EGU2020-6038
https://doi.org/10.5194/egusphere-egu2020-6038
EGU General Assembly 2020

Global transpiration modelling: can the optimality hypothesis improve partitioning of ecosystem-scale evapotranspiration?

Alison Prior and Iain-Colin Prentice
Imperial College London, Centre for Population Biology, School of Life Sciences, Natural Sciences, Silwood Park, Ascot, United Kingdom of Great Britain and Northern Ireland (a.prior18@imperial.ac.uk)

The volume of water entering the atmosphere through transpiration is thought to be greater than the flow of all rivers to the oceans. It makes up the majority of evapotranspiration (ET) and significantly contributes to rainfall and therefore also to surface water runoff. However, there is no consensus on how transpiration responds to a changing environment; or even as to whether it is increasing over time. Global transpiration estimates are most commonly made through the partitioning of ET models. However, in many ET models, the dynamics of vegetation growth and associated impacts on evapotranspiration are overlooked. Therefore, global estimates of transpiration from climate models are poorly constrained, with large uncertainties especially in stomatal conductance.

The 'P model' (for Production) is a recently developed, 'next-generation' model for Gross Primary Production, GPP. Derived from biochemical process of plants, the P model is built upon the established standard model for photosynthesis – combined with optimality hypotheses for the adaptation and acclimation of key model parameters – to determine GPP. The P model has the potential to provide a coupled global carbon and water model that responds correctly to changing environmental conditions. It requires only elevation, CO2 concentration, incident solar radiation, vapour pressure deficit (VPD) and temperature as inputs, in addition to remotely sensed green vegetation cover (fAPAR). The key idea motivating this research is that by exploiting the coupling of land-atmosphere carbon and water exchanges through stomatal behaviour, it should be possible to develop a near real-time transpiration monitoring system in which fAPAR is a key input. The P-model provides the means to do this. Initial results will be shown for both transpiration and GPP, with validation at >100 eddy-covariance flux-tower sites.