Carbon and Water Fluxes at High spatial Resolutions through Down-Scaling

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We propose an innovative top-down modeling approach to estimate high resolution (30 m) net primary production (NPP), evapotranspiration (ET) and *albedo* from MODIS products by integrating accurately classified land cover from Landsat/Sentinel and MODIS. Assuming that a measure of ecosystem ET in a landscape is a linear sum of ET of cover type (i), MODIS ET of a pixel can be expressed as:

$ET = sum(a_i * ET_i) + e$ [1]

where a_i is the compositional portion of cover type i within a MODIS pixel (where $sum(\alpha_i) = 1$) that can be calculated from classified land cover for the year; ET_i is the ET value of cover type i and can be estimated through multi-linear regression analysis with a zero intercept; and e is the residuals from the empirical model [1] and will be further examined for the potential influences of biophysical and socioeconomic driving forces. MODIS products of NPP, ET, and *albedo* of a landscape are estimated for their monthly and annual values by assuming that land cover during an individual year remains unchanged. This downscaling approach, currently tested for the Kalamazoo watershed in the southwestern Michigan, is only valid at a scale where similar climate, soil, and landforms exist (i.e. value of the same cover type in isolated patches are the same). To assure the validity of this approach, a multilinear regression analysis is performed with external factors such as soil type, climatic zone, and/or disturbance regime. Estimated ecosystem functions is then scaled up based on the 30 m resolution land cover of Landsat imagery for their high resolution spatiotemporal changes.

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