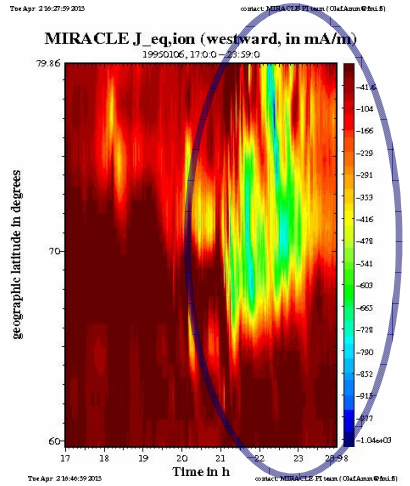

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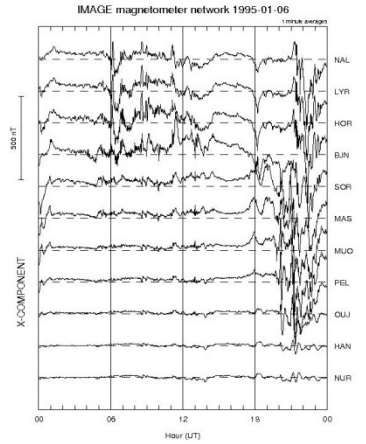
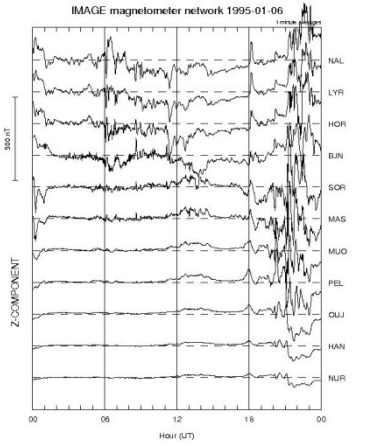
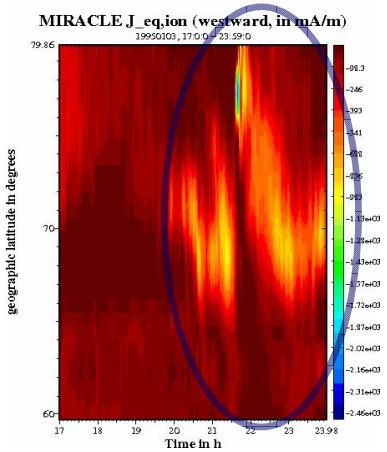
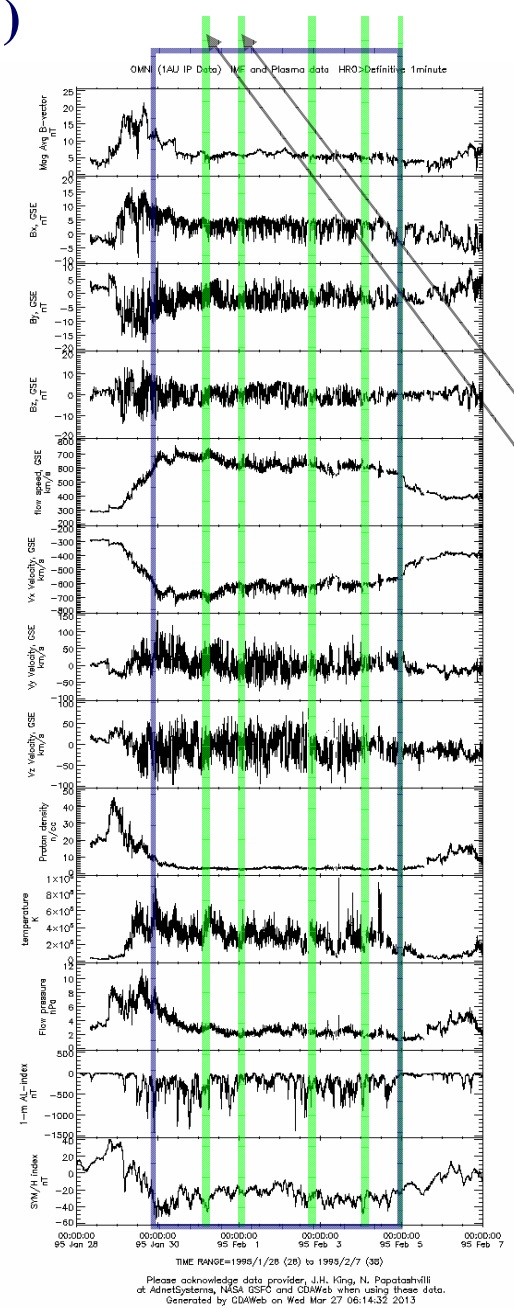






Solar wind conditions for “high latitude” substorms

1)

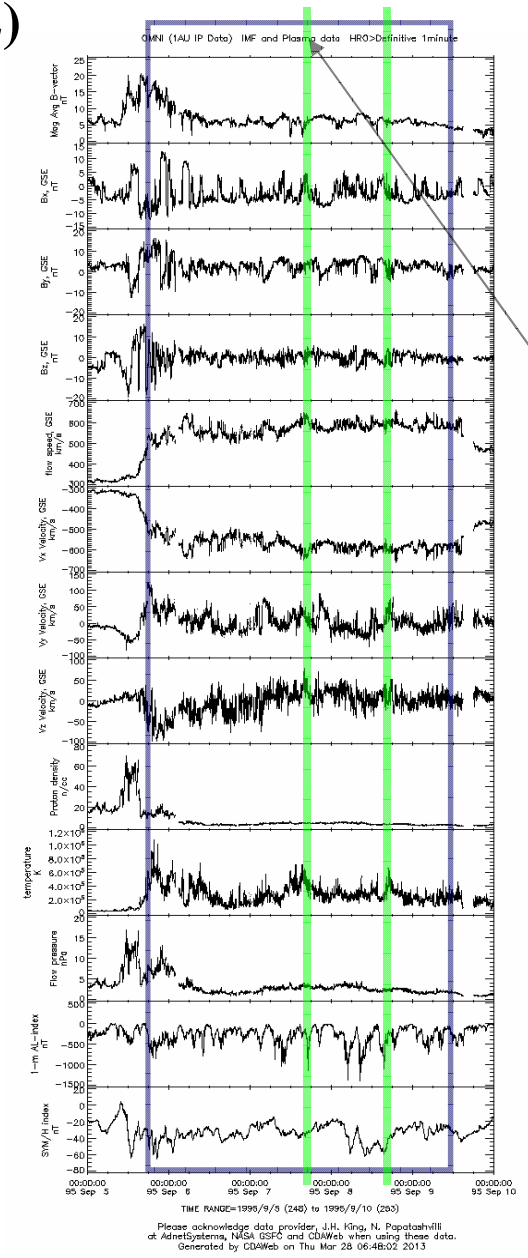


30 January 1995

HSS: 30.01-05.01 (inside the blue rectangle)

High-latitude substorms (green lines) – during the HSS, at high SW velocities

2)



08 September 1995

HSS: 05.09-09.09 (inside the blue rectangle)

High-latitude substorms (green lines) – during the HSS, at high SW velocities

Conclusions

It is shown that the interplanetary and solar wind conditions for the development of *"polar"* and *"high-latitude"* substorms are different:

- ***"Polar"*** **substorms are observed after the passage of solar wind high speed streams (where the velocity is reduced from high to low values), during late recovery phase of the storm.**

- ***"High latitude"*** **substorms, on the contrary, are observed during high speed stream, at high speeds of the solar wind and small values of the B_Z component of the IMF.**