Field experiments for the DPR algorithm development

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Target

Contribute to the scattering table at Ka-band radiowaves, particularly for solid precipitation

This fiscal year (JFY2013)

Continue rain observation at Sapporo

Observation: done. Data analysis: yet

Continue data analysis for Okinawa, Mt. Fuji, Nagaoka experiments

Nearly done. Need more careful analyses

Conduct melting layer observation at Zao

On going

Actually JAXA direct experiment

Ka-radar collaboration

EORC/JAXA: Y. Kaneko, K. Komachi, K. Yamamoto, R. Oki

Management, logistics, observation

NICT: K. Nakagawa, H. Hanado

Observation, Ka-radar maintenance

NIED: K. Iwanami, S. Nakai

Collaboration for snow observation (Tsukuba, Nagaoka)

Hokkaido Univ.: Y. Fujiyoshi, M. Nishikawa

Collaboration for snow observation, data analysis

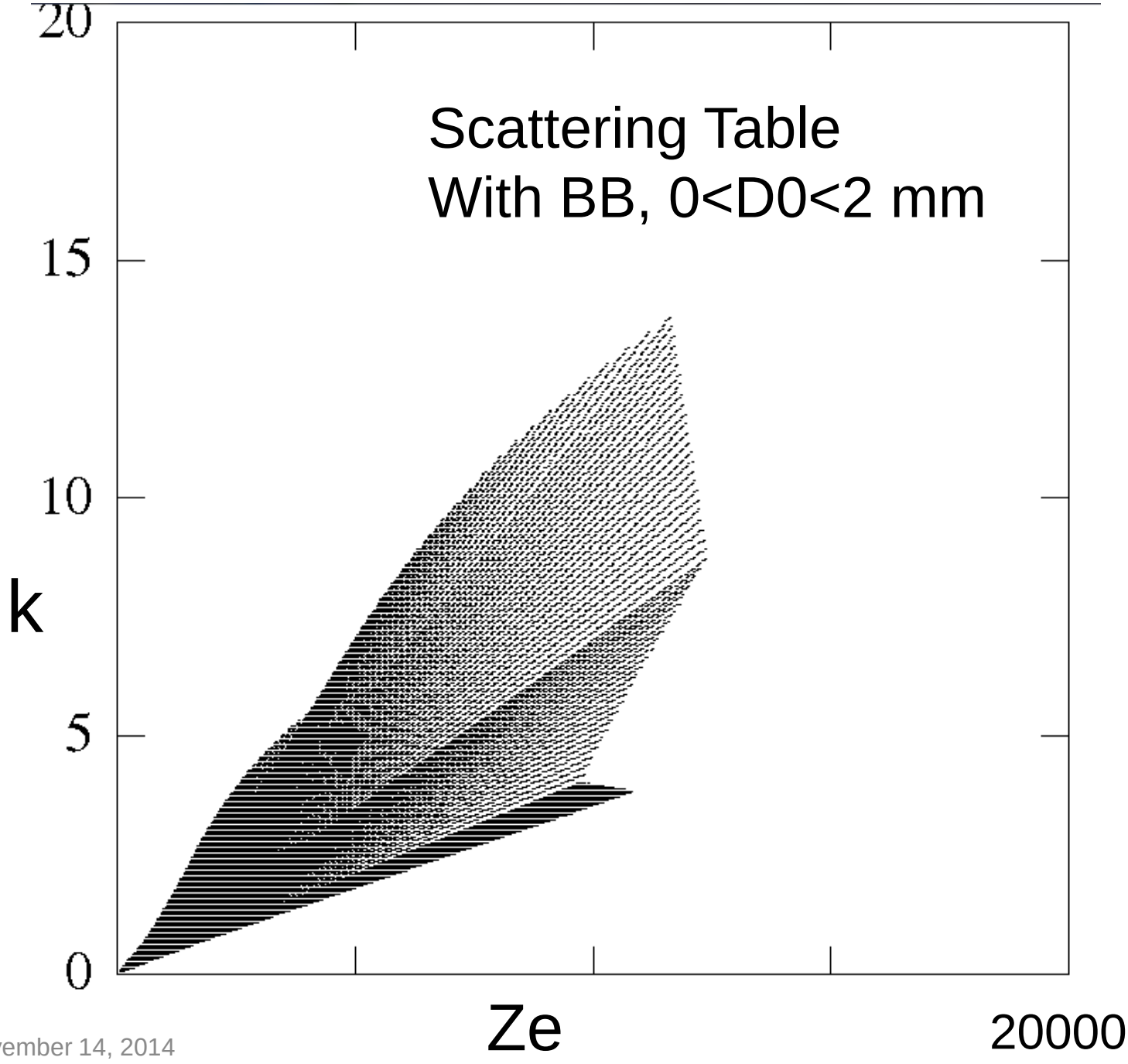
Nagoya Univ.: H. Minda

NU instrument maintenance

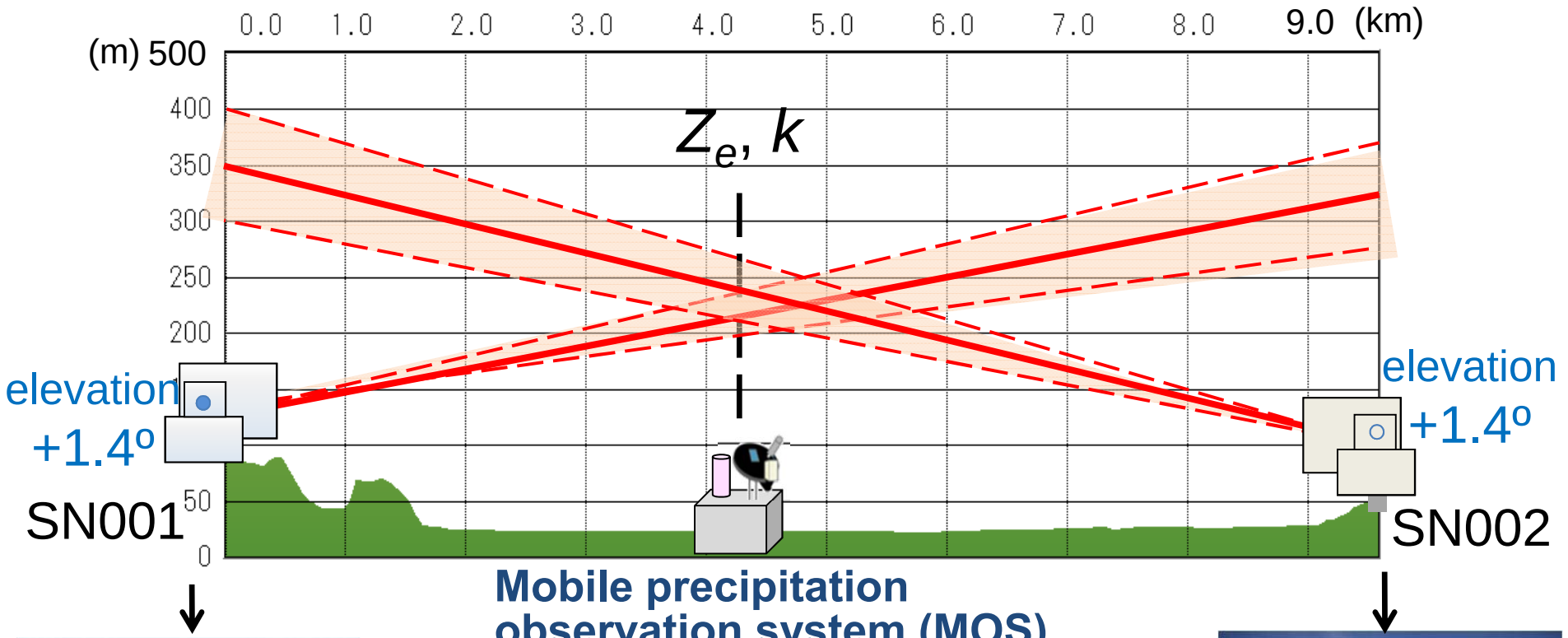
Yamaguchi Univ.: K. Suzuki

Video sonde operation including tethered balloon

Dokkyo Univ.: K. Nakamura: PI


Scattering Table
With BB, 0<D0<2 mm
20
15
10
5
0
k
Ze
20000

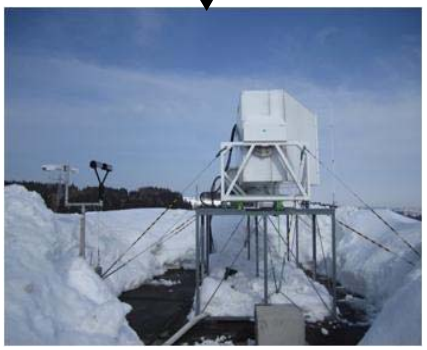
Dual Ka radar experiment in Nagaoka



Mobile precipitation observation system (MOS)

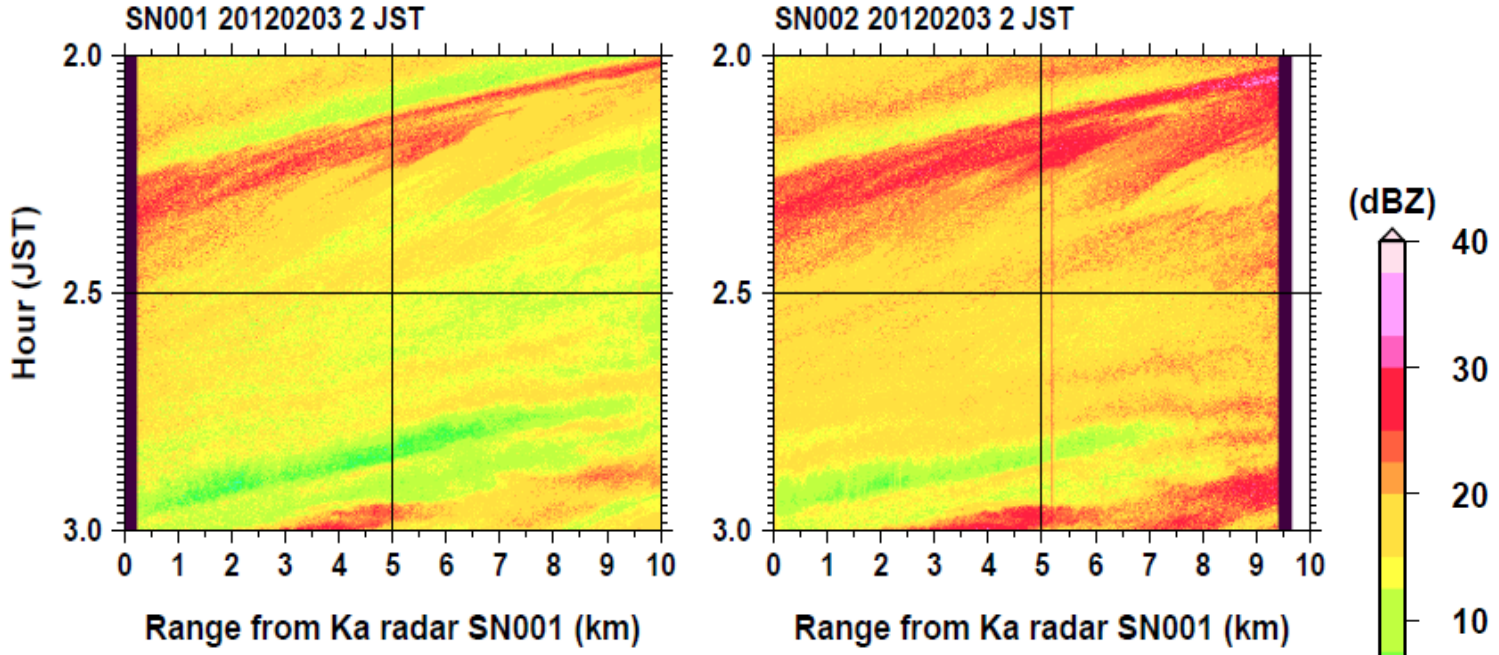
・melted fraction meter

・parsivel
・Humidity and Temperature Probe (HMP155)
・2DVD

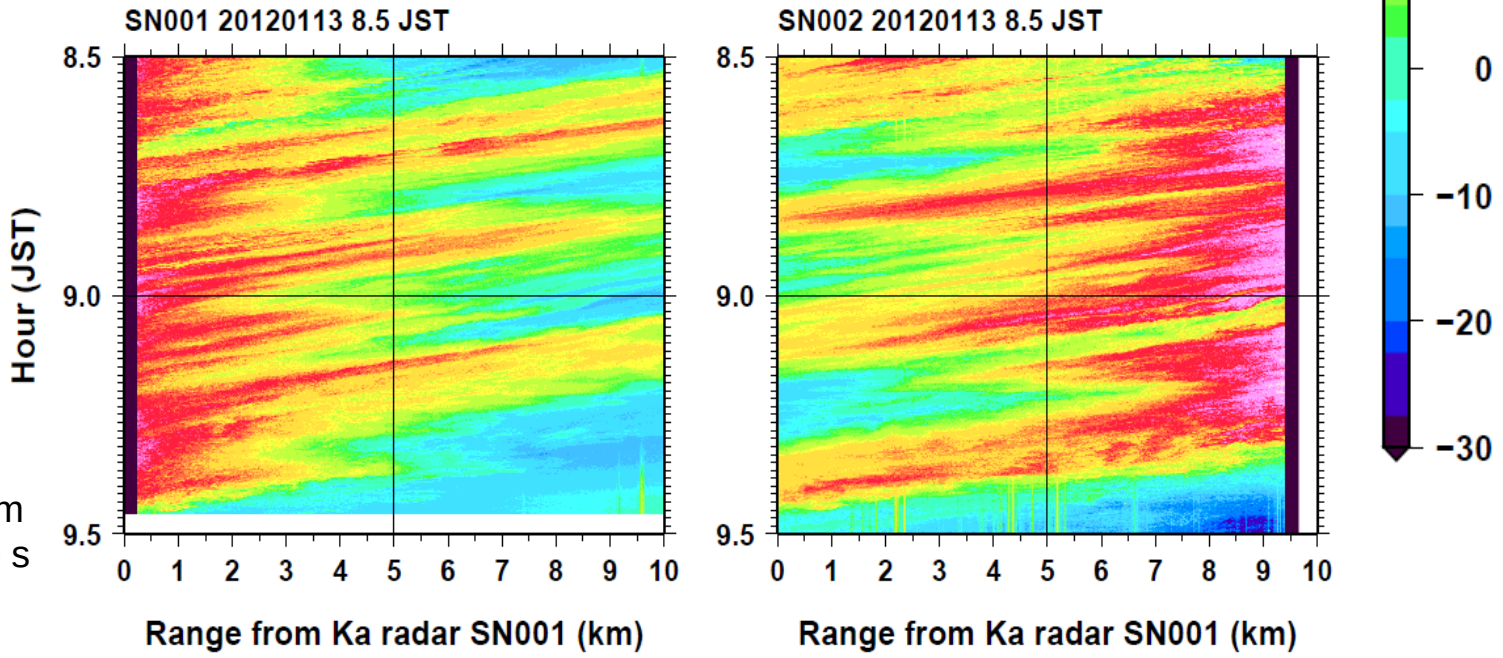


Time-range section of Z_m -snow events-

- 2012/02/03
  2:00～3:00

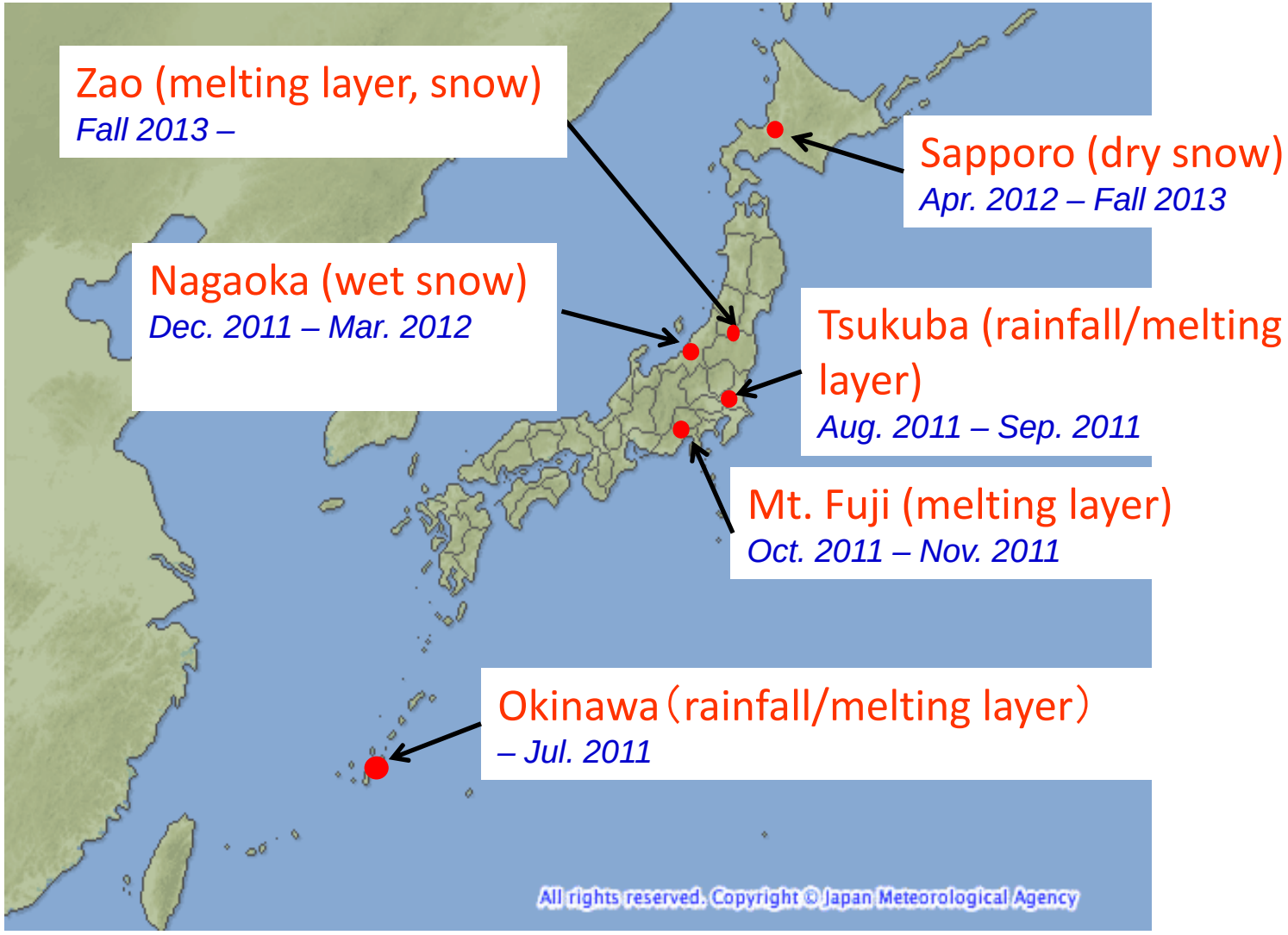


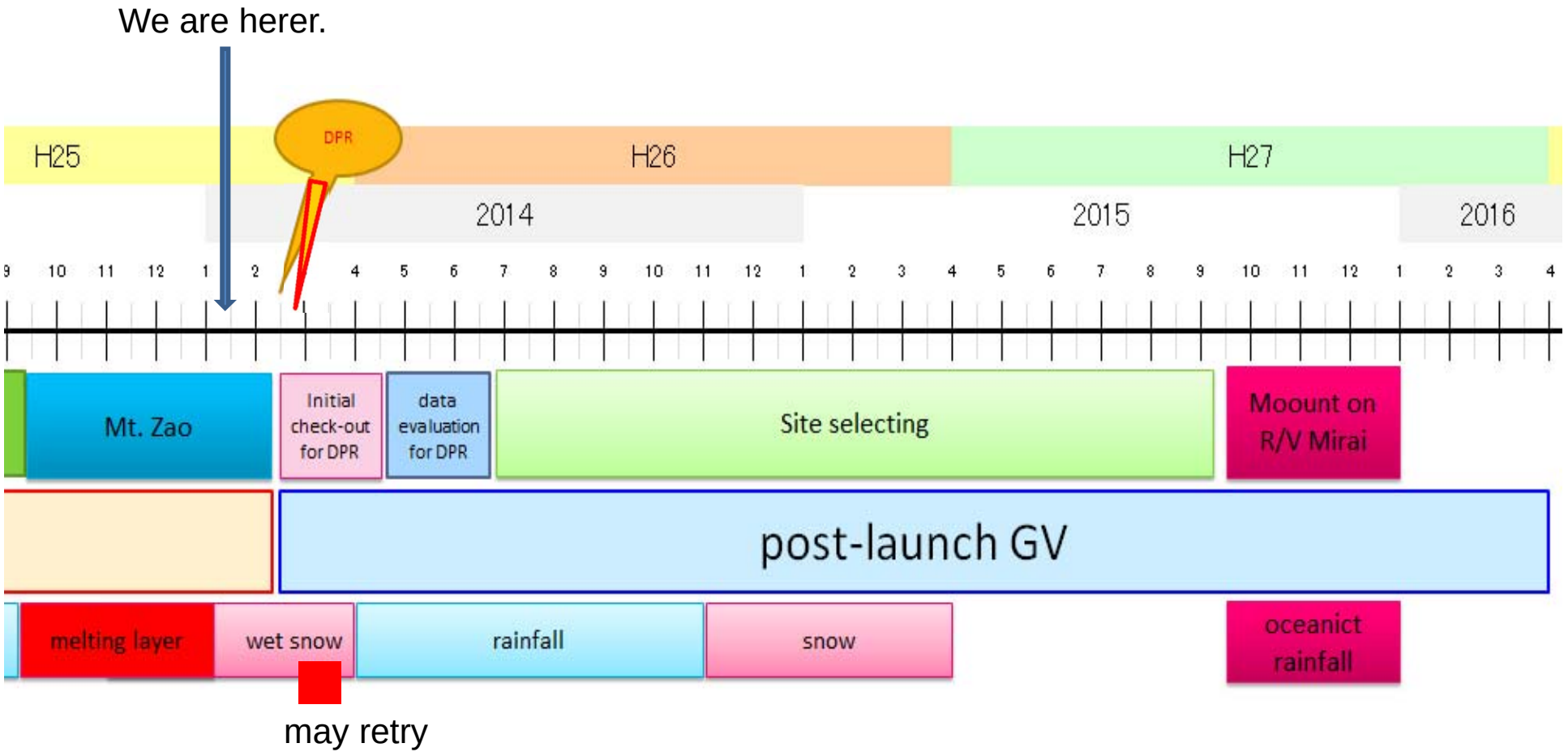
- 2012/01/13
  8:30～9:30



range resolution: 12.5 m
temporal resolution: 10 s

Japan's ground validation plans




We are herer.
DPR
H25
H26
H27
2014
2015
2016
9 10 11 12 1 2 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4
Mt. Zao
Initial check-out for DPR
data evaluation for DPR
Site selecting
Moount on R/V Mirai
post-launch GV
melting layer
wet snow
rainfall
snow
oceanict rainfall
may retry

International conferences

Nakagawa et al., Kaneko et al., EGU 2013
Nishikawa et al, Nakagawa et al., IGARSS 2013
Nishikawa et al., Nakagawa et al., 36th Radar Conference
Nakagawa et al., AOGS
Nishikawa et al., Nakagawa et al., 29th ISTS

Results of field experiments for the DPR algorithm development

Masanori NISHIKAWA

Institute of Low Temperature Science,
Hokkaido University

and Ka-radar collaboration

Topics and Objective

Results of measurements of snow and melting layer using the dual Ka-band radar system are reported.

1) Field Experiment 1 (Sapporo/Nagaoka):

To understand behavior of k-Z_e of snow, measured k-Z_e plots are classified by temperature.

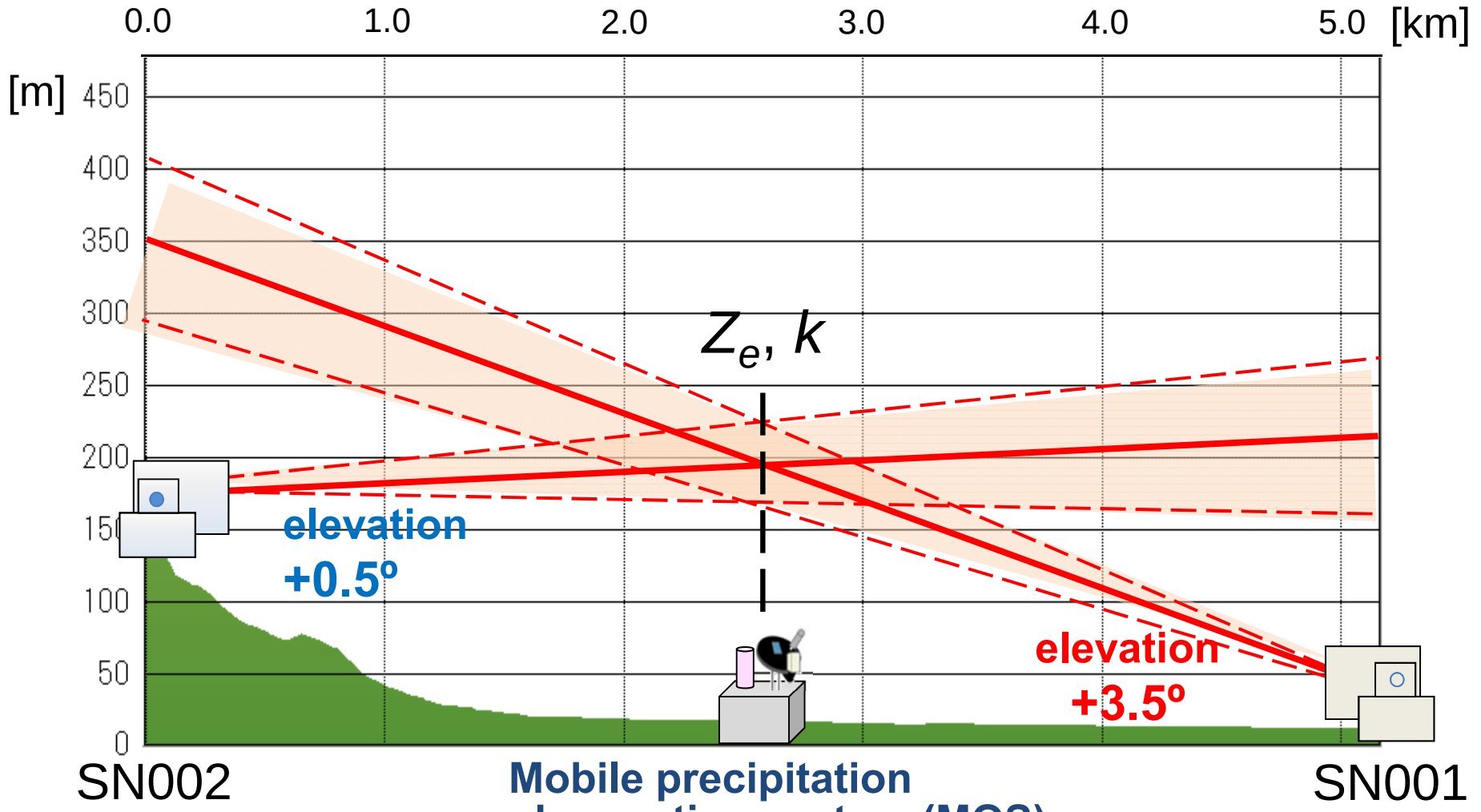
k-Z_e relations of snow are summarized for the algorithm.

2) Field Experiment 2 (Mt. Zao):

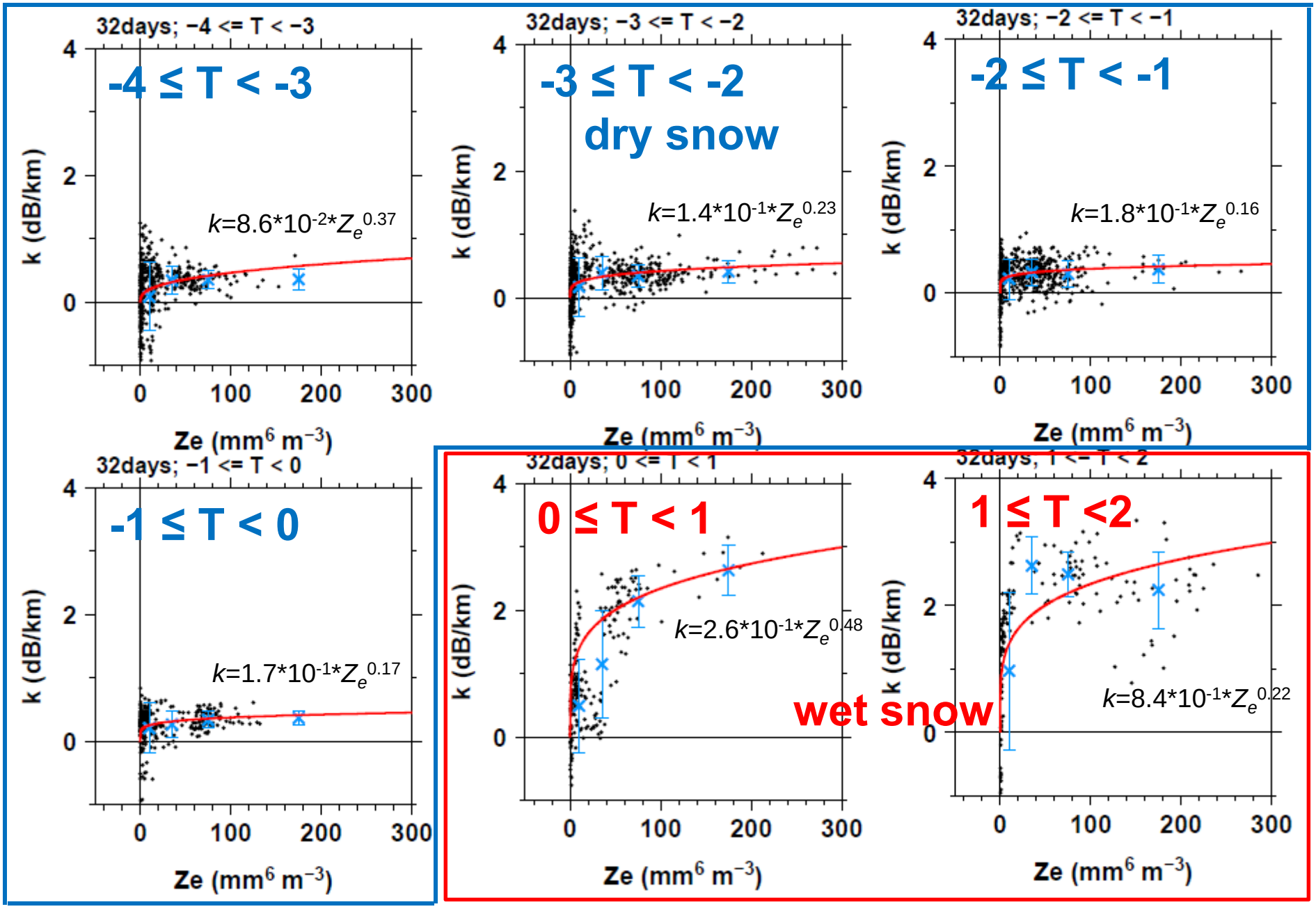
First results of k-Z_e relations of melting layer at Mt. Zao are presented.

Results 1:
k-Z_e relations of snow

Dual Ka radar experiment in Sapporo



k-Z_e plots by every 1 ºC for all snow events in Sapporo

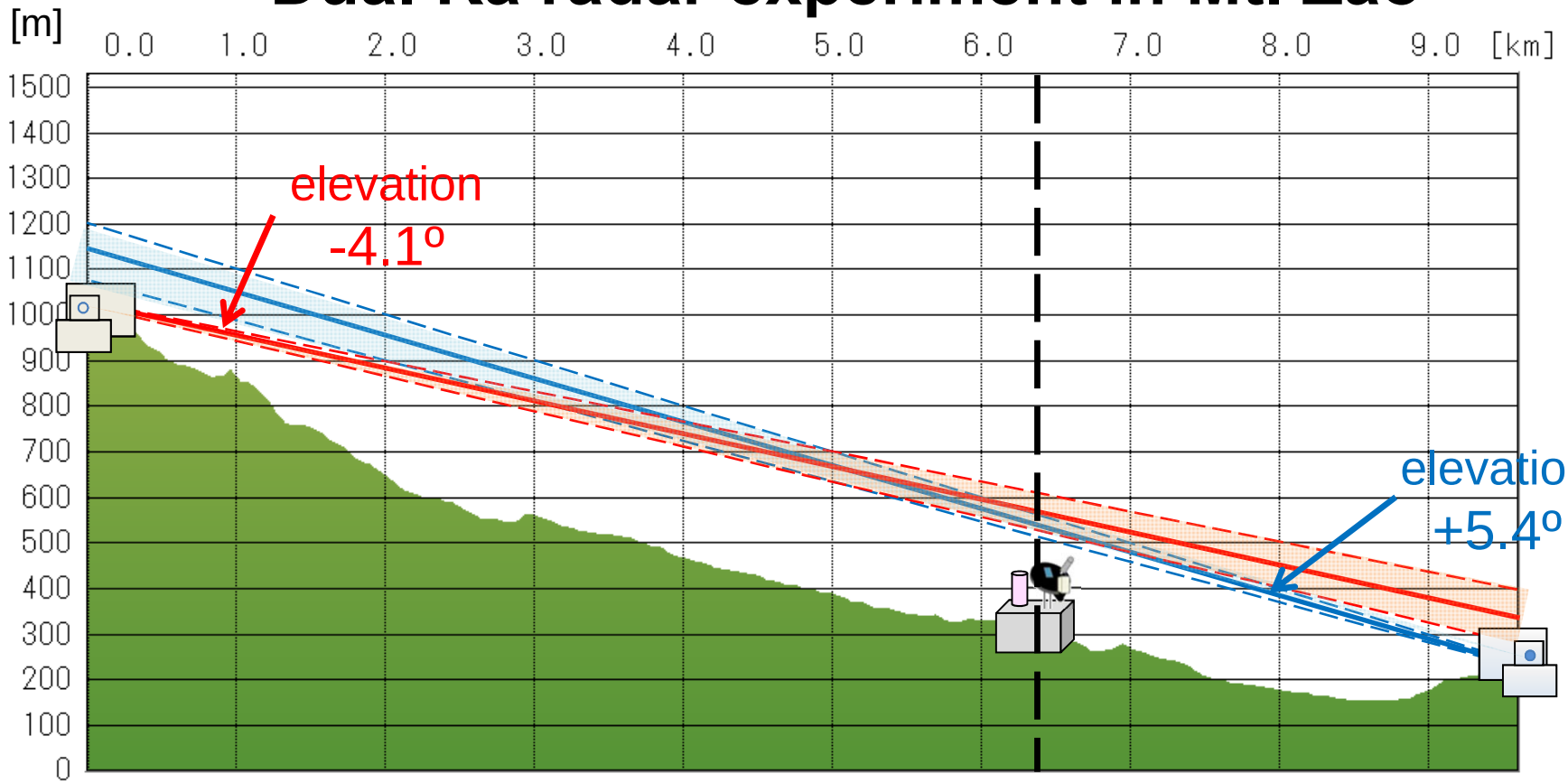


Summary of k-Z_e relations of Sapporo and Nagaoka experiments

Temperature range	Sapporo	Nagaoka
-12 ≤ T < -11	$k=1.6*10^{-1}*Z_e^{0.44}$	
-11 ≤ T < -10	$k=1.3*10^{-1}*Z_e^{0.29}$	
-10 ≤ T < -9	$k=1.4*10^{-1}*Z_e^{0.24}$	
-9 ≤ T < -8	$k=1.9*10^{-1}*Z_e^{0.16}$	
-8≤ T < -7	$k=1.1*10^{-1}*Z_e^{0.33}$	
-7≤ T < -6	$k=1.0*10^{-1}*Z_e^{0.30}$	
-6 ≤ T < -5	$k=1.4*10^{-1}*Z_e^{0.22}$	
-5 ≤ T < -4	$k=1.4*10^{-1}*Z_e^{0.25}$	$k=6.4*10^{-3}*Z_e^{0.65}$
-4 ≤ T < -3	$k=8.6*10^{-2}*Z_e^{0.37}$	$k=1.4*10^{-2}*Z_e^{0.45}$
-3 ≤ T < -2	$k=1.4*10^{-1}*Z_e^{0.23}$	$k=1.0*10^{-2}*Z_e^{0.50}$
-2 ≤ T < -1	$k=1.8*10^{-1}*Z_e^{0.16}$	$k=3.9*10^{-2}*Z_e^{-0.24}$
-1 ≤ T < 0	$k=1.7*10^{-1}*Z_e^{0.17}$	$k=4.6*10^{-2}*Z_e^{0.49}$
0 ≤ T < 1	$k=2.6*10^{-1}*Z_e^{0.48}$	$k=3.3*10^{-2}*Z_e^{0.55}$
1 ≤ T < 2	$k=8.4*10^{-1}*Z_e^{0.22}$	$k=3.8*10^{-2}*Z_e^{0.51}$
2 ≤ T < 3		$k=3.7*10^{-3}*Z_e^{0.84}$
3 ≤ T < 4		$k=9.1*10^{-3}*Z_e^{0.68}$

Results 2:
k-Z_e relations of melting layer

Dual Ka radar experiment in Mt. Zao



Radar site1

SN001

Inter. site

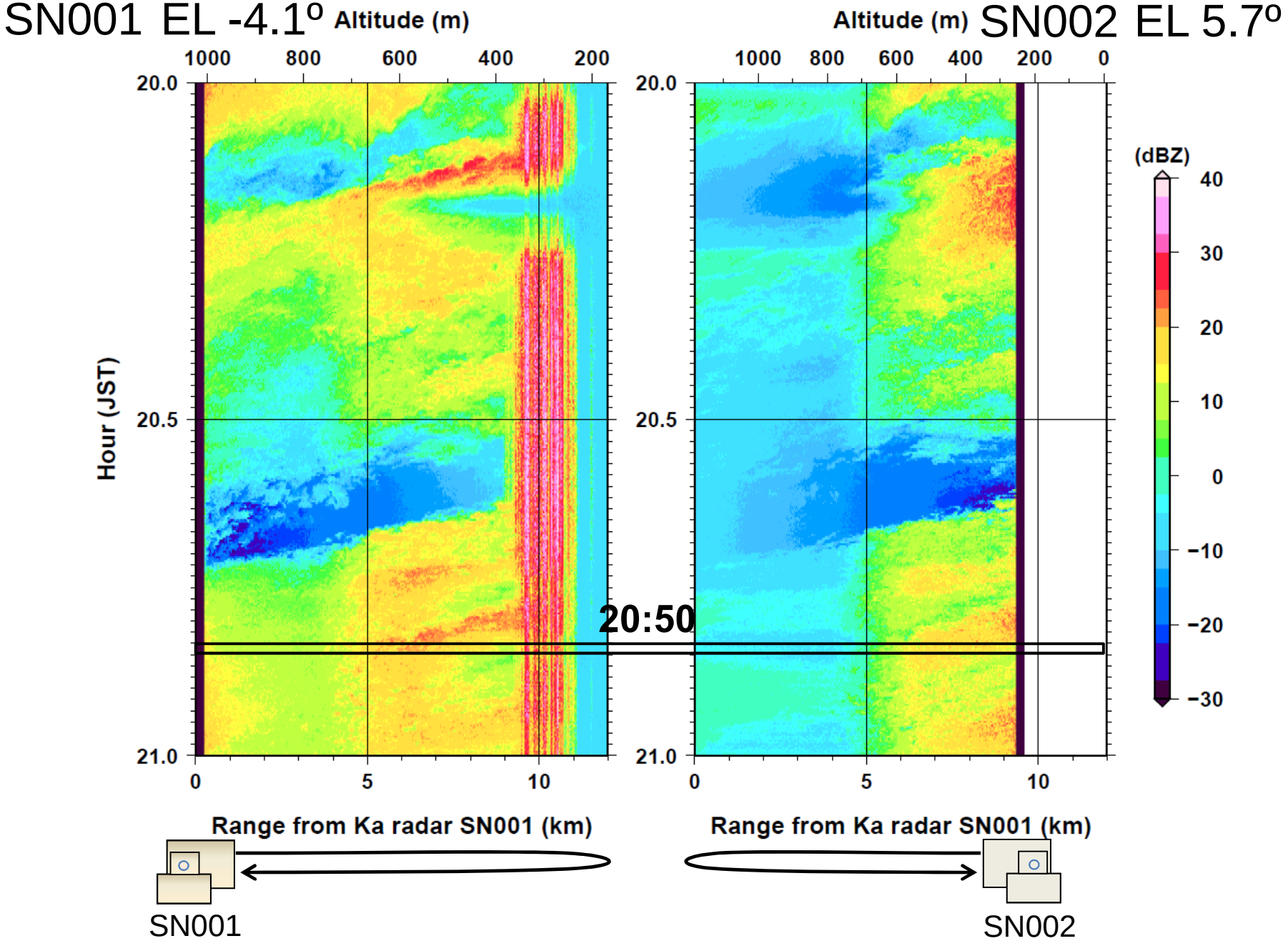
MOS

Radar site2

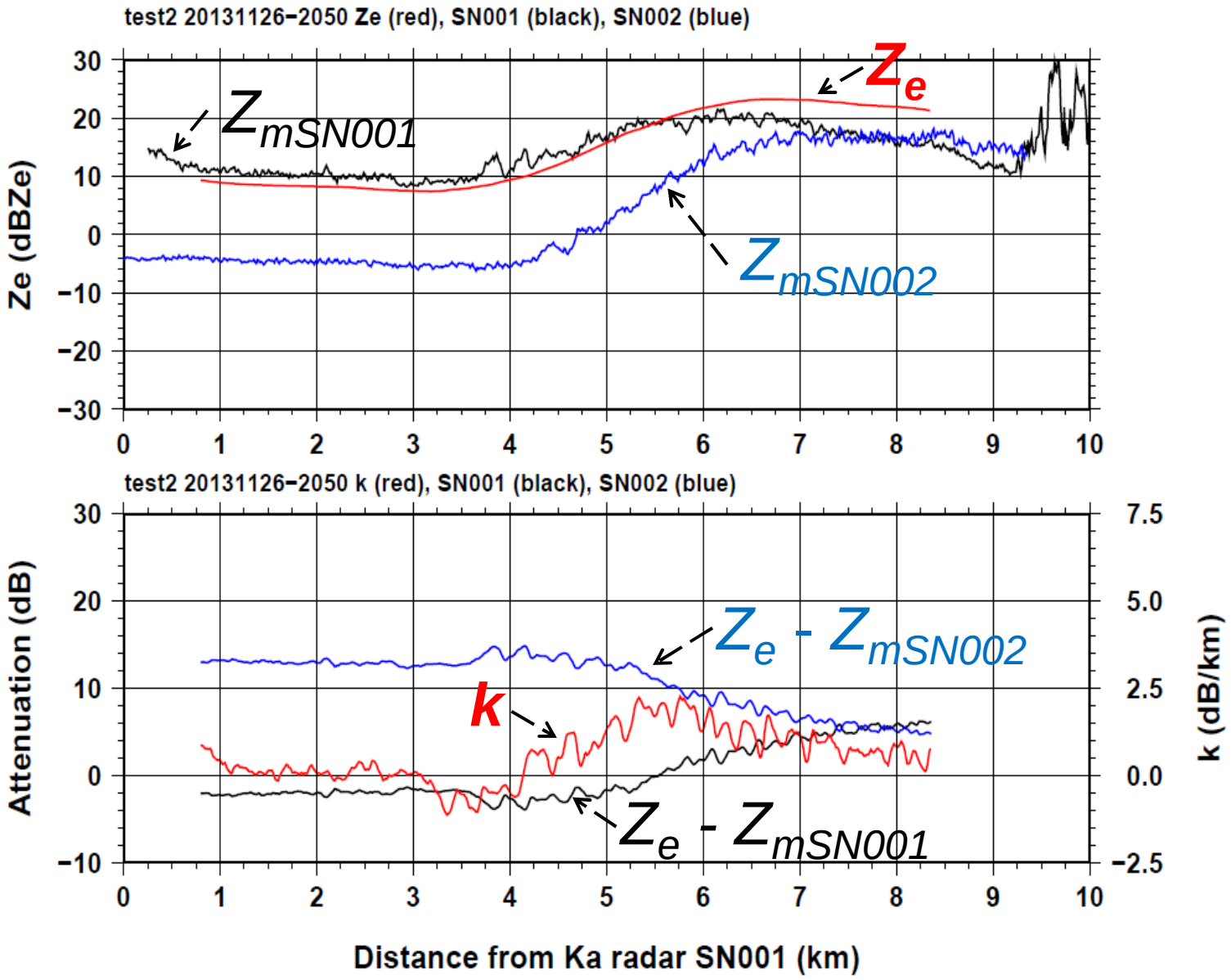
SN002

X-band marine radar

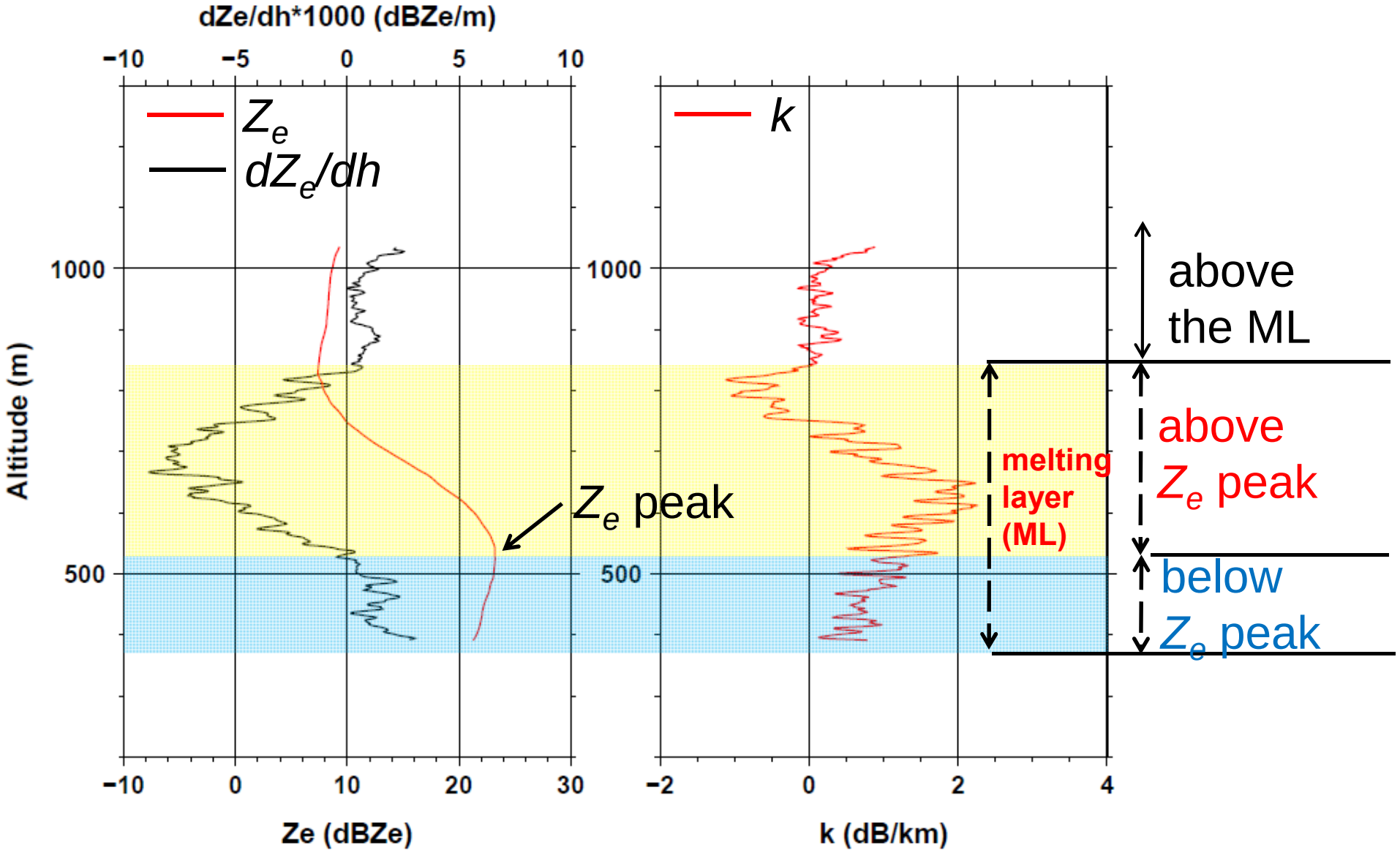
Time-range section of Z_m (2013/11/26 20-21)



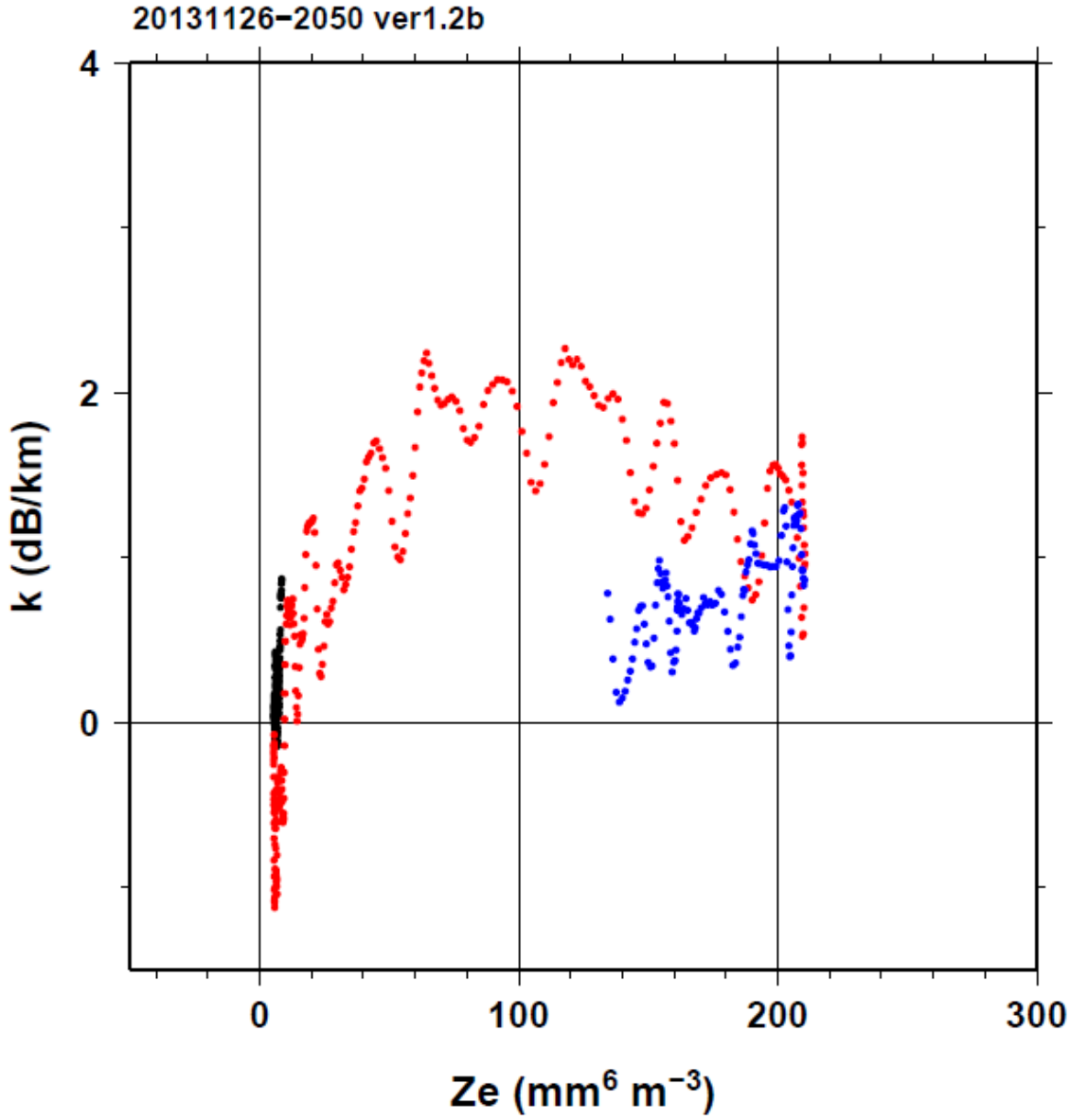
Estimation of Z_e and attenuation at a melting layer (2013/11/26 20:50)



Vertical profiles of Z_e, dZ_e/dh and k (2013/11/26 20:50)



k-Z_e plots around the melting layer (2013/11/26 20:50)



●: k-Z_e above the ML

●: k-Z_e above Z_e peak within the ML

●: k-Z_e below Z_e peak within the ML

Conclusion

1) k-Z_e relations of snow

- Measured k-Z_e plots were classified by temperature. Difference of k-Z_e relations between wet and dry snow appeared.
- k-Z_e relations obtained at two field experiments were summarized for the algorithm.

2) k-Z_e relations of melting layer

- First results of k-Z_e relations of melting layer were presented.
- Behavior of k-Z_e at melting layer was illustrated and this results indicate measured k-Z_e relations of snow obtained other field experiments were reasonable.

k-Z_e plots by every 1 ºC for all snow events in Nagaoka