A simple method to estimate evapotranspiration from a combination of vegetation index and temperature

Kaicun Wang (email: kcwang@umd.edu), Zhanqing Li, M. Cribb

1Department of Geography, University of Maryland
2Department of Atmospheric and Oceanic Science and ESSIC, University of Maryland

Abstract

Satellite remote sensing is a promising technique for estimating global or regional evapotranspiration (ET). A simple but relatively accurate method is essential when estimating ET using remote sensing data. Such a method is investigated by taking advantage of satellite measurements and the regression equation is obtained to estimate ET using surface net radiation, air or land surface temperatures and vegetation indices. ET predicted by equation (1) agrees reasonably well with the measured ET at the 8 sites. Figure 5 shows that equation (1) can accurately predict the ET at all sites for all years.

Data analysis

<table>
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<tr>
<th>Site</th>
<th>EF20</th>
<th>EF19</th>
<th>EF18</th>
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<th>EF12</th>
<th>EF09</th>
<th>EF08</th>
<th>EF07</th>
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</table>

Parameterization of ET

Surface net radiation is selected to parameterize ET because their linear relationship. Figure 3 shows the correlation coefficients between the daytime average air temperature, daytime-averaged LST, the EVI and the ET at EF20, EF07, EF19, EF15, EF09, EF18, EF12, and EF20. ET is parameterized as:

\[ ET = a_0 + a_1 \cdot T + a_2 \cdot VI \]

Where: VI can be EVI or NDVI, T can be daytime-averaged air temperature or LST.

Results

A simple but relatively accurate method is essential to estimate ET using remote sensing data. The suitability of the method also depends on the practicability of the required input. In the present study, this was done by taking advantage of satellite measurements and the regression equation is obtained to estimate ET using surface net radiation, air or land surface temperatures and vegetation indices. ET predicted by equation (1) agrees reasonably well with the measured ET at the 8 sites. Figure 5 shows that equation (1) can accurately predict the ET at all sites for all years.

Conclusion

A simple method to estimate evapotranspiration from a combination of vegetation index and temperature was developed. The method is based on satellite measurements and the regression equation is obtained to estimate ET using surface net radiation, air or land surface temperatures and vegetation indices. ET predicted by equation (1) agrees reasonably well with the measured ET at the 8 sites. Figure 5 shows that equation (1) can accurately predict the ET at all sites for all years.

Figure 1. Scatterplots of the predicted ET (using Equation (1) with EVI and daytime-averaged air temperature) as a function of the measured ET for the 8 sites.

Figure 2. Scatterplots of the ET as a function of (a) the daytime-averaged air temperature (Tair), (b) daytime-averaged land surface temperature (LST), (c) EVI, and (d) daytime-averaged land surface temperature (LST) vs. EVI.

Figure 3. Time series of the measured (blue dot) and predicted ET (black line) using equation (1) with EVI and daytime-averaged air temperature at the 8 sites.