# Priestley-Taylor모형과 MODIS를 이용한 실제증발산 추정

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# Estimation of actual evapotranspiration using Priestley-Taylor model and MODIS

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## 1. Introduction

Evapotranspiration (ET) is the combined net effect of two processes: evaporation and transpiration. In terrestrial ecosystem, ET uses over 60 percent of the precipitation, so it occupies the largest portion of the hydrological budget. So the accurate estimation of ET is imperative work for managing water resources and monitoring hydrological cycles. In this research, we estimated actual ET over a farmland of Haenam by using Priestley-Taylor (P-T) model (Priestley and Taylor, 1972).

## 2. Method

P-T model expressed as

$$\lambda E = \frac{\alpha \Delta A}{(\Delta + \gamma)} \tag{1}$$

where $\alpha$ is P-T coefficient, $A$ is available energy, $\Delta$ is the derivative of saturated vapor pressure versus temperature, and $\gamma$ is psychrometric constant.

We prepared the input data sets for daytime averaged temperature (Tday), available energy (AE), and

P-T coefficient (alpha). Tday data was derived from MT-CLIM whose forcing data was based on National Weather Station (NWS) data. AE data was obtained from MT-CLIM and MODIS products including Surface Reflectance product (MOD 43), Land Surface Temperature product (MOD 11), and Vegetation Indices product (MOD 13). Alpha was back-calculated from Biome-BGC.

## 3. Results and Discussions

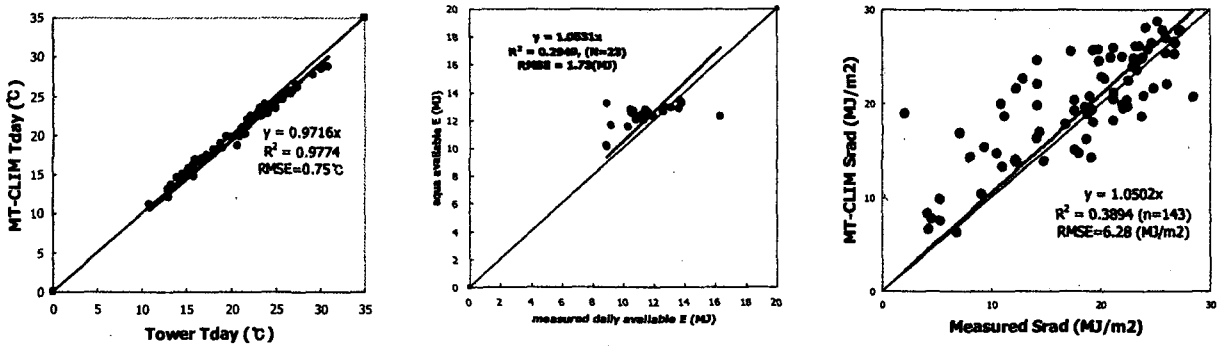


Fig. 1. Scatter plot of (a) Tower Tday and MT-CLIM Tday (b) measured daytime AE and MODIS daytime AE and (c) measured Srad and MT-CLIM Srad

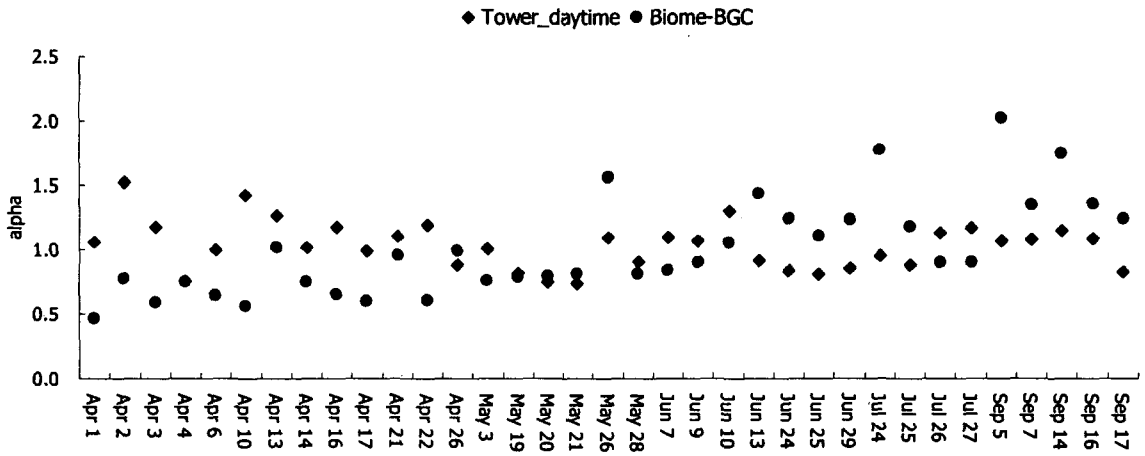


Fig. 2. Comparison of the measured alpha at flux tower and simulated alpha from Biome-BGC from April 1 to Sep. 30, 2003

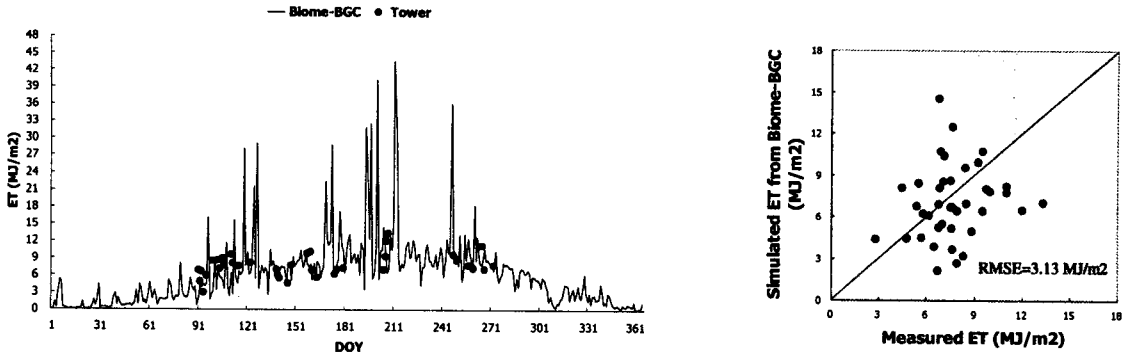


Fig. 3. (a) Comparison of Biome-BGC ET and Tower ET during 2003 in a farmland of Haenam (b) Scatter plot of the measured ET and simulated ET from Biome-BGC

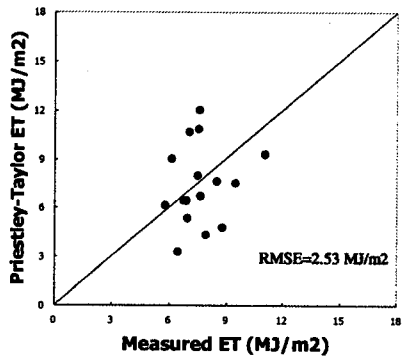


Fig. 4. Scatter plot of the measured ET and simulated ET from Priestley-Taylor model

Our analysis showed that above methods well predict Tday and AE (RMSE=0.75℃, Fig. 1 (a) and RMSE=1.73 MJ/m$^2$, Fig. 1 (b), respectively), but did not estimate well alpha (RMSE=0.44, Fig. 2). The simulated ET indicated serious discrepancy with measured ET (RMSE=2.53 MJ/m$^2$, Fig. 4). There were three reasons for the discrepancy: 1) MT-CLIM did not predict well the solar radiation over the farmland (RMSE=6.28 MJ/m$^2$, Fig. 1 (c)) 2) Biome-BGC did not estimate well ET over the farmland (RMSE=3.13 MJ/m$^2$, Fig. 3) and 3) These two error factors induced the inaccurate estimation of alpha back-calculated from Biome-BGC. The implication of these results is that the accurate estimation of alpha is the most important work and the back-calculating alpha from Biome-BGC is not valid in the farmland. Parameterization of alpha will be studied later.

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## References

Priestley, C. H. B. and R. J. Taylor, 1972. On the assessment of surface heat flux and evaporation using large-scale parameters. *Monthly Weather Review* 100(2), 81-92.