Bistatic observations of large and small scale ULF waves in SPEAR-induced HF coherent backscatter

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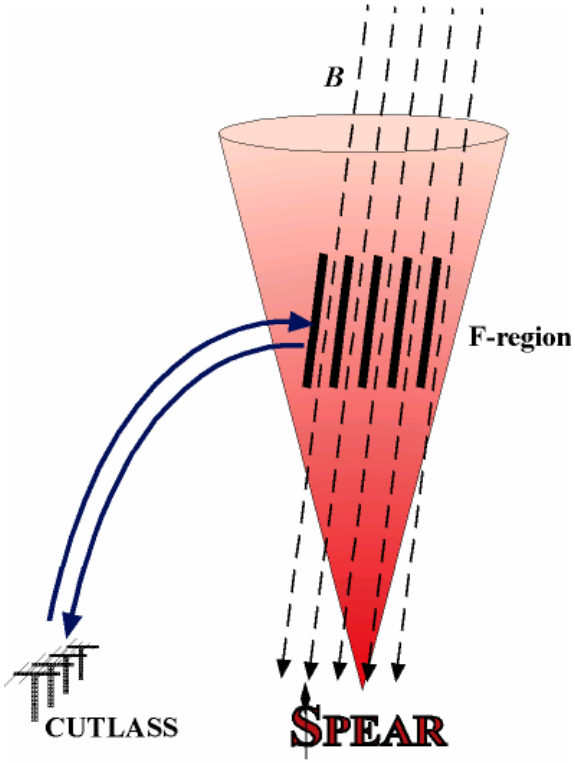
SuperDARN Workshop, 2008

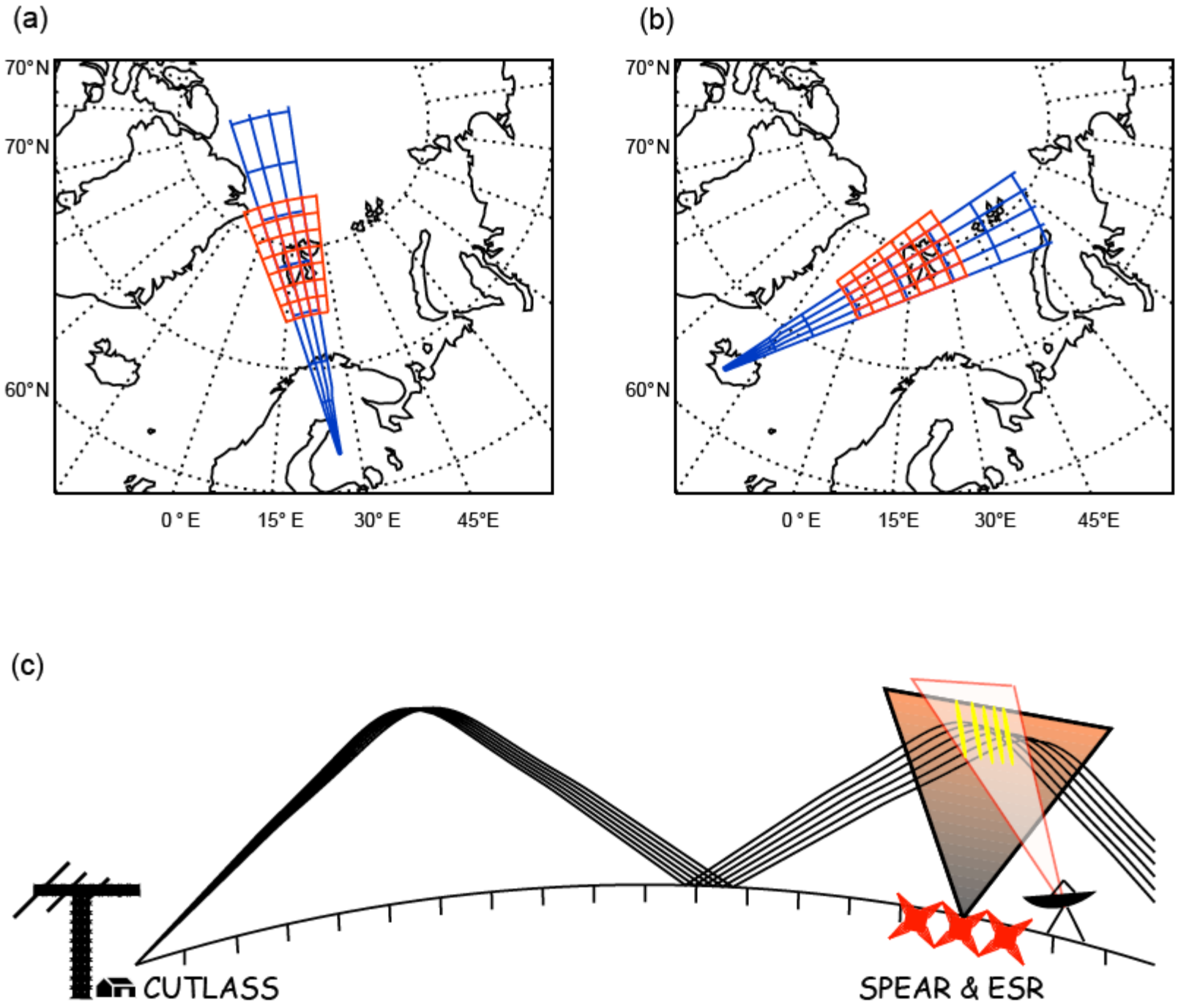
SPEAR capabilities



Generation of artificial field aligned irregularities

Active experiments 1:

Generation of artificial coherent backscatter with CUTLASS, and modification effects in the ESR data

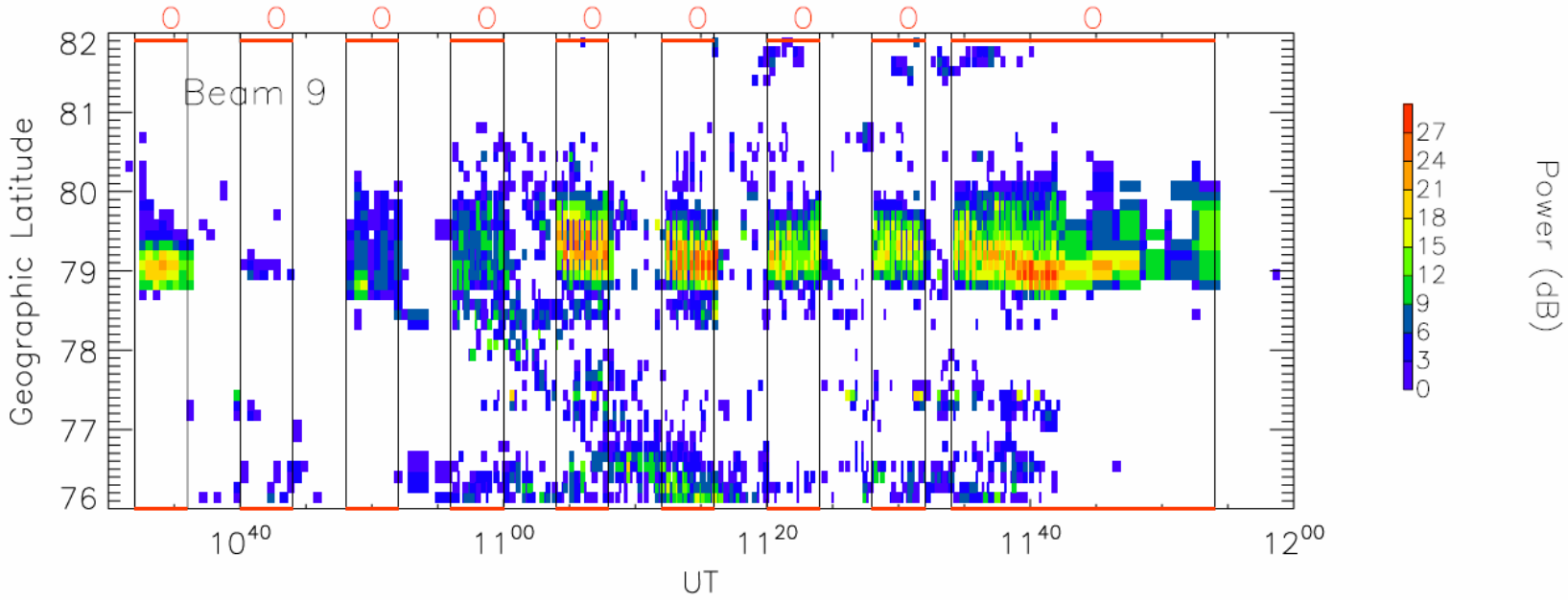

(a)
70°N
70°N
60°N
0 ° E
15° E
30° E
45°E
(b)
70°N
70°N
60°N
0 ° E
15°E
30°E
45°E
(c)
CUTLASS
SPEAR & ESR

SUPERDARN PARAMETER PLOT

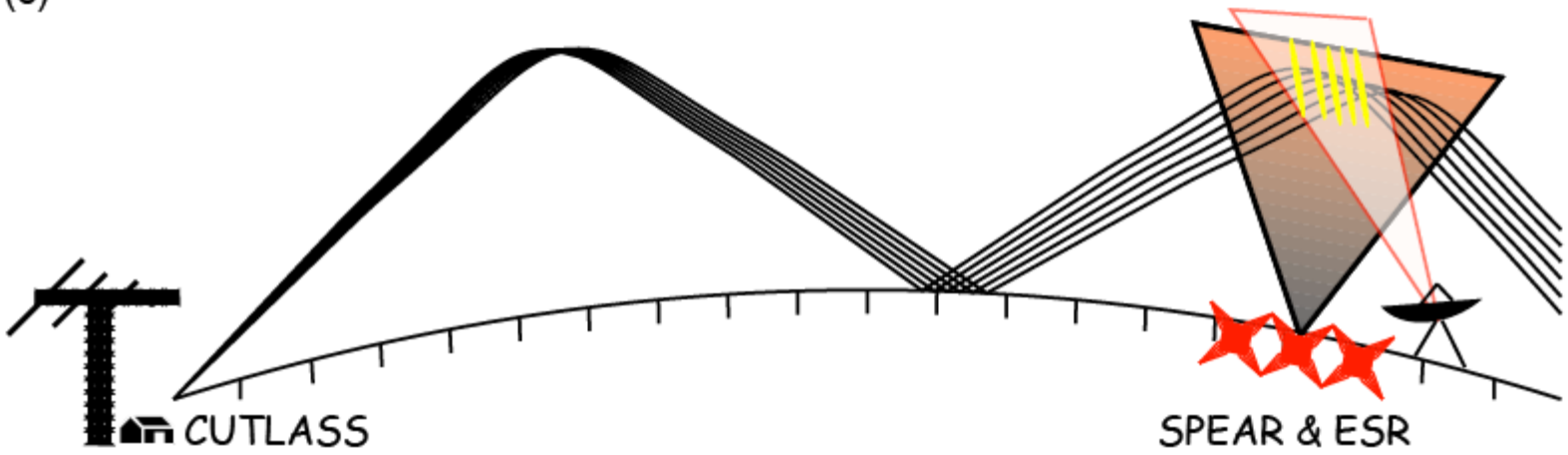
22 Feb 2007 (53)

SPEAR–induced scatter

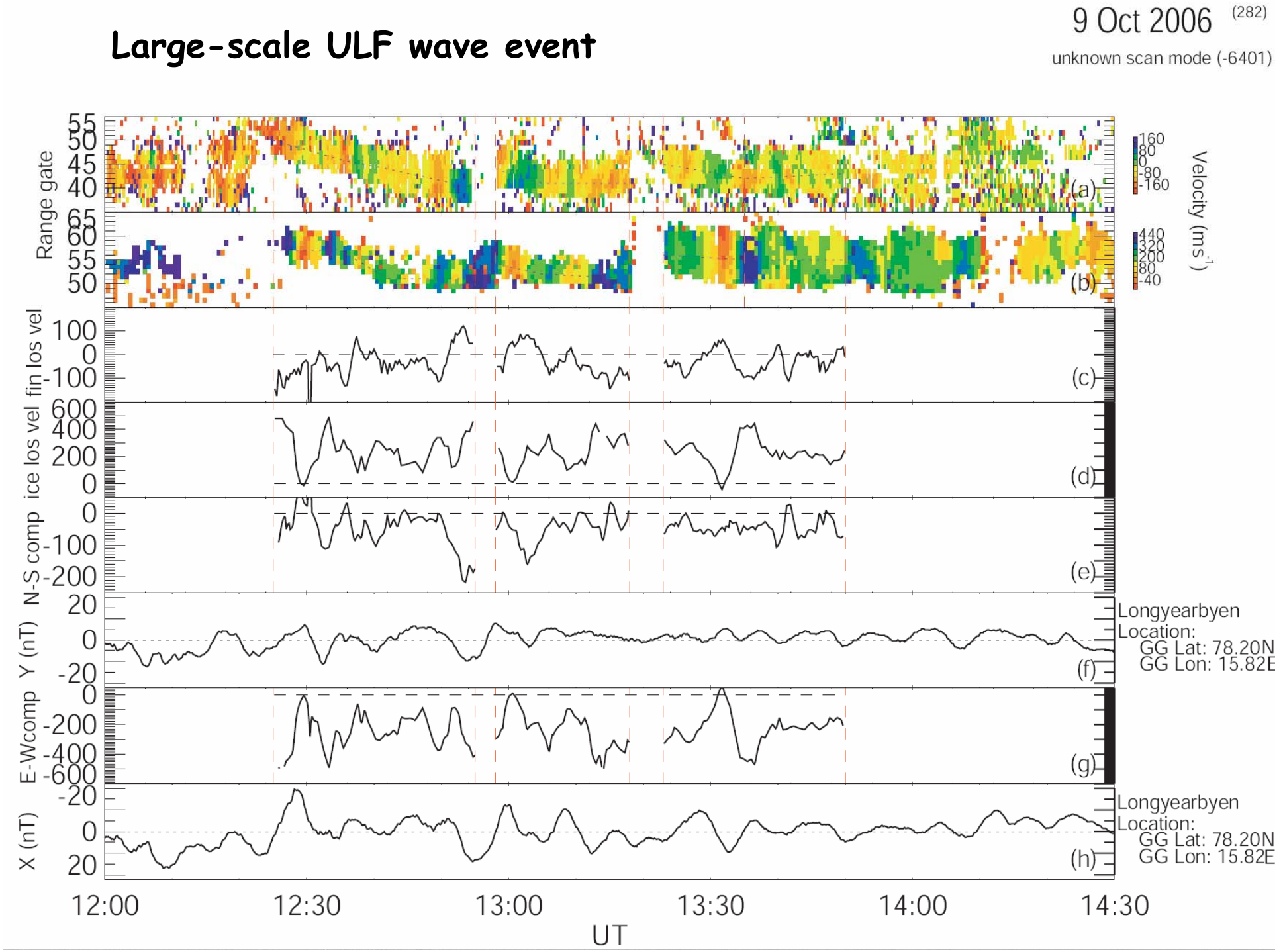
unknown scan mode (–26006)



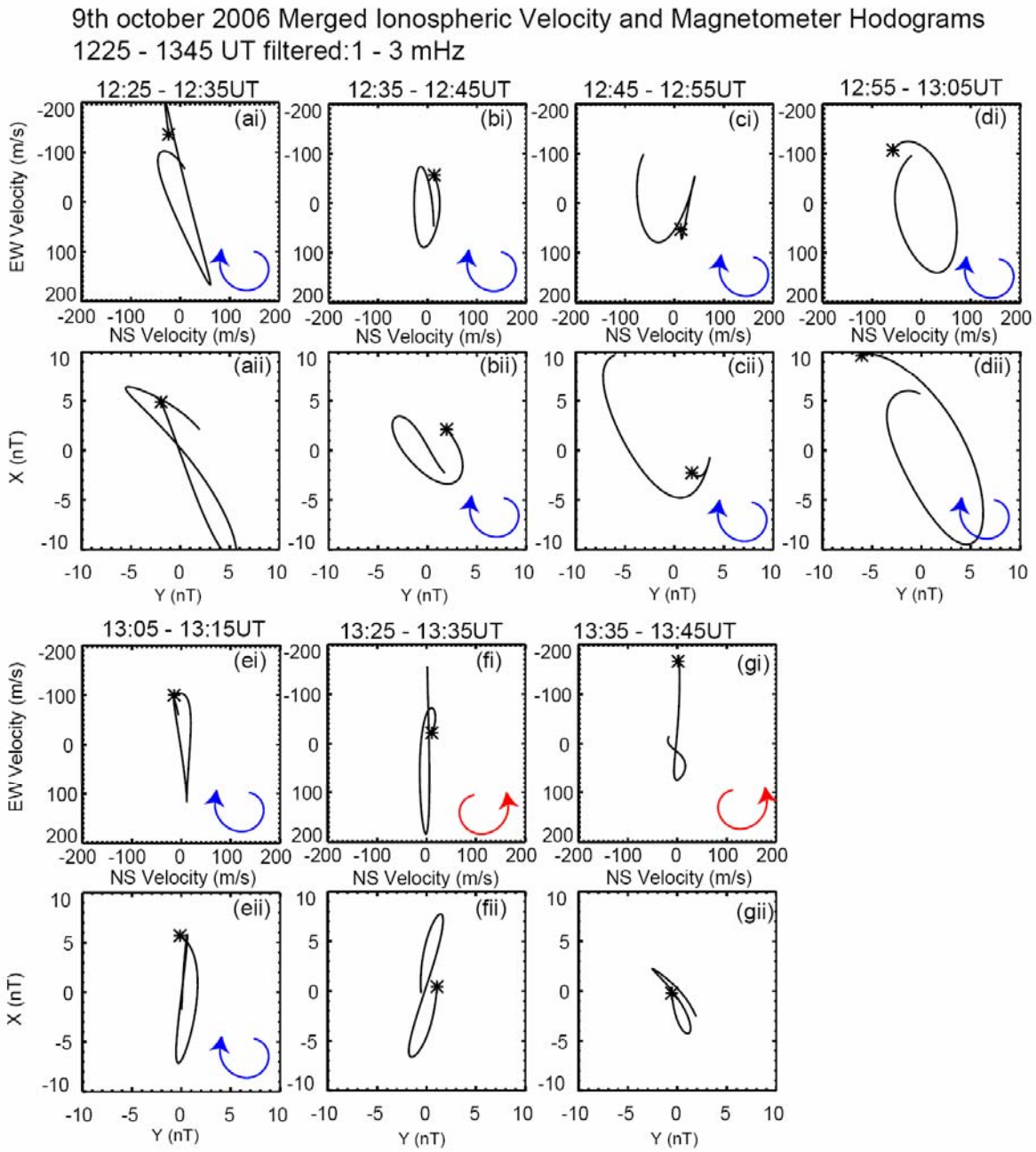
(c)



Large-scale ULF wave event



Large-scale ULF wave event



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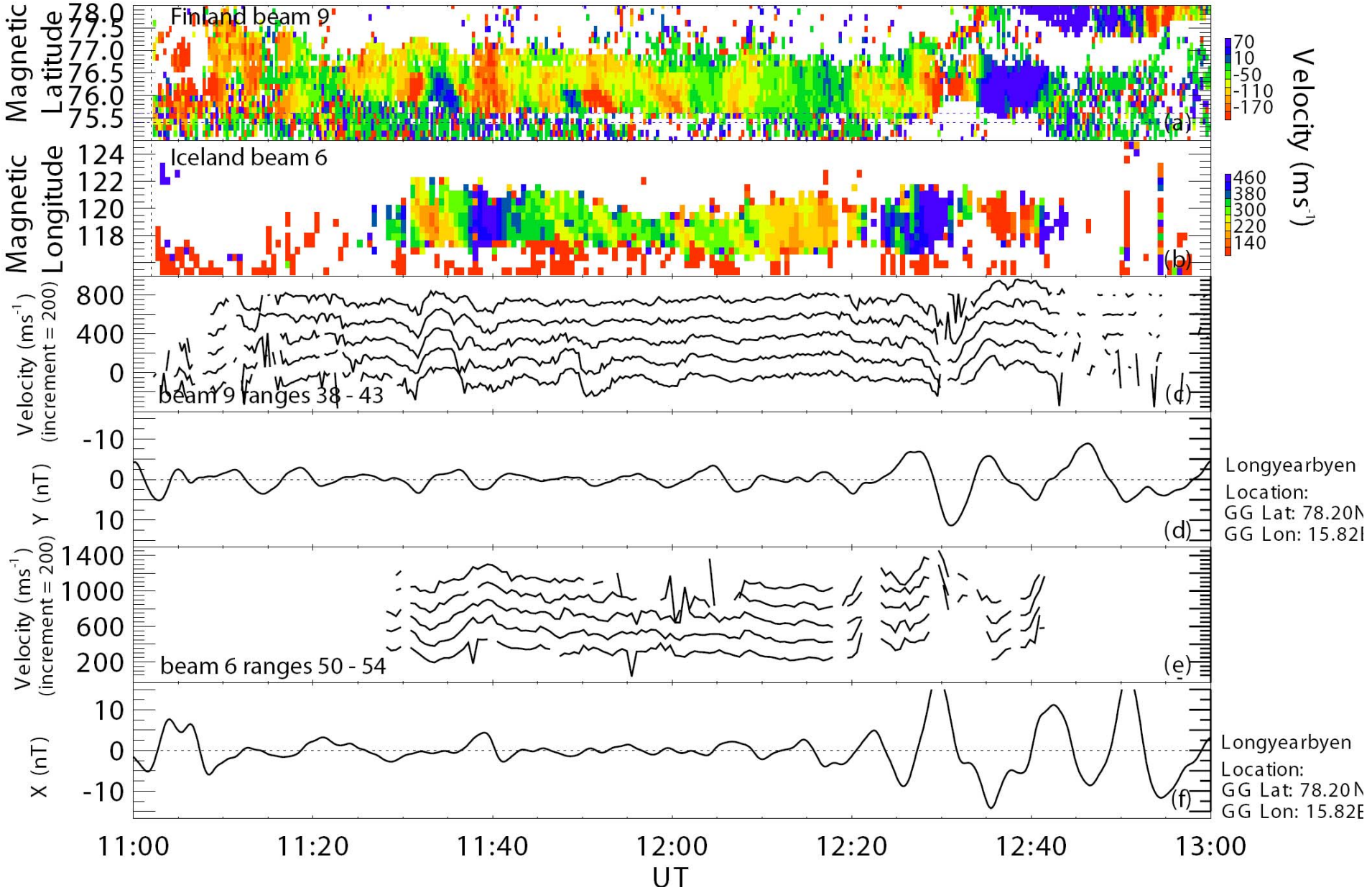
Small-scale ULF wave event

SuperDARN radar and IMAGE magentometer data: 12th Oct 2006



Small-scale ULF wave event

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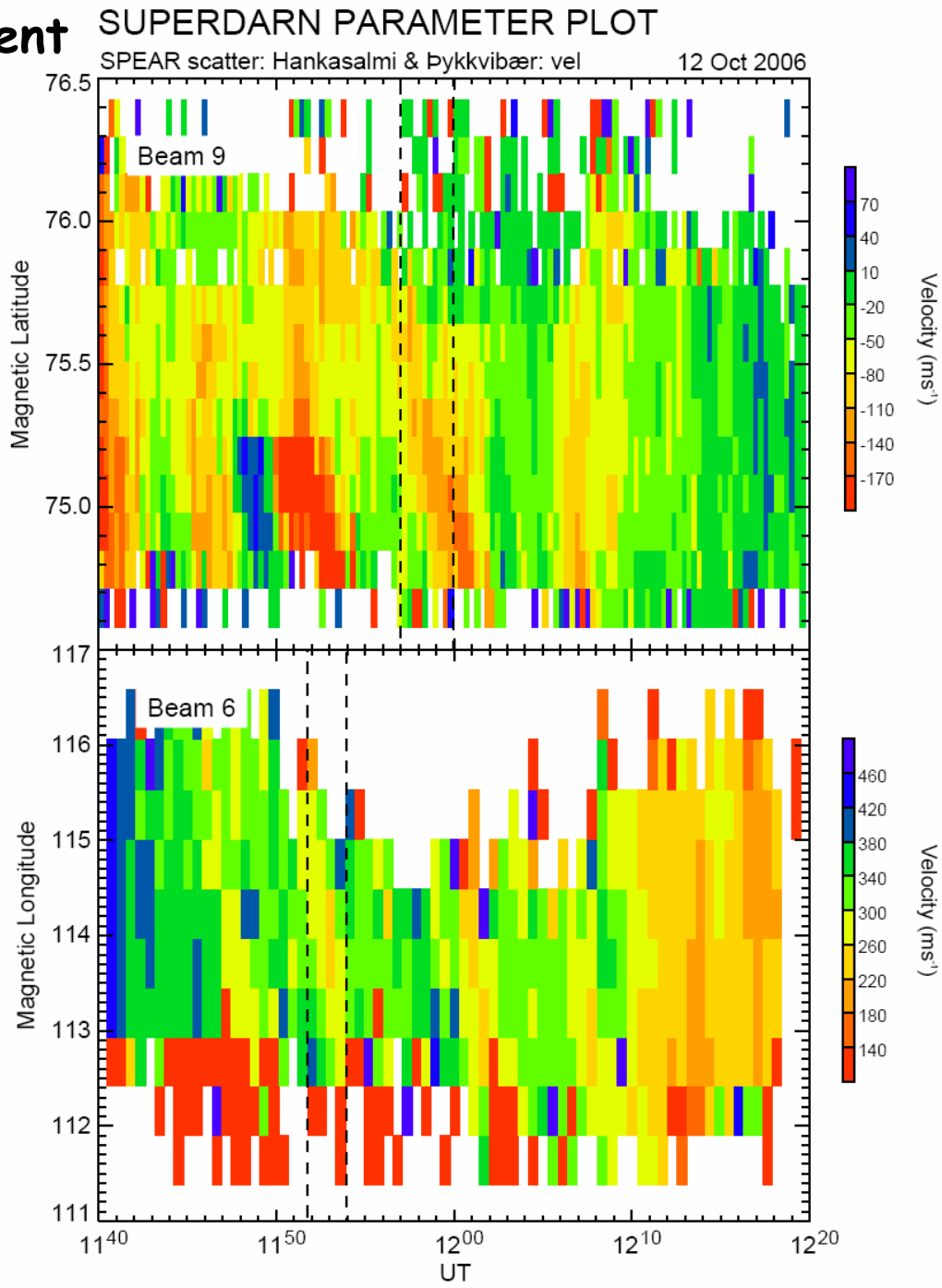
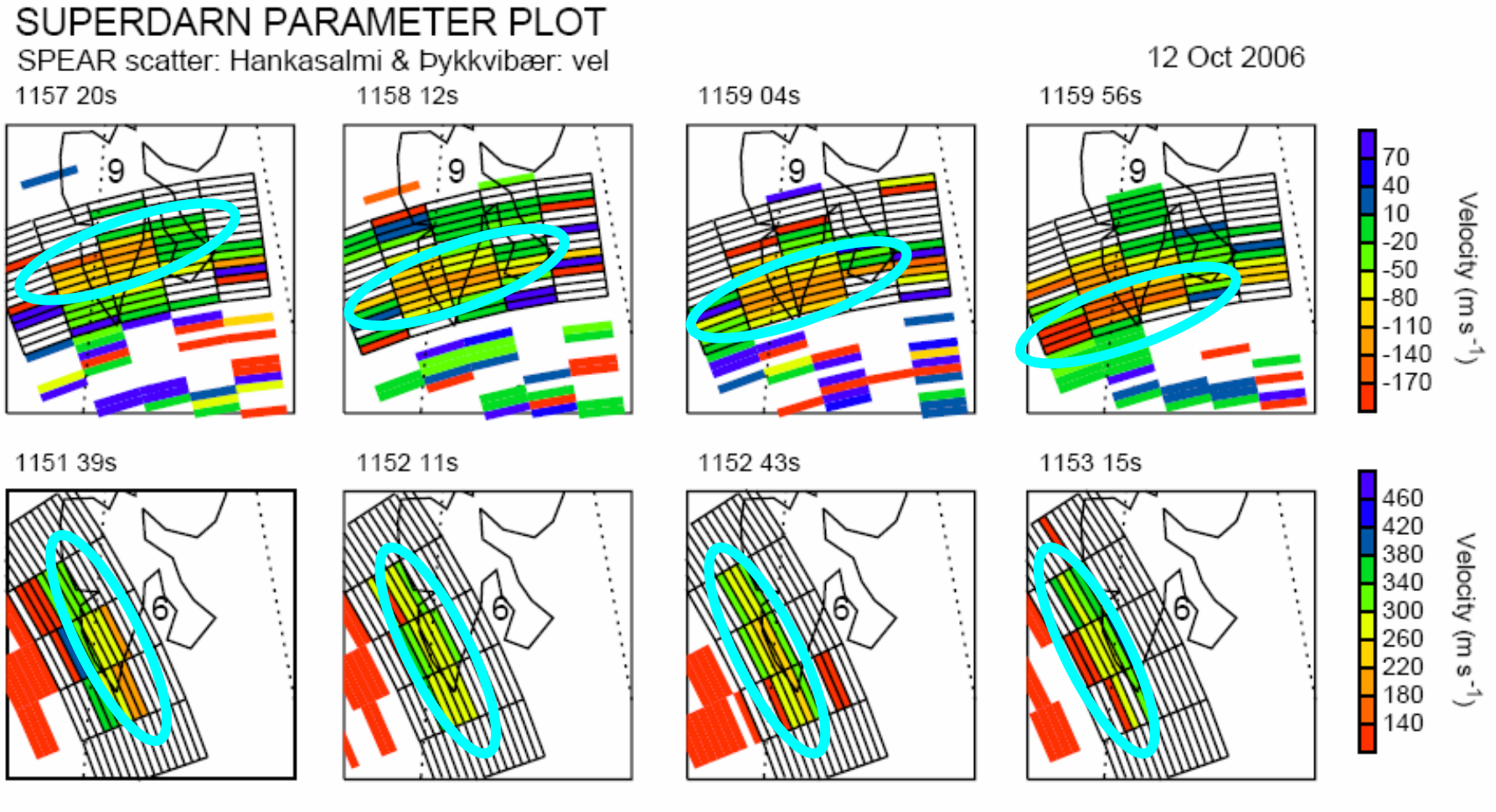


Small-scale ULF wave event



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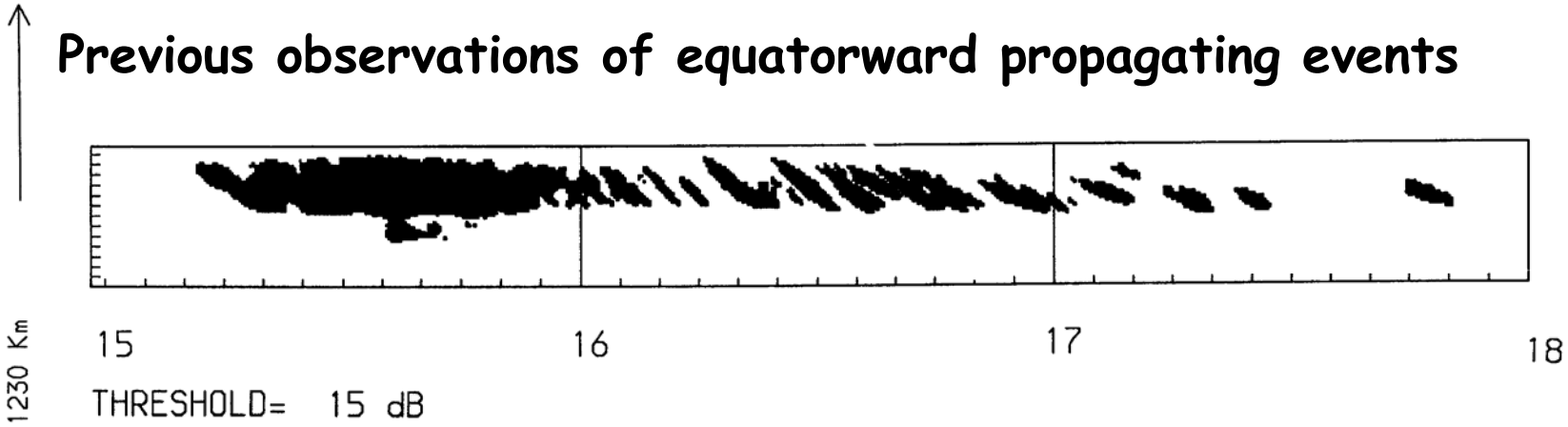
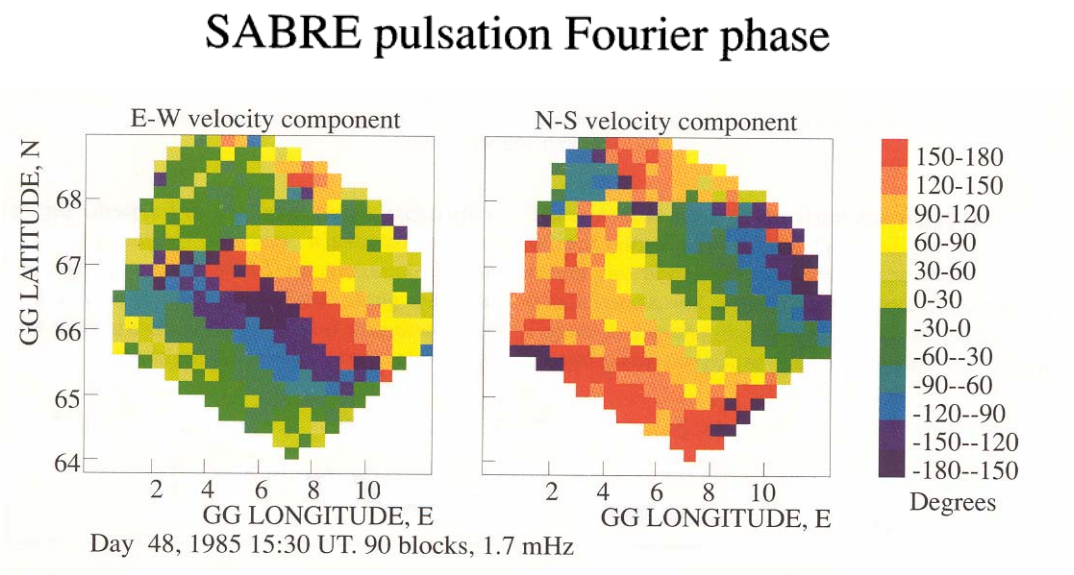
Previous observations of equatorward propagating events

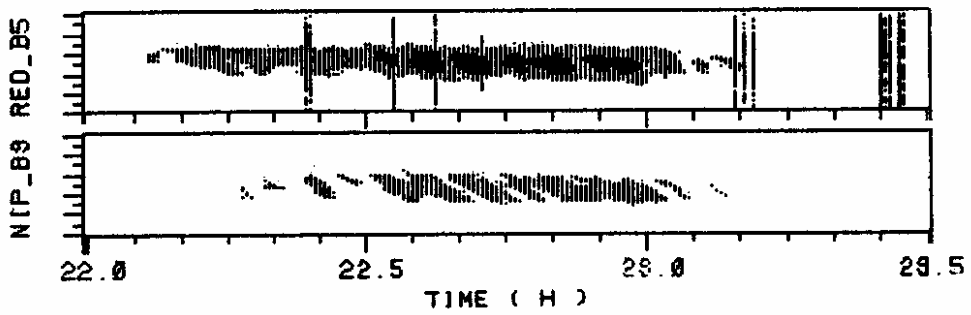


Equatorward propagating events observed at SABRE, L=5
Tian et al., (1991)

60 keV protons implicated
Yeoman et al., (1992)



Previous observations of equatorward propagating events



March 1, 1990

Equatorward propagating events observed at BARS, L=7.5

20 keV protons implicated

Grant et al., (1992)

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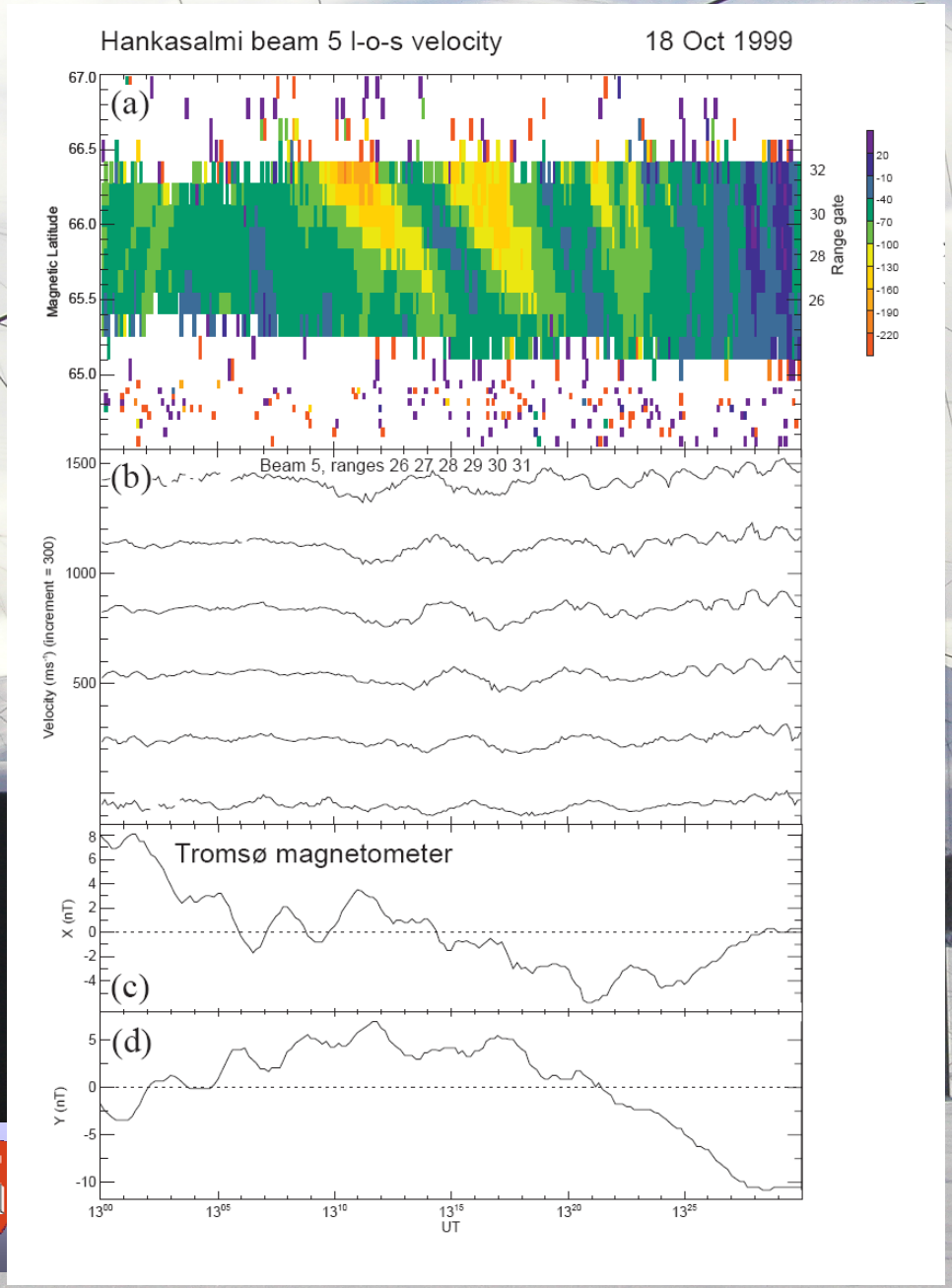
Previous observations of equatorward propagating events



Equatorward propagating events observed at Tromso

50 keV protons implicated

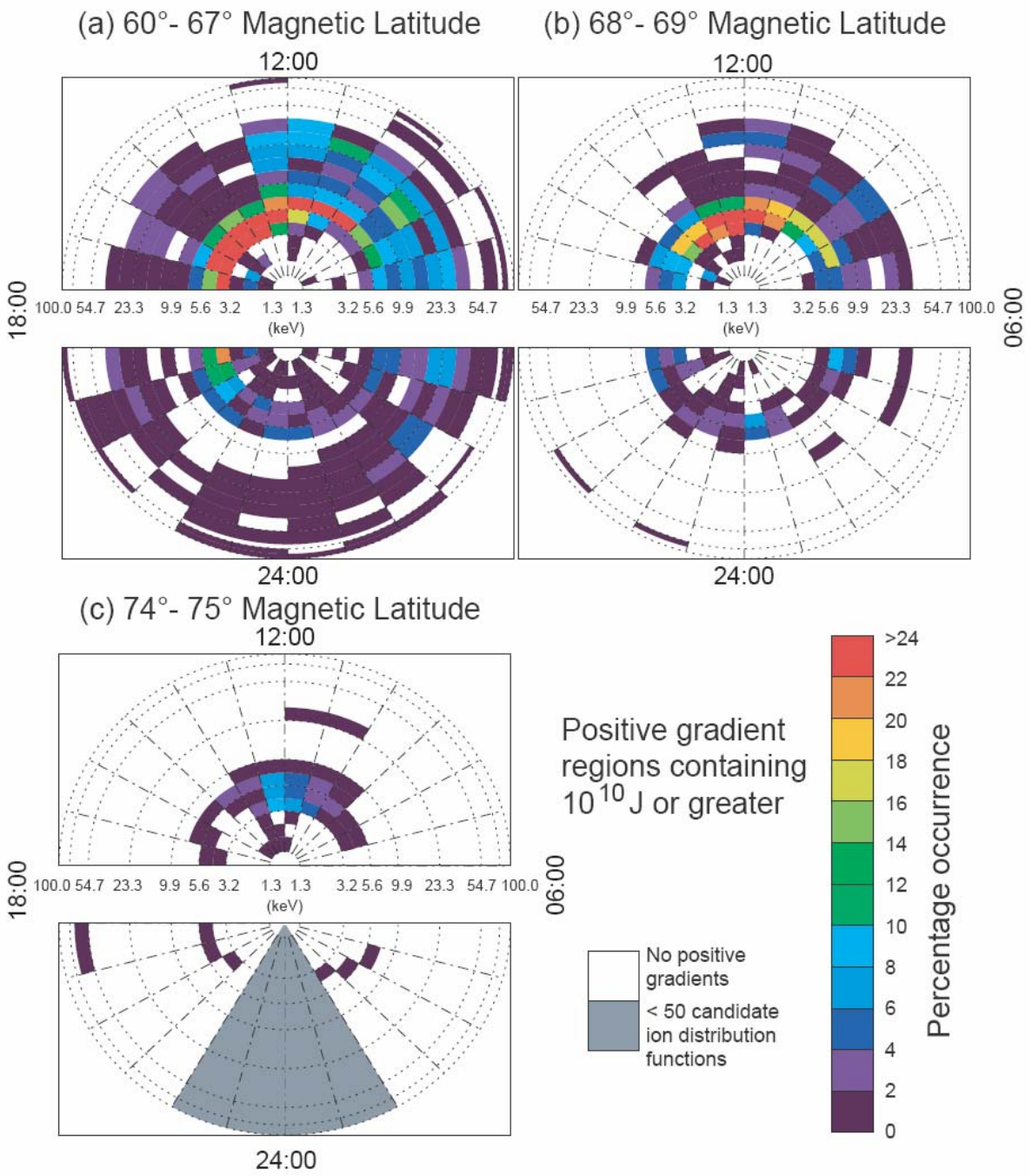
Yeoman & Wright, (2001)

A comparison of measurements at different L-shells

Study	*m*	τ (s)	L-shell	Implied proton energy (keV)
This study	60	300	15	10
Grant et al., 1992	~50	~300	7.5	20
Yeoman & Wright, 2001	35	260	6.4	50
Yeoman et al., 1992	20	~400	5	60

Why equatorward propagation? A mystery – high *m* events are observed with a variety of latitudinal propagations. Mann (1988) suggested that the details of the driving mechanism is important in determining this. The answer will have to wait for suitable satellite conjunctions

Measurements of magnetospheric particle population inversions



(from: Wilson et al.,2006)

Conclusions

- SPEAR-induced HF coherent scatter provides an excellent diagnostic of the electric field perpendicular to B over the ESR
- Structures of scale length ~100 km are imaged accurately by both CUTLASS radars
- Smaller structures are only imaged accurately along the HF radar beam
- Small scale waves, driven by wave-particle interactions are observed even at the high *L*-shells of Svalbard, and are similar to previous lower latitude observations, but are driven by particle populations of lower energy
- Such particle populations are indeed observed in the magnetosphere above Svalbard

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