Comparison between draft equations (from the draft you sent around 16.02.2022) and python equivalents (from the script you sent me 21.02.2022). A few comments and doubts.

Please consider that I’m a plastics noob, so some questions might be dumb 😊

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1. (Eq.1)

However, in the python script, the sign for f\_rec\*P\_waste is the opposite.

P\_use[t]/dt=P\_prod+f\_rec\*P\_waste-f\_inc\*P\_waste-f\_disc\*P\_waste

I would think that the python script is correct here, right? Because recycled plastics gets re-inserted into the use pool

1. (Eq.2)

While in the python script, there is another term.

d(P\_disc)/dt=f\_disc\*P\_waste×(1-f\_MP)-k\_P\_Disc\_to\_river\*P\_disc-k\_Disc\_P\_to\_MP\*P\_disc

I think, again, this should be right in the python script, right? With the “new term” expressing P fragmented to MP in the discarded pool, right?

1. (Eq.3)

While in the python script:

d(MP\_disc)/dt=f\_disc\*P\_waste×f\_MP+k\_Disc\_P\_to\_MP\*P\_disc-k\_MP\_Disc\_to\_river\*MP\_disc-k\_Disc\_MP\_to\_sMP\*MP\_disc

Again, seems like it should be OK as expressed in your python script. In Eq.3, the “P getting fragmented to MP in the discarded pool and added to the MP discarded pool” term appears to be missing. (k\_Disc\_P\_to\_MP\*P\_disc)

1. (Eq.4)

d(sMP\_disc)/dt=k\_Disc\_MP\_to\_sMP\*MP\_disc-k\_sMP\_Disc\_to\_river\*sMP\_disc-k\_Disc\_sMP\_to\_atm\*sMP\_disc

The two appear to be equivalent.

1. (Eq.5)

While in the python script:

d(P\_SurfOce)/dt=k\_P\_Disc\_to\_river\*P\_disc-k\_SurfOce\_P\_beach\*P\_SurfOce

the last term “” in Eq(5) is missing in the python script. I guess this is because you assume that all plastics floats, so k\_POce\_sed = 0, so the term is 0? Anyhow, in this case I’d prefer to have this term in the python script for completeness, but set k\_Poce\_sed to 0.

In addition, shouldn’t there be a term in there that expresses the fragmentation of P to MP in the surface ocean? Or does this not happen? Because how it is currently written, the only way of removing P from the surface ocean would be beaching, is this correct?

1. (Eq.6)

And its counterpart in the python script

d(MP\_SurfOce)/dt=k\_MP\_Disc\_to\_river\*MP\_disc-k\_SurfOce\_MP\_beach\*MP\_SurfOce-k\_SurfOce\_MP\_CoastSed\*MP\_SurfOce\*f\_shelf-k\_MP\_surf\_to\_deep\_oce\*MP\_SurfOce

There is one more term in the python script than in the draft equation Eq.6. As I understand it, python script has one term for the transfer of MP from surface ocean to coastal sediments, and another term for the sinking from surface ocean MP to the deep ocean. I guess this should be correct?

In addition, as before, I wondered If there should be a term that expresses the fragmentation of MP to sMP in the surface ocean? Or does this not happen?

- (Eq.6)

1. (Eq.7)

d(sMP\_SurfOce)/dt=k\_sMP\_Disc\_to\_river\*sMP\_disc+k\_sMP\_atm\_to\_oce\*sMP\_atm+k\_sMP\_soil\_to\_oce\*sMP\_soil-k\_sMP\_oce\_to\_atm\*sMP\_SurfOce-k\_sMPsed\*sMP\_SurfOce\*f\_shelf-k\_sMP\_surf\_to\_deep\_oce\*sMP\_SurfOce

As in Eq6, there is one more term in the python-script-equivalent of Eq.7 than in Eq.7 itself. Again, in the python script there appears to be a differentiation between sedimentation to the coastal shelf sediments, and sinking to the deep ocean. I guess the python version is the correct one?

(Eq.7)

1. (Eq.8)

d(MP\_DeepOce)/dt=-k\_MP\_surf\_to\_deep\_oce\*MP\_SurfOce\*f\_pelagic-k\_DeepOce\_MP\_to\_sMP\*MP\_DeepOce

I already mentioned the apparently wrong “-“ sign in the python equivalent in an email, so this is already taken care of. Apart from this, Eq.8 and its python-representation seem equivalent. Interesting that we have MP to sMP fragmentation in the deep ocean, but not the surface ocean. On purpose?

1. (Eq.9)

d(sMP\_DeepOce)/dt=k\_sMP\_surf\_to\_deep\_oce\*sMP\_SurfOce\*f\_pelagic+k\_DeepOce\_MP\_to\_sMP\*MP\_DeepOce

These two look equivalent.

1. (Eq.10)

d(P\_beach)/dt=k\_SurfOce\_P\_beach\*P\_SurfOce

These two look equivalent. No fragmentation of P to MP on the beach and no removal from plastics from the beach (it can only accumulate in the model). On purpose?

1. (Eq.11)

d(MP\_beach)/dt=k\_SurfOce\_MP\_beach\*MP\_SurfOce

Looking equivalent. Idem as for P\_beach. No fragmentation of MP to sMP on the beach and no “sink”, so it can only accumulate, and it can also not re-feed the surface ocean. On purpose?

1. (Eq.12)

d(MP\_sed)/dt=k\_SurfOce\_MP\_CoastSed\*MP\_SurfOce\*f\_shelf

These two look equivalent. Question: All sediments are coastal sediments, right? So there is no deep ocean sediment burial? Just confirming. Also, sediments can only accumulate (which seems logical though).

1. (Eq.13)

d(sMP\_sed)/dt=k\_SurfOce\_sMP\_CoastSed\*sMP\_SurfOce\*f\_shelf

Looking equivalent. As for the MP sediment, all sediments are coastal sediments. I guess this is on purpose?

1. (Eq.14)

d(sMP\_atm)/dt=k\_Disc\_sMP\_to\_atm\*sMP\_disc+k\_sMP\_atm\_to\_oce\*sMP\_SurfOce-k\_sMP\_atm\_to\_soil\*sMP\_atm-k\_sMP\_atm\_to\_oce\*sMP\_atm

In the python-equivalent, there is a positive term “k\_sMP\_atm\_to\_oce\*sMP\_SurfOce”, while in Eq.14 this says “”. Is this on purpose, assuming that ? In this case, I would prefer to maintain two different variables “**k\_sMP\_atm\_to\_oce”** and **“k\_sMP\_oce\_to\_atm”** and set them equal, to make it more logical.

1. (Eq. 14)

d(sMP\_soil)/dt=k\_sMP\_atm\_to\_soil\*sMP\_atm-k\_sMP\_soil\_to\_atm\*sMP\_soil-k\_sMP\_soil\_to\_oce\*sMP\_soil

There is a different wording. Is the same as k\_sMP\_soil\_to\_oce? I guess this term describes surface runoff “cleaning” sMP from the soil and transferring them into the ocean?