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Contribution to a KC Initiative

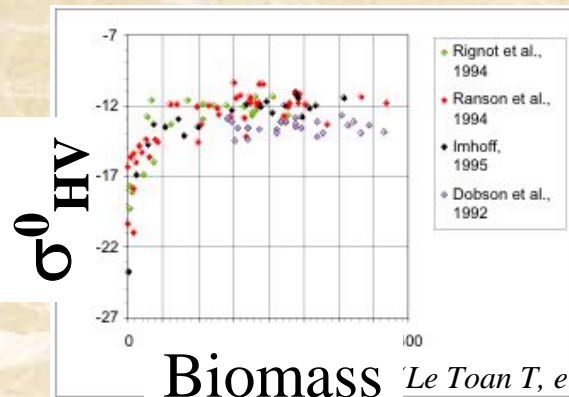
Manabu Watanabe
Motoyuki Sato
(Tohoku University)

K&C Initiative, 8th Science Advisory Panel Meeting, June 2007



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Relation between biomass and σ^0

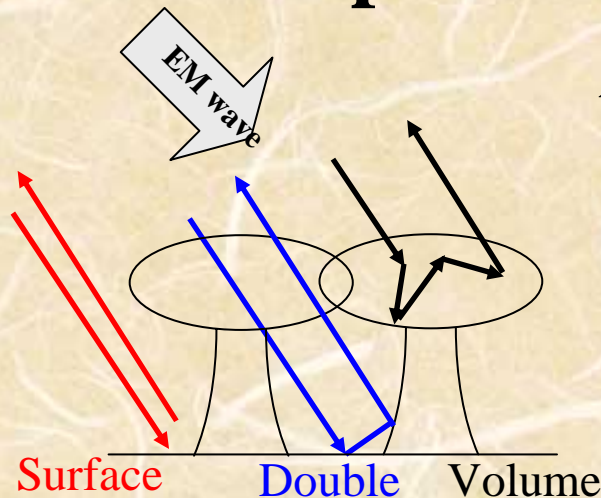


• Possible to reduce dispersion?



• Need a complete understanding of scattering process for **each test site**.

Tree component scattering model



Applying the model to the data under assumptions

$$S_{hh}S_{vv}^* > 0 \Rightarrow \alpha = -1 \text{ (Surface is dominant)}$$

$$S_{hh}S_{vv}^* < 0 \Rightarrow \beta = 1 \text{ (Double-bounce is dominant)}$$

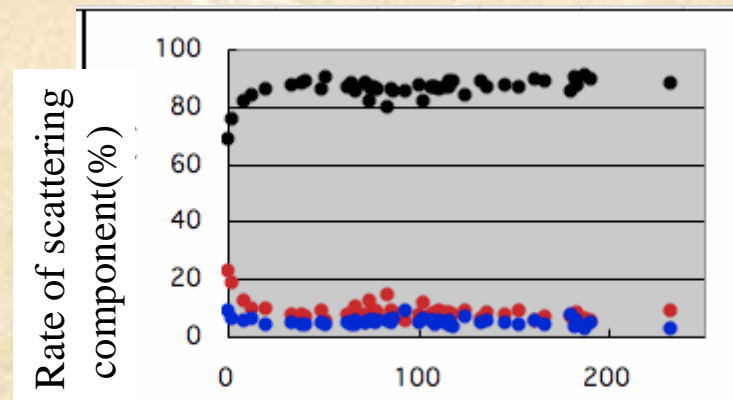
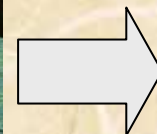
Volume ~88%

Surface ~ 7%

Double ~ 5%



L-band air-borne (PiSAR) data (R: HH, G: HV, B: VV)



Above ground dry biomass (tons/ha)

Radar measurement device



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Ground Based SAR (35MHz - 5GHz) TDR (Measure soil moisture)



Receiver Transmitter

Ground Penetrating Radar (100MHz, (250MHz, 500MHz, 800MHz))

Simultaneous field experiment with PALSAR obs.

Soil moisture (1)



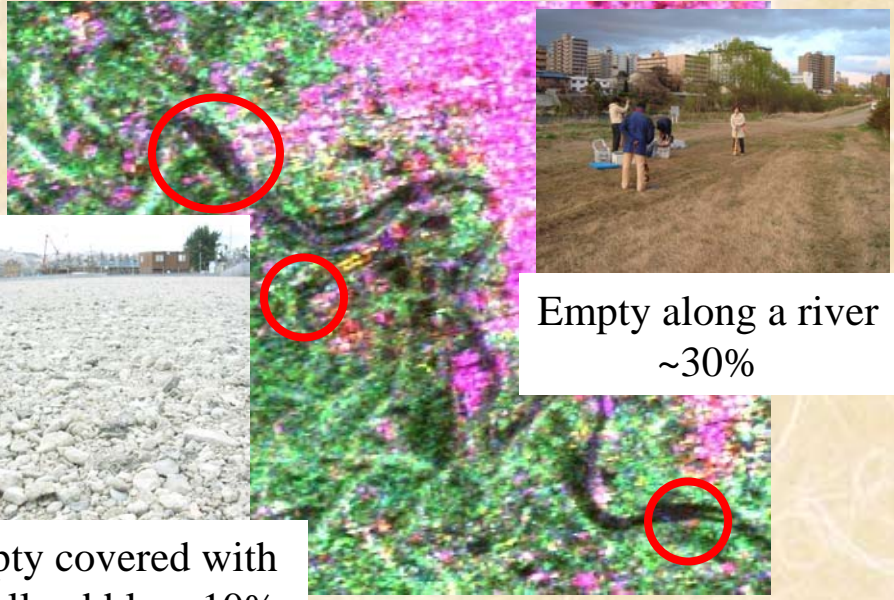
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Ulaanbaatar/Mongolia

Sendai/Japan



Swamp along a river
~50%



Empty along a river
~30%



Dry plain
~6%



Empty covered with
small pebble. ~10%

(R: HH, G: HV, B: VV)

- PALSAR(Pol.) obs. : 5/4, 2007
- Field experiment : 5/2 ~ 5/7, 2007

- PALSAR (Pol.) obs. : 4/14, 2007
- Field experiment : 4/14, 2007

TDR, GPR, Roughness

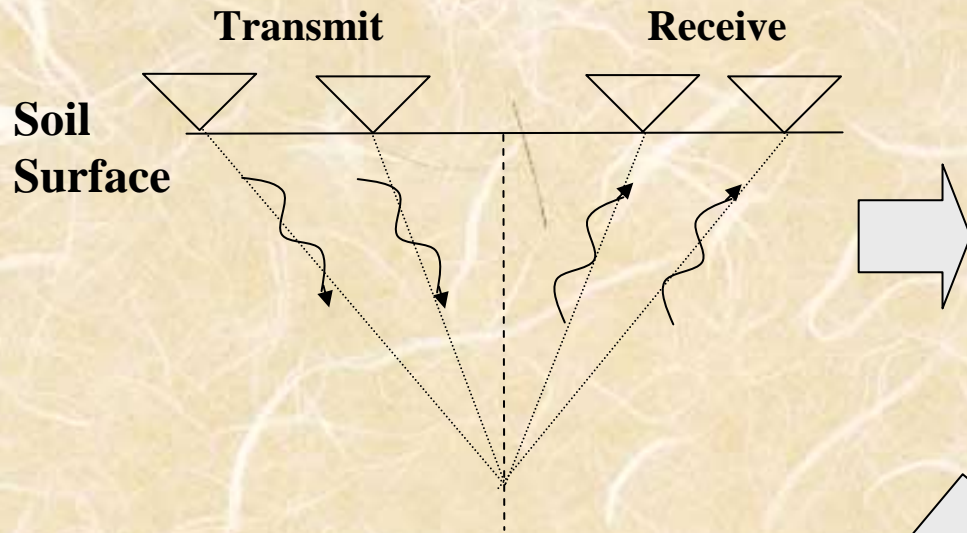
TDR, GPR, GB-SAR, Roughness

Soil moisture (2)

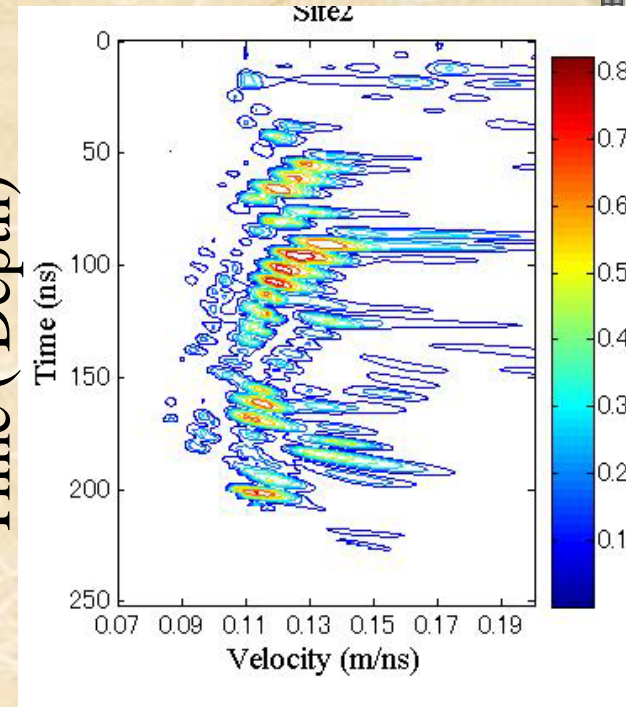


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GPR measurement(100MHz)



Time (Depth)



Velocity (v)

Permittivity: ϵ

$$\epsilon = (c/v)^2$$

c: Light speed

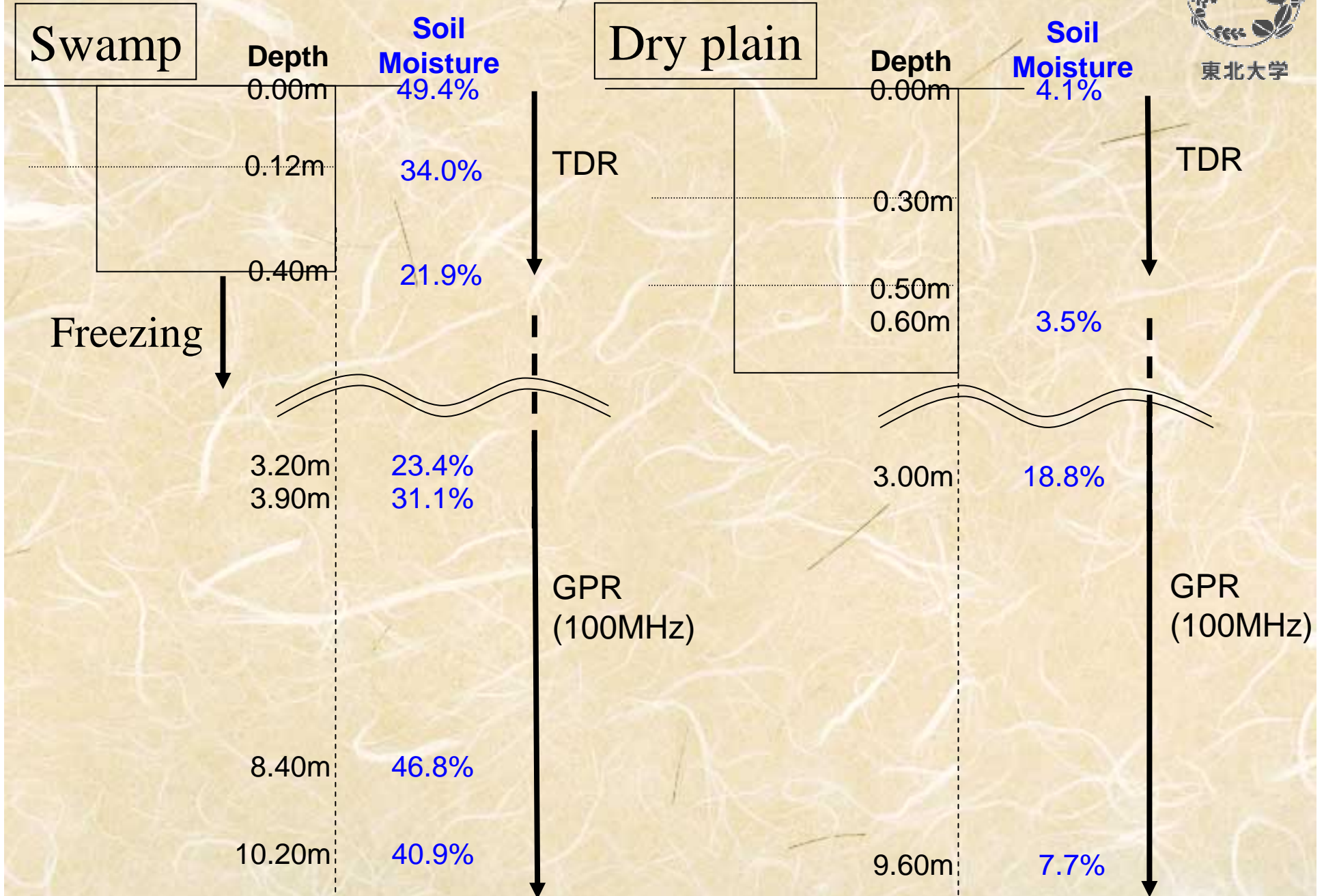
Soil moisture: θ (Topp equation)

$$\theta = -5.3 \times 10^{-2} + 2.92 \times 10^{-2} \epsilon - 5.5 \times 10^{-4} \epsilon^2 + 4.3 \times 10^{-6} \epsilon^3$$

Soil moisture in Mongolia (preliminary results)



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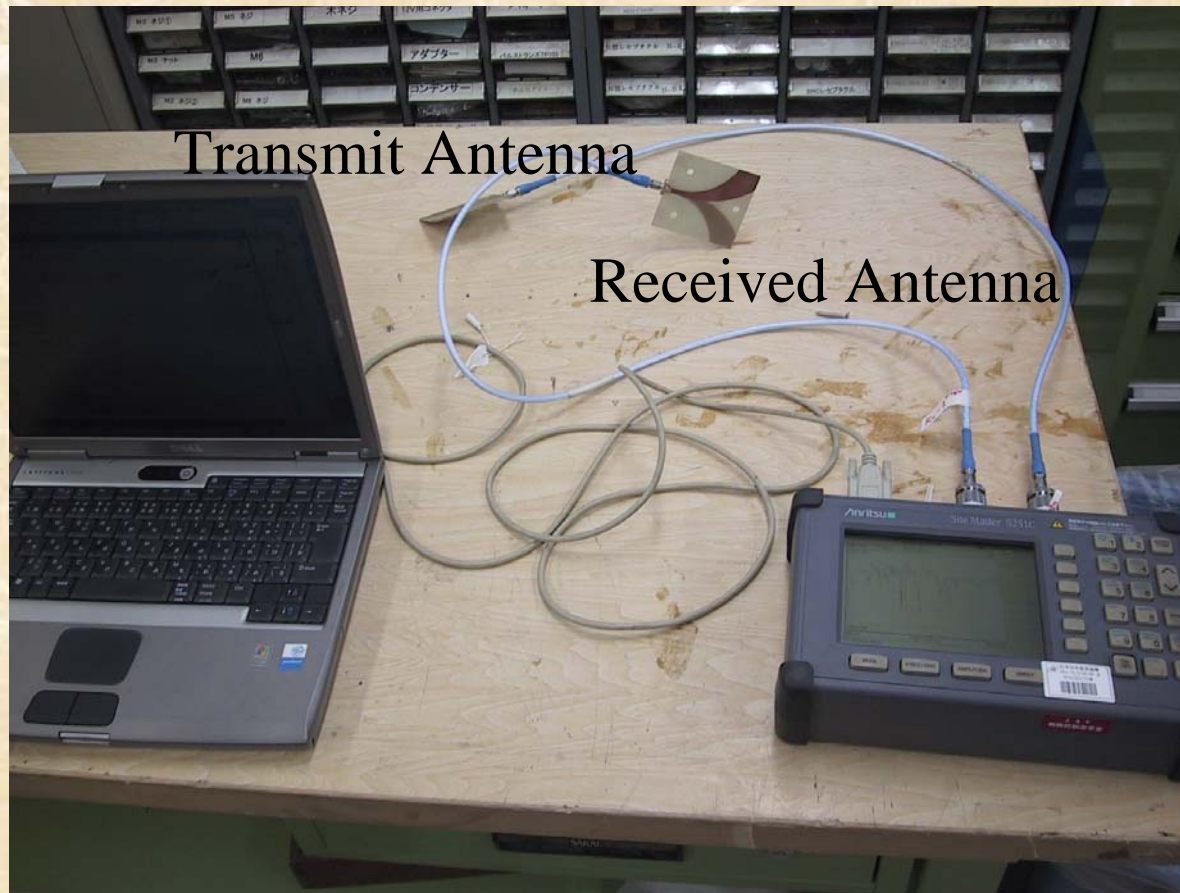
Tree permittivity (under preparation)

Direct measurement of EM wave velocity

$$\epsilon = (c/v)^2 \quad c: \text{Light speed}$$



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Signal transmitter
& Receiver

(Vector network analyzer
made by Anritsu)

600MHz~2.5GHz

Start a feasibility study



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Summary

- Start a simultaneous field experiment with PALSAR.
- Some experimental devices are under preparation.
(Measure soil moisture & tree permittivity)

If I can get a fund, I'd like to measure some other forest test site.
Please let me know, if you have a interest for these kind of work.
(mwatana@cneas.tohoku.ac.jp)