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')
```

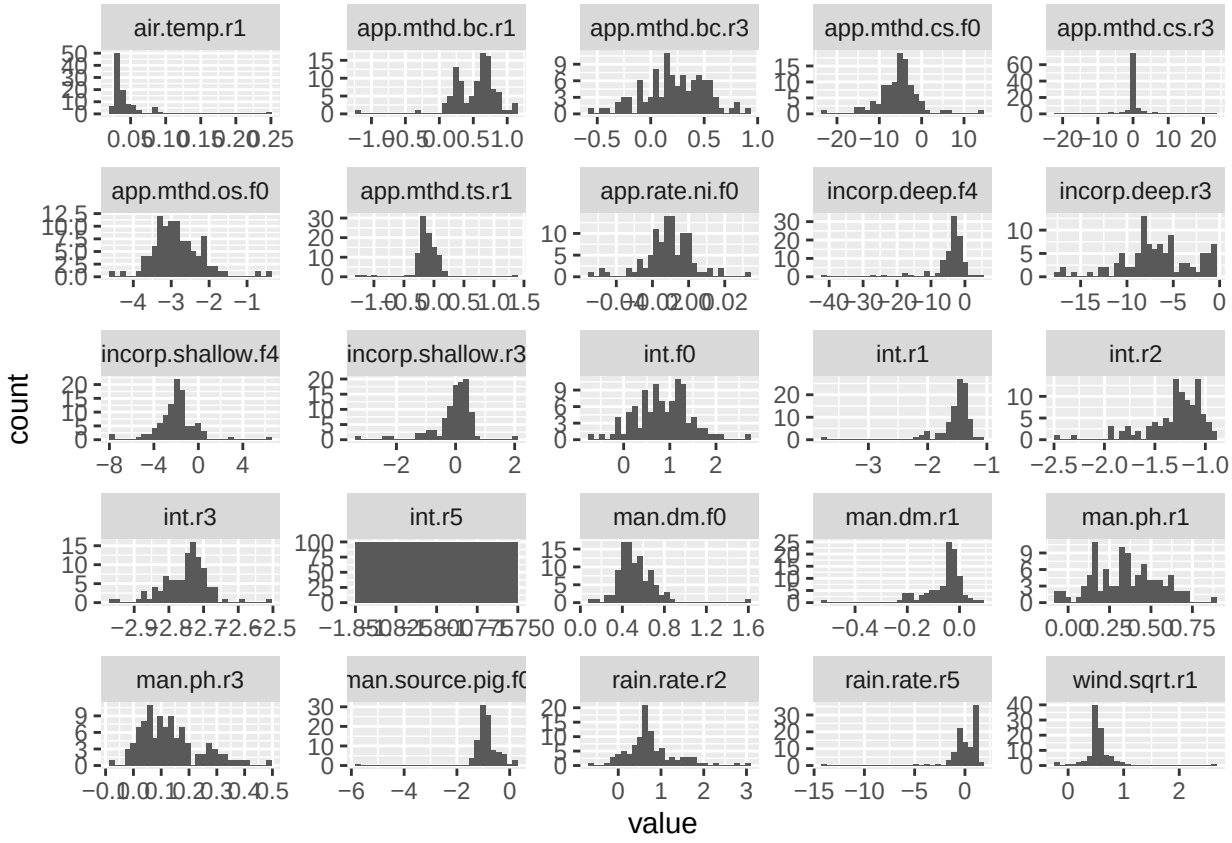
```
ps3 <- ps3[pars == 'ps3', ]
nn <- names(ps3)
ps3 <- as.numeric(ps3)
```

```
## 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
```

```
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)]
```

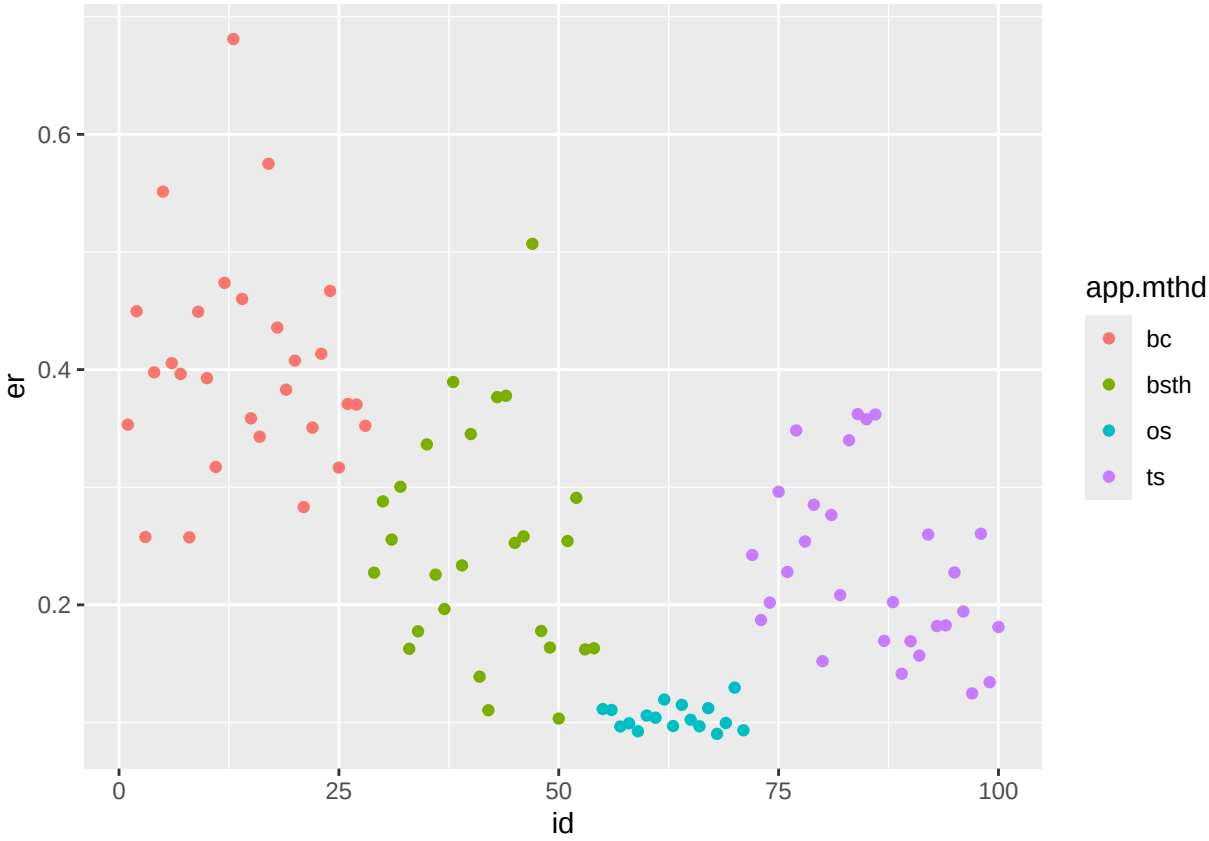
```
pred <- alfam2(dat, pars = ps3, group = 'id')
```

```
## 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",
##     ...)
## NULL
```

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.

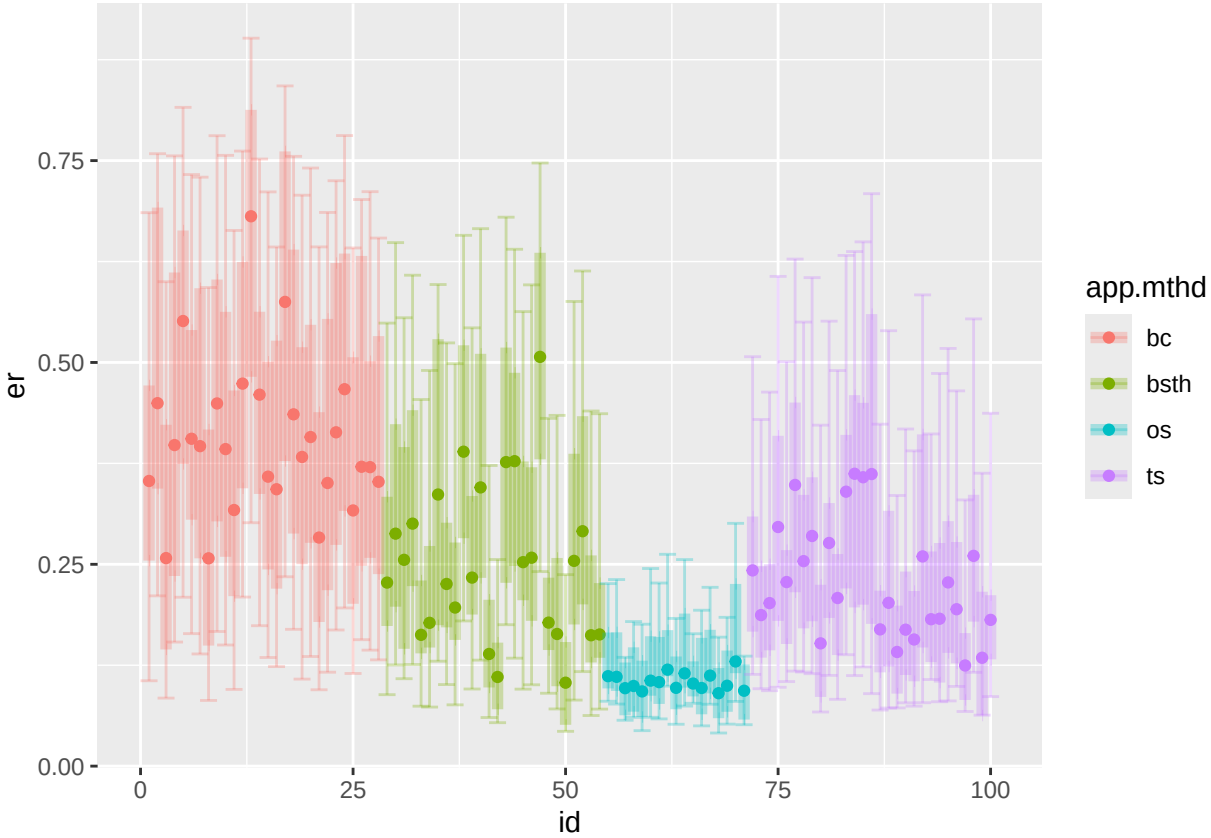
```
preduc <- alfam2(dat, group = 'id', conf.int = 0.95, pars.ci = pduc)
```

```
## 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)
```

```r
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.