Abstract

Introduction
Controls on litter decomposition
Key flux into soils and the atmosphere
Need to understand drivers at global scale
-Alternate models should be considered
No global-scale synthesis of litter turnover rate exists
Need global benchmarks for ESMs
Global maps with uncertainties are needed for ESM testing
Bayesian approaches/model averaging are needed to scale up observations and quantify uncertainty
Hypothesize that contribution of temperature model to explaining global observations is small
Precipitation model increases explanatory power
Precip/PET model should explain observations the best and most simple model
Adding temperature to the above model should result in a marginal increase in model power

Methods

Results

Discussion

Global map of litter turnover times using one-pool or multi-pool models
Based on LIDET and other large-scale datasets
Interpolate using CDI, but need to choose CDI function. Current functions are in dispute; need to choose some.
ki = k0*f(M, T, Chemistry, interactions)
Build up from simple to more complex
Use Bayesian inversion to extract parameters
Iterate through all possible models
Model averaging
Vary model weights by biome? Bin by temperature?
Model fit index for each site

Start with one model; add complexity; compare fits; evaluate if different models apply to different sites. If not, then conduct Bayesian assimilation on single model. If so, then pursue model fit index and combination of multiple model.

LIDET data with site met data
Four alternative models that include combinations of litter quality, precip, and temperature drivers
Fit models to dataset
In Bayesian framework, weight the different models at each observational site

Test for varying importance of drivers across sites
Extract parameters from model fitting and use them to generate a global map based on climate reanalysis data and CLM litter quality data. Do this for roots and leaves.
-Predictions of turnover generated for each model, then the maps get averaged

Models:

$$\frac{dC}{dt} = A * C * f(L, P, T)$$

$$A = \begin{bmatrix} k_1 & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{1n} & \cdots & k_n \end{bmatrix}$$

$$f(T) = e^{-\frac{E_a}{RT}}$$

$$f(P) = \frac{1}{1 + a * e^{b*P}}$$

$$f(P,T) = \left(1 - e^{-\alpha|T-273|}; T < 273 \middle| 1 - e^{-\beta P(T-273)}; T \geq 273\right)$$

$$f(L) = e^{-g*L_N}$$

$$\frac{dC}{dt} = A * C * f(L) * f(T)$$

$$\frac{dC}{dt} = A * C * f(L) * f(P)$$

$$\frac{dC}{dt} = A * C * f(L) * f(P, T)$$

$$\frac{dC}{dt} = A * C * f(L) * (P) * f(T)$$