Carbon Turnover in Soil: Spatial Model

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We are interested here in modelling the carbon cycle in soil.
In the first part we study a non linear system of ordinary differential equations ([1]). We will analyze this model and prove the existence and uniqueness of a positive solution, using the theory of cooperative differential systems due to Smith ([2]).
A more recent model takes into account the space dependence of the carbon cycle. Thus, the model becomes a reaction-diffusion-advection non linear PDE system. We will show in this part that this second model admits also a unique positive weak solution for reasonable hypothesis of the data.
Finally, we show the capability of the model to produce patterns considering chemotaxis and diffusion. We will explain ([3]) why considering only diffusion does not provide spatial self-organization of the microbes, as observed by Vogel ([4]).

Références

[1] Pansu et al, *Modeling organic transformations by microorganisms of soils in six contrasting ecosystems: validation of the MOMOS model.*, Global Biogeochem. Cycles, 2010.

[2] H. L. Smith, *Monotone Dynamical Systems, An introduction to the theory of competitive and cooperative systems*, Amer. Math. Soc, 1995.

[3] J.D. Murray, *Mathematical Biology II*, Springer, 2003.

[4] Vogel et al, *Submicron structures provide preferential spots for carbon and nitrogen sequestration in soils*, Nature communications, 2014.

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