

Comparison of 2 approaches for parameter uncertainty

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Packages

```
library(data.table)
library(knitr)
library(ALFAM2)
library(ggplot2)

packageVersion('ALFAM2')

## [1] '3.82'
```

Get pars

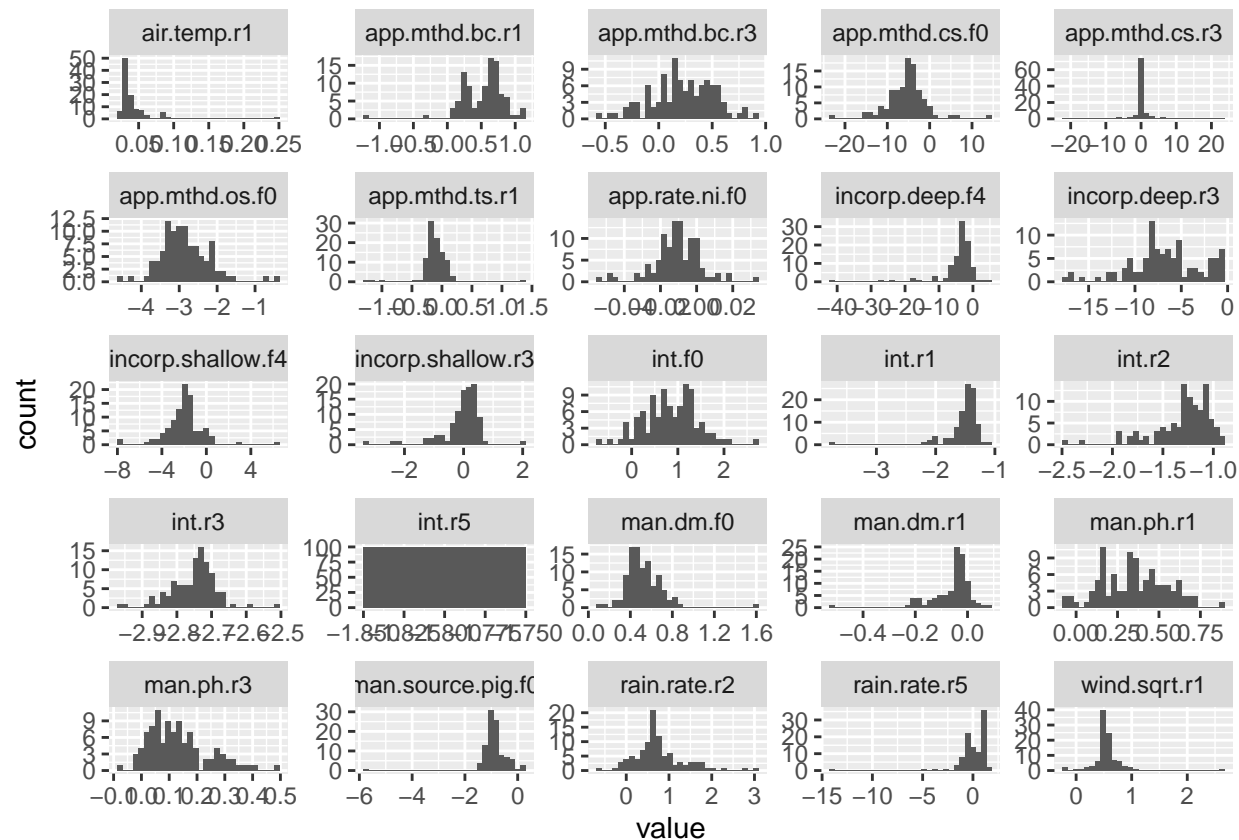
```
pdl <- fread('../pars/output/pars_boot_long.csv')
pdc <- fread('../pars/output/pars_boot.csv')
ps3 <- fread('../pars/output/pars.csv')

ps3 <- ps3[pars == 'ps3', ]
nn <- names(ps3)
ps3 <- as.numeric(ps3)

## Warning: NAs introduced by coercion
names(ps3) <- nn
ps3 <- ps3[!is.na(ps3)]
```

```
ggplot(pdl, aes(value)) +
  geom_histogram() +
  facet_wrap(~ parameter, scale = 'free')
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



Sampling function

```
getPars <- function(pp, n = 1) {
  if (n > 1) {
```

```

pars <- NULL
for (i in 1:n) {
  p <- data.table::data.table(t(getPars(pp, 1)))
  pars <- rbind(pars, p)
}
return(pars)
}

pp <- pp[sample(1:nrow(pp), nrow(pp)), ]
p <- pp[!duplicated(pp[, parameter]), ]
pars <- as.numeric(p[, value])
names(pars) <- as.character(p[, parameter])

return(pars)
}

```

Get uncorrelated parameters

```
pduc <- getPars(pdl, 100)
```

Compare

```
round(cor(pdc), 2)
```

```
## Warning in cor(pdc): the standard deviation is zero
```

```
##           iteration int.f0 app.mthd.os.f0 app.rate.ni.f0 man.dm.f0
## iteration           1.00  0.15          -0.27          -0.13          -0.11
## int.f0              0.15  1.00          -0.38          -0.48           0.16
## app.mthd.os.f0      -0.27 -0.38           1.00           0.16           0.34
## app.rate.ni.f0      -0.13 -0.48           0.16           1.00          -0.41
## man.dm.f0           -0.11  0.16           0.34          -0.41           1.00
## man.source.pig.f0    0.02 -0.11          -0.14           0.03          -0.28
## app.mthd.cs.f0       0.05  0.05          -0.03           0.02           0.07
## int.r1              -0.02 -0.29          -0.36           0.25          -0.55
## app.mthd.bc.r1       0.27 -0.05          -0.45           0.35          -0.76
## man.dm.r1           0.07  0.01          -0.35           0.61          -0.76
```

## air.temp.r1	-0.12	-0.08	0.46	-0.44	0.64
## wind.sqrt.r1	0.03	-0.08	0.24	-0.38	0.35
## app.mthd.ts.r1	-0.15	0.03	0.26	-0.21	0.37
## man.ph.r1	-0.17	-0.61	0.24	-0.03	0.22
## int.r2	0.09	0.21	-0.38	0.35	-0.42
## rain.rate.r2	0.03	0.28	0.05	-0.53	0.31
## int.r3	-0.04	-0.18	-0.04	0.10	0.35
## app.mthd.bc.r3	-0.14	-0.46	0.26	-0.16	0.18
## app.mthd.cs.r3	-0.01	0.12	-0.11	0.08	0.01
## man.ph.r3	0.09	0.38	0.11	-0.31	0.11
## incorp.shallow.f4	0.05	-0.26	0.16	0.00	0.00
## incorp.shallow.r3	0.12	0.38	-0.18	0.07	-0.07
## incorp.deep.f4	0.00	0.17	0.16	-0.14	0.15
## incorp.deep.r3	0.11	-0.11	-0.31	0.05	-0.27
## rain.rate.r5	-0.05	0.00	0.10	0.15	0.02
## int.r5	NA	NA	NA	NA	NA
##	man.source.pig.f0	app.mthd.cs.f0	int.r1	app.mthd.bc.r1	
## iteration	0.02	0.05	-0.02	0.27	
## int.f0	-0.11	0.05	-0.29	-0.05	
## app.mthd.os.f0	-0.14	-0.03	-0.36	-0.45	
## app.rate.ni.f0	0.03	0.02	0.25	0.35	
## man.dm.f0	-0.28	0.07	-0.55	-0.76	
## man.source.pig.f0	1.00	0.01	0.64	0.16	
## app.mthd.cs.f0	0.01	1.00	0.04	-0.06	
## int.r1	0.64	0.04	1.00	0.32	
## app.mthd.bc.r1	0.16	-0.06	0.32	1.00	
## man.dm.r1	0.18	-0.01	0.42	0.71	
## air.temp.r1	-0.51	0.00	-0.63	-0.68	
## wind.sqrt.r1	-0.59	-0.06	-0.52	-0.32	
## app.mthd.ts.r1	-0.46	-0.11	-0.57	-0.19	
## man.ph.r1	0.05	-0.10	0.04	-0.35	
## int.r2	-0.13	0.04	0.32	0.51	
## rain.rate.r2	-0.26	-0.10	-0.48	-0.14	
## int.r3	-0.52	-0.03	-0.39	-0.08	
## app.mthd.bc.r3	0.12	-0.08	0.02	-0.30	
## app.mthd.cs.r3	-0.08	0.07	0.06	0.01	
## man.ph.r3	0.29	0.05	0.10	-0.18	
## incorp.shallow.f4	0.00	-0.10	0.02	-0.21	
## incorp.shallow.r3	-0.12	0.03	0.07	0.25	

## incorp.deep.f4		0.04	-0.26	-0.19	-0.19
## incorp.deep.r3		0.08	-0.11	0.23	0.26
## rain.rate.r5		0.05	-0.45	0.03	-0.10
## int.r5		NA	NA	NA	NA
##	man.dm.r1	air.temp.r1	wind.sqrt.r1	app.mthd.ts.r1	man.ph.r1
## iteration	0.07	-0.12	0.03	-0.15	-0.17
## int.f0	0.01	-0.08	-0.08	0.03	-0.61
## app.mthd.os.f0	-0.35	0.46	0.24	0.26	0.24
## app.rate.ni.f0	0.61	-0.44	-0.38	-0.21	-0.03
## man.dm.f0	-0.76	0.64	0.35	0.37	0.22
## man.source.pig.f0	0.18	-0.51	-0.59	-0.46	0.05
## app.mthd.cs.f0	-0.01	0.00	-0.06	-0.11	-0.10
## int.r1	0.42	-0.63	-0.52	-0.57	0.04
## app.mthd.bc.r1	0.71	-0.68	-0.32	-0.19	-0.35
## man.dm.r1	1.00	-0.85	-0.66	-0.29	-0.35
## air.temp.r1	-0.85	1.00	0.83	0.45	0.40
## wind.sqrt.r1	-0.66	0.83	1.00	0.28	0.22
## app.mthd.ts.r1	-0.29	0.45	0.28	1.00	0.11
## man.ph.r1	-0.35	0.40	0.22	0.11	1.00
## int.r2	0.59	-0.52	-0.23	-0.02	-0.56
## rain.rate.r2	-0.51	0.50	0.57	0.15	-0.07
## int.r3	-0.10	0.27	0.20	0.43	0.29
## app.mthd.bc.r3	-0.28	0.26	0.15	0.16	0.59
## app.mthd.cs.r3	0.08	-0.09	-0.07	0.01	-0.12
## man.ph.r3	-0.25	0.00	0.06	-0.40	-0.43
## incorp.shallow.f4	-0.11	0.16	0.16	0.03	0.25
## incorp.shallow.r3	0.22	-0.23	-0.17	-0.05	-0.43
## incorp.deep.f4	-0.20	0.15	0.03	0.08	-0.08
## incorp.deep.r3	0.25	-0.19	-0.12	-0.09	0.09
## rain.rate.r5	0.07	-0.08	-0.14	-0.08	0.07
## int.r5	NA	NA	NA	NA	NA
##	int.r2	rain.rate.r2	int.r3	app.mthd.bc.r3	app.mthd.cs.r3
## iteration	0.09	0.03	-0.04	-0.14	-0.01
## int.f0	0.21	0.28	-0.18	-0.46	0.12
## app.mthd.os.f0	-0.38	0.05	-0.04	0.26	-0.11
## app.rate.ni.f0	0.35	-0.53	0.10	-0.16	0.08
## man.dm.f0	-0.42	0.31	0.35	0.18	0.01
## man.source.pig.f0	-0.13	-0.26	-0.52	0.12	-0.08
## app.mthd.cs.f0	0.04	-0.10	-0.03	-0.08	0.07

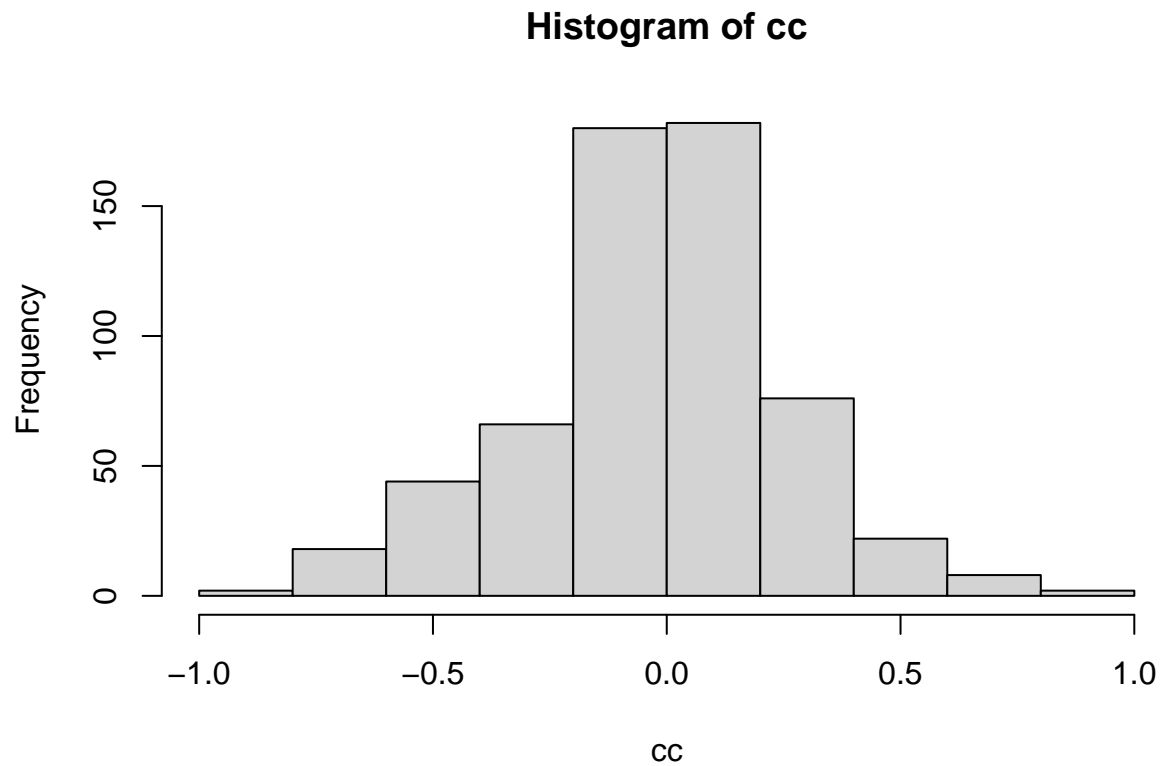
## int.r1	0.32	-0.48	-0.39	0.02	0.06
## app.mthd.bc.r1	0.51	-0.14	-0.08	-0.30	0.01
## man.dm.r1	0.59	-0.51	-0.10	-0.28	0.08
## air.temp.r1	-0.52	0.50	0.27	0.26	-0.09
## wind.sqrt.r1	-0.23	0.57	0.20	0.15	-0.07
## app.mthd.ts.r1	-0.02	0.15	0.43	0.16	0.01
## man.ph.r1	-0.56	-0.07	0.29	0.59	-0.12
## int.r2	1.00	-0.34	-0.03	-0.35	0.17
## rain.rate.r2	-0.34	1.00	0.09	-0.04	-0.12
## int.r3	-0.03	0.09	1.00	0.01	-0.03
## app.mthd.bc.r3	-0.35	-0.04	0.01	1.00	-0.09
## app.mthd.cs.r3	0.17	-0.12	-0.03	-0.09	1.00
## man.ph.r3	-0.13	0.23	-0.66	-0.24	-0.02
## incorp.shallow.f4	-0.12	-0.06	-0.14	0.40	0.01
## incorp.shallow.r3	0.41	-0.04	0.07	-0.69	-0.01
## incorp.deep.f4	-0.19	0.23	-0.03	-0.08	-0.32
## incorp.deep.r3	0.14	-0.18	0.11	0.00	-0.27
## rain.rate.r5	-0.01	-0.19	0.03	-0.13	-0.41
## int.r5	NA	NA	NA	NA	NA
##	man.ph.r3	incorp.shallow.f4	incorp.shallow.r3	incorp.deep.f4	
## iteration	0.09		0.05	0.12	0.00
## int.f0	0.38		-0.26	0.38	0.17
## app.mthd.os.f0	0.11		0.16	-0.18	0.16
## app.rate.ni.f0	-0.31		0.00	0.07	-0.14
## man.dm.f0	0.11		0.00	-0.07	0.15
## man.source.pig.f0	0.29		0.00	-0.12	0.04
## app.mthd.cs.f0	0.05		-0.10	0.03	-0.26
## int.r1	0.10		0.02	0.07	-0.19
## app.mthd.bc.r1	-0.18		-0.21	0.25	-0.19
## man.dm.r1	-0.25		-0.11	0.22	-0.20
## air.temp.r1	0.00		0.16	-0.23	0.15
## wind.sqrt.r1	0.06		0.16	-0.17	0.03
## app.mthd.ts.r1	-0.40		0.03	-0.05	0.08
## man.ph.r1	-0.43		0.25	-0.43	-0.08
## int.r2	-0.13		-0.12	0.41	-0.19
## rain.rate.r2	0.23		-0.06	-0.04	0.23
## int.r3	-0.66		-0.14	0.07	-0.03
## app.mthd.bc.r3	-0.24		0.40	-0.69	-0.08
## app.mthd.cs.r3	-0.02		0.01	-0.01	-0.32

## man.ph.r3	1.00	0.03	0.11	0.18
## incorp.shallow.f4	0.03	1.00	-0.62	-0.13
## incorp.shallow.r3	0.11	-0.62	1.00	0.14
## incorp.deep.f4	0.18	-0.13	0.14	1.00
## incorp.deep.r3	-0.18	-0.04	0.10	-0.19
## rain.rate.r5	0.08	-0.11	0.19	0.27
## int.r5	NA	NA	NA	NA
##	incorp.deep.r3	rain.rate.r5	int.r5	
## iteration	0.11	-0.05	NA	
## int.f0	-0.11	0.00	NA	
## app.mthd.os.f0	-0.31	0.10	NA	
## app.rate.ni.f0	0.05	0.15	NA	
## man.dm.f0	-0.27	0.02	NA	
## man.source.pig.f0	0.08	0.05	NA	
## app.mthd.cs.f0	-0.11	-0.45	NA	
## int.r1	0.23	0.03	NA	
## app.mthd.bc.r1	0.26	-0.10	NA	
## man.dm.r1	0.25	0.07	NA	
## air.temp.r1	-0.19	-0.08	NA	
## wind.sqrt.r1	-0.12	-0.14	NA	
## app.mthd.ts.r1	-0.09	-0.08	NA	
## man.ph.r1	0.09	0.07	NA	
## int.r2	0.14	-0.01	NA	
## rain.rate.r2	-0.18	-0.19	NA	
## int.r3	0.11	0.03	NA	
## app.mthd.bc.r3	0.00	-0.13	NA	
## app.mthd.cs.r3	-0.27	-0.41	NA	
## man.ph.r3	-0.18	0.08	NA	
## incorp.shallow.f4	-0.04	-0.11	NA	
## incorp.shallow.r3	0.10	0.19	NA	
## incorp.deep.f4	-0.19	0.27	NA	
## incorp.deep.r3	1.00	0.22	NA	
## rain.rate.r5	0.22	1.00	NA	
## int.r5	NA	NA	1	

```
cc <- cor(pdc)
```

```
## Warning in cor(pdc): the standard deviation is zero
```

```
cc <- c(cc)
cc <- cc[cc != 1]
hist(cc)
```



```
round(cor(pduc), 2)
```

```
## Warning in cor(pduc): the standard deviation is zero
```

```
##      man.dm.r1 app.mthd.cs.f0 int.f0 man.ph.r3 app.mthd.os.f0
## man.dm.r1      1.00      -0.02  -0.12      0.15      0.18
## app.mthd.cs.f0 -0.02       1.00  -0.14      0.01     -0.14
## int.f0        -0.12     -0.14   1.00     -0.03      0.15
## man.ph.r3      0.15       0.01  -0.03      1.00     -0.02
## app.mthd.os.f0 0.18     -0.14   0.15     -0.02      1.00
## int.r3         0.19     -0.05   0.05     -0.14      0.22
```


## int.r5	NA	NA	NA	NA	NA
## int.r1	0.17	-0.04	-0.01	0.08	0.00
## incorp.deep.r3	0.01	-0.12	0.12	0.09	0.03
## rain.rate.r5	-0.19	-0.09	0.04	-0.15	-0.13
## app.mthd.cs.r3	0.11	0.07	0.11	0.07	-0.01
## rain.rate.r2	0.15	-0.14	-0.04	-0.08	0.02
## app.mthd.ts.r1	-0.08	-0.14	0.08	-0.06	-0.06
## app.mthd.bc.r3	0.05	-0.19	-0.02	-0.12	0.20
## app.mthd.bc.r1	-0.14	-0.15	0.16	-0.04	0.17
## man.source.pig.f0	0.00	-0.10	0.07	-0.14	-0.18
## int.r2	-0.07	-0.02	-0.05	0.15	-0.06
## incorp.shallow.r3	-0.07	0.08	-0.05	0.09	0.01
## wind.sqrt.r1	0.03	-0.01	-0.12	-0.02	0.00
## app.rate.ni.f0	-0.17	0.21	-0.16	-0.13	0.03
## man.dm.f0	-0.03	0.08	-0.20	-0.01	-0.01
## incorp.deep.f4	-0.21	0.03	0.17	-0.06	-0.08
## man.ph.r1	-0.10	0.07	0.05	-0.22	0.16
## air.temp.r1	0.15	-0.11	-0.16	0.09	0.10
## incorp.shallow.f4	0.16	0.03	0.08	-0.04	0.07
##	int.r3	int.r5	int.r1	incorp.deep.r3	rain.rate.r5
## man.dm.r1	0.19	NA	0.17	0.01	-0.19
## app.mthd.cs.f0	-0.05	NA	-0.04	-0.12	-0.09
## int.f0	0.05	NA	-0.01	0.12	0.04
## man.ph.r3	-0.14	NA	0.08	0.09	-0.15
## app.mthd.os.f0	0.22	NA	0.00	0.03	-0.13
## int.r3	1.00	NA	-0.05	-0.01	-0.10
## int.r5	NA	1	NA	NA	NA
## int.r1	-0.05	NA	1.00	0.11	-0.10
## incorp.deep.r3	-0.01	NA	0.11	1.00	-0.13
## rain.rate.r5	-0.10	NA	-0.10	-0.13	1.00
## app.mthd.cs.r3	0.01	NA	0.09	-0.06	0.07
## rain.rate.r2	0.16	NA	0.13	0.13	0.11
## app.mthd.ts.r1	-0.14	NA	-0.11	0.05	0.00
## app.mthd.bc.r3	0.10	NA	0.06	0.17	-0.13
## app.mthd.bc.r1	-0.08	NA	0.04	0.20	0.16
## man.source.pig.f0	0.21	NA	-0.14	0.05	-0.11
## int.r2	-0.22	NA	-0.07	-0.03	-0.14
## incorp.shallow.r3	-0.22	NA	0.12	-0.01	-0.03
## wind.sqrt.r1	0.04	NA	0.10	0.03	-0.09

## app.rate.ni.f0	0.10	NA	-0.08	0.05	-0.19
## man.dm.f0	-0.02	NA	-0.13	-0.11	0.20
## incorp.deep.f4	0.01	NA	-0.07	0.03	-0.04
## man.ph.r1	-0.03	NA	-0.14	0.01	-0.02
## air.temp.r1	0.13	NA	0.04	-0.08	-0.01
## incorp.shallow.f4	0.06	NA	0.10	0.02	-0.05
##	app.mthd.cs.r3	rain.rate.r2	app.mthd.ts.r1	app.mthd.bc.r3	
## man.dm.r1	0.11	0.15	-0.08	0.05	
## app.mthd.cs.f0	0.07	-0.14	-0.14	-0.19	
## int.f0	0.11	-0.04	0.08	-0.02	
## man.ph.r3	0.07	-0.08	-0.06	-0.12	
## app.mthd.os.f0	-0.01	0.02	-0.06	0.20	
## int.r3	0.01	0.16	-0.14	0.10	
## int.r5	NA	NA	NA	NA	
## int.r1	0.09	0.13	-0.11	0.06	
## incorp.deep.r3	-0.06	0.13	0.05	0.17	
## rain.rate.r5	0.07	0.11	0.00	-0.13	
## app.mthd.cs.r3	1.00	0.16	0.00	-0.06	
## rain.rate.r2	0.16	1.00	0.02	0.06	
## app.mthd.ts.r1	0.00	0.02	1.00	0.13	
## app.mthd.bc.r3	-0.06	0.06	0.13	1.00	
## app.mthd.bc.r1	0.02	0.05	-0.03	0.02	
## man.source.pig.f0	0.08	0.18	-0.07	0.04	
## int.r2	0.09	-0.08	0.02	-0.18	
## incorp.shallow.r3	-0.03	-0.16	0.13	-0.01	
## wind.sqrt.r1	-0.17	-0.03	0.03	0.01	
## app.rate.ni.f0	-0.13	0.02	-0.13	0.04	
## man.dm.f0	0.07	0.16	-0.02	0.27	
## incorp.deep.f4	0.00	-0.19	0.19	0.05	
## man.ph.r1	0.00	-0.04	0.08	-0.08	
## air.temp.r1	0.01	-0.01	-0.41	0.09	
## incorp.shallow.f4	0.06	0.04	-0.13	0.03	
##	app.mthd.bc.r1	man.source.pig.f0	int.r2	incorp.shallow.r3	
## man.dm.r1	-0.14	0.00	-0.07	-0.07	
## app.mthd.cs.f0	-0.15	-0.10	-0.02	0.08	
## int.f0	0.16	0.07	-0.05	-0.05	
## man.ph.r3	-0.04	-0.14	0.15	0.09	
## app.mthd.os.f0	0.17	-0.18	-0.06	0.01	
## int.r3	-0.08	0.21	-0.22	-0.22	

## int.r5	NA	NA	NA	NA
## int.r1	0.04	-0.14	-0.07	0.12
## incorp.deep.r3	0.20	0.05	-0.03	-0.01
## rain.rate.r5	0.16	-0.11	-0.14	-0.03
## app.mthd.cs.r3	0.02	0.08	0.09	-0.03
## rain.rate.r2	0.05	0.18	-0.08	-0.16
## app.mthd.ts.r1	-0.03	-0.07	0.02	0.13
## app.mthd.bc.r3	0.02	0.04	-0.18	-0.01
## app.mthd.bc.r1	1.00	-0.12	0.14	-0.02
## man.source.pig.f0	-0.12	1.00	-0.05	-0.05
## int.r2	0.14	-0.05	1.00	0.07
## incorp.shallow.r3	-0.02	-0.05	0.07	1.00
## wind.sqrt.r1	-0.03	-0.04	0.16	0.07
## app.rate.ni.f0	0.13	0.09	-0.08	0.01
## man.dm.f0	-0.01	0.08	-0.15	0.08
## incorp.deep.f4	0.03	-0.06	0.06	0.00
## man.ph.r1	-0.09	0.02	-0.16	-0.14
## air.temp.r1	-0.05	-0.05	0.07	-0.15
## incorp.shallow.f4	0.10	-0.12	0.00	-0.17
##	wind.sqrt.r1	app.rate.ni.f0	man.dm.f0	incorp.deep.f4
## man.dm.r1	0.03	-0.17	-0.03	-0.21
## app.mthd.cs.f0	-0.01	0.21	0.08	0.03
## int.f0	-0.12	-0.16	-0.20	0.17
## man.ph.r3	-0.02	-0.13	-0.01	-0.06
## app.mthd.os.f0	0.00	0.03	-0.01	-0.08
## int.r3	0.04	0.10	-0.02	0.01
## int.r5	NA	NA	NA	NA
## int.r1	0.10	-0.08	-0.13	-0.07
## incorp.deep.r3	0.03	0.05	-0.11	0.03
## rain.rate.r5	-0.09	-0.19	0.20	-0.04
## app.mthd.cs.r3	-0.17	-0.13	0.07	0.00
## rain.rate.r2	-0.03	0.02	0.16	-0.19
## app.mthd.ts.r1	0.03	-0.13	-0.02	0.19
## app.mthd.bc.r3	0.01	0.04	0.27	0.05
## app.mthd.bc.r1	-0.03	0.13	-0.01	0.03
## man.source.pig.f0	-0.04	0.09	0.08	-0.06
## int.r2	0.16	-0.08	-0.15	0.06
## incorp.shallow.r3	0.07	0.01	0.08	0.00
## wind.sqrt.r1	1.00	0.00	-0.02	0.01

## app.rate.ni.f0	0.00	1.00	0.05	-0.10
## man.dm.f0	-0.02	0.05	1.00	0.09
## incorp.deep.f4	0.01	-0.10	0.09	1.00
## man.ph.r1	0.02	-0.03	0.00	0.12
## air.temp.r1	0.10	0.06	0.01	-0.18
## incorp.shallow.f4	-0.06	-0.17	0.04	-0.09
##	man.ph.r1	air.temp.r1	incorp.shallow.f4	
## man.dm.r1	-0.10	0.15	0.16	
## app.mthd.cs.f0	0.07	-0.11	0.03	
## int.f0	0.05	-0.16	0.08	
## man.ph.r3	-0.22	0.09	-0.04	
## app.mthd.os.f0	0.16	0.10	0.07	
## int.r3	-0.03	0.13	0.06	
## int.r5	NA	NA	NA	
## int.r1	-0.14	0.04	0.10	
## incorp.deep.r3	0.01	-0.08	0.02	
## rain.rate.r5	-0.02	-0.01	-0.05	
## app.mthd.cs.r3	0.00	0.01	0.06	
## rain.rate.r2	-0.04	-0.01	0.04	
## app.mthd.ts.r1	0.08	-0.41	-0.13	
## app.mthd.bc.r3	-0.08	0.09	0.03	
## app.mthd.bc.r1	-0.09	-0.05	0.10	
## man.source.pig.f0	0.02	-0.05	-0.12	
## int.r2	-0.16	0.07	0.00	
## incorp.shallow.r3	-0.14	-0.15	-0.17	
## wind.sqrt.r1	0.02	0.10	-0.06	
## app.rate.ni.f0	-0.03	0.06	-0.17	
## man.dm.f0	0.00	0.01	0.04	
## incorp.deep.f4	0.12	-0.18	-0.09	
## man.ph.r1	1.00	-0.01	0.03	
## air.temp.r1	-0.01	1.00	0.08	
## incorp.shallow.f4	0.03	0.08	1.00	

Input data

Vary inputs.

```
n <- 100
set.seed(123)
```

```
dat <- data.table(id = 1:n, ct = rep(168, n), app.mthd = sample(c('bc', 'bsth', 'ts', 'os'), n, replace = TRUE),
  man.dm = rnorm(n, 5, 1), man.ph = rnorm(n, 7, 0.5), wind.sqrt = rnorm(n, sqrt(5), sqrt(0.5)),
  air.temp = rnorm(n, 10, 2), app.rate.ni = rnorm(n, 40, 10), TAN.app = 100)
```

Sort by application method for plotting.

```
dat <- dat[order(app.mthd), ]
dat[, id := 1:nrow(dat)]
```

```
pred <- alfam2(dat, pars = ps3, group = 'id')
```

```
## User-supplied parameters are being used.
```

```
## Warning in alfam2(dat, pars = ps3, group = "id"): Running with 18 parameters. Dropped 7 with no match.
```

```
## These secondary parameters have been dropped:
```

```
##   man.source.pig.f0
```

```
##   rain.rate.r2
```

```
##   incorp.shallow.f4
```

```
##   incorp.shallow.r3
```

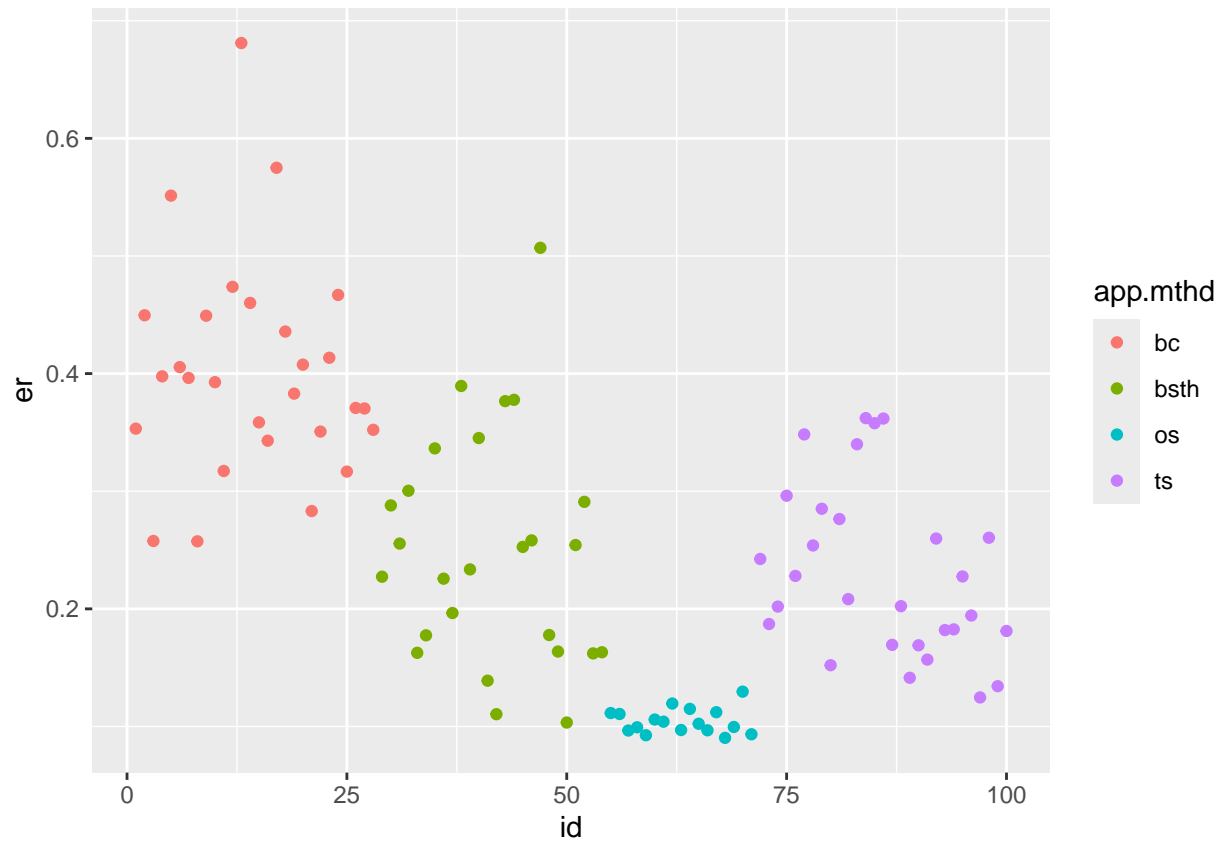
```
##   incorp.deep.f4
```

```
##   incorp.deep.r3
```

```
##   rain.rate.r5
```

```
dat1 <- merge(dat, pred)
```

```
ggplot(dat1, aes(id, er, colour = app.mthd)) +
  geom_point()
```



Confidence intervals

```
args(alfam2)
```

```
## function (dat, pars = ALFAM2::alfam2pars02, add.pars = NULL,
##   app.name = "TAN.app", time.name = "ct", time.incorp = NULL,
##   group = NULL, center = c(app.rate = 40, man.dm = 6, man.tan = 1.2,
##     man.ph = 7.5, air.temp = 13, wind.2m = 2.7, wind.sqrt = sqrt(2.7),
##     crop.z = 10), pass.col = NULL, incorp.names = c("incorp",
##     "deep", "shallow"), prep.dum = TRUE, prep.incorp = TRUE,
##   add.incorp.rows = FALSE, check = TRUE, warn = TRUE, value = "emis",
```

```
##      conf.int = NULL, pars.ci = NULL, n.ci = NULL, var.ci = "er",
##      ...)
```

With correlated parameters.

```
predcor <- alfam2(dat, group = 'id', conf.int = 0.95, pars.ci = pdc)
```

```
## User-supplied parameters are being used.
```

```
## Warning in alfam2(dat = dat, pars = pars, add.pars = add.pars, app.name = app.name, : Running with 16 parameters. Dropped 8 with no mat
## These secondary parameters have been dropped:
```

```
##   man.source.pig.f0
##   wind.2m.r1
##   ts.cereal.hght.r1
##   rain.rate.r2
##   incorp.shallow.f4
##   incorp.shallow.r3
##   incorp.deep.f4
##   incorp.deep.r3
```

```
datcor <- merge(dat, predcor)
```

Uncorrelated.

```
preduc <- alfam2(dat, group = 'id', conf.int = 0.95, pars.ci = pduc)
```

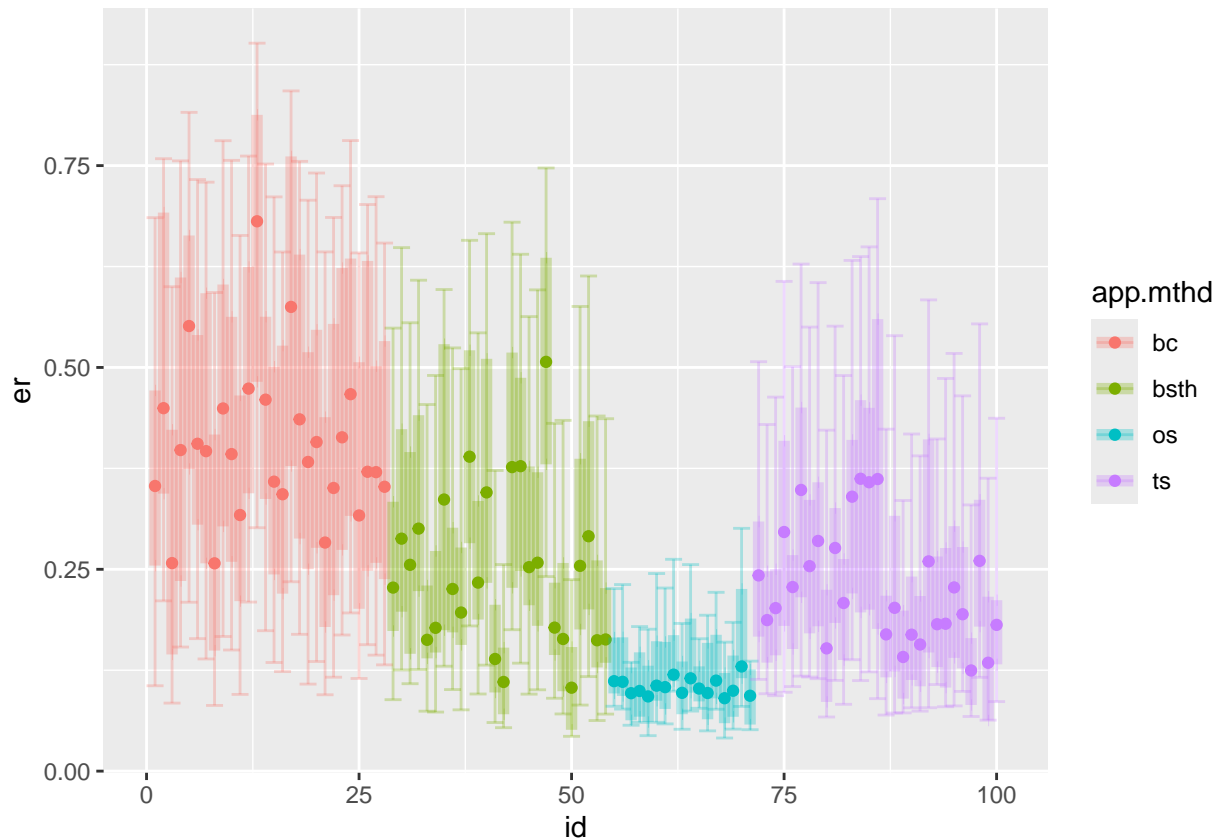
```
## User-supplied parameters are being used.
```

```
## Warning in alfam2(dat = dat, pars = pars, add.pars = add.pars, app.name = app.name, : Running with 16 parameters. Dropped 8 with no mat
## These secondary parameters have been dropped:
```

```
##   man.source.pig.f0
##   wind.2m.r1
##   ts.cereal.hght.r1
##   rain.rate.r2
##   incorp.shallow.f4
##   incorp.shallow.r3
##   incorp.deep.f4
##   incorp.deep.r3
```

```
datuc <- merge(dat, preduc)
```

```
ggplot(dat1, aes(id, er, colour = app.mthd)) +
  geom_point() +
  geom_errorbar(data = datcor, aes(ymin = er.lwr, ymax = er.upr), alpha = 0.3, width = 0, lwd = 2) +
  geom_errorbar(data = datuc, aes(ymin = er.lwr, ymax = er.upr), alpha = 0.3, width = 2)
```



Error bars with whiskers are from uncorrelated parameters, and wide transparent bars are from the correlated values (complete sets).

Conclusion

Confidence intervals are always wider when correlation among parameters is ignored.