1. Slurry mass tests using `abm_variable()`

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29 May, 2025 15:19

Overview

Point of these tests is to check behavior of `abm()` when slurry mass is variable. Development of the relevant code has been challenging, so it is important to check behavior of multiple scenarios after an update.

Prep

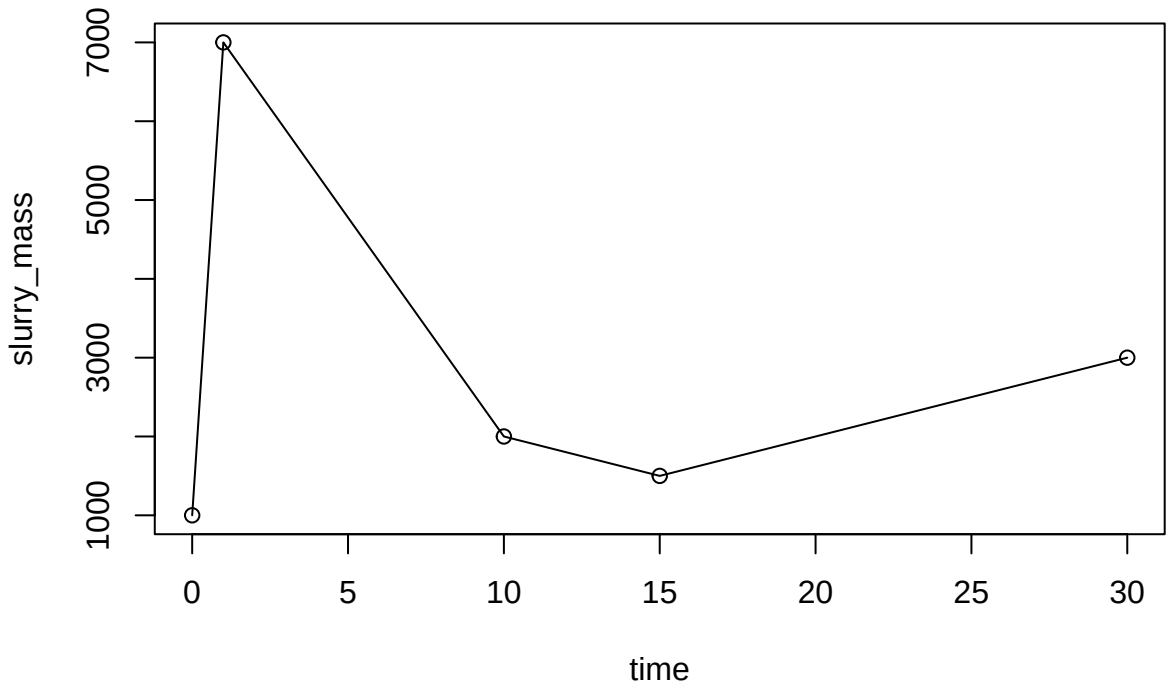
```
devtools::load_all()
```

```
## i Loading ABM
```

Case 1, consecutive removals

Slurry mass data.

```
slurry_mass_dat <- data.frame(time = c(0, 1, 10, 15, 30), slurry_mass = c(1000, 7000, 2000, 1500, 3000))
plot(slurry_mass ~ time, data = slurry_mass_dat, type = 'o')
```



Default, with "early" behavior.

```
out1 <- abm(30, delta_t = 0.1, add_pars = list(storage_depth = 4, area = 1000,
                                               slurry_mass = slurry_mass_dat))
```

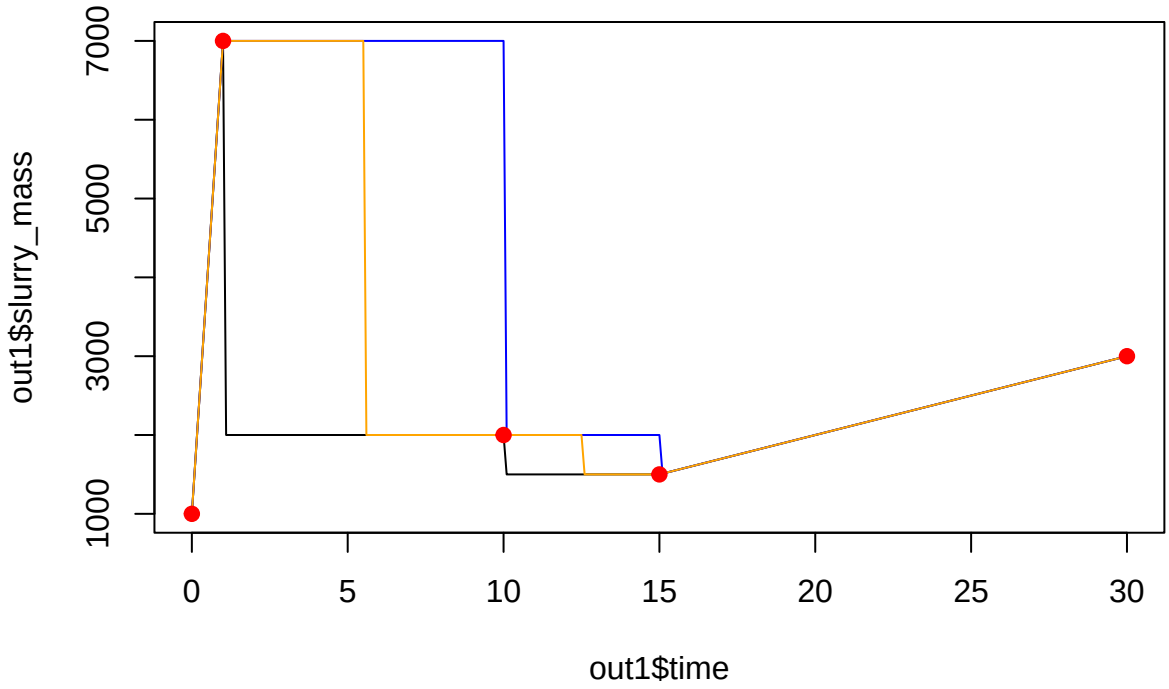
Late

```
out2 <- abm(30, delta_t = 0.1, add_pars = list(storage_depth = 4, area = 1000,
                                               slurry_mass = slurry_mass_dat,
                                               approx_method.slurry_mass = 'late'))
```

And mid

```
out3 <- abm(30, delta_t = 0.1, add_pars = list(storage_depth = 4, area = 1000,
                                               slurry_mass = slurry_mass_dat,
                                               approx_method.slurry_mass = 'mid'))
```

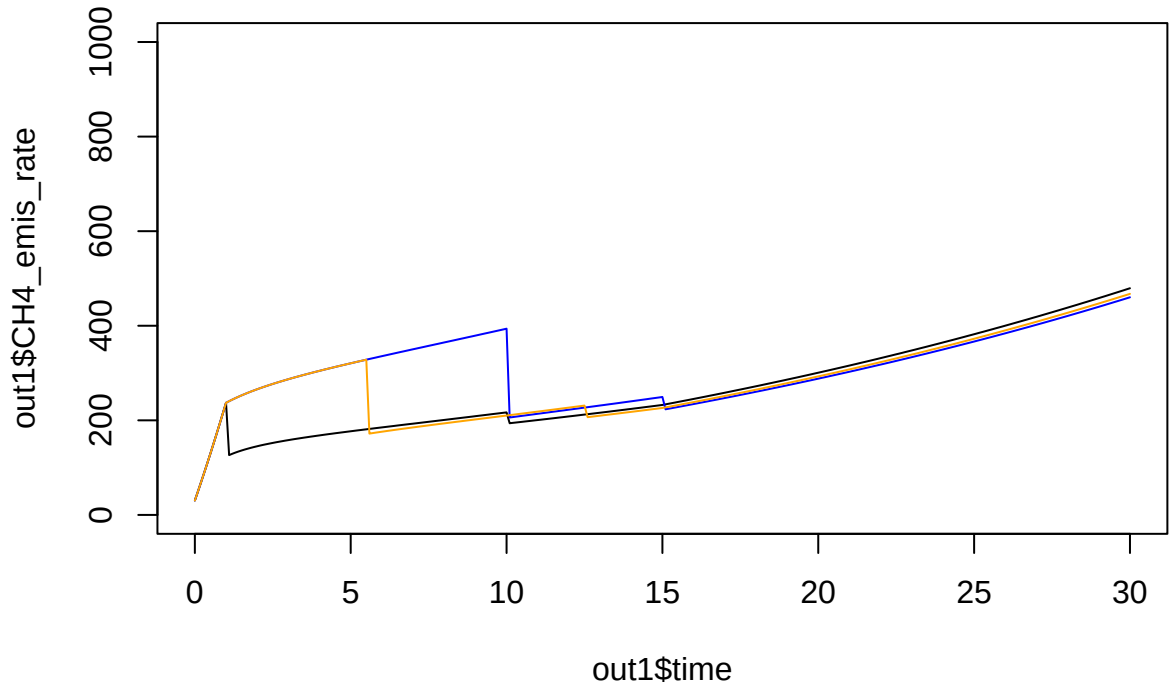
```
plot(out1$time, out1$slurry_mass, type = 'l')
lines(out2$time, out2$slurry_mass, type = 'l', col = 'blue')
lines(out3$time, out3$slurry_mass, type = 'l', col = 'orange')
points(slurry_mass_dat$time, slurry_mass_dat$slurry_mass, col = 'red', pch = 19)
```



Expect that all three approaches hit the red points (input level) exactly.

Methane production rate:

```
plot(out1$time, out1$CH4_emis_rate, type = 'l', ylim = c(0, 1000))
lines(out2$time, out2$CH4_emis_rate, type = 'l', col = 'blue')
lines(out3$time, out3$CH4_emis_rate, type = 'l', col = 'orange')
```



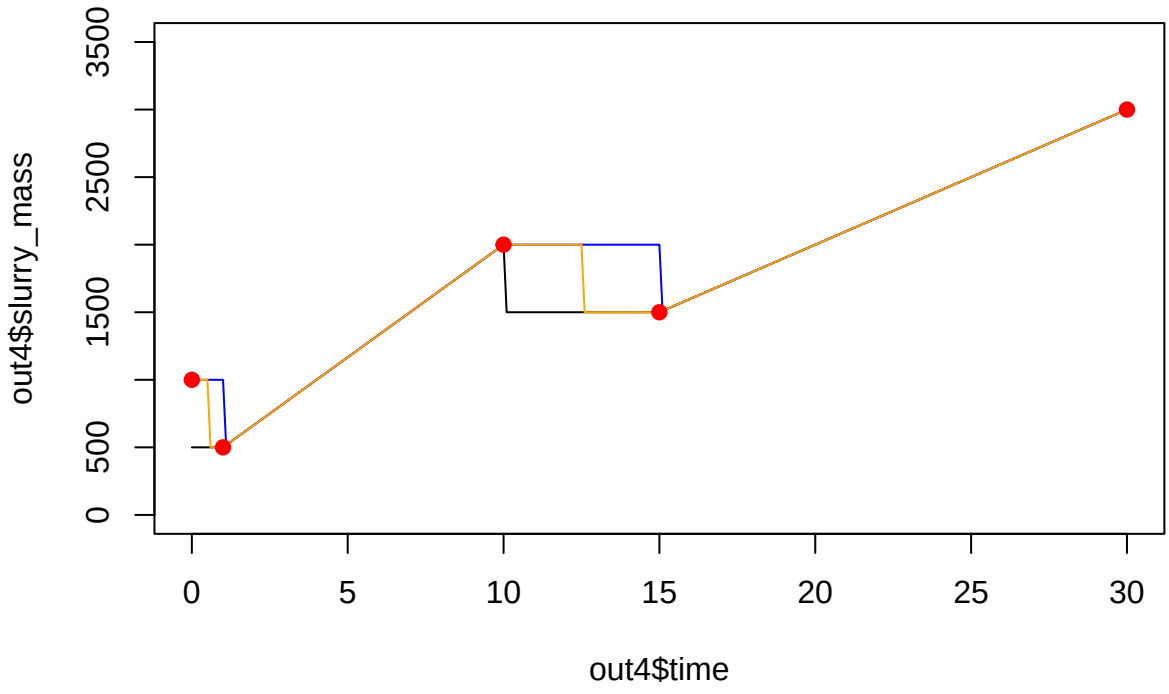
Case 2, slurry removal at the beginning

```
slurry_mass_dat <- data.frame(time = c(0, 1, 10, 15, 30),
                              slurry_mass = c(1000, 500, 2000, 1500, 3000))

out4 <- abm(30, delta_t = 0.1, add_pars = list(storage_depth = 4, area = 1000,
                                               slurry_mass = slurry_mass_dat,
                                               approx_method.slurry_mass = 'early'))
```

```
## Warning in checkCOD(dat = dat, grps = pars$grps, subs = pars$subs, COD_conv =
## pars$COD_conv, : COD balance is off by -7.4%
```

```
out5 <- abm(30, delta_t = 0.1, add_pars = list(storage_depth = 4, area = 1000,
                                               slurry_mass = slurry_mass_dat,
                                               approx_method.slurry_mass = 'late'))

out6 <- abm(30, delta_t = 0.1, add_pars = list(storage_depth = 4, area = 1000,
                                               slurry_mass = slurry_mass_dat,
                                               approx_method.slurry_mass = 'mid'))
```

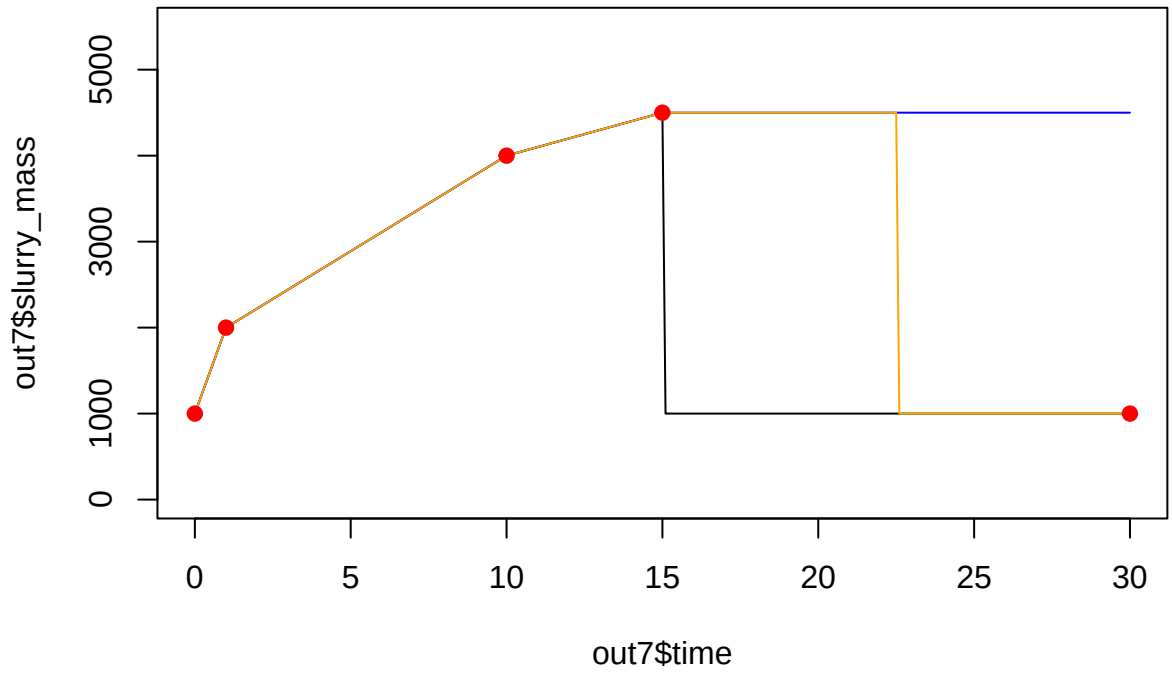
```
plot(out4$time, out4$slurry_mass, type = 'l', ylim = c(0, 3500))
lines(out5$time, out5$slurry_mass, type = 'l', col = 'blue')
lines(out6$time, out6$slurry_mass, type = 'l', col = 'orange')
points(slurry_mass_dat$time, slurry_mass_dat$slurry_mass, col = 'red', pch = 19)
```



Case 3, slurry removal at end

```
slurry_mass_dat <- data.frame(time = c(0, 1, 10, 15, 30),
                              slurry_mass = c(1000, 2000, 4000, 4500, 1000))

out7 <- abm(30, delta_t = 0.1, add_pars = list(storage_depth = 4, area = 1000,
                                               slurry_mass = slurry_mass_dat,
                                               approx_method.slurry_mass = 'early'))

out8 <- abm(30, delta_t = 0.1, add_pars = list(storage_depth = 4, area = 1000,
                                               slurry_mass = slurry_mass_dat,
                                               approx_method.slurry_mass = 'late'))

out9 <- abm(30, delta_t = 0.1, add_pars = list(storage_depth = 4, area = 1000,
                                               slurry_mass = slurry_mass_dat,
                                               approx_method.slurry_mass = 'mid'))
```

```
plot(out7$time, out7$slurry_mass, type = 'l', ylim = c(0, 5500))
lines(out8$time, out8$slurry_mass, type = 'l', col = 'blue')
lines(out9$time, out9$slurry_mass, type = 'l', col = 'orange')
points(slurry_mass_dat$time, slurry_mass_dat$slurry_mass, col = 'red', pch = 19)
```



Note that last input point is ignored for 'late' method.

```
plot(out7$time, out7$CH4_emis_rate, type = 'l')
lines(out8$time, out8$CH4_emis_rate, type = 'l', col = 'blue')
lines(out9$time, out9$CH4_emis_rate, type = 'l', col = 'orange')
```