[Coupling metrics to diagnose land-atmosphere interactions]()

Vegetated Coupling (Little Omega)

- References:

    - Ek, M., C. Tassone, J. Meng, B. Holtslag, and C. Jacobs, 2015: Assessing local land-atmosphere coupling from a global land data assimilation (GLDAS) reanalysis. American Geophysical Union Fall Meeting, A31I-02.
    - Ek, M. et al., 2016: On the nature of local land-atmosphere coupling strength for vegetated surfaces. Monograph.
    - Jacobs, C. M. J., and co-authors, 2008: Evaluation of European Land Data Assimilation System (ELDAS) products using in situ observations. *Tellus*, **60A**(5), 1023-1037, doi: 10.1111/j.1600-0870.2008.00351.x.
    - Jarvis, P. G., and K. G. McNaughton, 1986: Stomatal control of transpiration: scaling up from leaf to region. *Adv. Ecol. Res.*, **15**, 1-49, doi: 10.1016/S0065-2504(08)60119-1.

- Principle:
    - A "decoupling parameter" based on the ratio of canopy conductance (g_c) versus aerodynamic conductance (g_a) scaled by moisture holding capacity of the atmosphere:

$$\Omega = \left[\left(\frac{\gamma}{m+\gamma}\right)\frac{g_a}{g_c} + 1\right]^{-1}$$

      indicates strong/weak coupling over vegetated surfaces as $\Gamma \rightarrow 0{,}1$. γ is the psychrometric constant, m is the slope of saturation vapor pressure with temperature.
    - More intuitive is a scale where 1 indicates strong and 0 indicates weak coupling, an actual "coupling parameter":

$$\omega = \left[\left(\frac{m+\gamma}{\gamma}\right)\frac{g_c}{g_a} + 1\right]^{-1}$$

    - An additional term can be defined for soil heat flux modulation of coupling (see Ek et al. 2016).

- Data needs:
    - LSM and/or GCM output often has all needed terms for model diagnosis. From a theoretical viewpoint, it is easy to plot distributions as a function of varying conductances, or the terms that determine those conductances.

- Observational data sources:
    - g_c is very difficult to measure or estimate in the field, largely restricting this metric to LSM output or laboratory situations unless special instrumentation is deployed.

- Caveats:
    - See Ek et al. (2016) for a full discussion including the derivation and relationship to evaporative fraction for transpiration.

Supported by NASA/MAP Grant: NNX13AQ21G