

Effect of soil type on soil water content and carbon cycle in different type of tropical forests using process based model in Thailand, Southeast Asia

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Objective

Seasonal variation in soil water content would be effect on the carbon cycle in tropical forest. A process-based terrestrial biogeochemical model (**VISIT model**) was applied to tropical primary forests of three types: seasonal dry evergreen forest (**DEF**), dry deciduous forest (**DDF**) and mixed deciduous forest (**MDF**) in Thailand. We evaluated the importance of soil water content on the carbon budget of tropical ecosystems.

Conclusion

VISIT model was applied to tropical primary forests of three types: **DEF**, **DDF** and **MDF**.

- 1) Carbon stocks in **DDF** were lower than other sites, and deciduous event in dry season was very important factor to carbon stock and LAI.
- 2) SWC at field data was lower than that at the estimation in **DEF** site, but aboveground biomass in field data was higher than the estimation.
- 3) We need to investigate the relationship between soil characters and SWC, SWC and NEP or GPP, especially under the low SWC condition.

VISIT model

VISIT model: A process-based terrestrial biogeochemical model (**V**egetation **I**ntegrative **S**imulator for **T**race gases) to evaluate the atmosphere– ecosystem exchange and internal dynamics of carbon at a daily time step.

Soil water content was estimated using bucket model which decided soil water flow by soil character. And, DDF had deciduous event in dry season in this model. Other parameters were same among three forests.

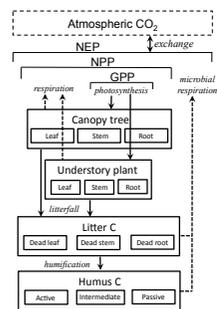


Fig.1 An overview of the VISIT model.



Table1. Soil characters at the three sites

Vegetation type	DEF	DDF	MDF
Bulk density	0.99 ⁴⁾	1.15 ⁴⁾	1.00 ⁴⁾
Sand (%)	61.2 ¹⁾	67.2 ²⁾	48.9 ³⁾
Clay (%)	24.9 ¹⁾	17.4 ²⁾	11.6 ³⁾
Solid ratio (%)	39 ⁴⁾	44 ⁴⁾	40 ⁴⁾
Soil type	4	2	3

1) Yamashita et al., (2010), 2) Sakurai et al. (1999), 3) Takahashi et al. (2011), 4) the present study

Only DDF site was deciduous in dry season.

Fig.2 Site description in this study.

Results and discussion

Although estimation of soil water content (SWC) remain a matter of improvement, especially in **DEF**, VISIT model could estimate the difference of soil water content in the three sites (Fig.3b).

Carbon stocks in **DDF** site was lower than other sites because of deciduous event in dry season. LAI (leaf area index) of canopy tree in **DDF** site was estimated about 1.9, it was also lower than other sites (5.1-5.3). In the results of VISIT model, the biomass under canopy was increased in **DDF** site due to low LAI of canopy tree (Fig. 4b). SWC at field data was lower than that at the estimation in **DEF** site (Fig.3). but aboveground biomass in field data was higher than the estimation (Table 2). Therefore, we need to investigate the relationship between SWC and NEP or GPP.

Fig.3 a) precipitation by NCEP/NCAR, b) soil water contents which were estimated by VISIT model, and c) soil water contents by field observation.

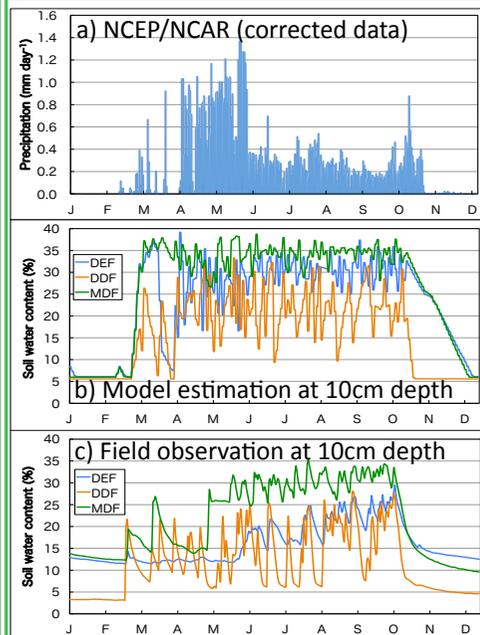


Table 2. Comparison of aboveground biomass between field data and VISIT model.

	Field data	VISIT model	Year
DEF	226.3 ¹⁾	183.6	1993
DDF	45.6 ²⁾	86.4	2009

1) Kanzaki et al. (2009), 2) Ladpala et al. (2009)

Fig.4 Carbon stocks (t C ha⁻¹) in a) DEF, b) DDF, and c) MDF.

