



Quality control of weather radar data by using dual-polarization

7 February 2018
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Observation Department
Japan Meteorological Agency

Contents

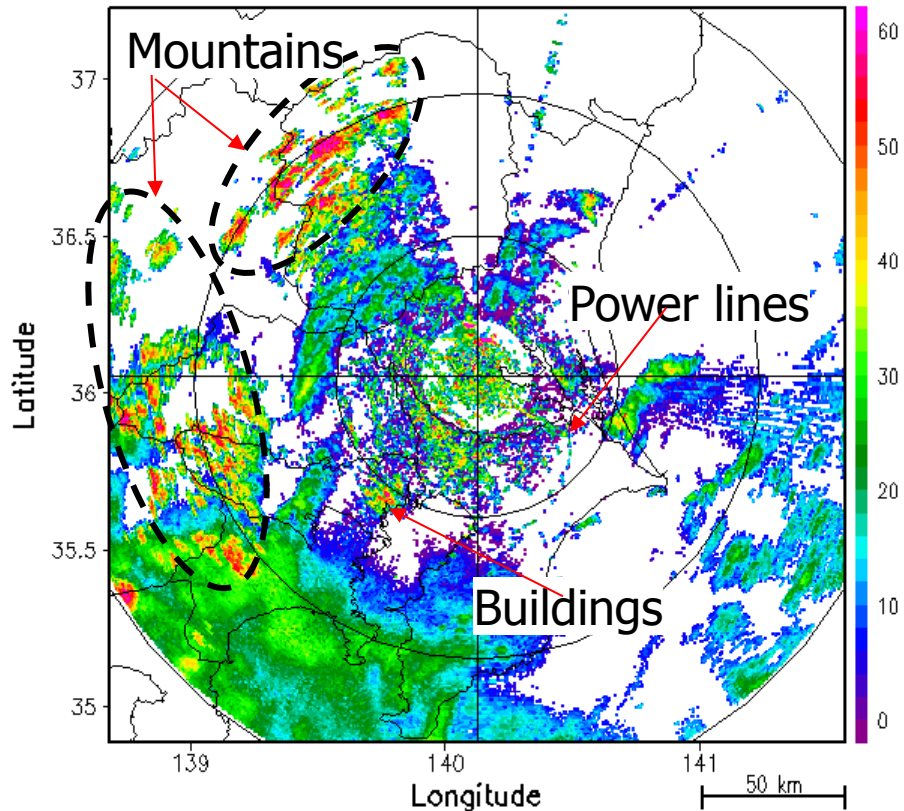
- Ground clutter removal
- Sea clutter removal
- Clear air echo removal
- JMA's practical case

Removal of ground clutter (GC)

- MTI filter cannot fully remove GC
- MTI filter may degrade data.

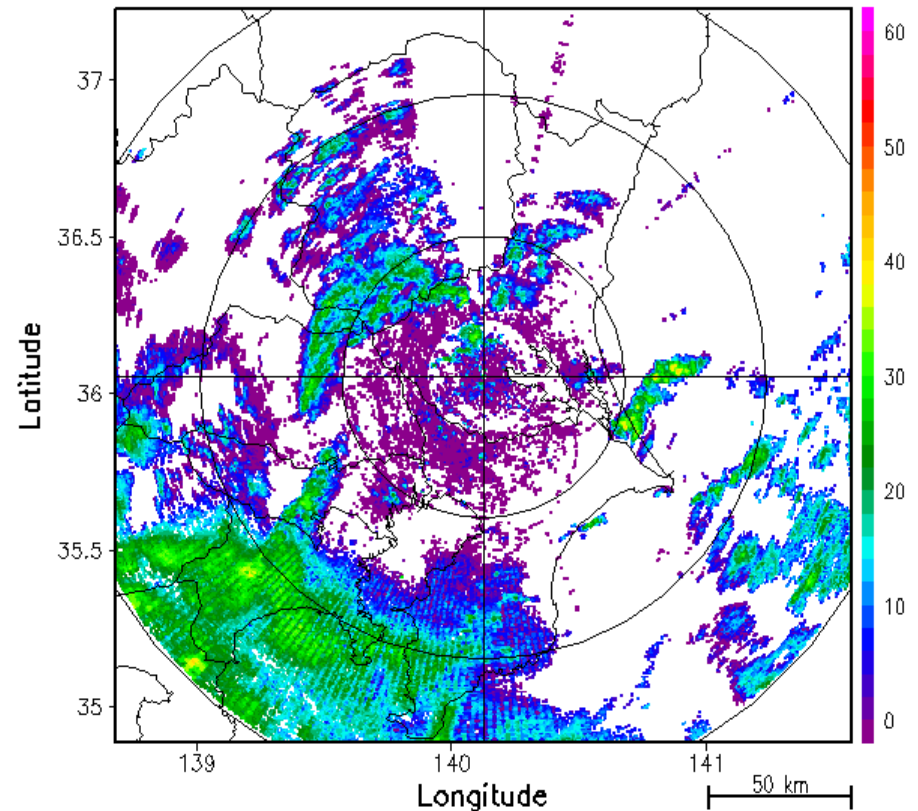
Normal

MRI-C 2011 07/20 08:41:19JST PPI EL= 0.5 deg
Zhh (dBZ)



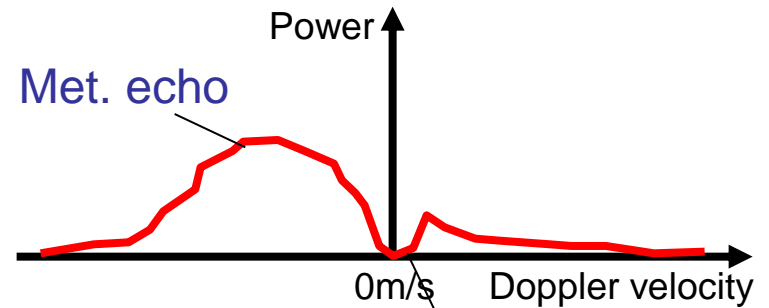
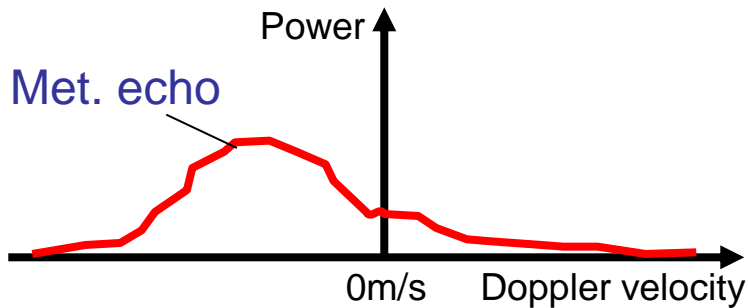
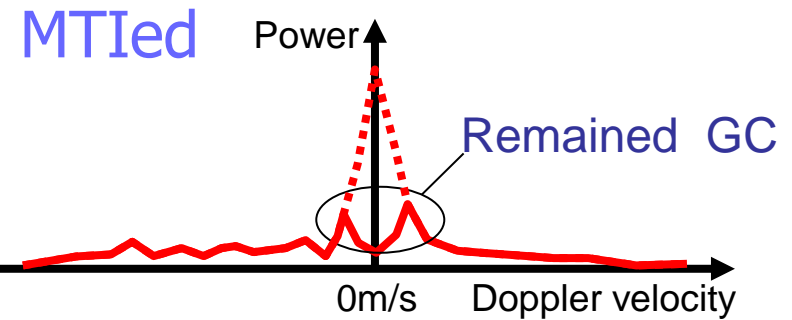
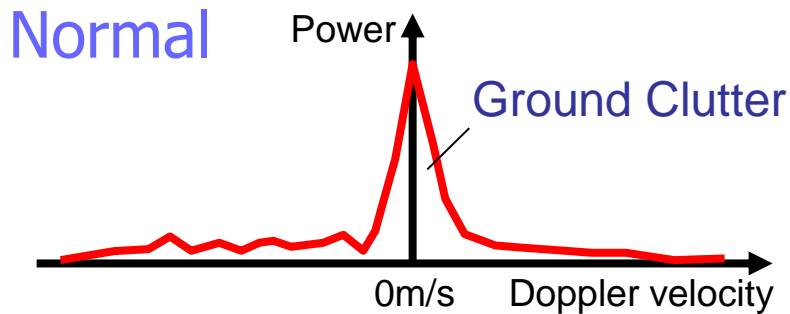
MTIed

MRI-C 2011 07/20 08:41:19JST PPI EL= 0.5 deg
Reflectivity (dBZ)



Clutter removal (MTI filter)

- MTI filter : moving target indication (MTI) is one of the method to mitigate the clutter and identify moving targets
- It removes and interpolates the power component around 0 m/s in velocity-power space (periodogram)



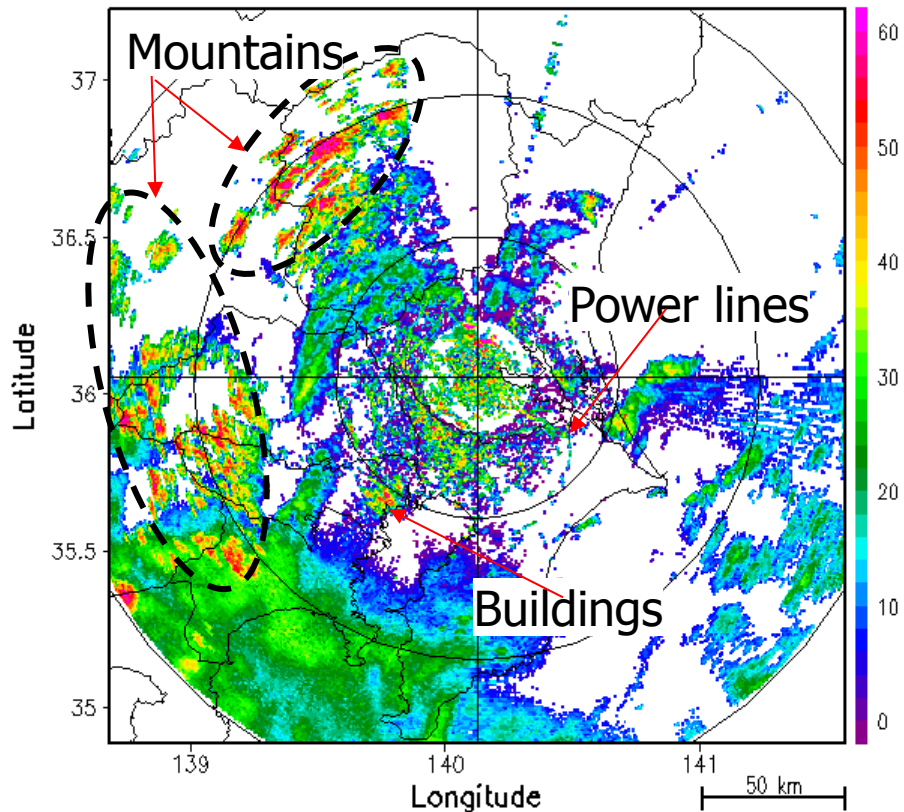
Suppressed met. echo

Removal of ground clutter (GC)

- Φ_{DP} is spatially fluctuating in ground clutter regions.
- Φ_{DP} is spatially smooth in precipitation echo.

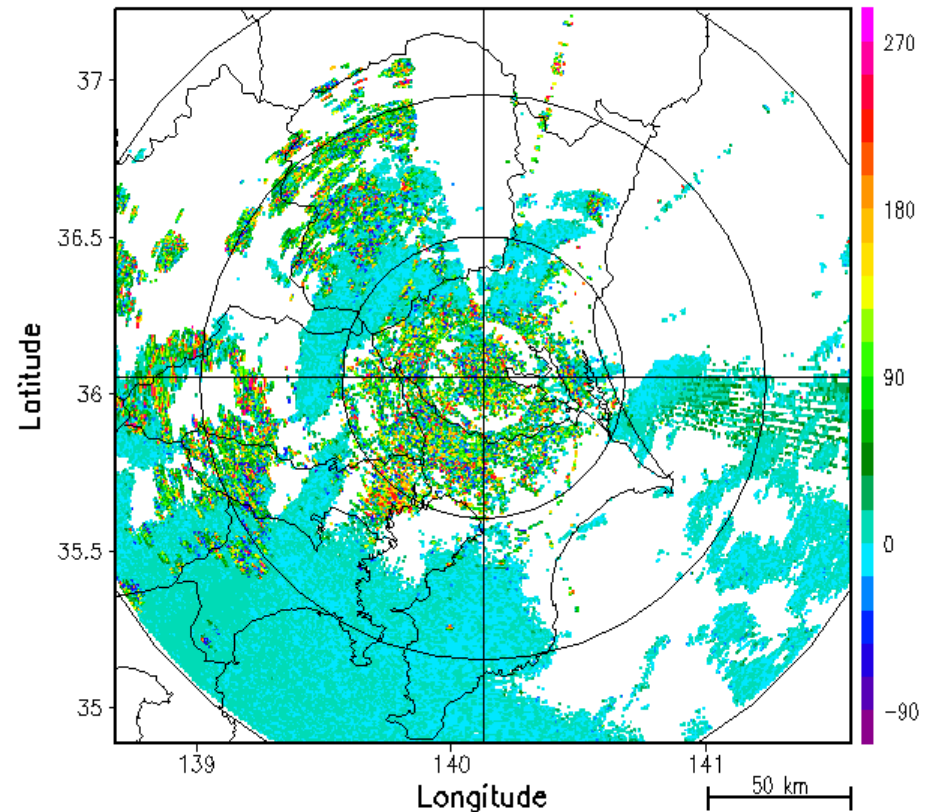
Z

MRI-C 2011 07/20 08:41:19JST PPI EL= 0.5 deg
Zhh (dBZ)



Φ_{dp}

MRI-C 2011 07/20 08:41:19JST PPI EL= 0.5 deg
Phi-dp (deg)

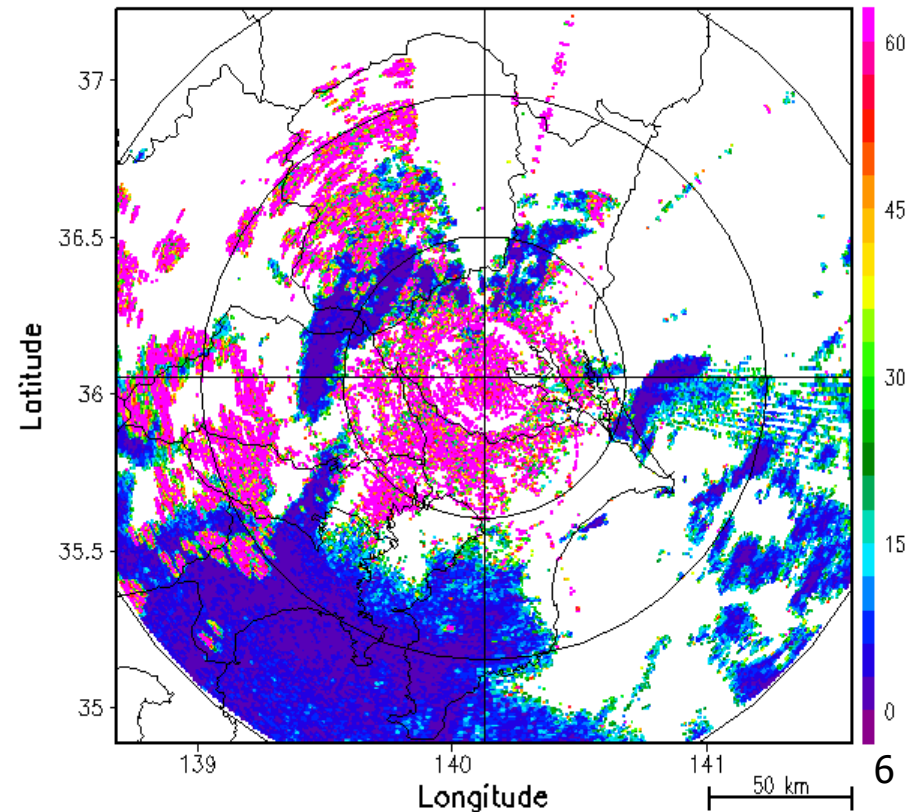
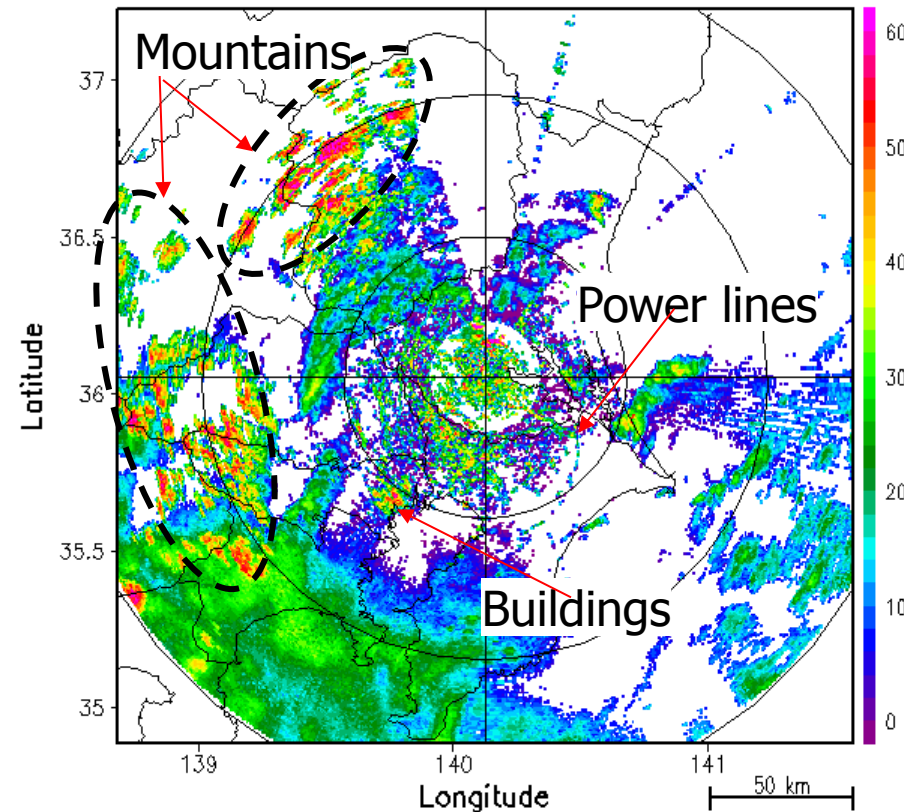


Removal of ground clutter (GC)

- GC can be efficiently identified and removed using standard deviation of Φ_{DP}

MRI-C 2011 07/20 08:41:19JST PPI EL= 0.5 deg
Zhh (dBZ)

MRI-C 2011 07/20 08:41:19JST PPI EL= 0.5 deg
S(Phi-dp) (deg)

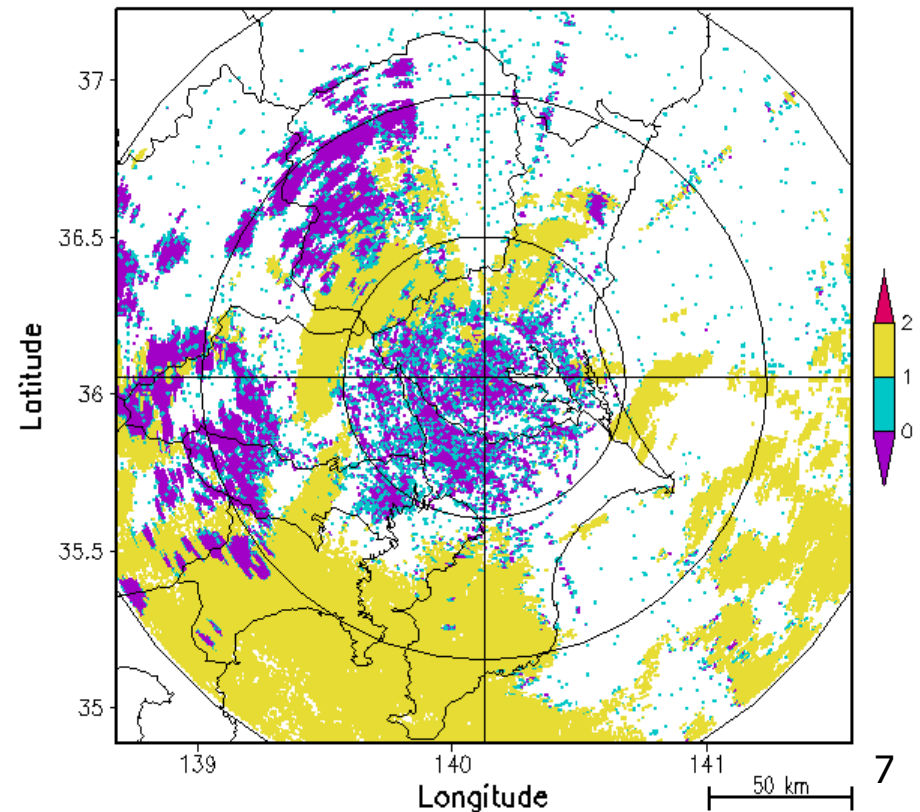
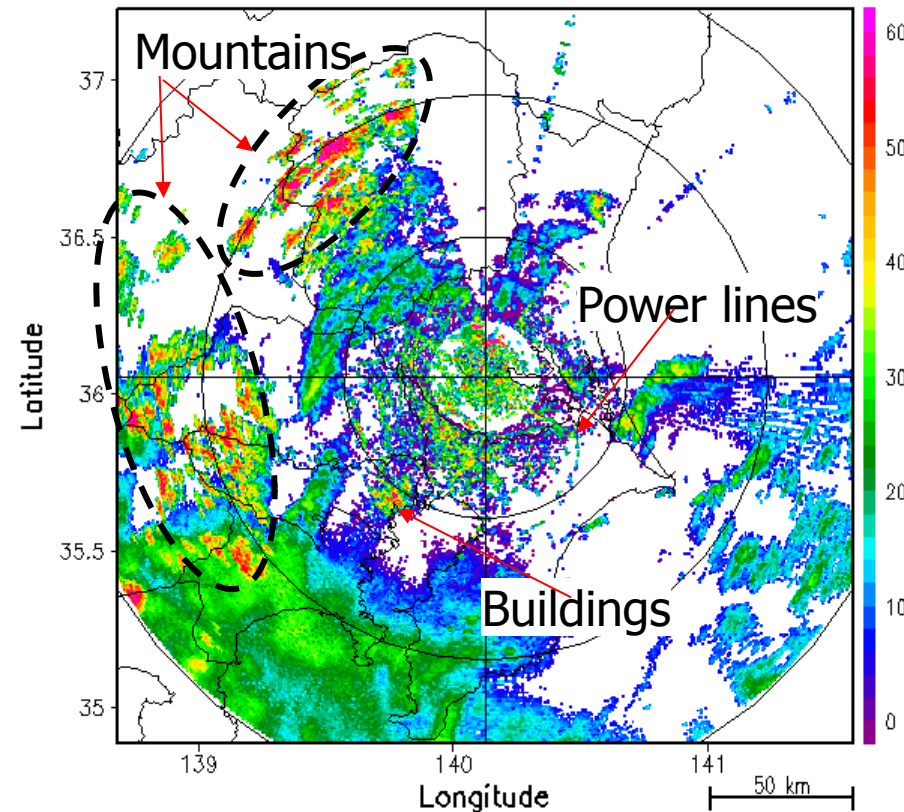


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MRI-C 2011 07/20 08:41:19JST PPI EL= 0.5 deg
Zhh (dBZ)

MRI-C 2011 07/20 08:41:19JST PPI EL= 0.5 deg
TYPE (---)

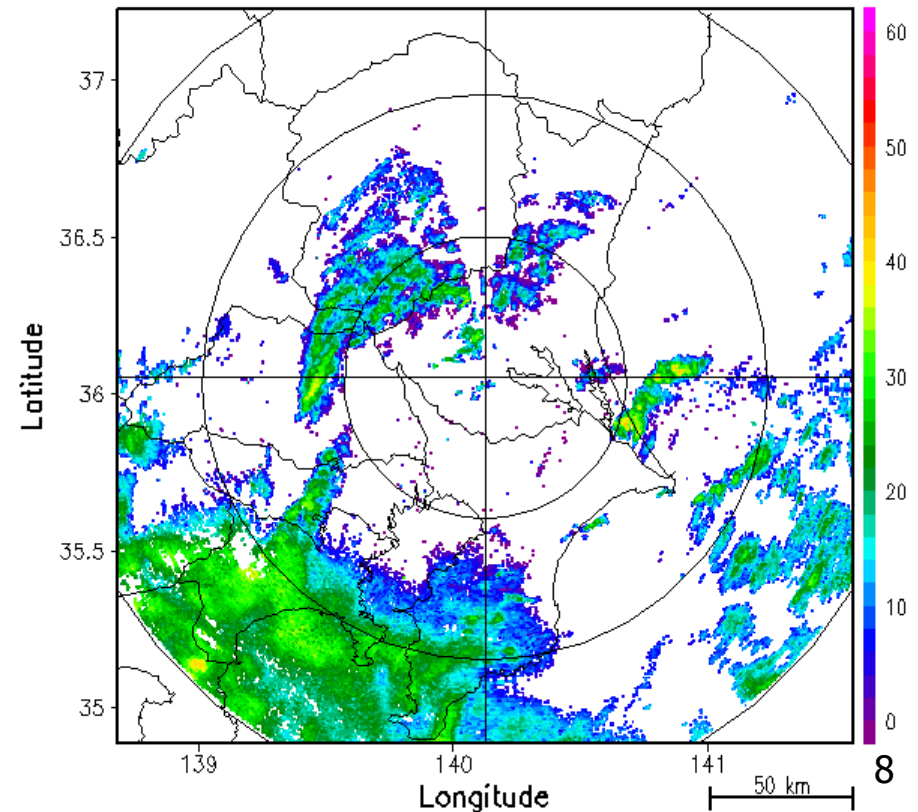
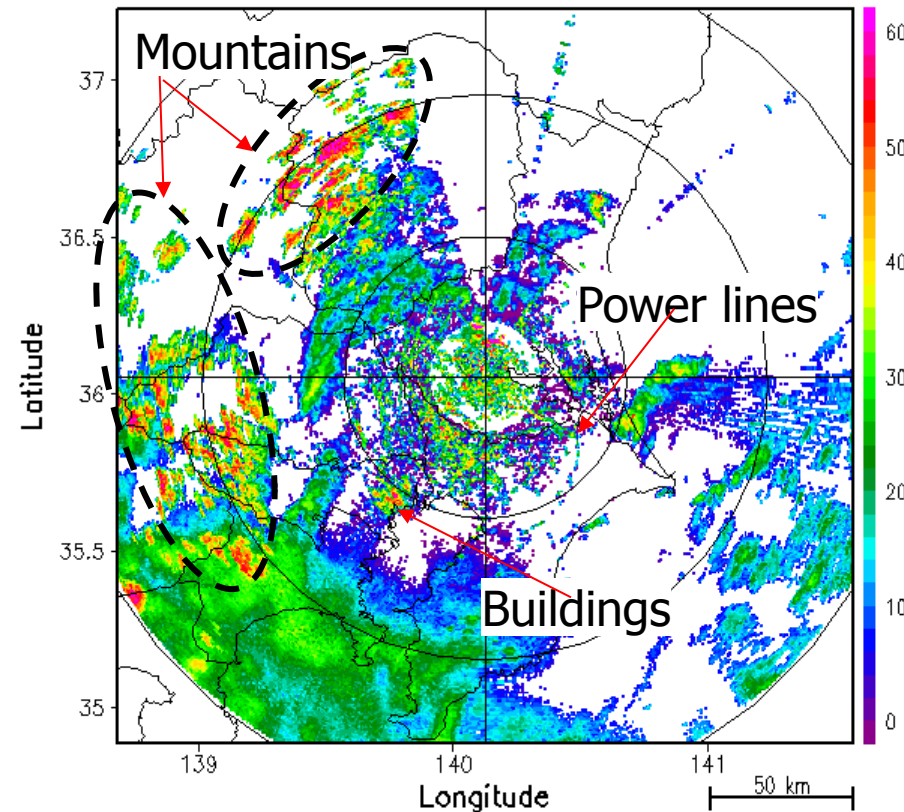


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MRI-C 2011 07/20 08:41:19JST PPI EL= 0.5 deg
Zhh (dBZ)

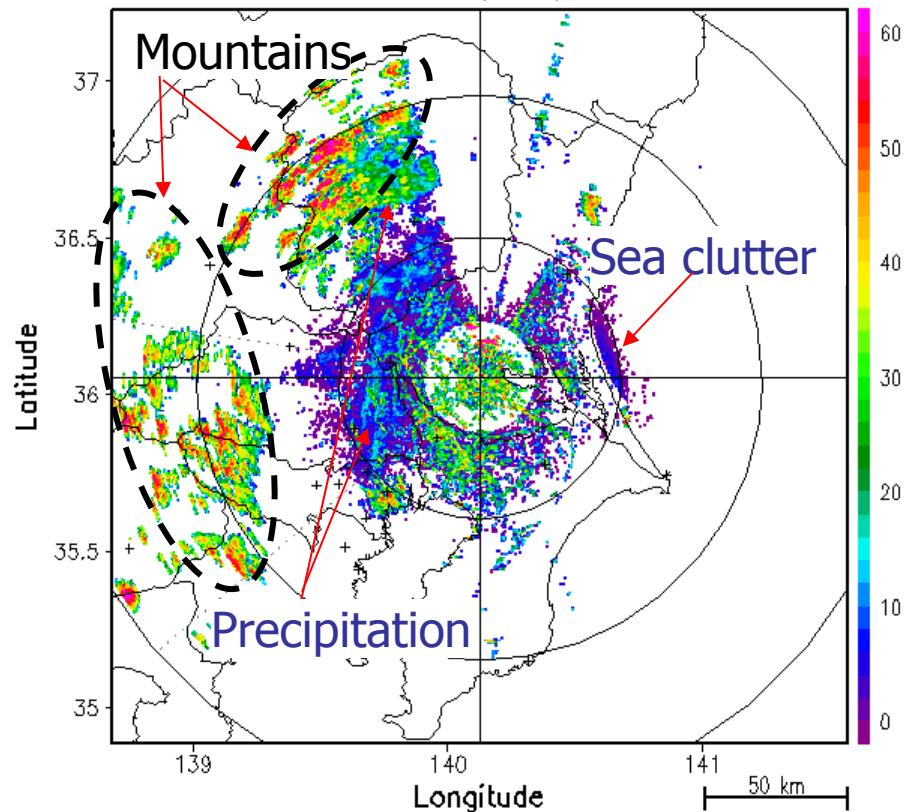
MRI-C 2011 07/20 08:41:19JST PPI EL= 0.5 deg
Reflectivity (dBZ)



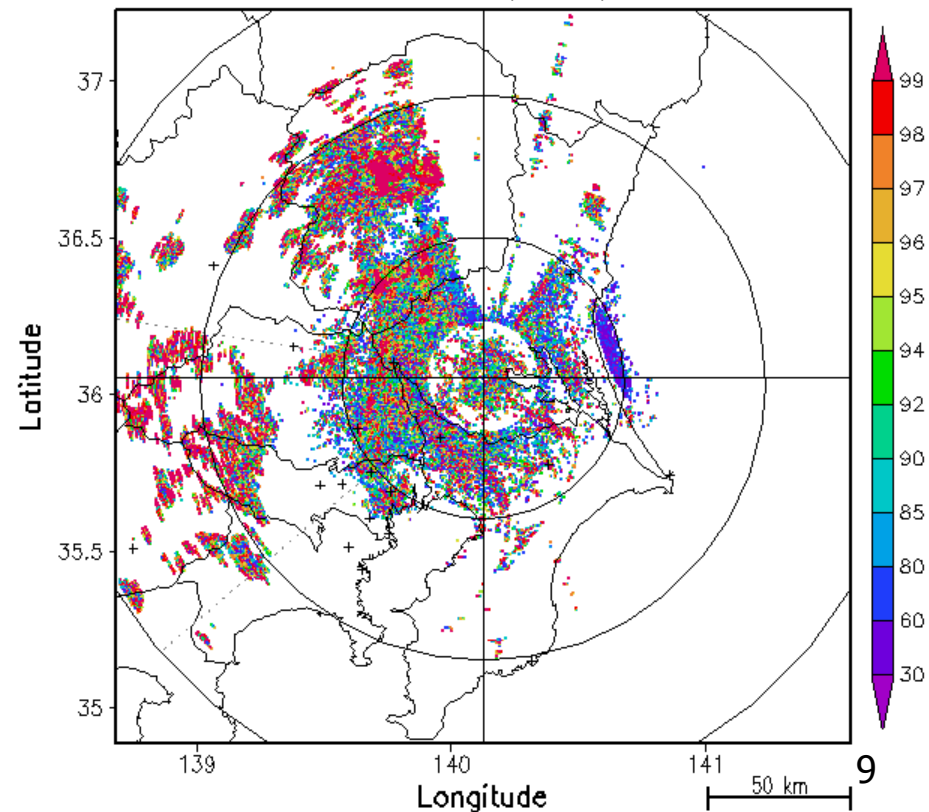
Removal of sea clutter (SC)

- SC can be efficiently identified and removed using ρ_{hv} and standard deviation of Φ_{DP}

MRI-C 2011 10/02 01:00:17JST PPI EL= 0.5 deg
Zhh (dBZ)



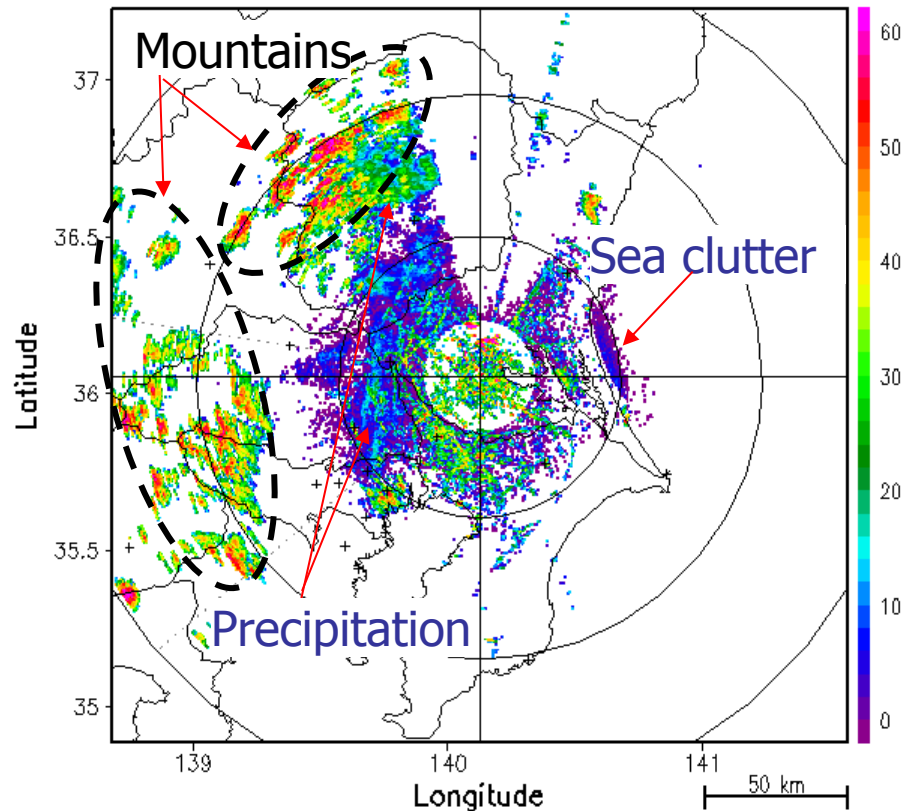
MRI-C 2011 10/02 01:00:17JST PPI EL= 0.5 deg
Rho-hv (x100)



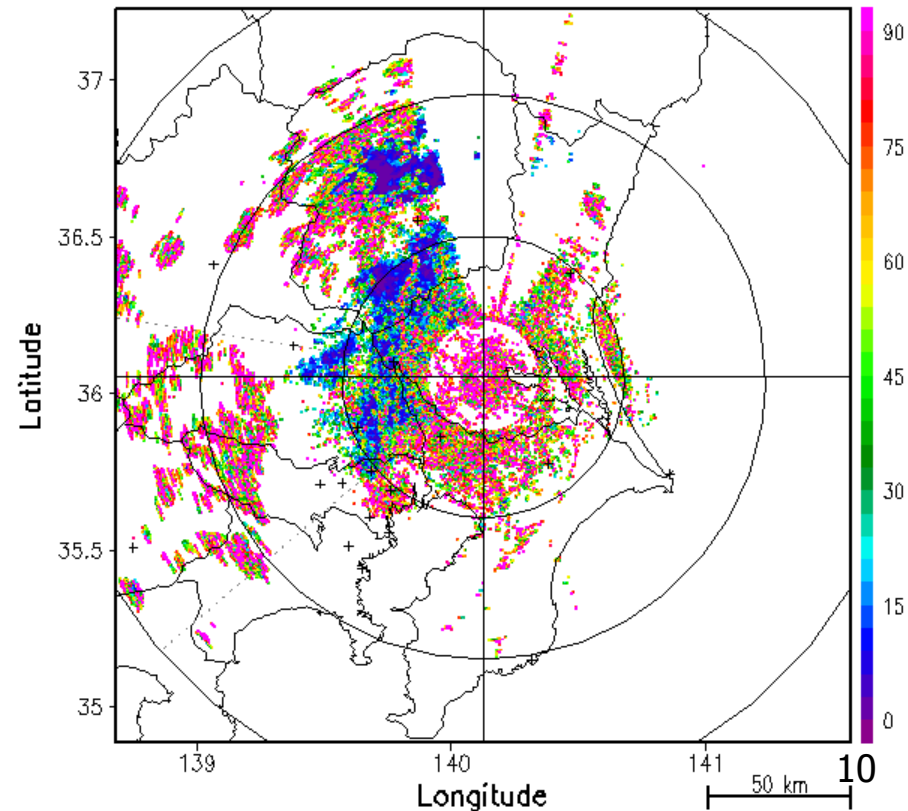
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MRI-C 2011 10/02 01:00:17JST PPI EL= 0.5 deg
Zhh (dBZ)



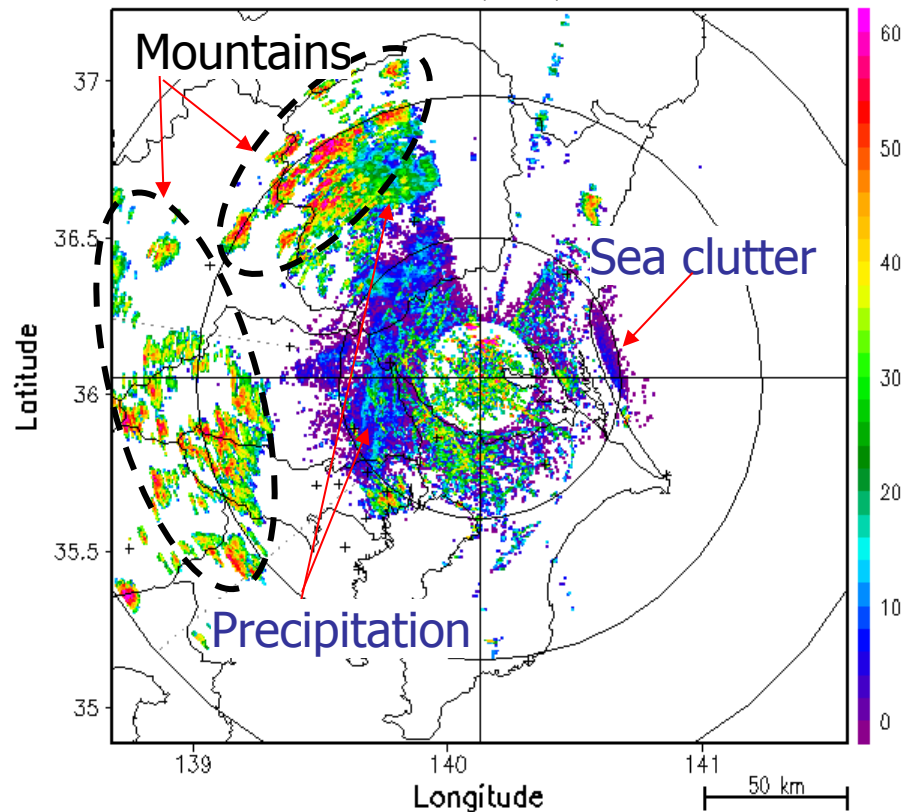
MRI-C 2011 10/02 01:00:17JST PPI EL= 0.5 deg
S(Phi-dp) (deg)



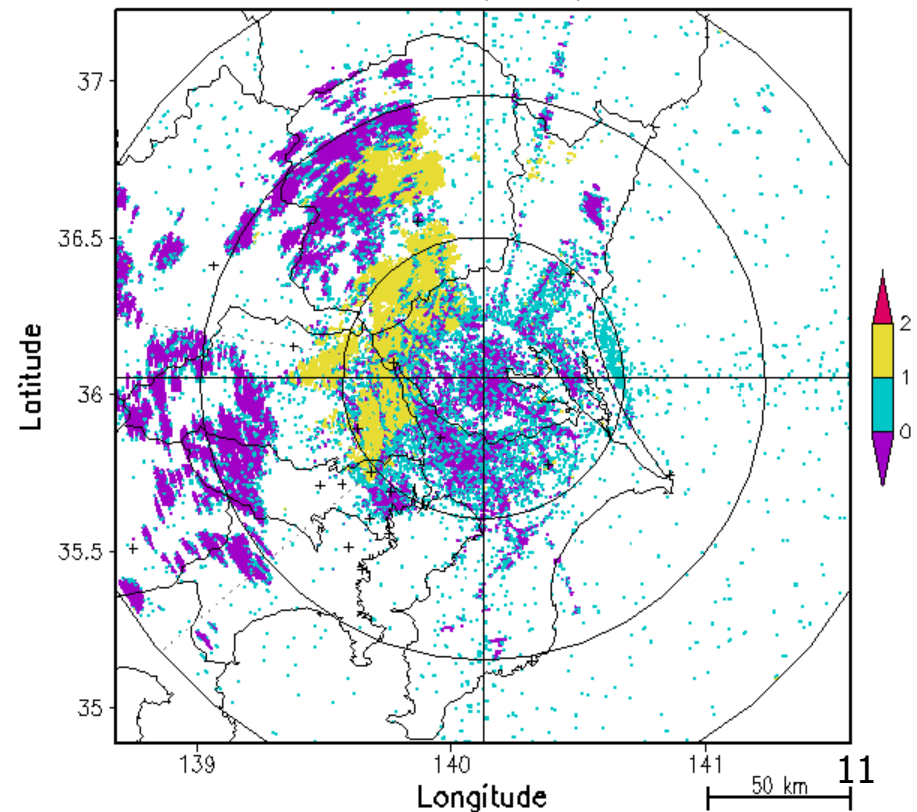
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MRI-C 2011 10/02 01:00:17JST PPI EL= 0.5 deg
Zhh (dBZ)



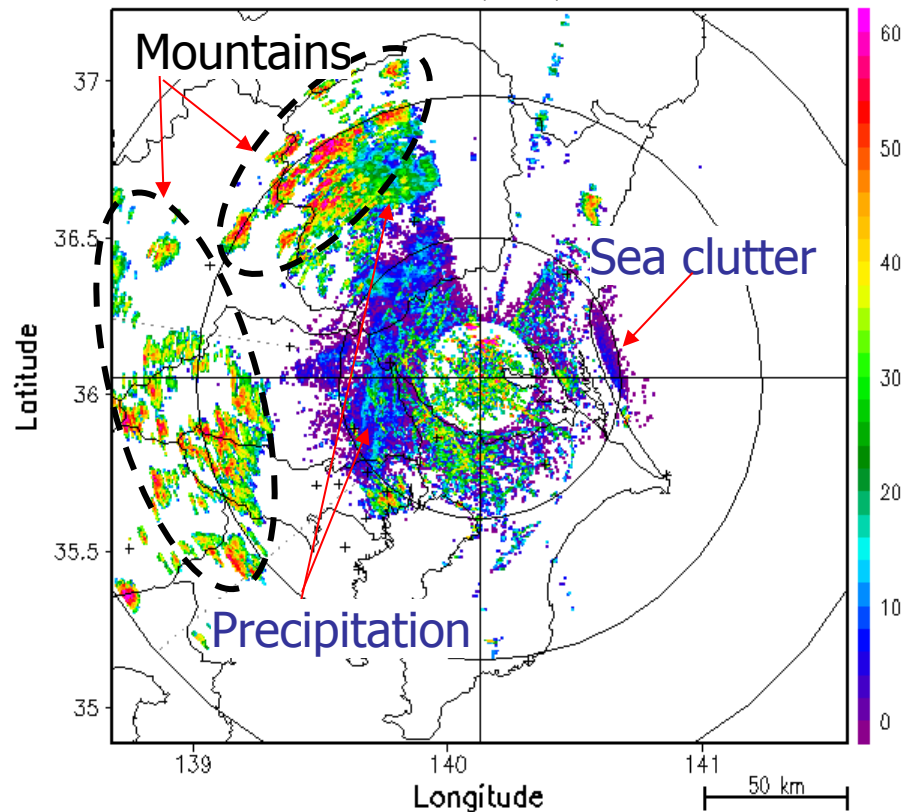
MRI-C 2011 10/02 01:00:17JST PPI EL= 0.5 deg
TYPE (---)



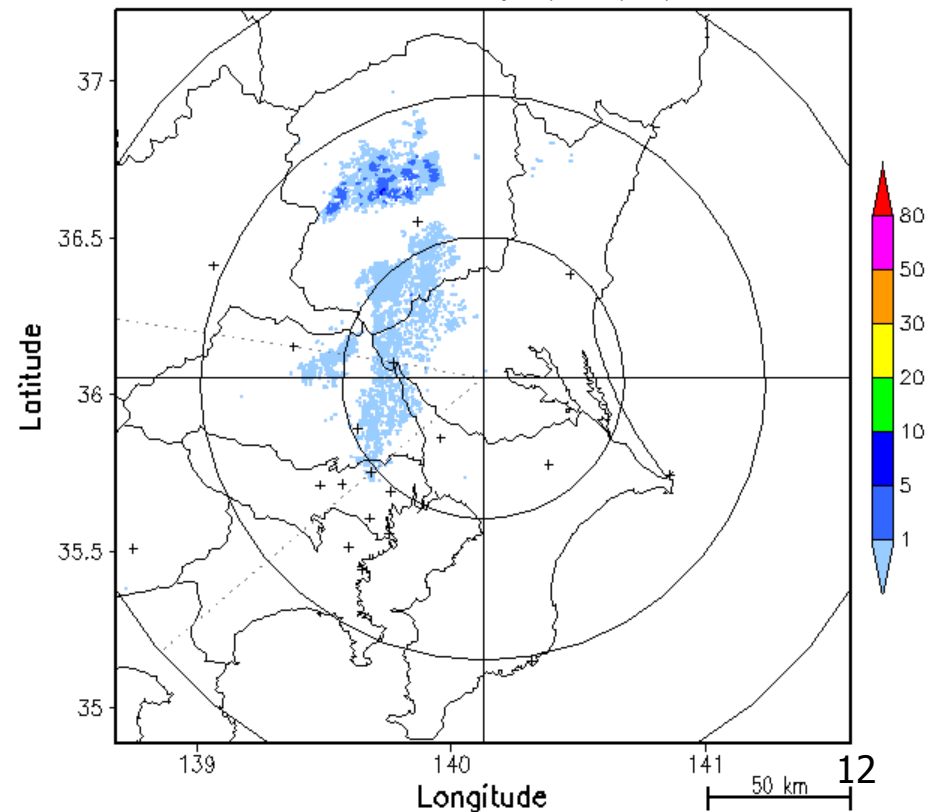
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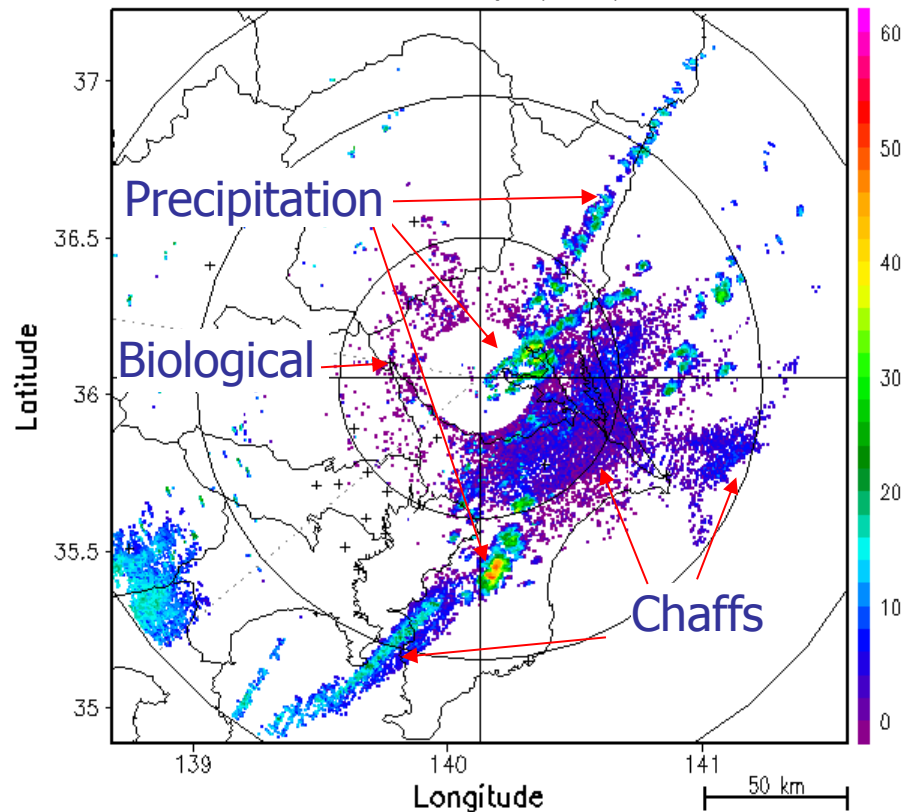
MRI-C 2011 10/02 01:00:17JST PPI EL= 0.5 deg
Rain Intensity (mm/h)



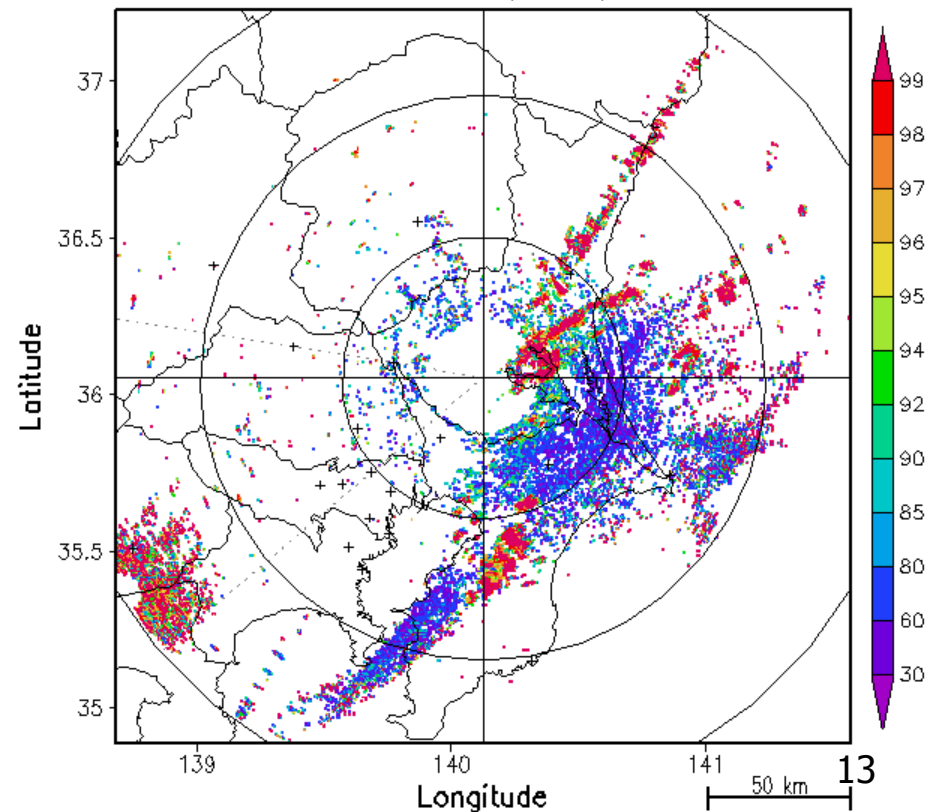
Removal of clear air echoes

- Biological echoes and chaffs are efficiently identified and removed using Z_{dr} , ρ_{hv} and standard deviation of Φ_{DP} .

MRI-C 2011 10/25 22:27:48JST PPI EL= 1.0 deg
Reflectivity (dBZ)



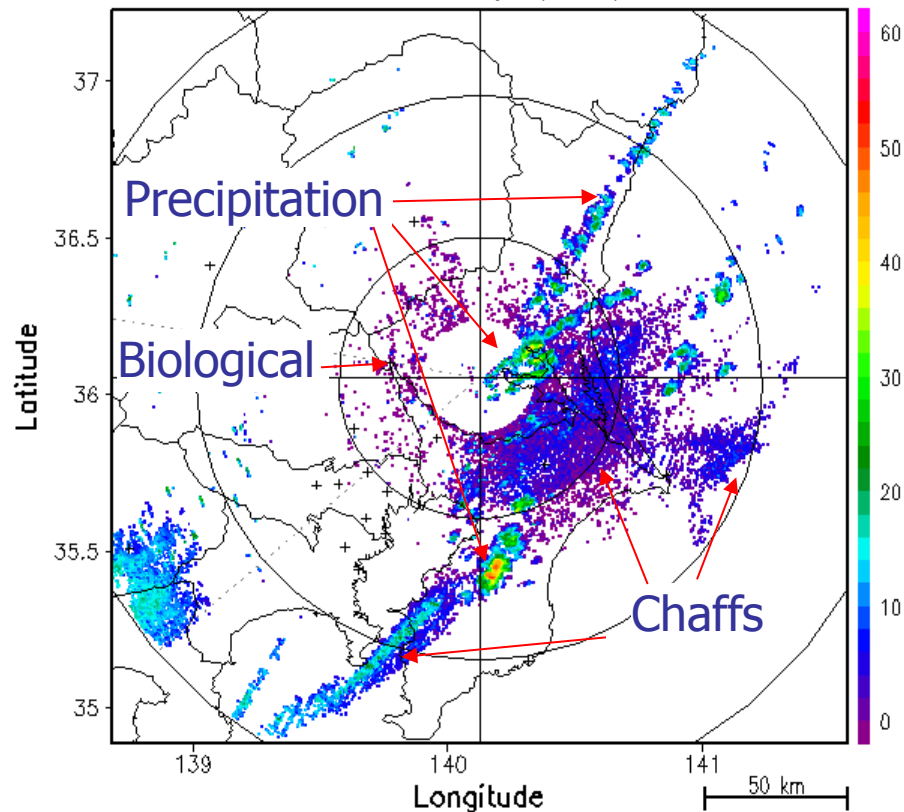
MRI-C 2011 10/25 22:27:48JST PPI EL= 1.0 deg
Rho-hv ($\times 100$)



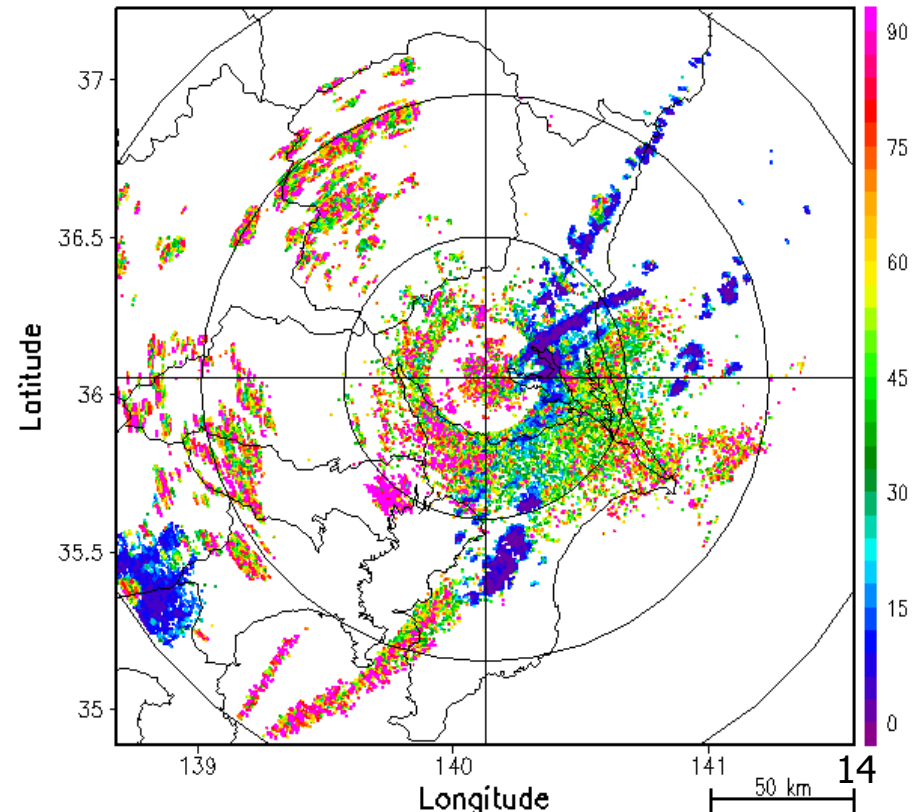
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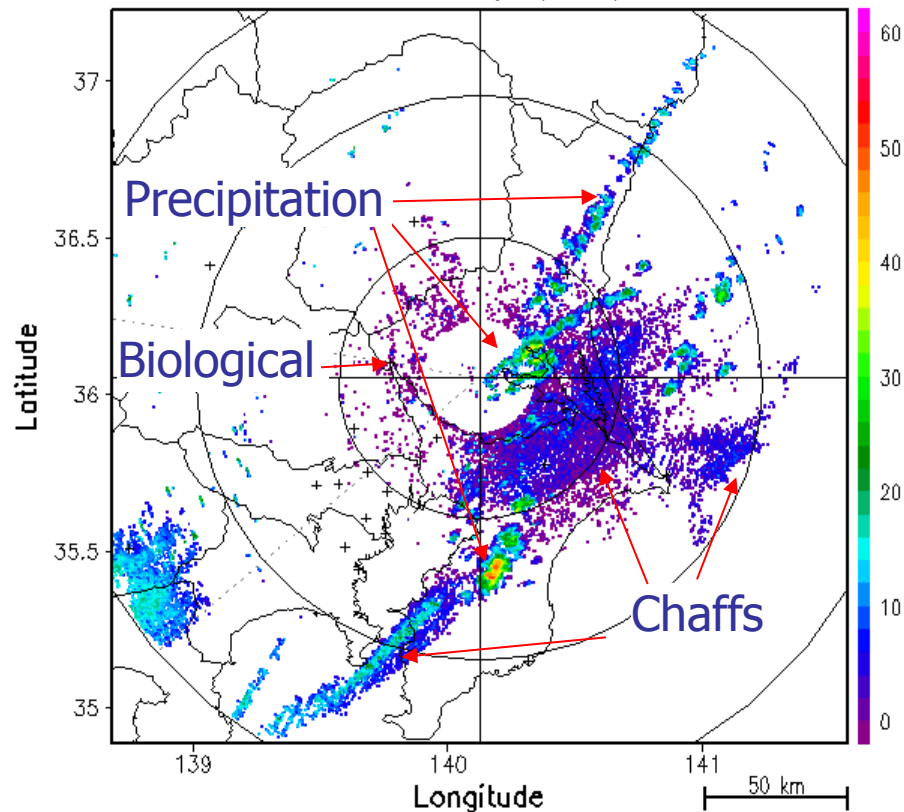
MRI-C 2011 10/25 22:27:49JST PPI EL= 1.0 deg
 $S(\Phi_{DP})$ (deg)



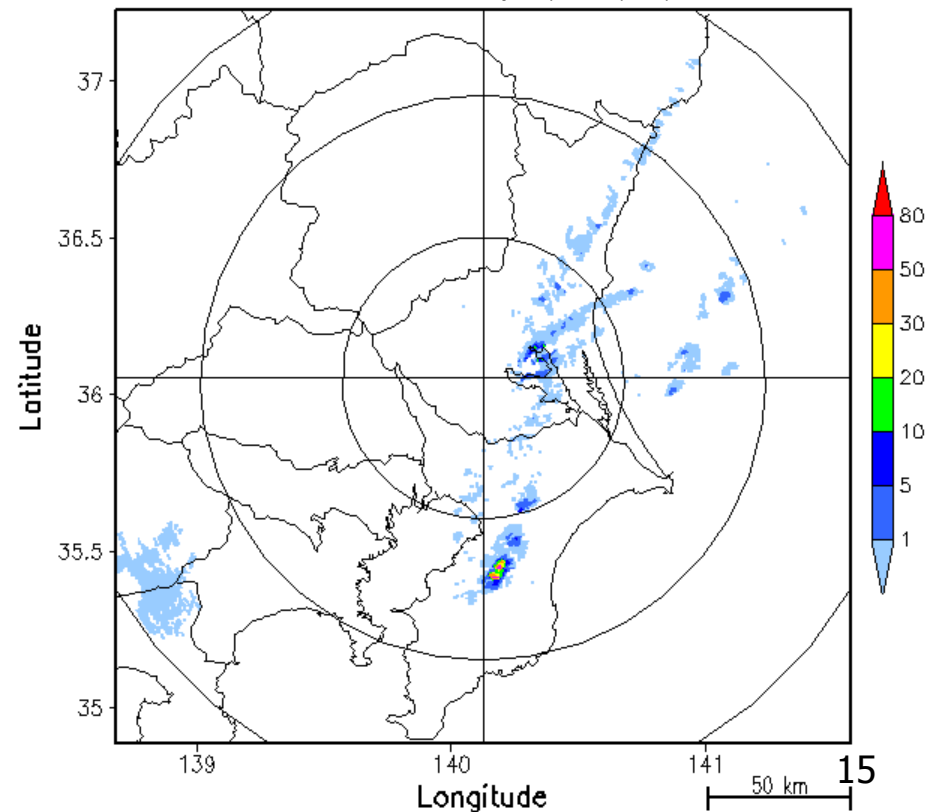
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Rain Intensity (mm/h)



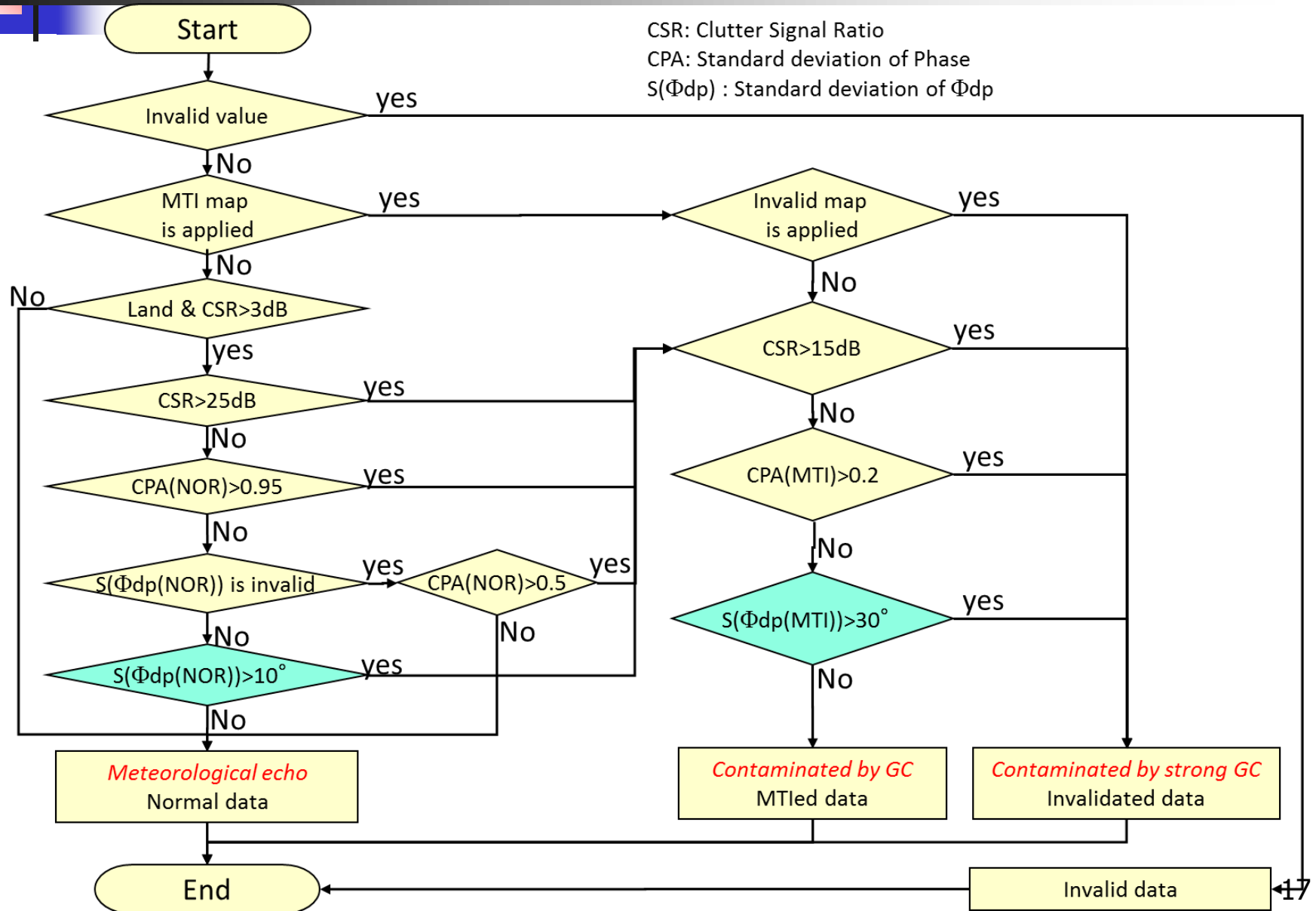


JMA's practical case for QC

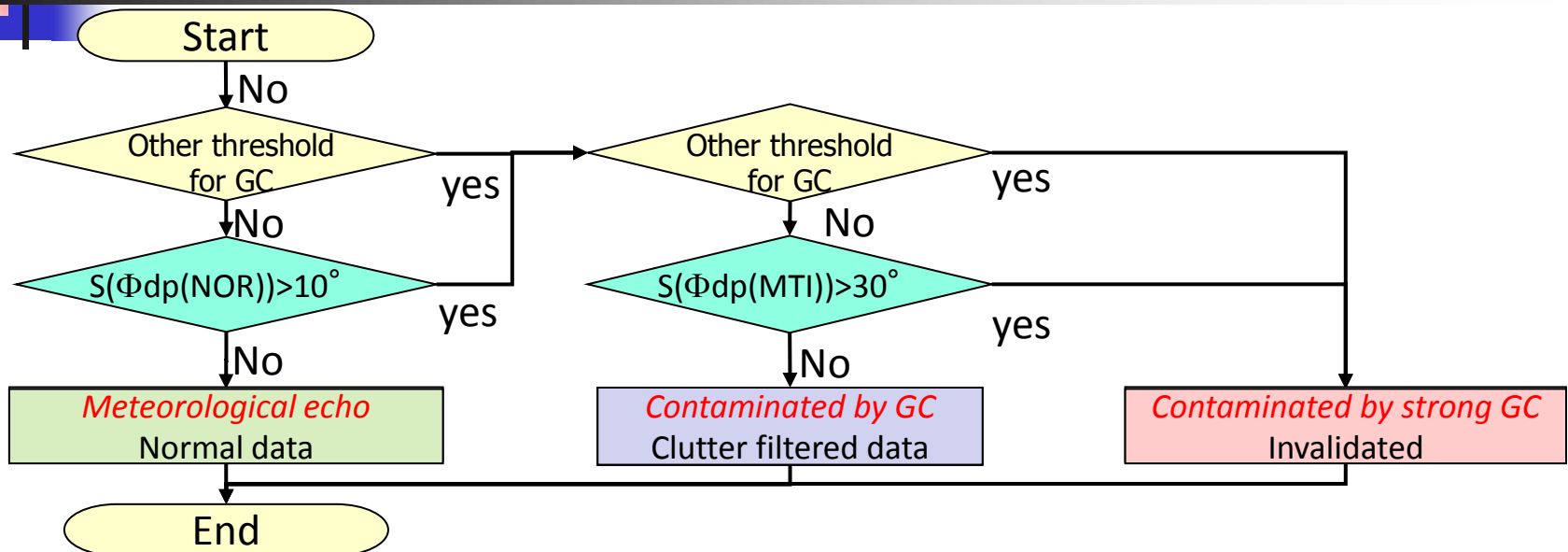
with dual-pol parameters

- Clutter removal
 - Standard deviation of Φ_{DP} ($S(\Phi_{DP})$) is used
- Clear air echo removal
 - Zdr and ρ_{hv} are used
 - Textures are not used but it seems to be useful

Clutter removal



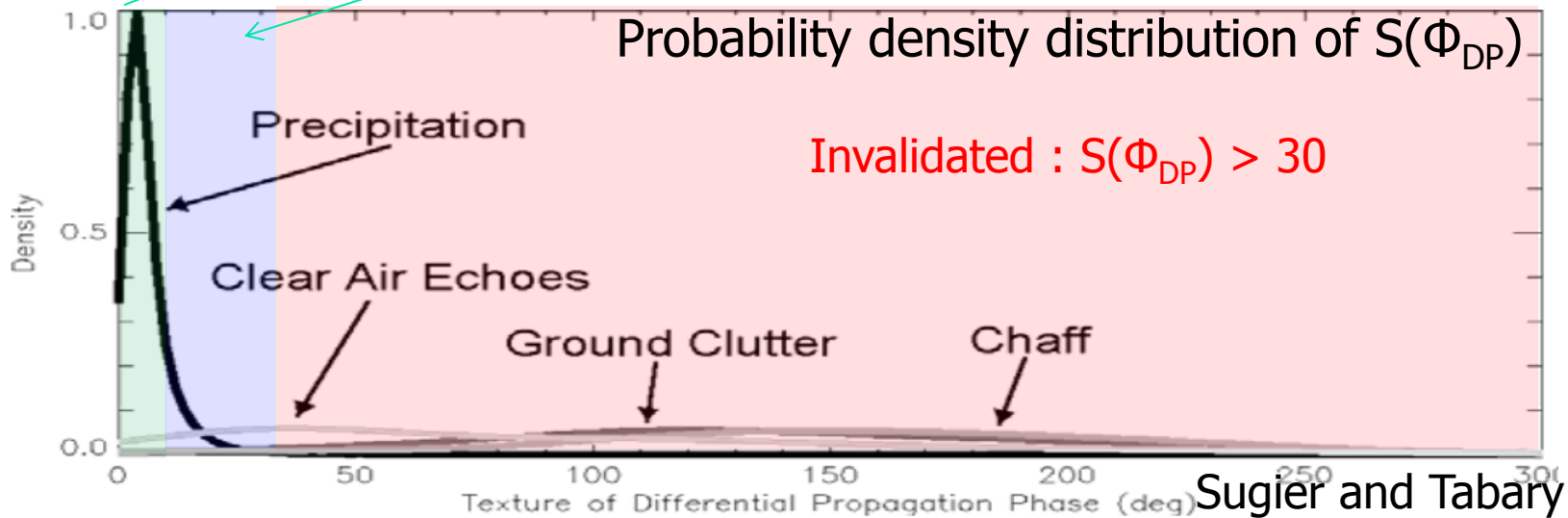
Clutter removal



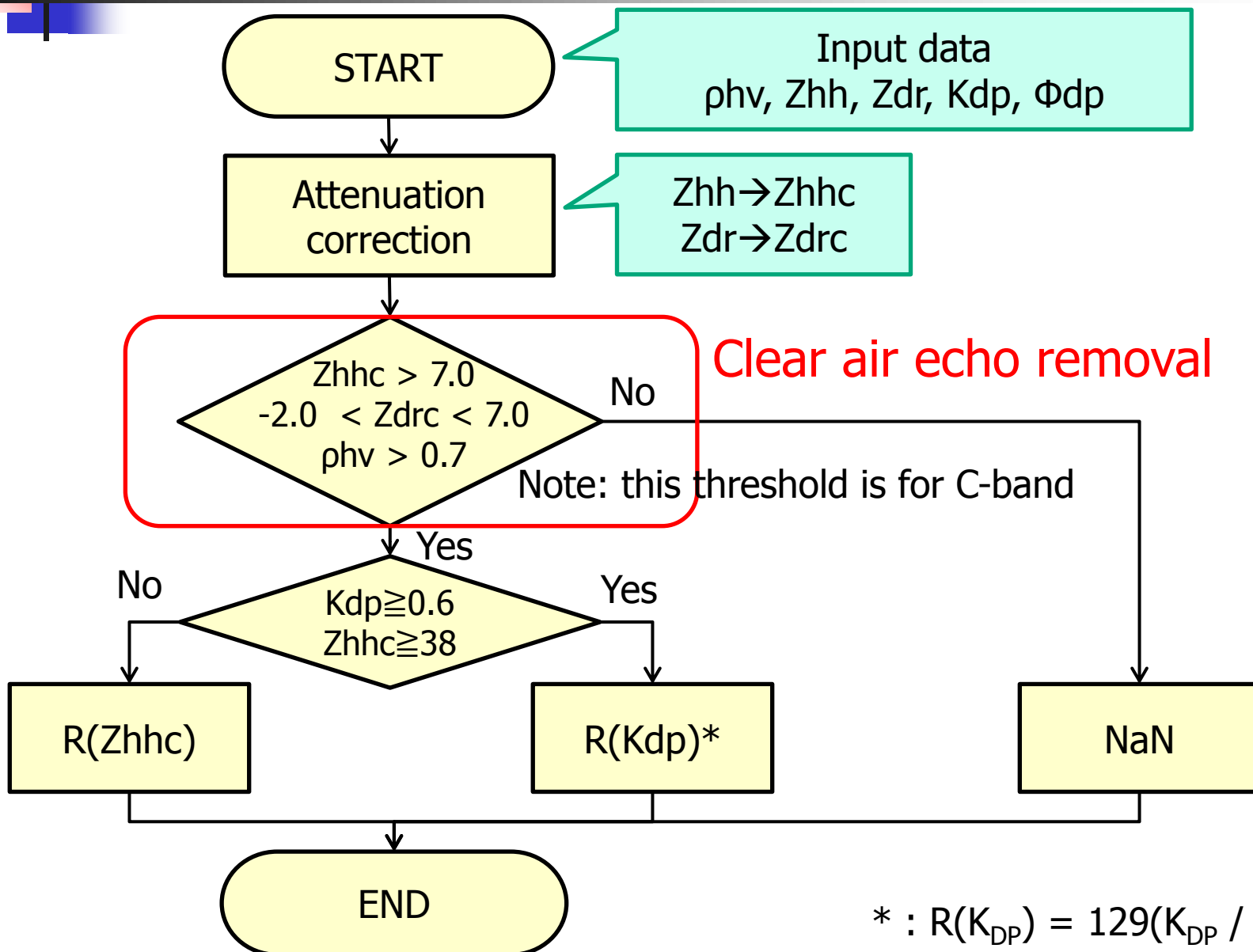
Normal : $S(\Phi_{DP}) < 10$

Clutter filtered : $10 < S(\Phi_{DP}) < 30$

Invalidated : $S(\Phi_{DP}) > 30$



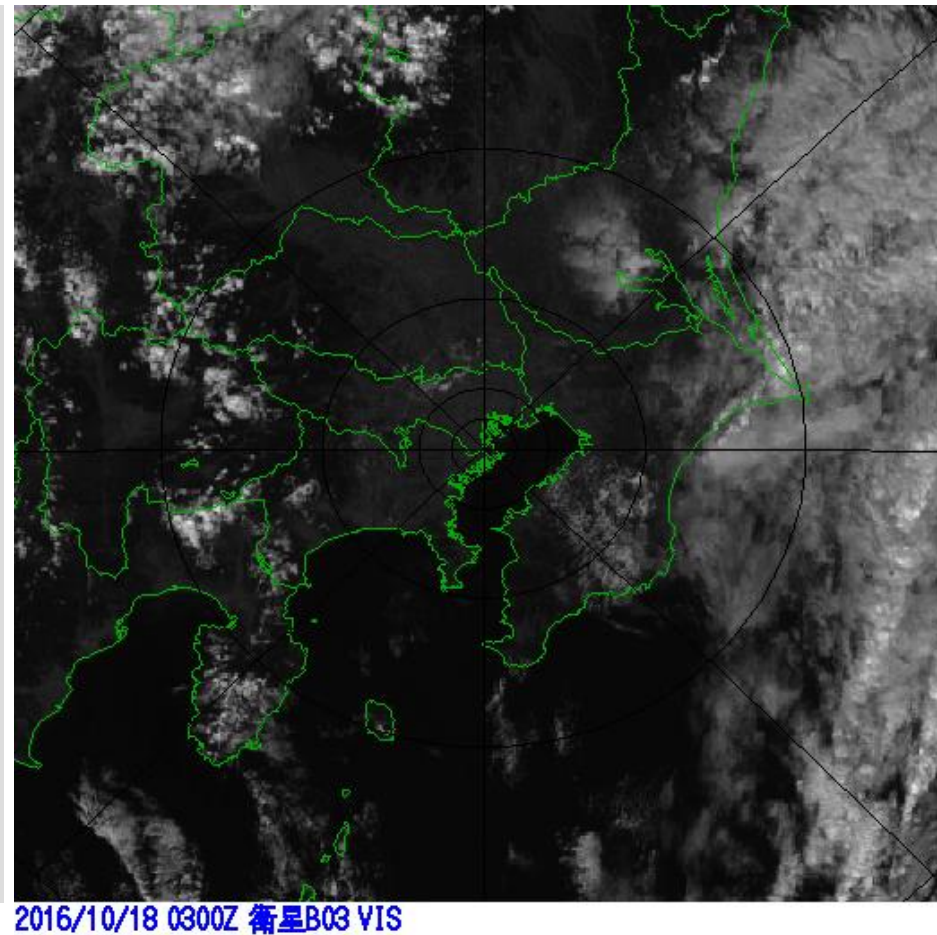
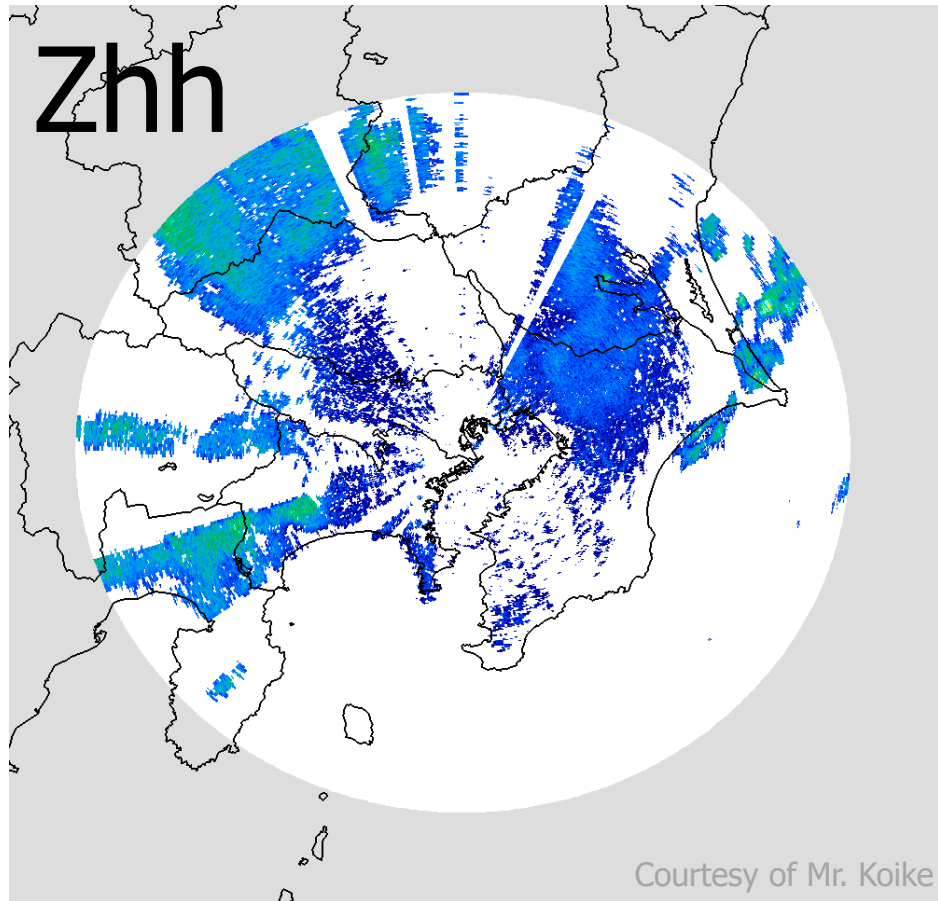
Clear air echo removal



* : $R(K_{DP}) = 129(K_{DP} / f)^{0.85}$ 19

Clear air echo removal (ex.)

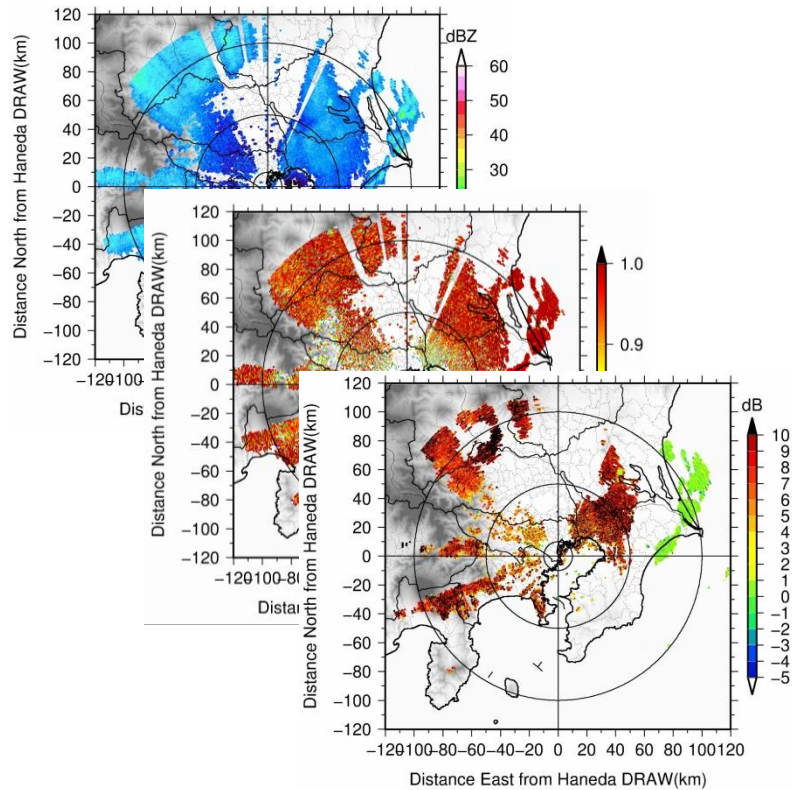
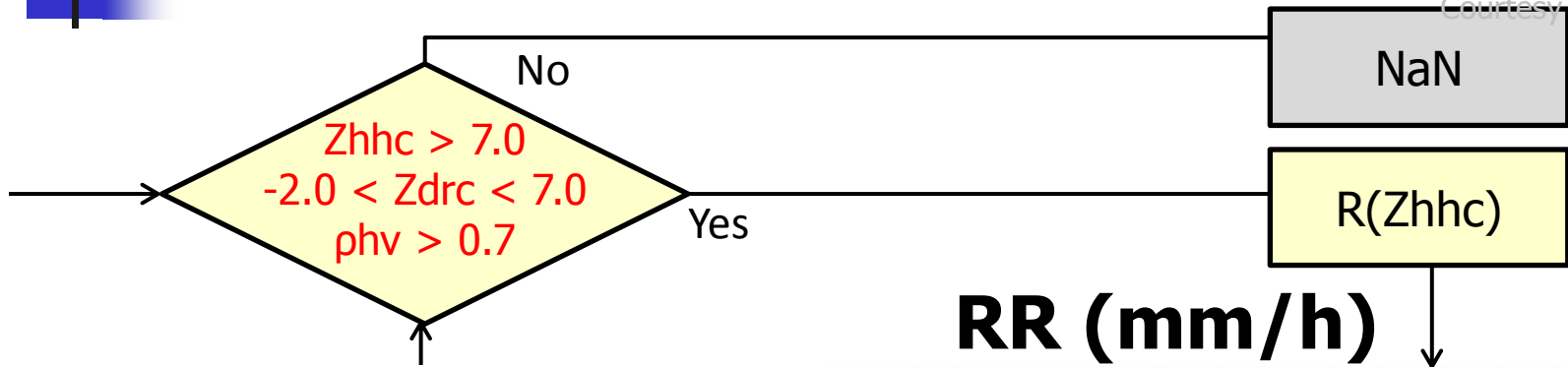
Courtesy of Mr. Umehara



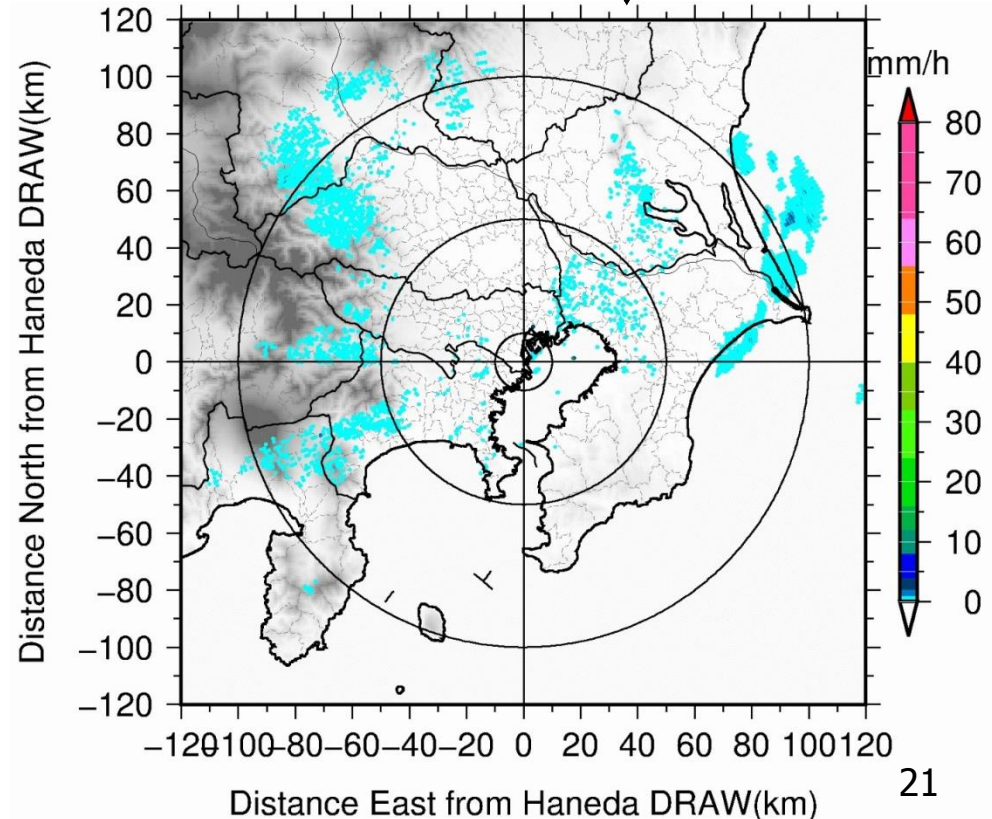
It seems all parts of this echo are meteorological echo but...

Clear air echo removal (ex.)

Courtesy of Mr. Umehara



RR (mm/h)



Clear air echo removal (ex.)

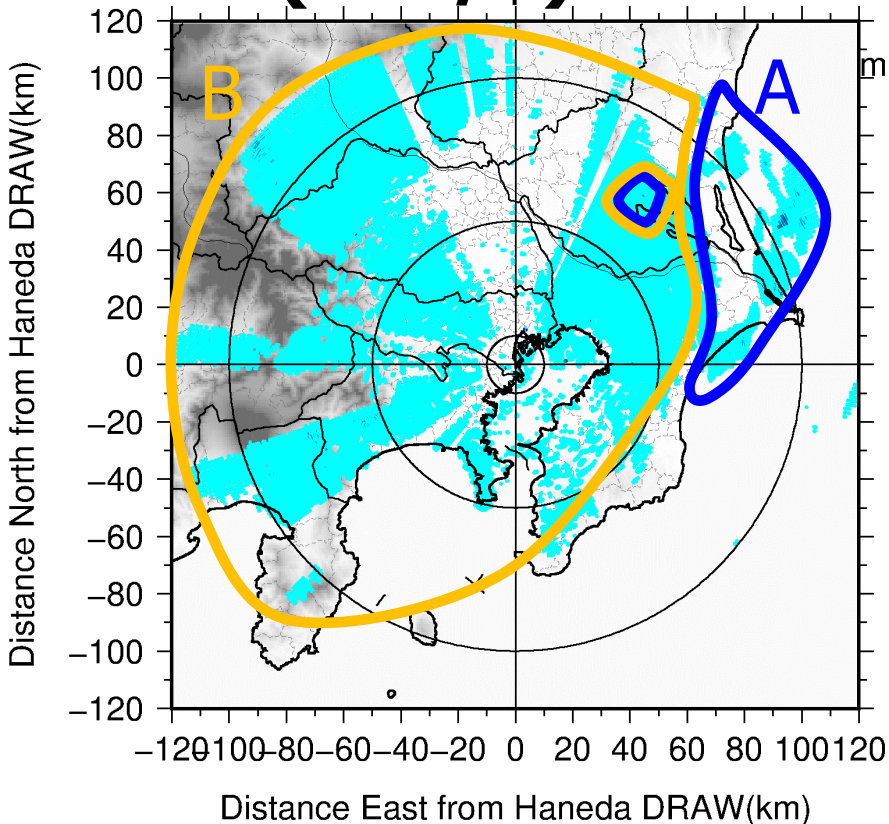
Courtesy of Mr. Umehara

- Most of clear air echo can be removed
- Clear air echo might be still remained

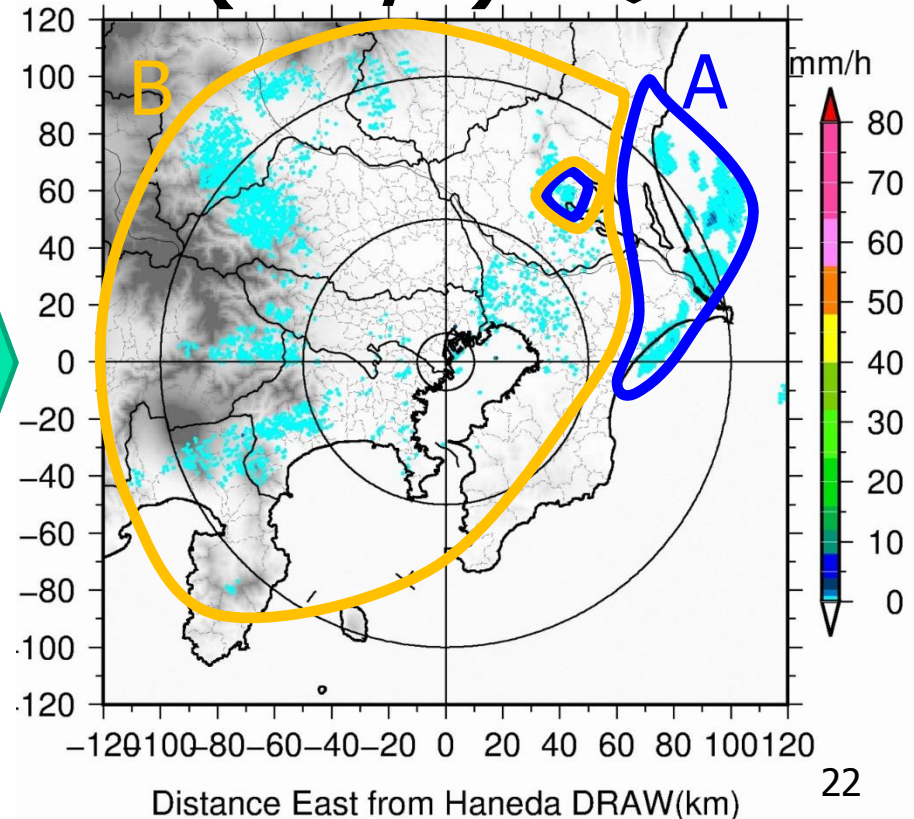
No threshold

$Z_{hfc} > 7.0$
 $-2.0 < Z_{drc} < 7.0$
 $\rho_{hv} > 0.7$

RR (mm/h)



RR (mm/h)





Summary

- Ground clutter removal
 - $S(\Phi_{dp})$ is useful
- Sea clutter removal
 - $S(\Phi_{dp})$ and ρ_{hv} are useful
- Clear air echo removal
 - $S(\Phi_{dp})$, ρ_{hv} , Z_{dr} and $S(Z_{dr})$ are useful
- JMA's practical case