**Background and reference to the KEYLINK model**

KEYLINK was first published in:

**Deckmyn, Gaby**, Flores, Omar; Mayer, Mathias; Domene, Xavier; Schnepf, Andrea; Kuka, Katrin; Van Looy, Kris; Rasse, Daniel P.; Briones, Maria J., I; Barot, Sebastien; Berg, Matty; Vanguelova, Elena; Ostonen, Ivika; Vereecken, Harry; Suz, Laura M.; Frey, Beat; Frossard, Aline; Tiunov, Alexei; Frouz, Jan; Grebenc, Tine; Opik, Maarja; Javaux, Mathieu; Uvarov, Alexei; Vinduskova, Olga; Krogh, Paul Henning; Franklin, Oskar; Jimenez, Juan; Yuste, Jorge Curiel.  **KEYLINK: towards a more integrative soil representation for inclusion in ecosystem scale models. I. review and model concept.** PeerJ - ISSN 2167-8359 - 8(2020), p.1-69

Flores, Omar; **Deckmyn, Gaby**, Yuste, Jorge Curiel; Javaux, Mathieu; Uvarov, Alexei; van der Linde, Sietse; De Vos, Bruno; Vereecken, Harry; Jimenez, Juan; Vinduskova, Olga; Schnepf, Andrea **KEYLINK : towards a more integrative soil representation for inclusion in ecosystem scale models-II: model description, implementation and testing** PeerJ - ISSN 2167-8359 - 9(2021), p. -

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**How to run the KEYLINK model**

**Keylink consists of**

**3 source code files**

* KEYLINK\_Functions.py
  + Contains all functions to run different versions of keylink except core equation and plotting
* KEYLINK\_core.py
  + Contains the main loop over the days, the main set of equations (biomass of all C-pools) as well as plotting functions
* KEYLINK.\_main.py
  + Sets which runmode is used from 4 options (only 3 implemented currently)
  + ‘single’, ‘bayesian’, ‘posterior’

**6-8 files with input data**

* KL\_climateParams\_Brussels.txt
* KL\_engineerParams.txt
* KL\_FaunalParams.txt
* KL\_initSoil.txt
* KL\_runparams.txt
* KL\_runparams.txt
* PrecipKMIBrass.txt

***Only for bayesian run:***

* KL\_calibData.txt

***Only for posterior run***

* KL\_gmax.txt

***KEYLINK ’single’ run***

The easiest version of KEYLINK is the version which will finish 1 run.

Some plots are made and data are exported

***KEYLINK ‘bayesian’ run***

Optimisation of the model using a bayesian approach comparing the output to a set of calibration values is possible. Getting the right data towards which to optimise is non-trivial, currently it is set towards the biomasses of all 12 C pools over 10 years, with flat prior distributions and optimising gmax of all soil biota (9 parameters).

Output are the likelyhoods and parameters that were tried (prior) and accepted (posterior), the best fit run and the output from this best fit run.

***KEYLINK ‘posterior’ run***

Once a parameterisation has been done, it is also possible to run KEYLINK automatically using a sample of input data derived from the bayesian optimisation ( we generally use a latin hypercube sample (100 parameter sets) from our ‘posterior distribution’), currently set to use gmax input data (9 parameters).

Output is all raw data from all runs + averages and standard deviations

**Writing new versions or extensions of KEYLINK**

We welcome all users to use and improve the keylink MODEL; Upon request a branch will be created for you so you can keep a track of your own changes. Merging with the master version can only be done by the owners.

When adding functionalities we ask you to always use flags so the new parts can be switched on or off, making sure with the flag turned off the model will run as before. Indicate these flags at the top of your code.