北海道レーダー観測 1 年目のエコー通信簿

initial backscatter occurrence statistics from the superdarn hokkaido radar

20061202 to 20080126

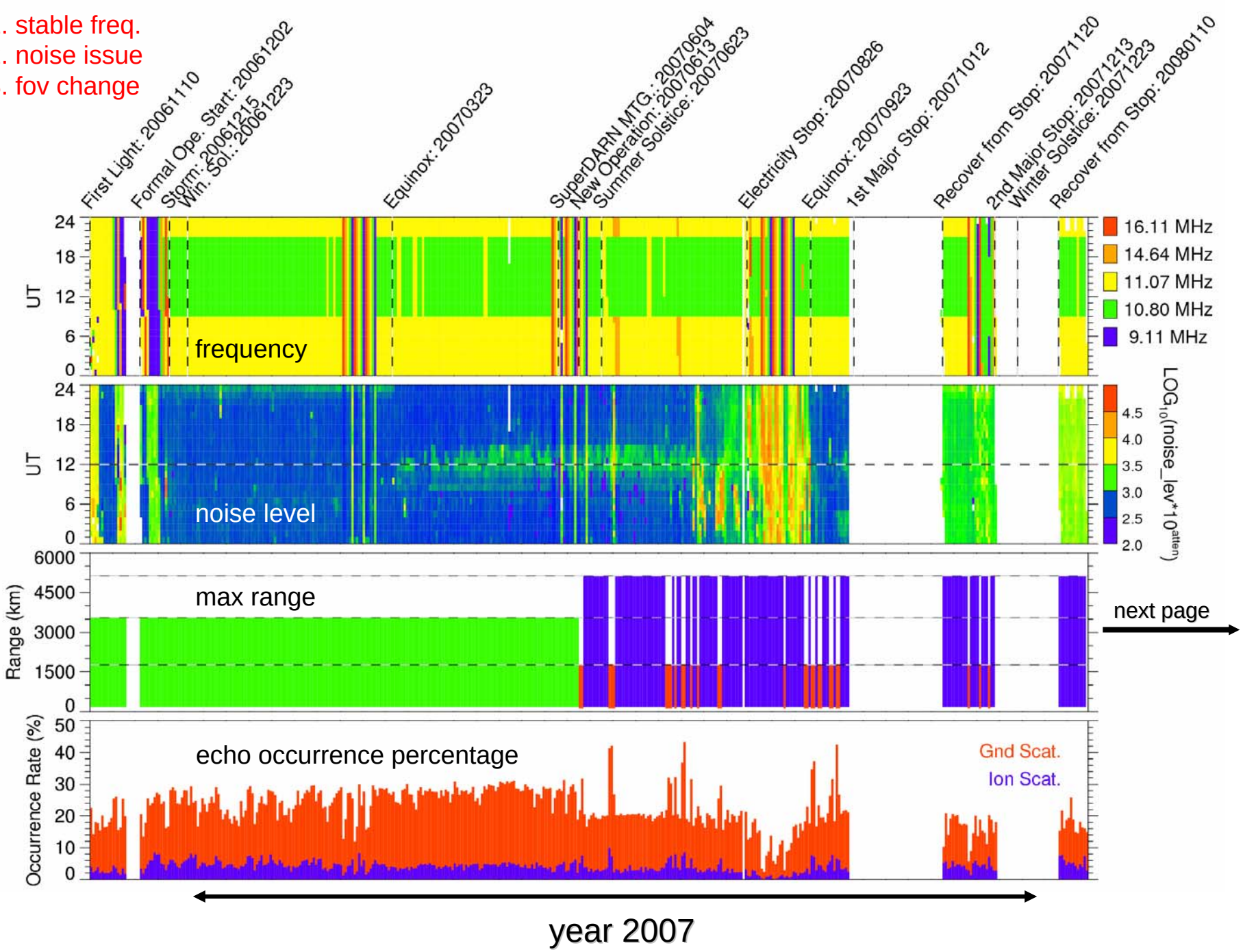
global distribution of deca-metre scale irregularities

k. hosokawa
and
all of sd people in japan

before moving on

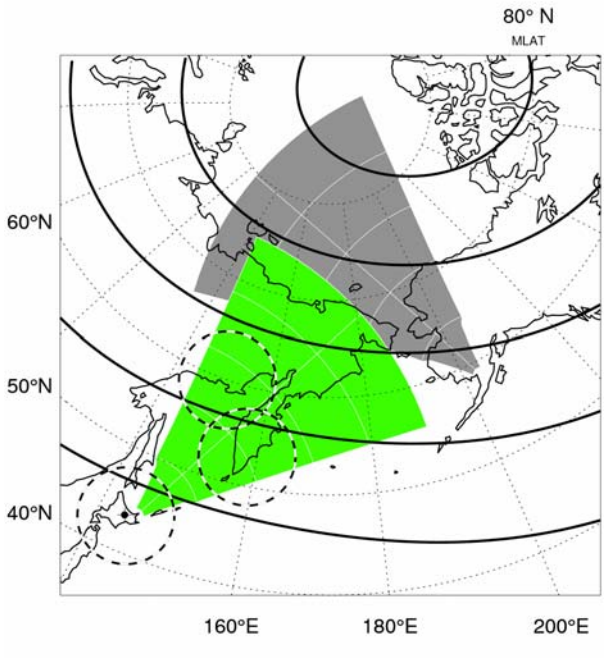
let me check the status of the radar

1. stable freq.
2. noise issue
3. fov change



history of changing fov

old normal mode

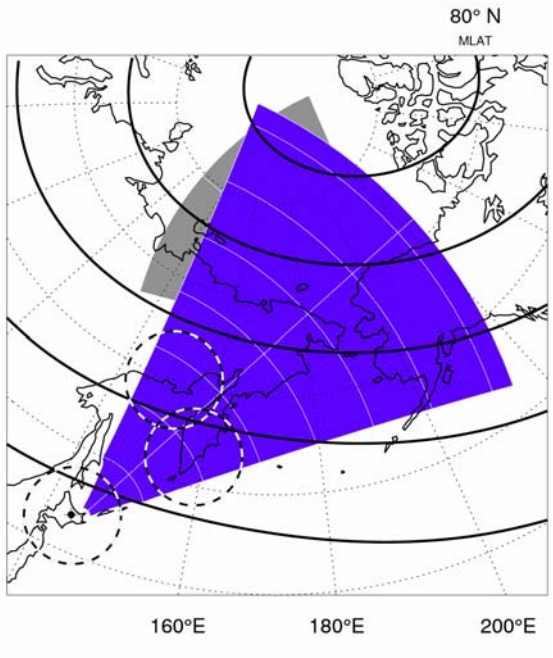


first gate: 180 km
gate sep: 45 km

no. of gates: 75
no. of cells: 1200
max range: 3555 km

20061202 - 20070613

current normal mode

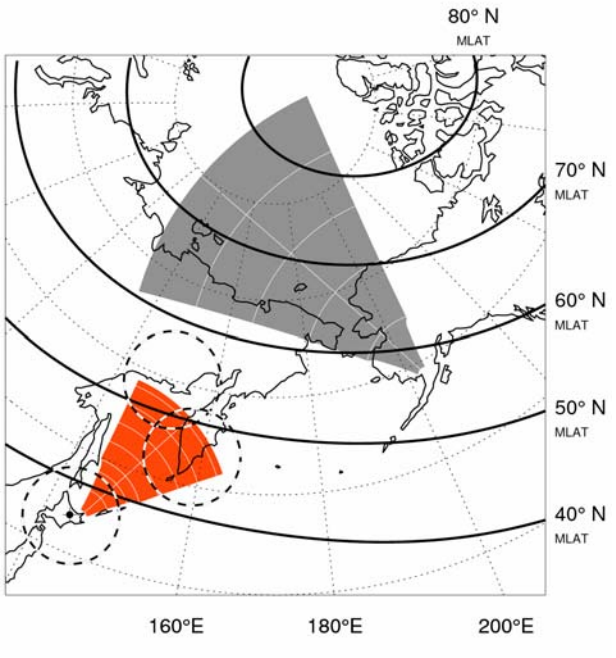


first gate: 180 km
gate sep: 45 km

no. of gates: 110
no. of cells: 1760
max range: 5130 km

20070613 -

ogawa's myopic mode



first gate: 120 km
gate sep: 15 km

no. of gates: 110
no. of cells: 1760
max range: 1770 km

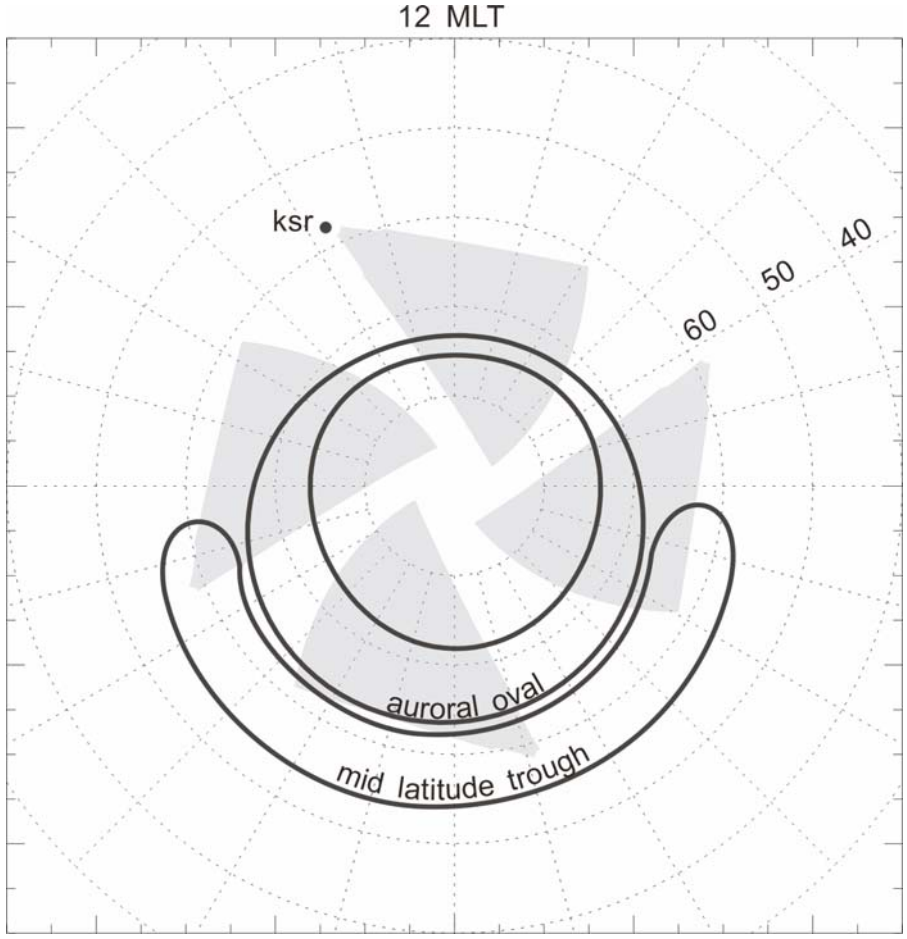
during DT period

echo occurrence statistics

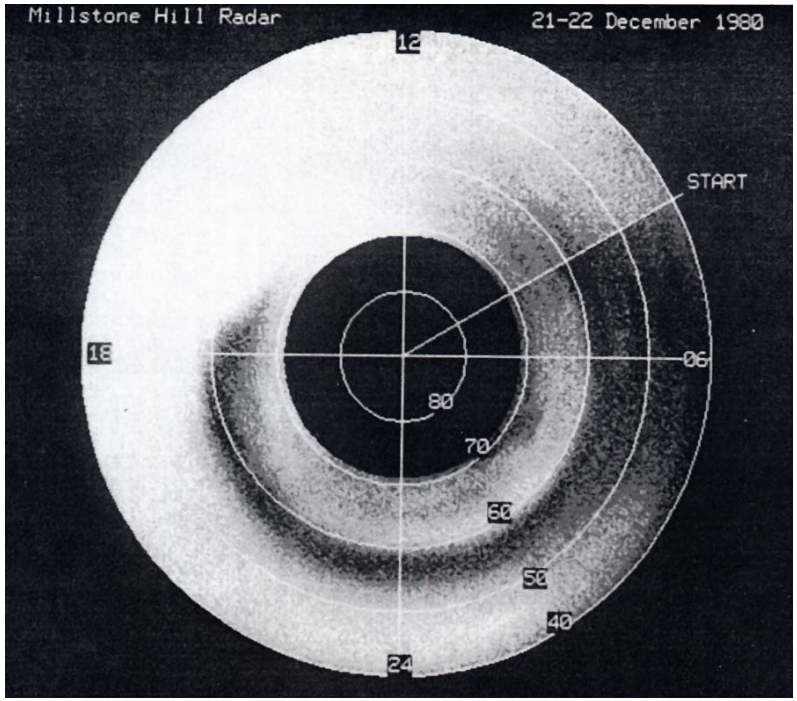
important note:

what I’ve done is a statistics with huge dataset,
transient features therefore may be invisible …

structures responsible for generation of irregularities

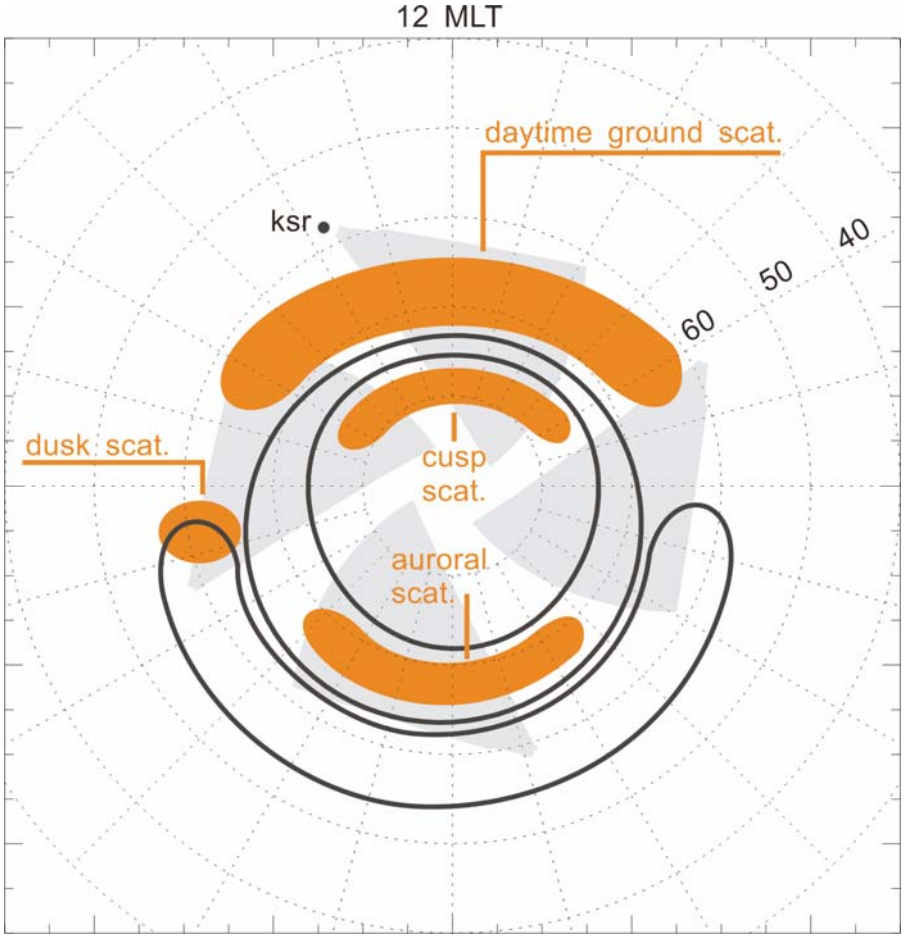


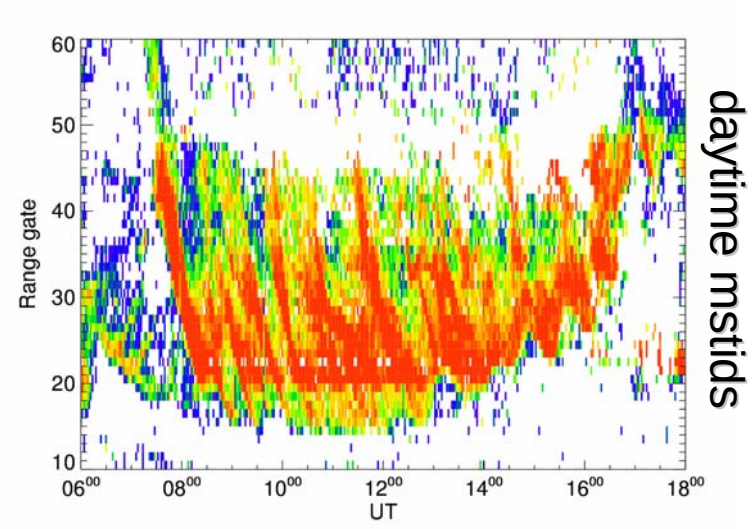
the fov of nict's king salmon radar, statistical location of auroral oval (*feldstein and starkov*, 1975) and mid-latitude trough in aacgm coordinates.



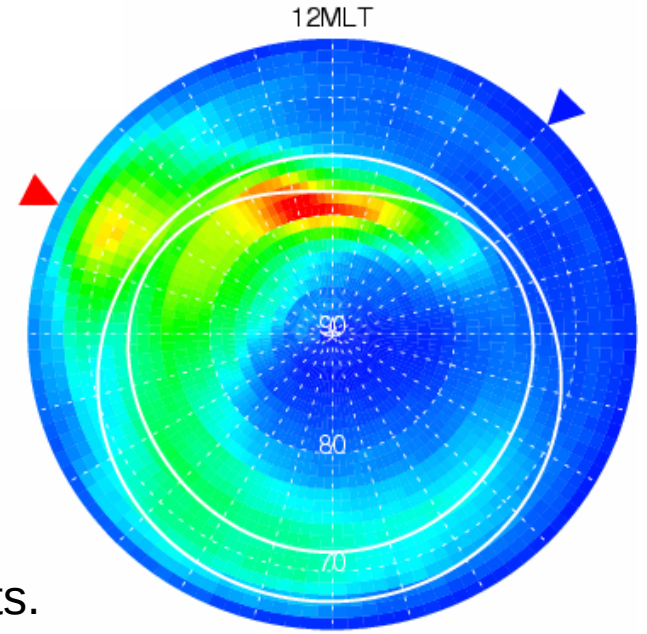
2d visualization of mid latitude trough (*holt et al.,* 1984) from millstone hill incoherent scatter radar obs.

learn from the superdarn echoes at high latitudes





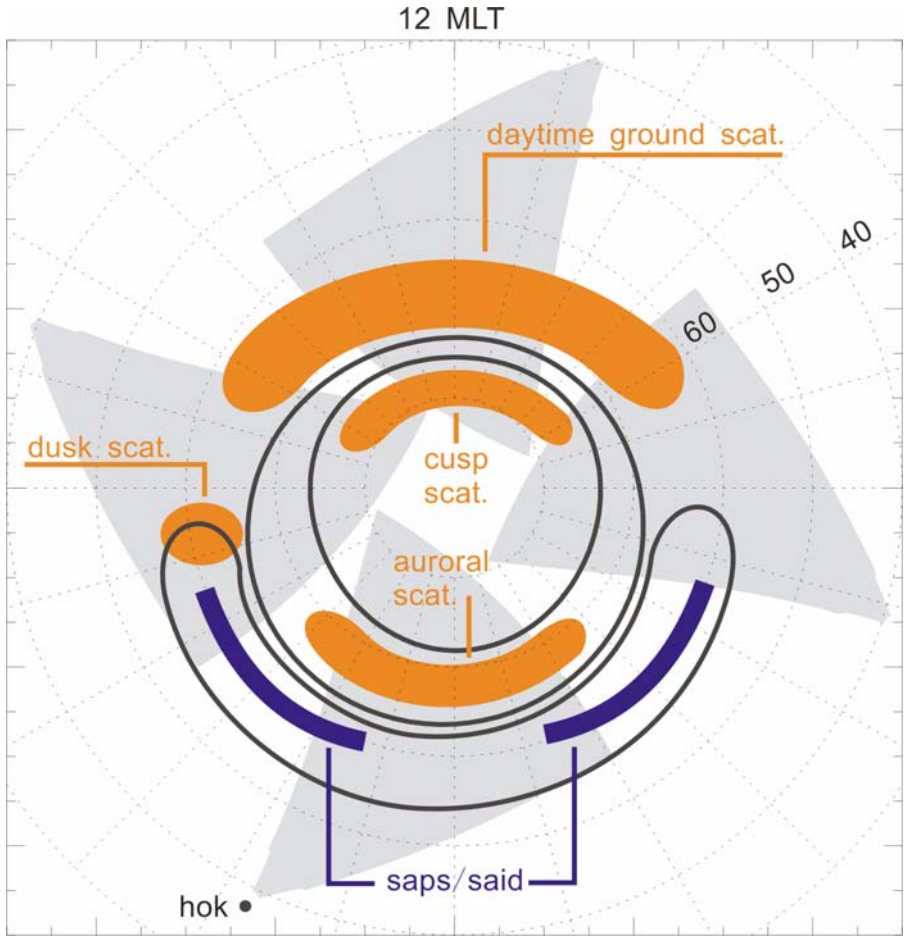
daytime mstids



There exist 4 hard targets for coherent HF radar measurements in the high-latitudes. These are daytime ground scat., cusp, auroral and dusk scats.

hosokawa et al., 2001

what we expect before deployment



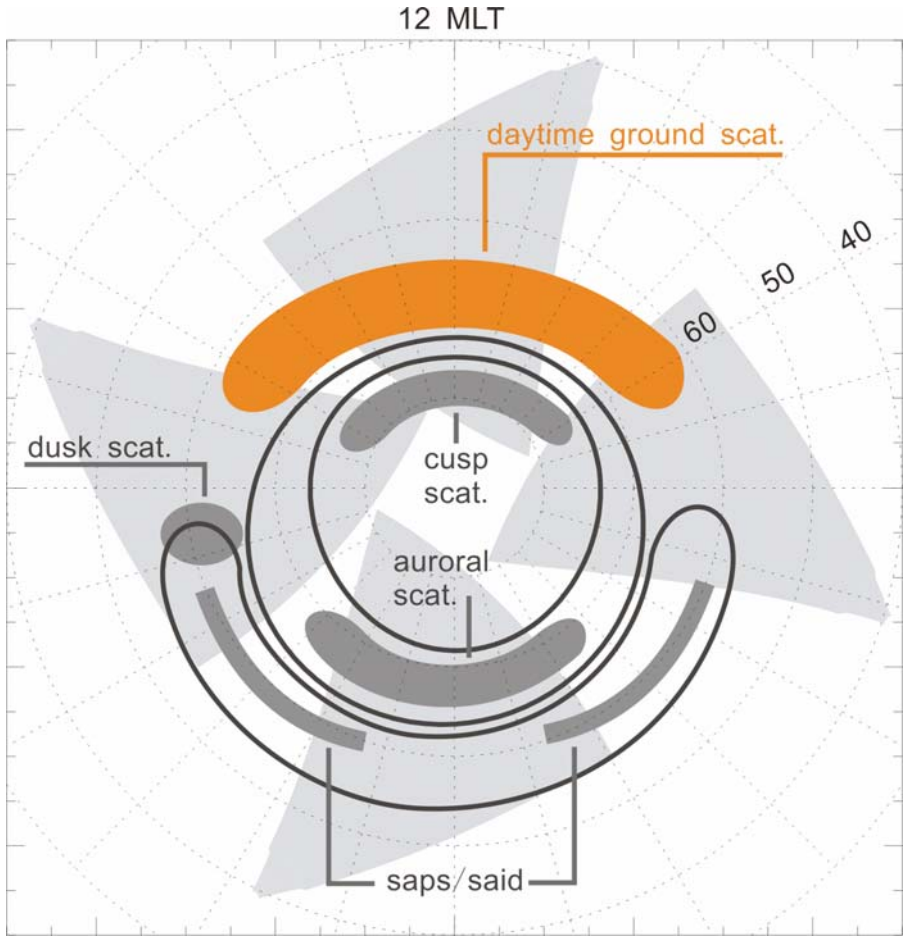
1. daytime ground scatter (including wavy feature associated with mstid, lstid)
2. cusp scatter (in disturbed cond.)
3. auroral scatter (in disturbed cond.)
4. dusk scatter (associated with trough)
5. saps / said (maybe transient feature)

Then do we find

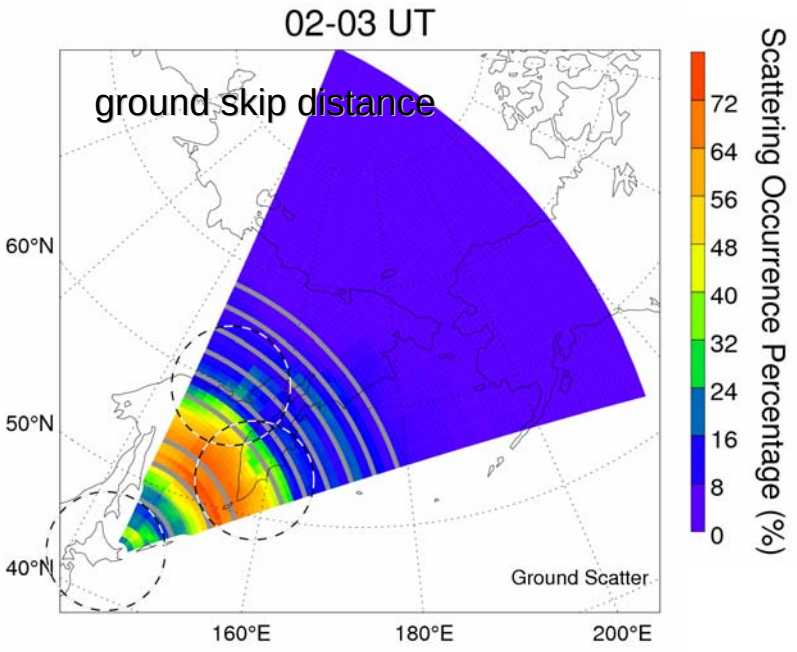
any new echoes ?

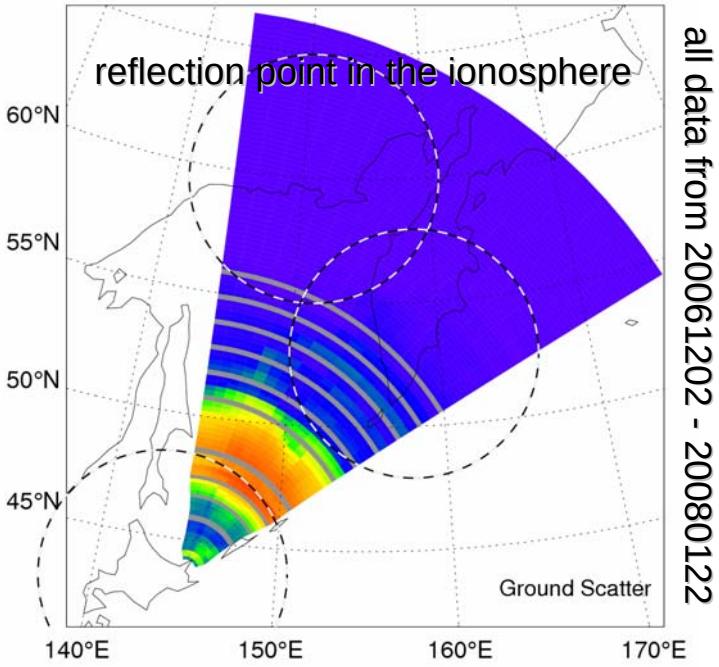
6. mid-latitude nighttime FAIs
7. Es, meteor (and PMSE?)

daytime ground backscatters · · · · · ·



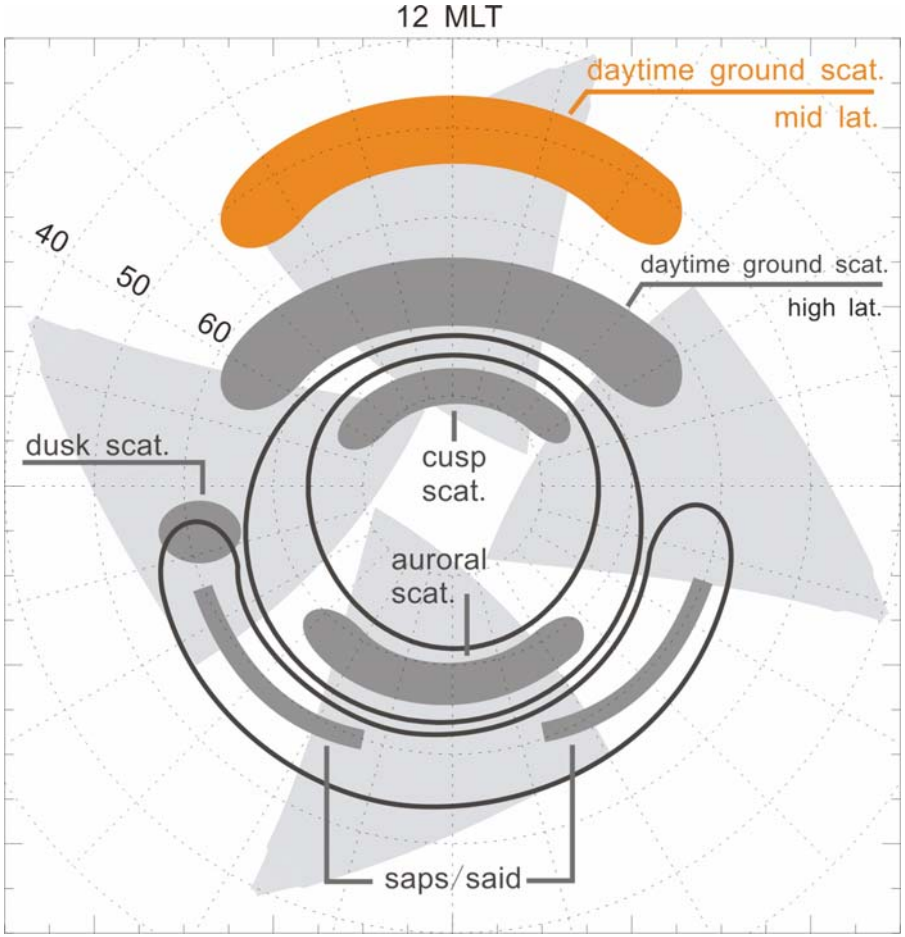
geographic latitude: 45 N to 50 N
(reflection pnt.)
AACGM latitude: 40 N to 45 N



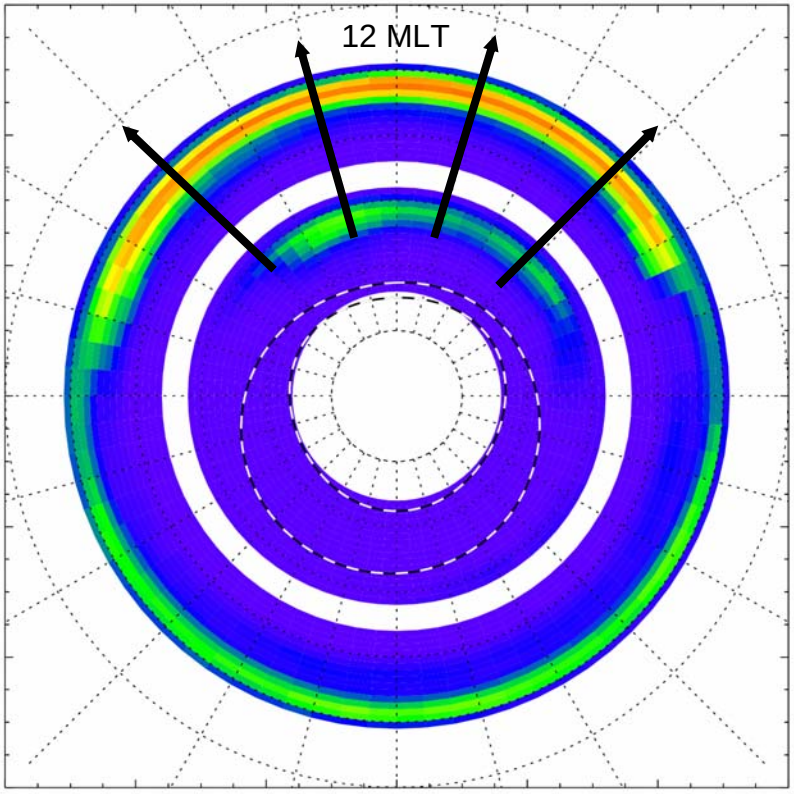


all data from 20061202 - 20080122

daytime ground backscatters (hokkaido + king salmon)

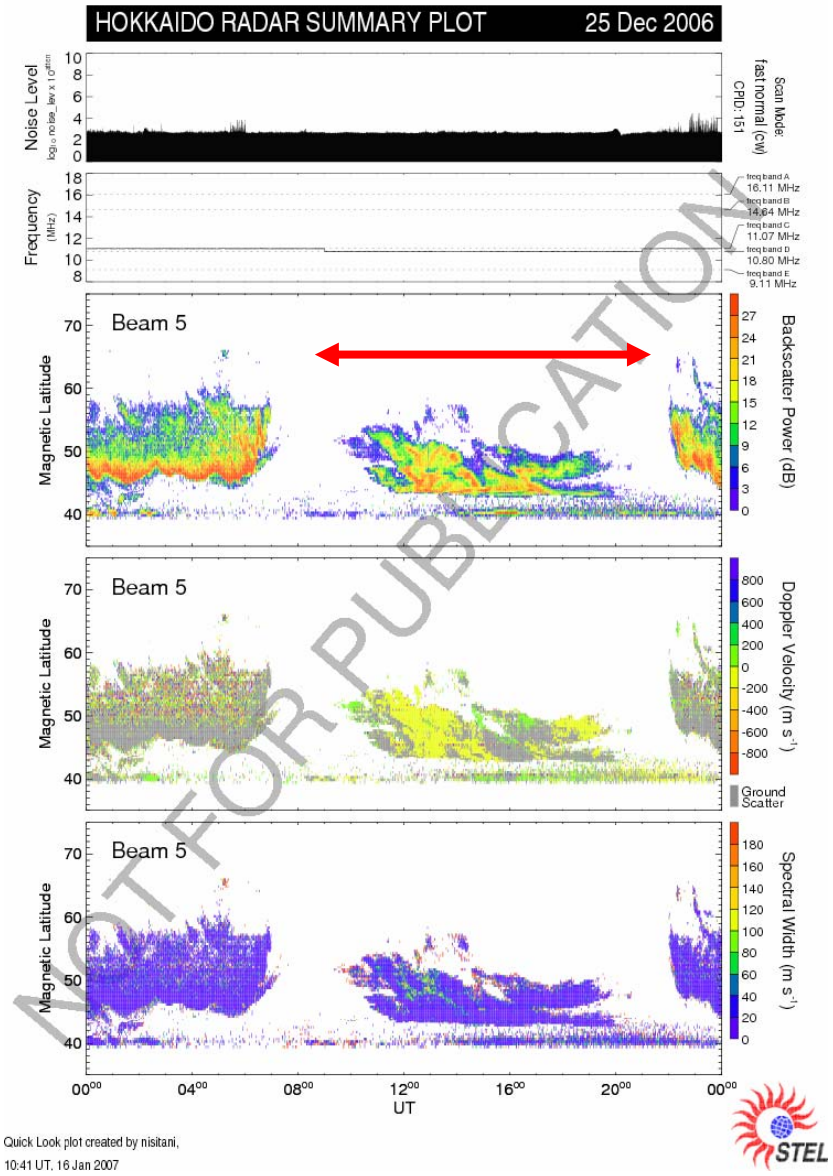


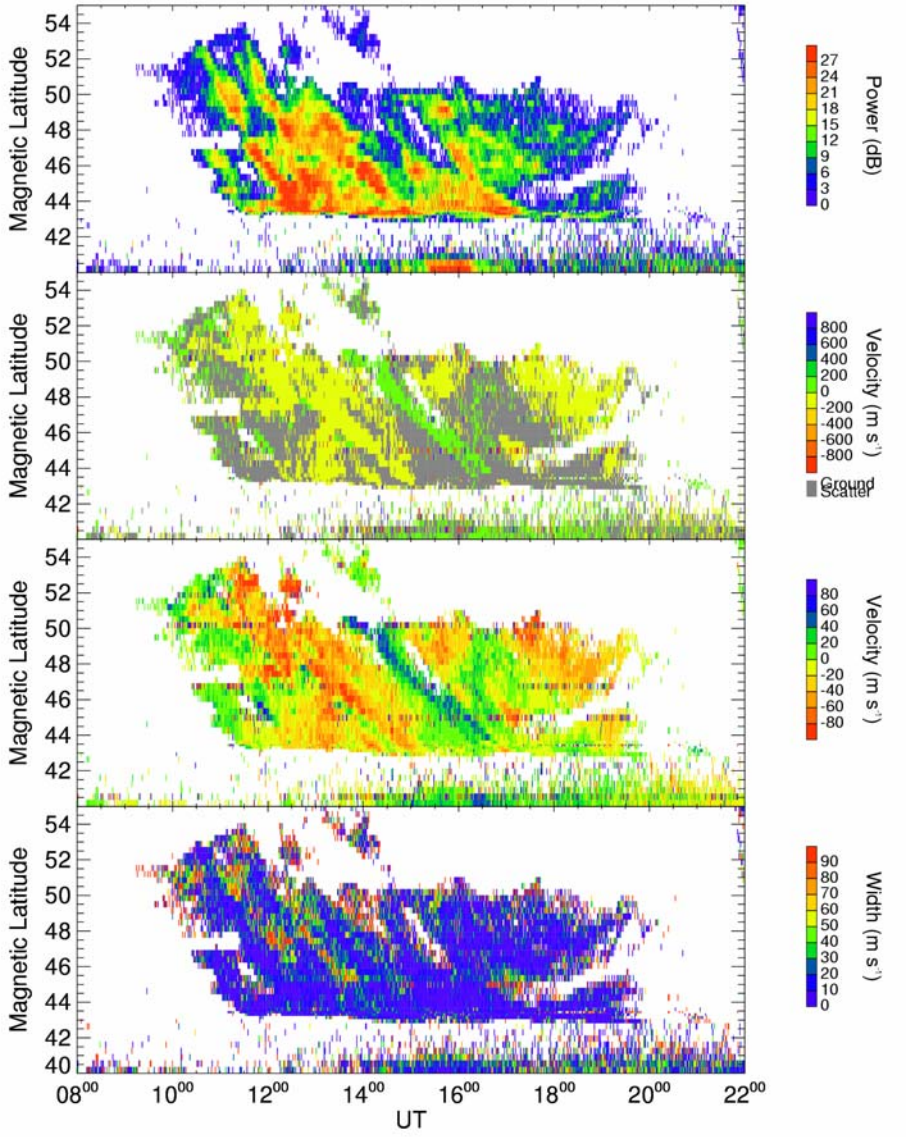
occurrence of ground scatter
(at ionospheric reflection point)
hok + ksr



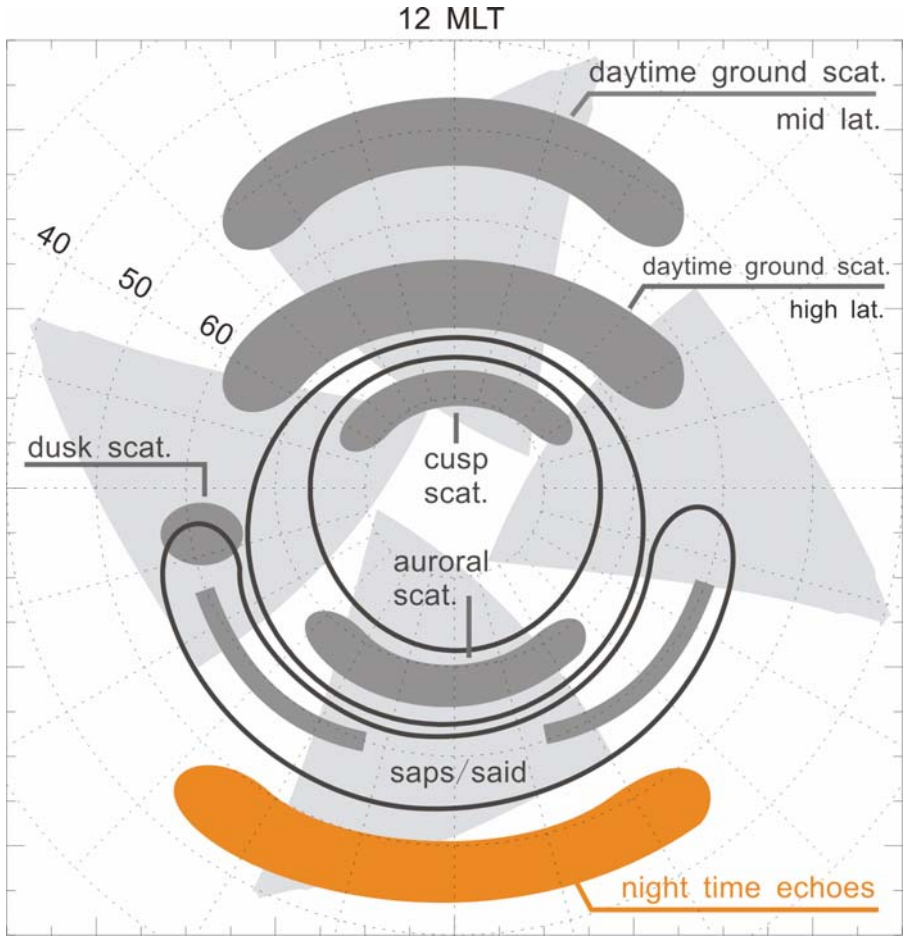
combining observations of hok and ksr is a good approach for investigating propagation of daytime mstid from auroral to mid-latitudes.

nighttime ground/ionospheric (mixed) backscatters



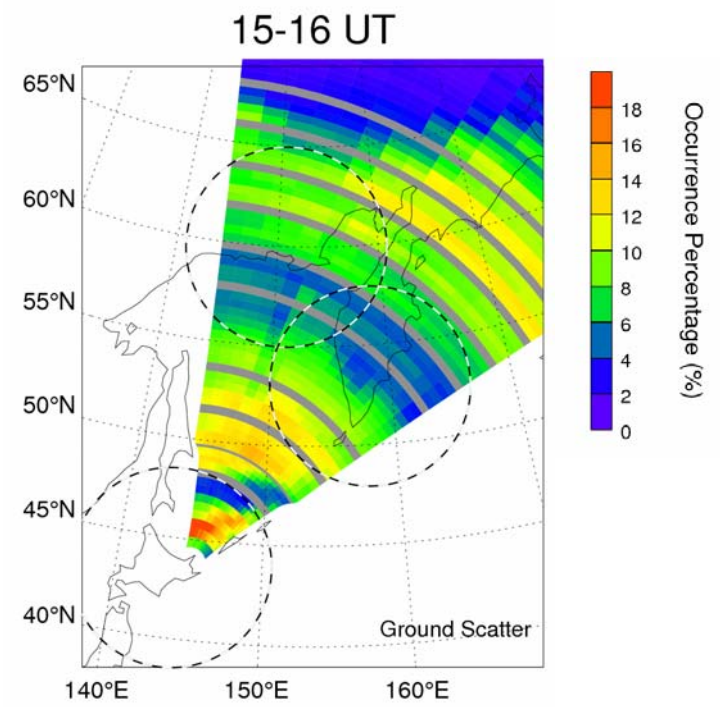


nighttime ground/ionospheric (mixed) backscatters

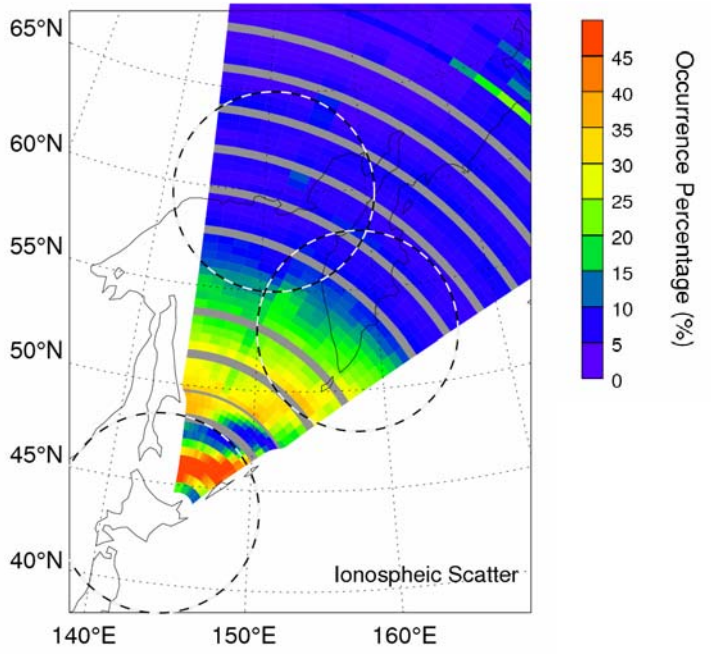


these nighttime echoes may include some wavy feature associated with nighttime mstids (simultaneous obs. with omti is desirable)

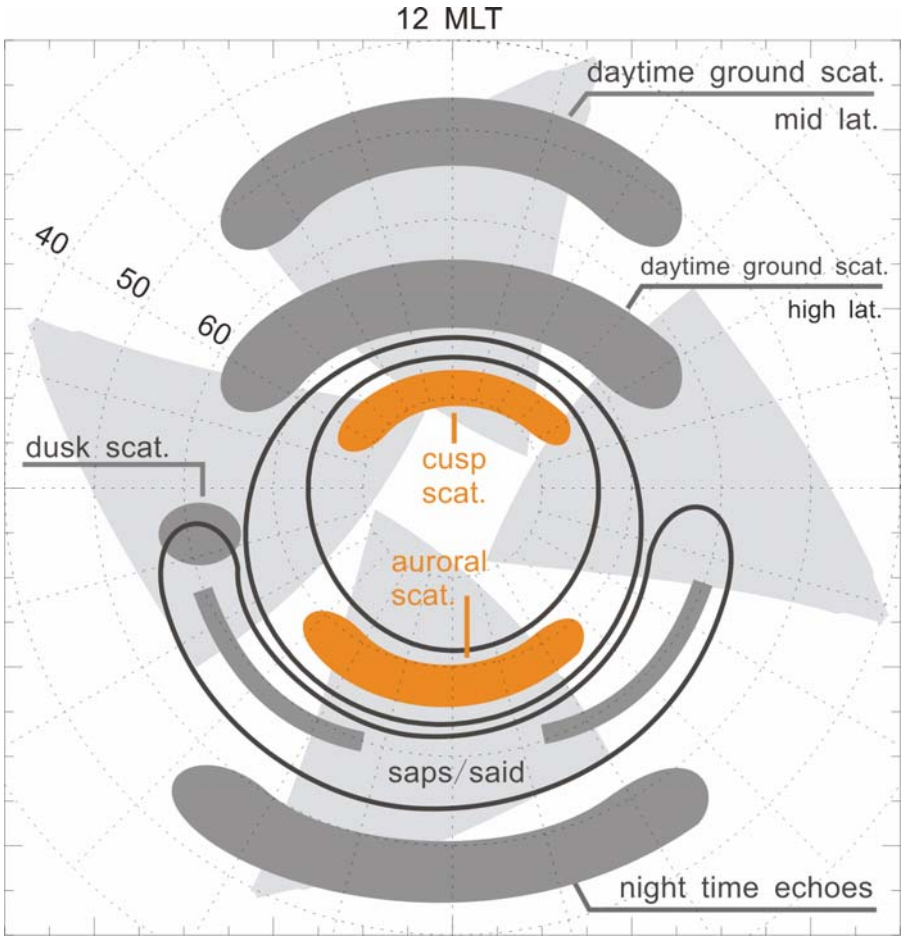
ground scatter @ landing pnt.

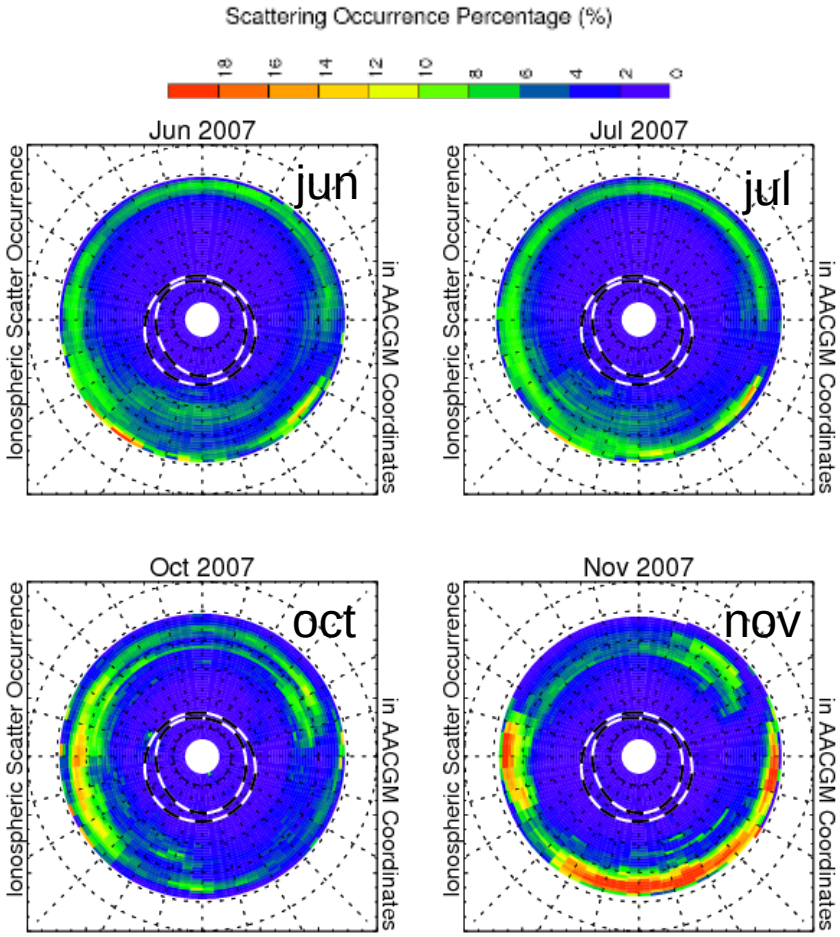


ionospheric scatter



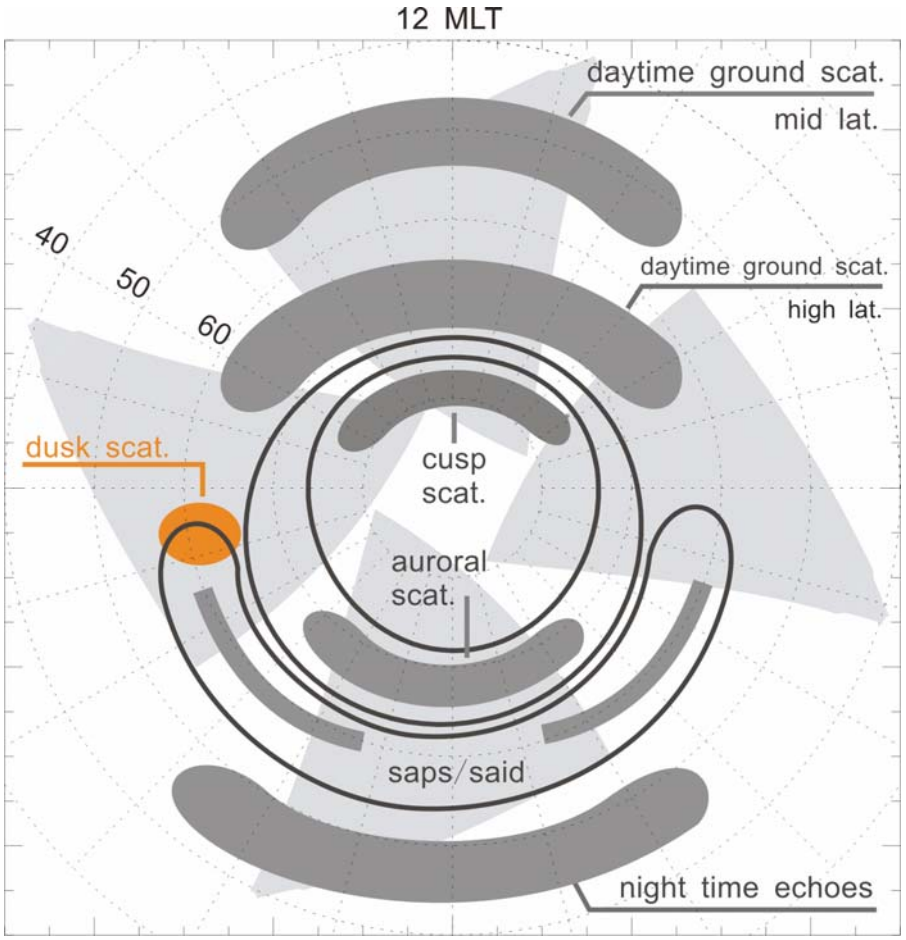
can we observe cusp and auroral scatters?



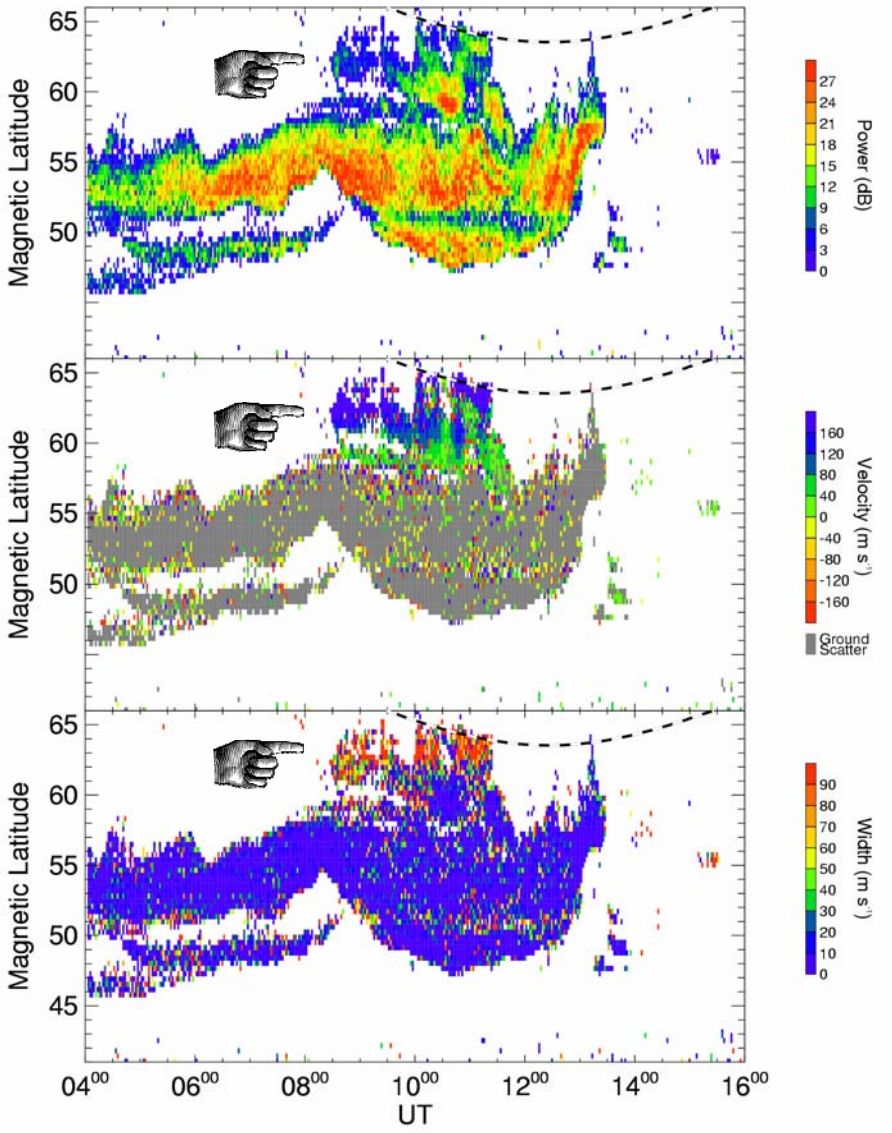


ionospheric backscatter of cusp and auroral oval origin cannot be identified in the current statistics, probably due to extremely low geomagnetic activeity in 2007.

dusk scatter (trough scatter)

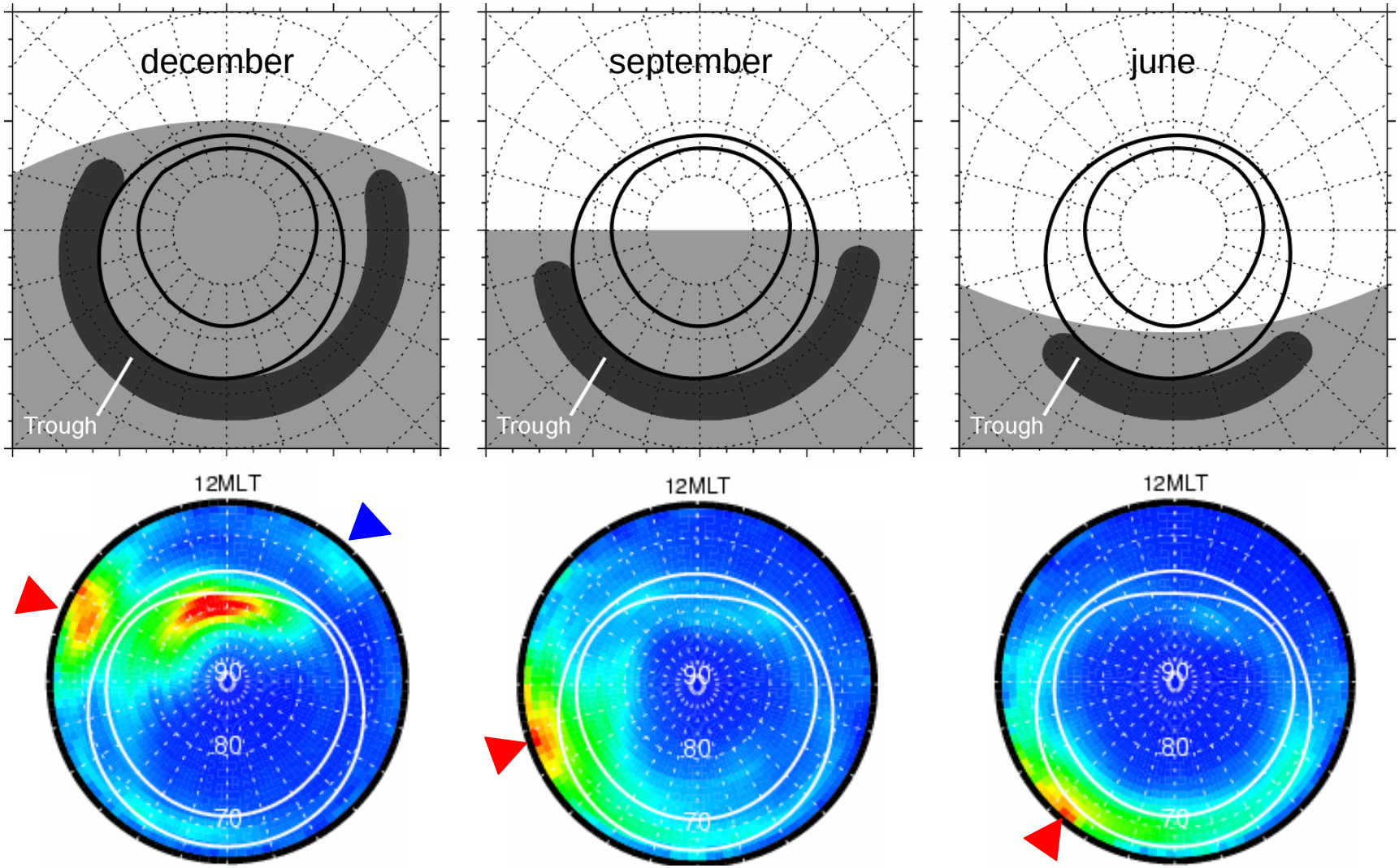


dusk scatter (*ruohoniemi et al*., 1987, *hosokawa et al*., 2001, 2002) is prominent especially in feb, mar and apr.



dusk scatter (trough scatter)

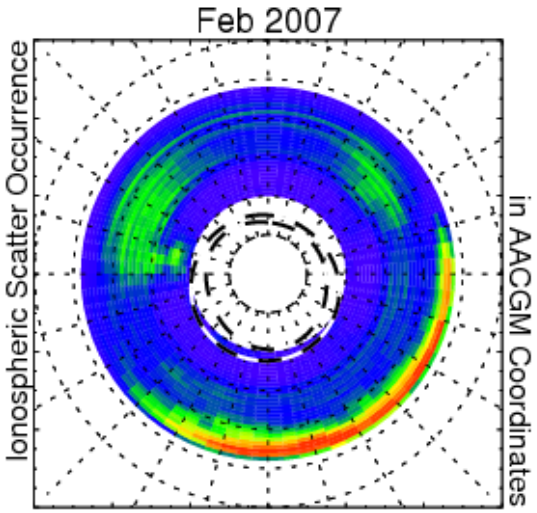
dusk scatters are always collocated with the sunward edge of trough.

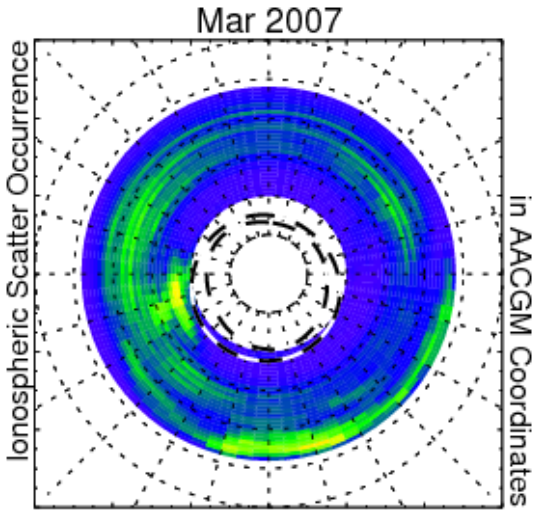


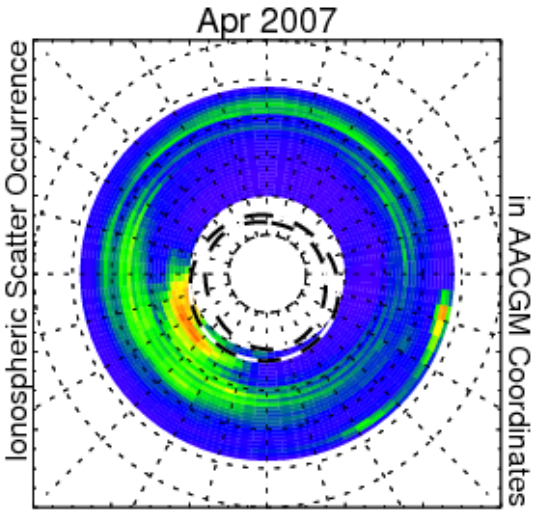
hosokawa et al., 2001

dusk scatter (trough scatter)

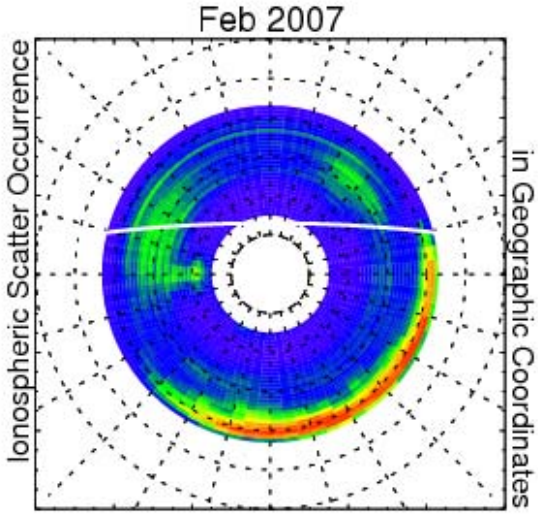
geomagnetic coordinates

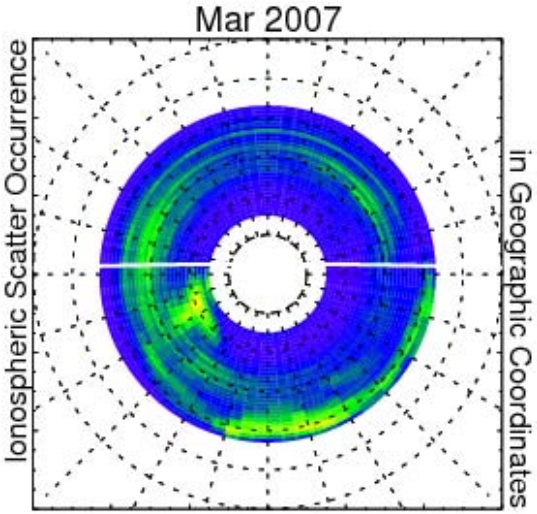


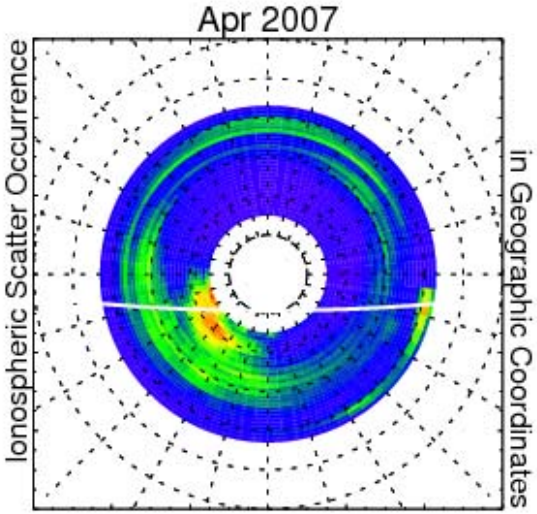




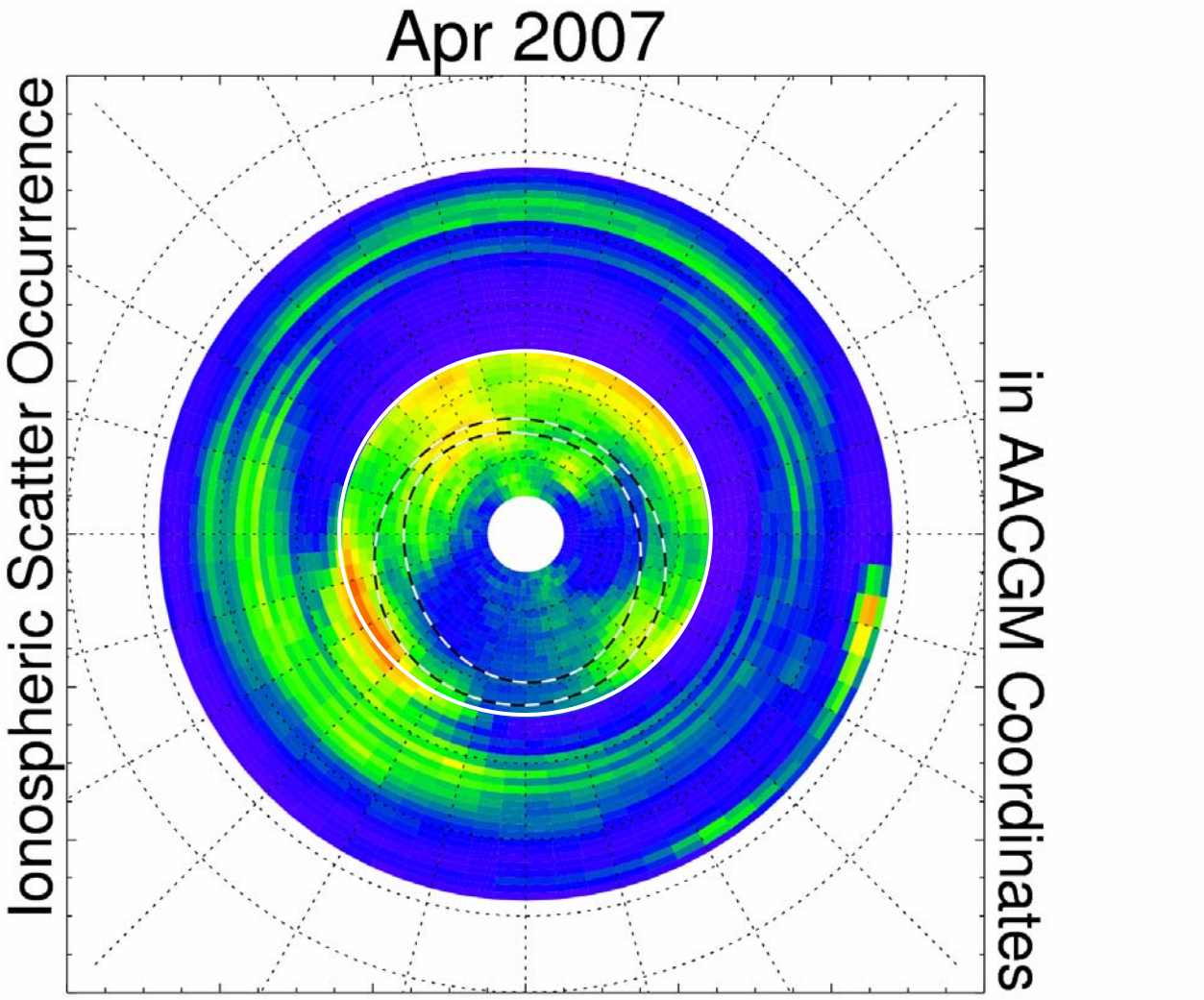
geographic coordinates





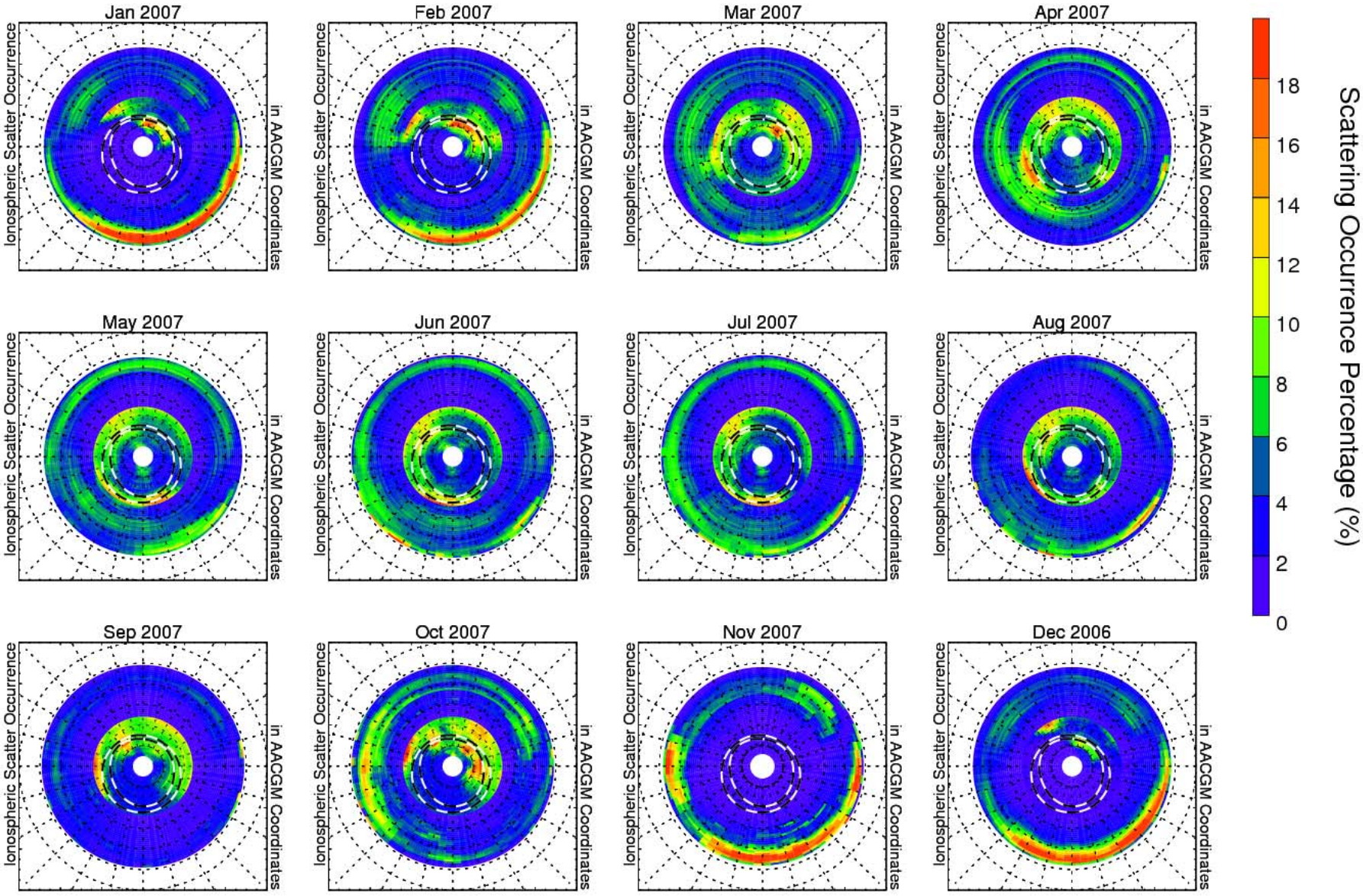


dusk scatter (trough scatter)



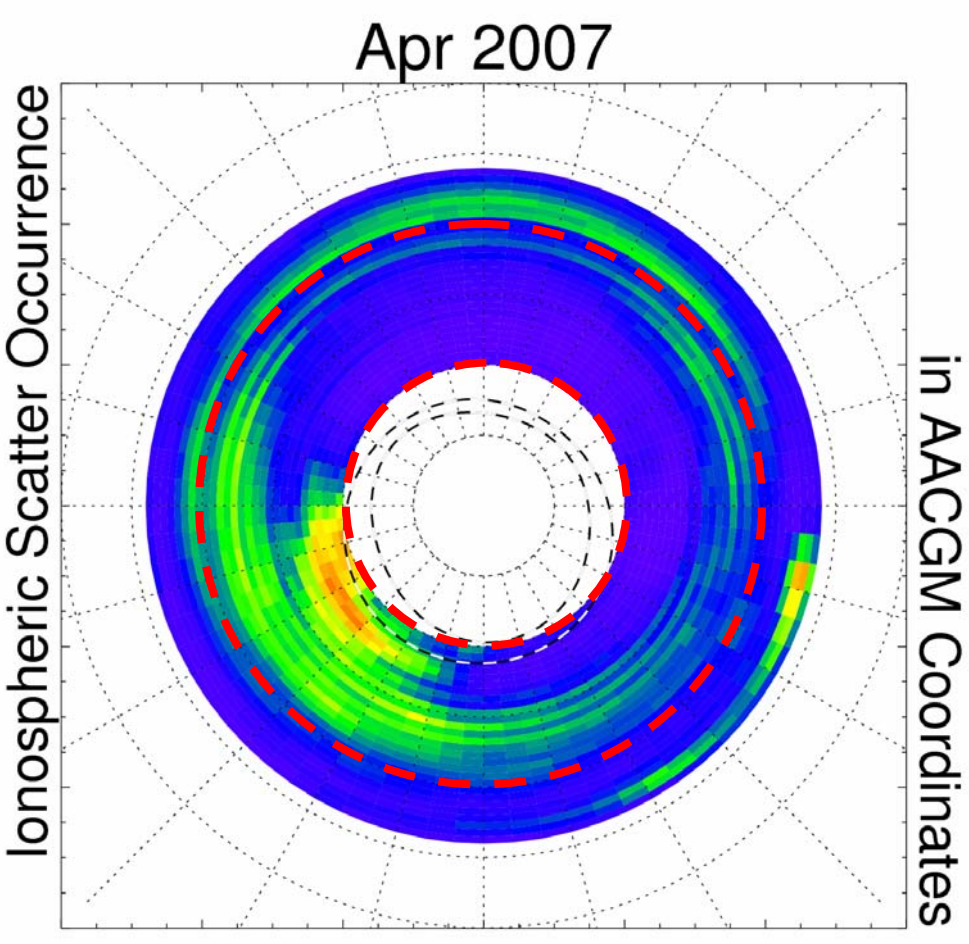
ksr + hok

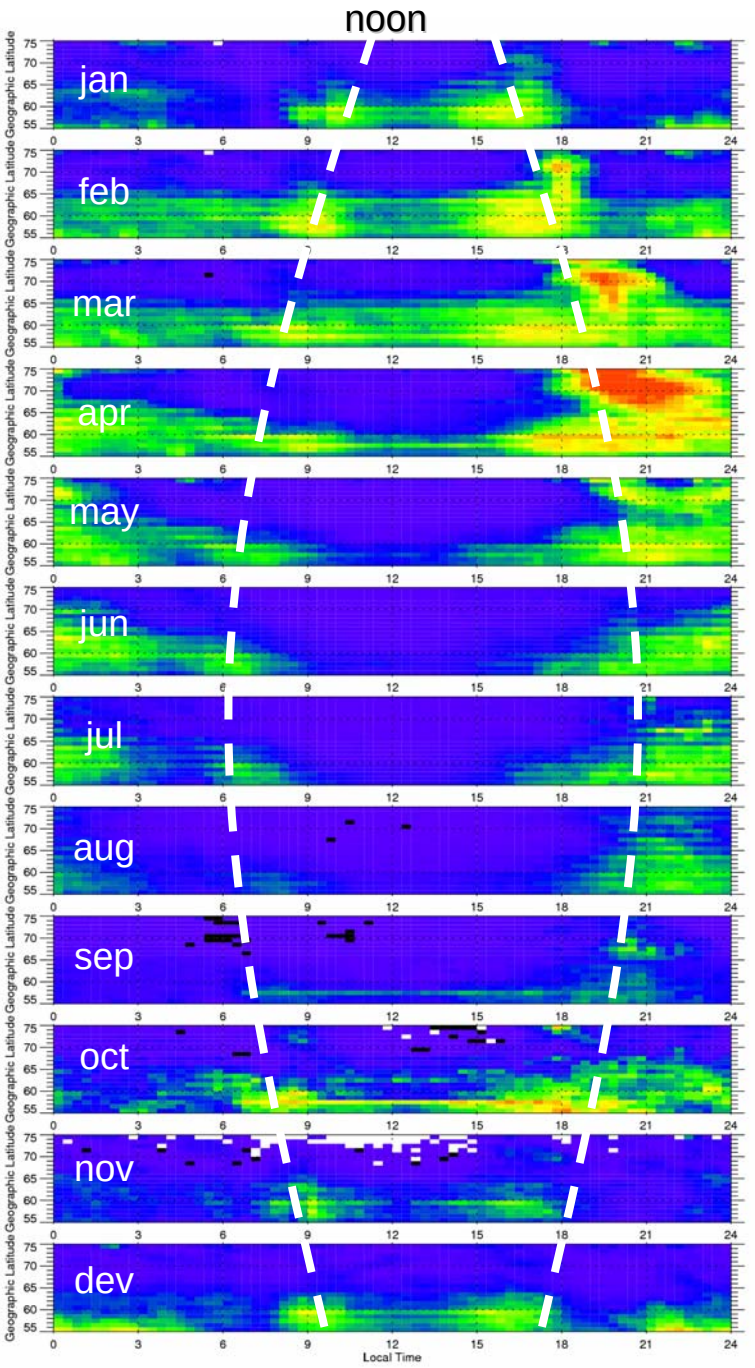
dusk scatter (trough scatter)



dusk scatter (trough scatter)

localtime where low latitude part of dusk scatter echoes appears shifts systematically with movement of terminator.





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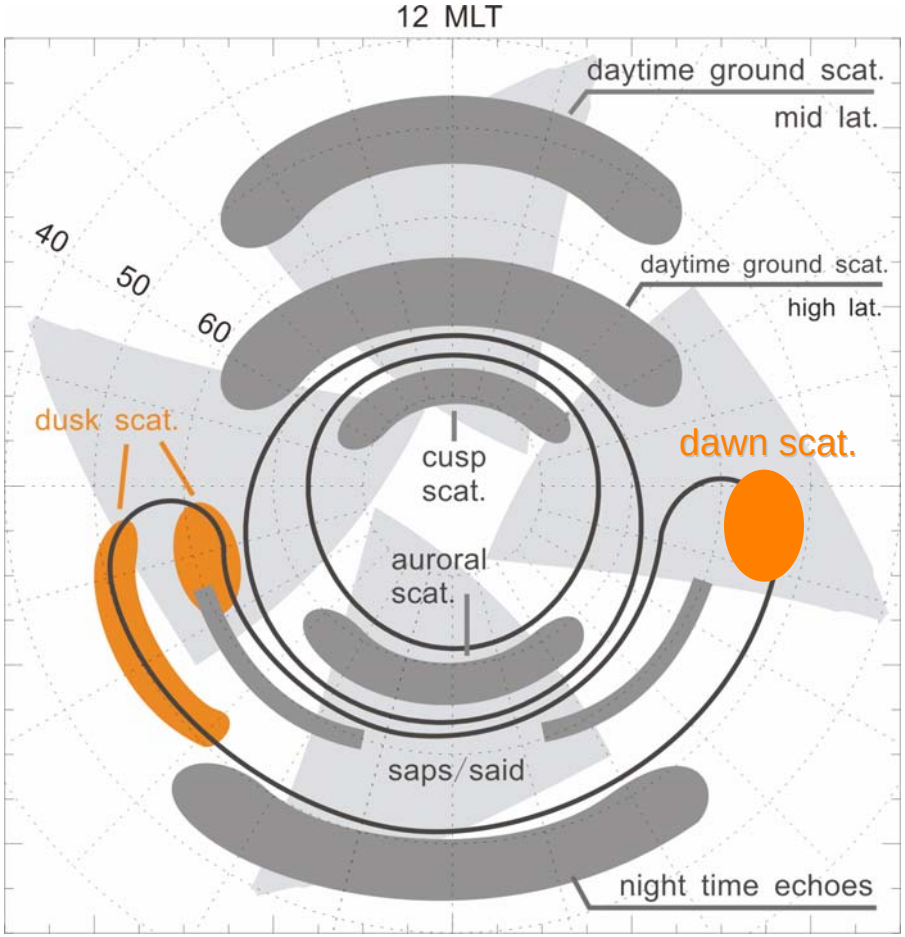
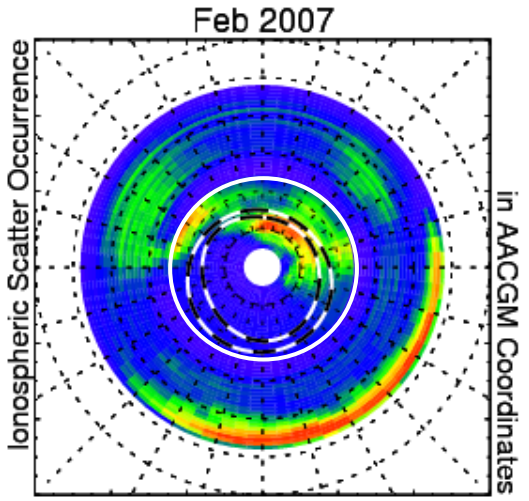
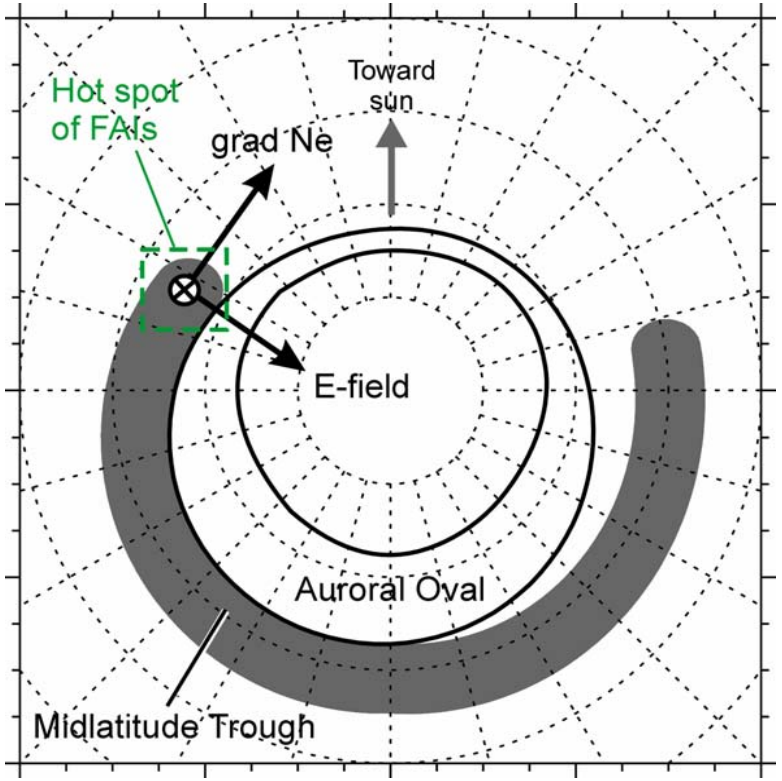


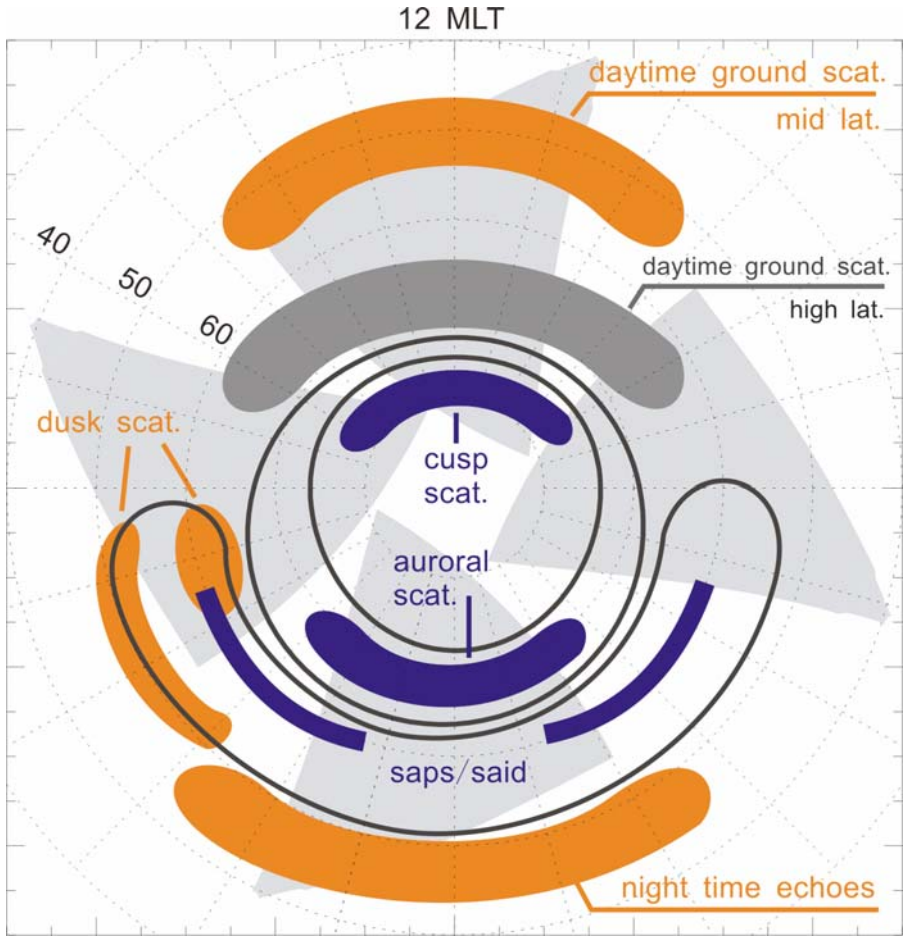


hok + ksr



generation process of low-latitude part of dusk scatter is still unknown. Information on an ambient electric field is needed for detailed discussion.

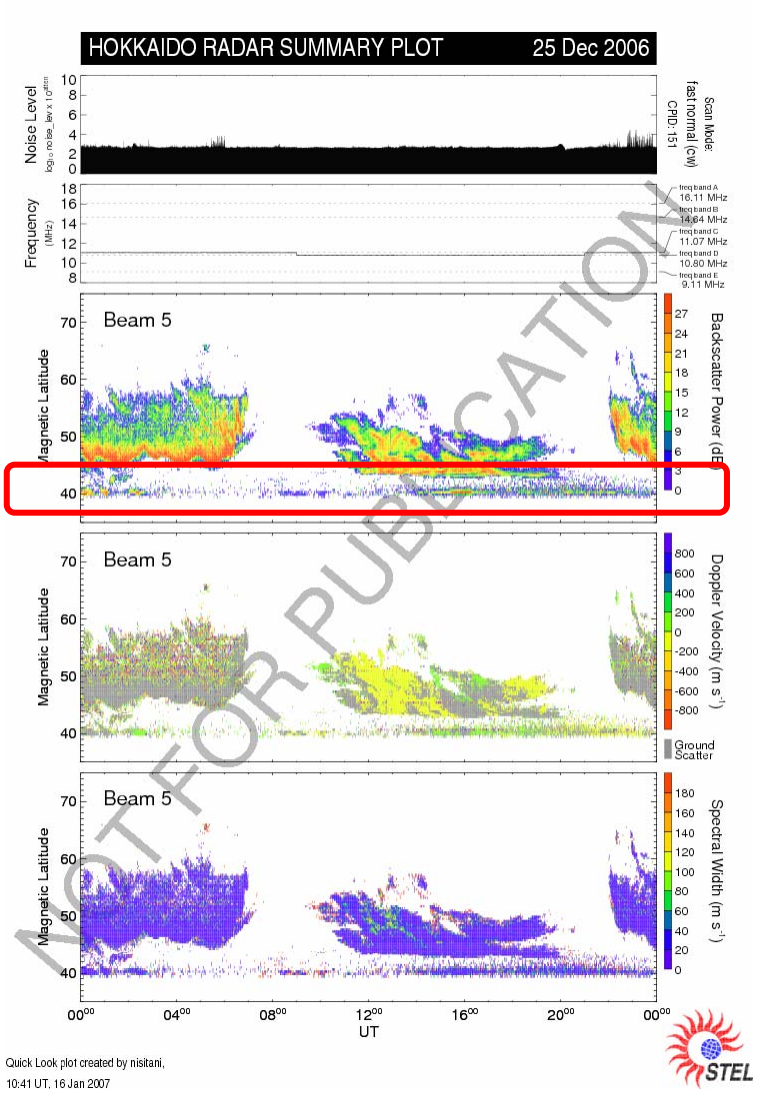
catalogue of backscatter echoes as seen from hokkaido



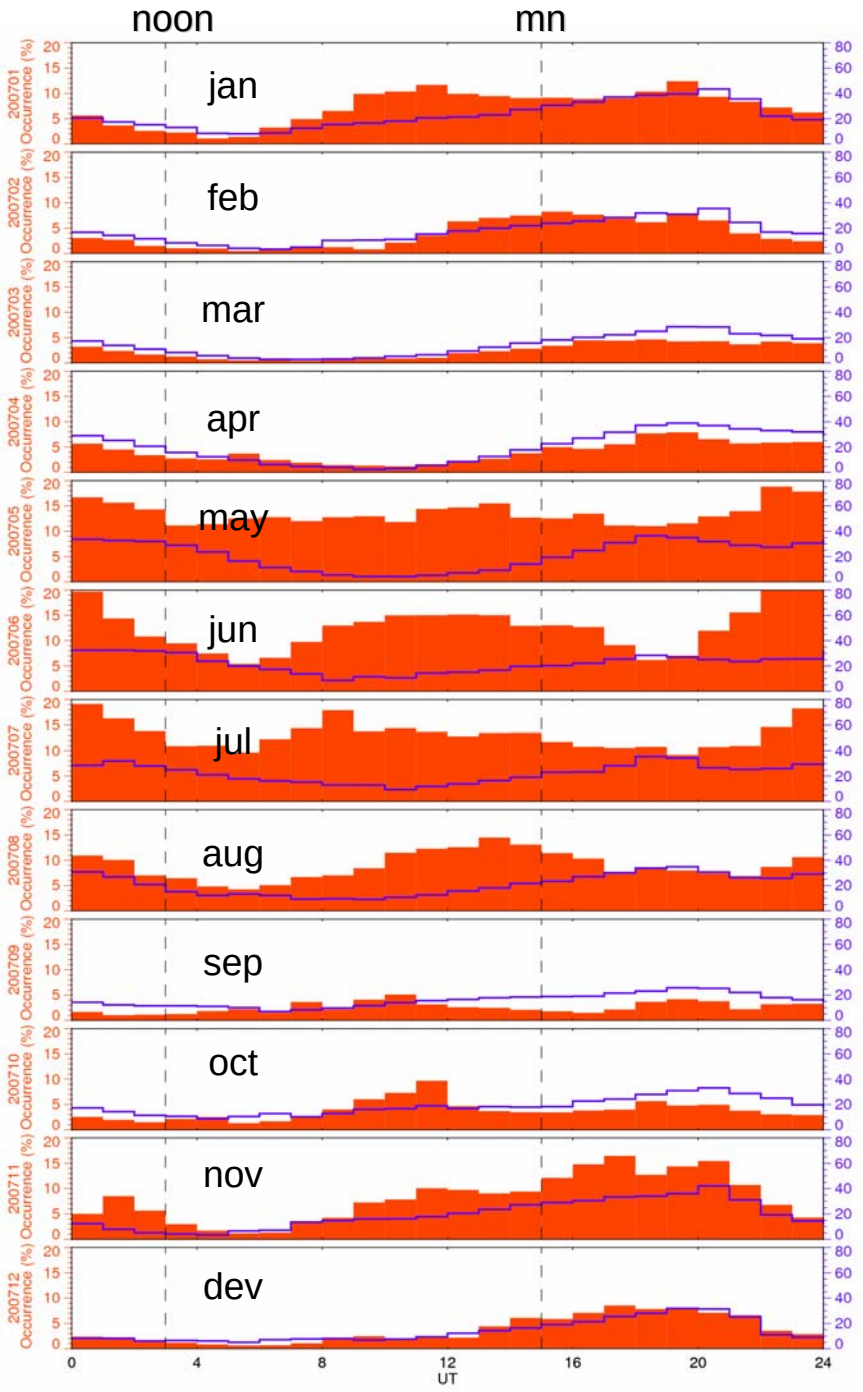
daytime ground scatter, dusk scatter and nighttime echoes are the dominant three hard targets for the hokkaido sd radar.

1. daytime ground scatter (including wavy feature associated with mstid, lstid)
2. cusp scatter - invisible (in disturbed cond.)
3. auroral scatter - invisible (in disturbed cond.)
4. dusk scatter splitting into two parts
5. saps / said - invisible (maybe transient feature)
6. mid-latitude nighttime FAIs
7. Es, meteor (and PMSE?)

E-region scatter and meteor scatter

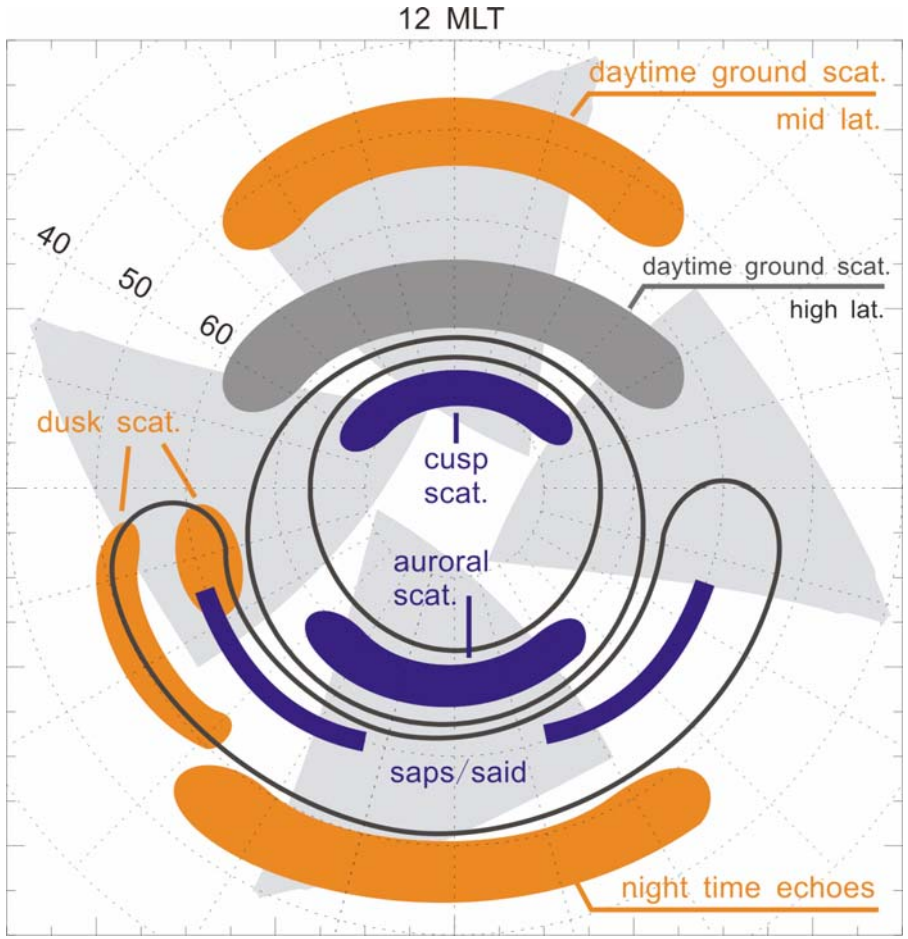


occurrence of E-region echoes (range < 600 km, pwr_l > 15 dB)



occurrence of meteor (range < 600 km, pwr_l < 12 dB)

catalogue of backscatter echoes as seen from hokkaido



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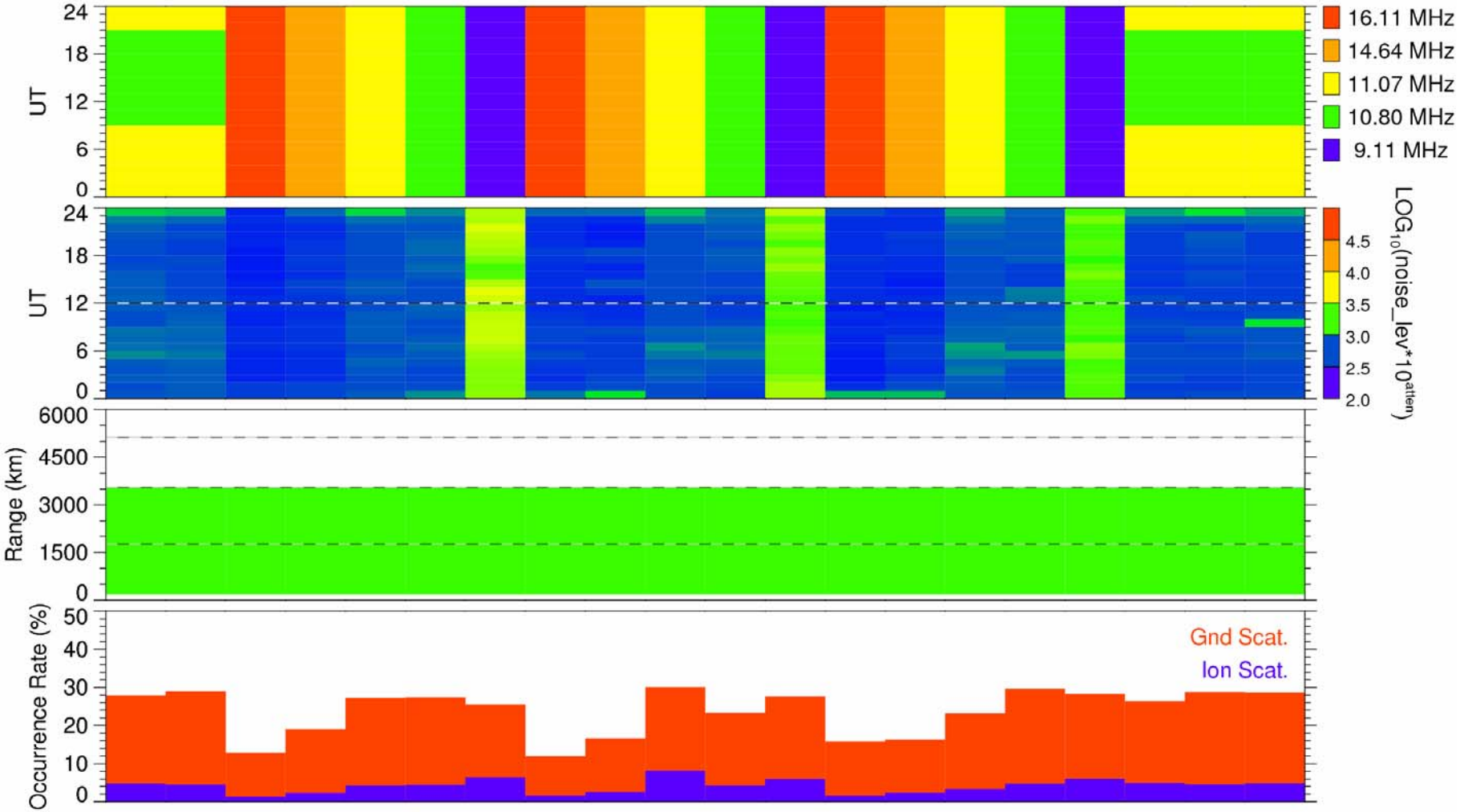
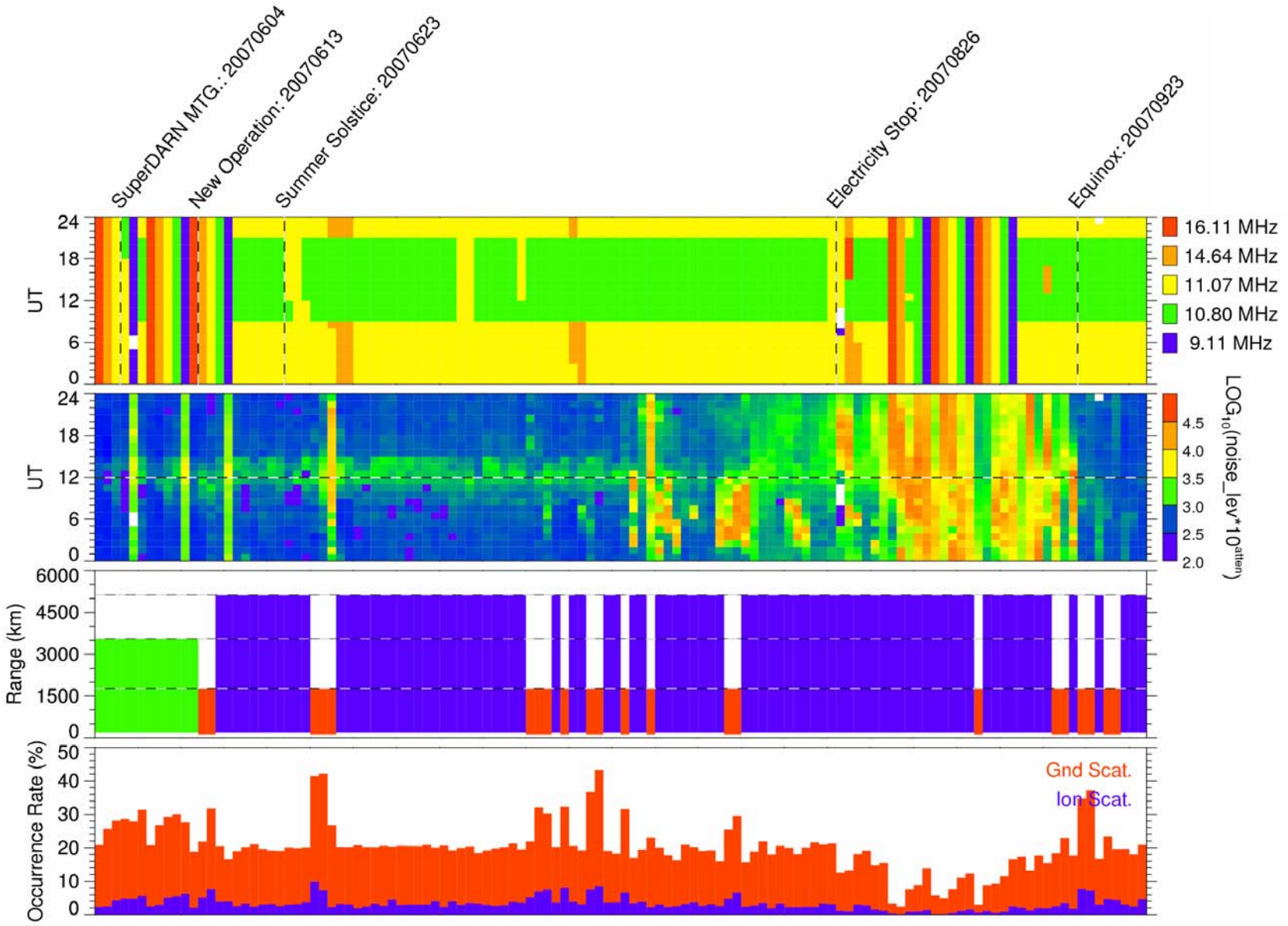
frequency dependence



change fov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New Operation: 20070613
Summer Solstice: 20070623
Electricity Stop: 20070826
Equinox: 20070923
UT
24
18
12
6
0
16.11 MHz
14.64 MHz
11.07 MHz
10.80 MHz
9.11 MHz
4.5
4.0
3.5
3.0
2.5
2.0
LOG10(noise_lev*10atten)
Range (km)
6000
4500
3000
1500
0
Occurrence Rate (%)
50
40
30
20
10
0
Gnd Scat.
Ion Scat.