

Modeling of relative Yield, P-Uptake and P-Balance

Marc PErez

2025-02-13

```
RES <- readRDS("data/RES.rds")
Dmlr <- RES$nlme.coef.mrg
Dmlr$soil_0_20_P_CO2_log[is.infinite(Dmlr$soil_0_20_P_CO2_log)] <- NA
Dmlr$soil_0_20_P_AAE10_log
```

[1]	NA	3.0773123	NA	2.9069011	NA	2.9601051	NA
[8]	2.9069011	NA	3.9815491	NA	3.7954892	3.5973123	NA
[15]	NA	3.5890591	NA	4.4485164	NA	4.2541933	3.9926809
[22]	NA	NA	4.4578296	1.8870696	2.1162555	2.3321439	2.2300144
[29]	2.4069451	2.3321439	2.3887628	NA	2.1972246	1.8245493	NA
[36]	2.3795461	2.4849066	2.3223877	2.3418058	2.3418058	2.1400662	2.2925348
[43]	0.8329091	1.9878743	1.7047481	2.9069011	1.7047481	1.1939225	1.7917595
[50]	NA	1.6292405	1.7749524	2.6461748	1.4586150	NA	1.9878743
[57]	2.1282317	2.1162555	1.8870696	2.1162555	3.1441523	3.4111477	3.2425924
[64]	NA	3.1863526	3.4045252	3.1945831	3.1863526	3.1045867	NA
[71]	2.7850112	2.7972813	2.9014216	2.8449094	2.8094027	2.7850112	3.2580965
[78]	3.0007198	2.4069451	2.6026897	2.8033604	2.6026897	2.5726122	2.7663191
[85]	2.7343675	NA	2.9069011	2.8903718	NA	3.0587071	2.9069011
[92]	2.9069011	3.1045867	2.8390785	2.6741486	3.3809947	4.2017031	4.3907386
[99]	4.3000028	4.0412953	NA	4.1697612	4.0656021	4.2640873	4.0656021
[106]	3.1822118	2.6461748	3.3809947	3.0540012	NA	3.0726933	3.0955776
[113]	2.6461748	3.0056826	NA	3.4873751	3.5945688	3.7424202	3.8044378
[120]	3.5945688	3.4531571	4.0412953	3.6480575	2.7013612	2.7472709	2.8507065
[127]	2.7472709	NA	2.6100698	2.4069451	2.6390573	2.7013612	3.1223649
[134]	2.8622009	NA	2.9123507	3.1223649	2.8507065	3.0106209	3.0492730
[141]	2.1860513	2.9391619	2.9014216	2.9652731	2.9391619	2.8903718	3.1570004
[148]	NA	3.1045867	3.1570004	2.7972813	2.4336134	2.8033604	2.7146947
[155]	2.3608540	2.2407097	2.7146947	2.3702437	NA	3.4468079	3.2580965

[162]	NA	3.4011974	3.3534067	3.3141860	3.0056826	3.5055574	3.2580965
[169]	3.1986731	3.5025499	3.3741687	3.4812401	NA	3.3741687	3.3741687
[176]	3.4750672	3.3393220	NA	3.6163088	3.4719665	3.6988298	3.6788291
[183]	3.4242627	3.5496174	3.5496174	3.2542430	NA	2.7343675	3.1223649
[190]	2.8390785	2.8033604	2.7343675	2.8390785	3.1267605	2.7972813	3.2771447
[197]	3.5973123	NA	3.5751507	3.5695327	3.5695327	3.8712010	3.1441523
[204]	3.6163088	4.0741419	3.7352858	3.8329798	3.9039908	3.6584202	3.6635616
[211]	3.6635616	3.7376696	NA	3.8133070	3.6963515	3.6963515	3.7954892
[218]	3.5890591	NA	3.9512437	3.9160150	3.7773481	NA	3.6737658
[225]	3.8372995	3.7447871	3.6813512	3.6838669	3.4307562	3.7954892	3.6838669
[232]	2.9338569	2.4765384	2.7911651	2.7725887	2.6741486	2.9338569	2.7725887
[239]	2.5649494	NA	2.6741486	2.6672282	2.9123507	2.6878475	2.7013612
[246]	2.9704145	NA	2.6878475	2.6390573	2.9123507	2.7600099	2.8213789
[253]	3.0540012	2.8903718	3.2228678	3.0252911	NA	3.2228678	3.2695689
[260]	3.0106209	3.0106209	2.7911651	NA	2.4510051	2.4423470	2.2823824
[267]	2.5416020	2.6461748	2.2823824	2.7911651	2.4510051	3.5174978	3.6609943
[274]	3.9019727	3.4843123	NA	3.4078419	3.4372078	3.9019727	3.6323091
[281]	3.4078419	3.4499875	3.6813512	3.3741687	3.2733640	3.3286267	NA
[288]	3.3877744	3.6813512	3.3741687	3.4307562	4.1541846	3.5263605	3.5467397
[295]	NA	4.1541846	3.8649314	3.4339872	3.6296601	3.5263605	3.8372995
[302]	3.0955776	3.2386785	3.4594663	3.2386785	3.3178158	3.4339872	3.1484534
[309]	3.6712245	3.6712245	NA	3.7062281	3.6349511	3.6428355	3.7977339
[316]	4.2766661	NA	3.6349511	3.7424202	4.2766661	3.8607297	3.6712245
[323]	NA	3.4339872	3.7208625	3.7352858	3.6323091	3.9569964	3.5174978
[330]	3.4339872	3.9569964	3.4688560	4.1125119	3.5204608	3.6661225	3.6082116
[337]	3.7887248	3.4688560	4.1125119	NA	3.6270041	4.0758411	4.0621657
[344]	4.1447208	NA	3.9627161	3.9926809	3.9627161	4.1447208	4.2556127
[351]	4.0360090	2.9856819	2.5095993	3.0301337	NA	3.0301337	2.7013612
[358]	2.7212954	2.8094027	2.6810215	2.9856819	2.9177707	2.7408400	NA
[365]	2.8213789	2.9177707	3.0155349	2.9549103	2.5572273	2.9549103	2.9014216
[372]	3.5263605	NA	3.6136170	3.4563167	3.2958369	3.4563167	3.6216707
[379]	3.5234150	3.5263605	3.3286267	2.9014216	2.9391619	2.7663191	2.9391619
[386]	2.6246686	2.8390785	2.5014360	2.7663191	NA	3.1696856	4.1383614
[393]	NA	3.8501476	4.1141472	4.0342406	4.1141472	4.1383614	3.9759363
[400]	3.9239516	4.2253728	3.9180051	NA	3.8351420	4.2061840	3.9796817
[407]	3.9376908	3.8774316	4.2061840	3.9852735	3.9852735	3.6686767	3.5723456
[414]	3.6686767	3.2228678	3.5695327	3.3568971	3.2347492	NA	3.5582011
[421]	3.5723456	3.7037681	4.2106450	3.6054978	3.8066625	3.8416005	3.7013020
[428]	3.8066625	4.2106450	NA	3.5582011	4.3832759	4.6288867	4.3502779
[435]	4.2499228	4.3956830	4.3832759	4.3254563	NA	4.6288867	4.3385971
[442]	4.3770141	4.5358201	4.3081110	4.2282925	NA	4.3515674	4.3515674
[449]	4.5358201	4.5174313	4.4601444	4.2668963	4.1972019	4.2456340	4.3294167
[456]	4.3993753	4.3993753	4.2456340	4.2668963	NA	4.1287460	3.9702919

```
[463] 3.7376696 3.9702919 4.0758411 3.9039908 4.0656021 4.1972019      NA
[470] 3.9473901 4.1972019
```

```
# d <- RES$data
```

Setup

```
library(mlr3verse, quietly = TRUE)

mse <- msrs(c("regr.mse"))

if (!interactive())
  lgr::get_logger("mlr3")$set_threshold("warn")

get_benchi_table <- function(tasks, nfolds = 5) {
  set.seed(123)
  learners <- lrns(c("regr.featureless", "regr.lm", "regr.xgboost", "regr.ranger"))
  learners$regr.xgboost$param_set$set_values(
    eta = 0.04,
    nrounds = 300,
    max_depth = 2
  )

  benchi <- xfun::cache_rds({
    benchmark(benchmark_grid(
      tasks,
      learners,
      rsmp("cv", folds = nfolds)
    ))
  },
  file = "benchmark.rds",
  dir = "cache/",
  hash = list(tasks, nfolds)
)

res <- tidyr::pivot_wider(benchi$aggregate(mse),
  id_cols = task_id,
  names_from = learner_id,
  values_from = regr.mse
) |> as.data.frame()
```

```

rownames(res) <- res$task_id
res <- res[, -1]
colnames(res) <- gsub("regr.", "", colnames(res))
stopifnot(any(colnames(res) == "featureless"))
res <- 1 - res / res$featureless
res[, -1, drop = FALSE] |> round(3)
}

```

Testing prediction quality using

- Linear models
- Random forests (default parameters)
- XGBoost (with parameter tuning)

Weather Variables:

```

[1] "anavg_temp" "anum_prec" "juvdev_prec" "juvdev_sun" "anum_sun"
[6] "juvdev_temp"

```

Phosphor Variable sets:

Response Variables

```

Y_vars <- c("Ymain_rel", "annual_P_uptake", "annual_P_balance")

```

With Weather data

TODO: Group - cross validation

```

\ (nam){
  mytsk <- as_task_regr(
    Dmlr[complete.cases(Dmlr$Ymain_rel), c(y, Weather_vars, P_var_sets[[nam]], "Site")],
    target = y,
    id = nam)
  mytsk$set_col_roles("Site", "group")
  mytsk
}

```

Algorithm learns to predict location from weather since we do not do stratified cross-validation (leaving out locations).

Ymain_rel

```
y <- "Ymain_rel"
lapply(names(P_var_sets), \(nam) as_task_regr(
  Dmlr[complete.cases(Dmlr[,c("Ymain_rel",Weather_vars,P_var_sets$AAE10_CO2_kPS)])],c(y, We
  target = y,
  id = nam)) |>
get_benchi_table() |> knitr::kable()
```

	lm	xgboost	ranger
onlyweather	0.138	0.544	0.542
k	0.107	0.553	0.505
PS	0.195	0.572	0.596
kPS	0.141	0.570	0.618
AAE10	0.255	0.605	0.598
CO2	0.200	0.645	0.638
AAE10_CO2	0.222	0.651	0.647
AAE10_CO2_kPS	0.197	0.663	0.625
CO2_kPS	0.183	0.663	0.627

	lm	xgboost	ranger
onlyweather	0.201	0.518	0.520
k	0.186	0.476	0.487
PS	0.234	0.603	0.585
kPS	0.265	0.569	0.555
AAE10	0.294	0.530	0.582
CO2	0.259	0.569	0.578
AAE10_CO2	0.288	0.515	0.594
AAE10_CO2_kPS	0.347	0.596	0.607
CO2_kPS	0.275	0.530	0.575

annual_P_uptake

```
y <- "annual_P_uptake"
lapply(names(P_var_sets), \(nam) as_task_regr(
  Dmlr[complete.cases(Dmlr[,c("Ymain_rel",Weather_vars,P_var_sets$AAE10_CO2_kPS)])],c(y, We
  target = y,
```

```
id = nam)) |>
get_benchi_table() |> knitr::kable()
```

	lm	xgboost	ranger
onlyweather	0.414	0.784	0.782
k	0.380	0.763	0.766
PS	0.397	0.757	0.816
kPS	0.434	0.777	0.814
AAE10	0.489	0.822	0.834
CO2	0.472	0.797	0.846
AAE10_CO2	0.468	0.852	0.855
AAE10_CO2_kPS	0.488	0.796	0.819
CO2_kPS	0.457	0.808	0.840

	lm	xgboost	ranger
onlyweather	0.468	0.649	0.648
k	0.456	0.564	0.609
PS	0.477	0.594	0.617
kPS	0.459	0.560	0.474
AAE10	0.503	0.619	0.621
CO2	0.481	0.615	0.642
AAE10_CO2	0.484	0.566	0.580
AAE10_CO2_kPS	0.465	0.528	0.423
CO2_kPS	0.487	0.536	0.428

annual_P_balance

```
y <- "annual_P_balance"
lapply(names(P_var_sets), \(nam) as_task_regr(
  Dmlr[complete.cases(Dmlr[,c("Ymain_rel",Weather_vars,P_var_sets$AAE10_CO2_kPS)])],c(y, Wea
  target = y,
  id = nam)) |>
get_benchi_table() |> knitr::kable()
```

	lm	xgboost	ranger
onlyweather	0.027	0.103	0.102
k	0.045	0.565	0.243
PS	0.627	0.864	0.774
kPS	0.639	0.837	0.860
AAE10	0.392	0.597	0.561
CO2	0.490	0.707	0.695
AAE10_CO2	0.471	0.760	0.732
AAE10_CO2_kPS	0.630	0.852	0.827
CO2_kPS	0.645	0.881	0.866

	lm	xgboost	ranger
onlyweather	0.011	0.120	0.121
k	-0.008	0.313	0.127
PS	0.310	0.647	0.608
kPS	0.282	0.609	0.617
AAE10	0.225	0.510	0.524
CO2	0.225	0.532	0.591
AAE10_CO2	0.225	0.546	0.585
AAE10_CO2_kPS	0.335	0.617	0.596
CO2_kPS	0.302	0.626	0.631

Without Weather data

```
if("onlyweather" %in% names(P_var_sets))
  P_var_sets <- P_var_sets[-1]
```

xgboost & ranger are no good in this setting since only very few variables available

Ymain_rel

```
y <- "Ymain_rel"
lapply(names(P_var_sets), \(nam) as_task_regr(
  Dmlr[complete.cases(Dmlr[,c("Ymain_rel",Weather_vars,P_var_sets$AAE10_CO2_kPS)])],c(y, P_
  target = y,
  id = nam)) |>
  get_benchi_table() |> knitr::kable()
```

	lm	xgboost	ranger
k	-0.010	0.058	-0.008
PS	0.035	-0.018	-0.124
kPS	0.024	0.001	-0.060
AAE10	0.124	0.064	-0.107
CO2	0.092	-0.009	-0.137
AAE10_CO2	0.116	0.082	0.095
AAE10_CO2_kPS	0.117	0.109	0.069
CO2_kPS	0.051	-0.032	-0.044

	lm	xgboost	ranger
k	-0.005	-0.200	-0.312
PS	0.060	-0.141	-0.221
kPS	0.054	-0.343	-0.353
AAE10	0.099	0.104	-0.009
CO2	0.068	-0.086	-0.226
AAE10_CO2	0.073	0.067	0.064
AAE10_CO2_kPS	0.072	-0.045	-0.059
CO2_kPS	0.023	-0.168	-0.196

annual_P_uptake

```

y <- "annual_P_uptake"
lapply(names(P_var_sets), \(nam) as_task_regr(
  Dmlr[complete.cases(Dmlr[,c("Ymain_rel",Weather_vars,P_var_sets$AAE10_CO2_kPS)])],c(y, P_var_sets$
  target = y,
  id = nam)) |>
get_benchi_table() |> knitr::kable()

```

	lm	xgboost	ranger
k	-0.028	-0.103	-0.170
PS	0.012	-0.024	-0.123
kPS	0.064	-0.152	-0.199
AAE10	0.065	-0.129	-0.254
CO2	0.058	-0.078	-0.176
AAE10_CO2	0.070	-0.012	-0.058
AAE10_CO2_kPS	0.099	-0.066	-0.008

	lm	xgboost	ranger
CO2_kPS	0.095	-0.059	-0.083

	lm	xgboost	ranger
k	-0.006	-0.265	-0.434
PS	-0.006	-0.278	-0.485
kPS	-0.006	-0.225	-0.317
AAE10	0.021	-0.139	-0.398
CO2	0.005	-0.126	-0.276
AAE10_CO2	0.017	-0.194	-0.310
AAE10_CO2_kPS	0.020	-0.229	-0.363
CO2_kPS	-0.054	-0.206	-0.295

annual_P_balance

```

y <- "annual_P_balance"
lapply(names(P_var_sets), \(nam) as_task_regr(
  Dmlr[complete.cases(Dmlr[,c("Ymain_rel",Weather_vars,P_var_sets$AAE10_CO2_kPS)])],c(y, P_var_sets[nam]),
  target = y,
  id = nam)) |>
get_benchi_table() |> knitr::kable()

```

	lm	xgboost	ranger
k	0.016	0.499	0.629
PS	0.598	0.695	0.666
kPS	0.598	0.681	0.667
AAE10	0.338	0.288	0.224
CO2	0.438	0.436	0.401
AAE10_CO2	0.447	0.495	0.498
AAE10_CO2_kPS	0.594	0.703	0.700
CO2_kPS	0.589	0.686	0.680

	lm	xgboost	ranger
k	0.011	0.175	0.160
PS	0.309	0.274	0.178

	lm	xgboost	ranger
kPS	0.305	0.279	0.244
AAE10	0.147	0.062	-0.102
CO2	0.189	0.170	0.085
AAE10_CO2	0.192	0.062	0.015
AAE10_CO2_kPS	0.313	0.235	0.201
CO2_kPS	0.313	0.274	0.243

```
cor(Dmlr$annual_P_balance, Dmlr$PS) # 0.54389
```

```
[1] 0.5611764
```

```
cor(Dmlr$fert_P_tot, Dmlr$PS) # 0.48236
```

```
[1] 0.5455537
```

```
cor(Dmlr$annual_P_uptake, Dmlr$PS) # 0.070678
```

```
[1] 0.09920453
```

We did manage to have high predictive power for weather. This could also be due to our regression models recovering location&year from it and hence still overfitting on the test set.

Without Weather data we only managed for annual balance to get some predictive power (30%). Since we the balance is uptake - fert_P, this means that we mostly predicted fert_P. Interestingly PS is best to predict this quantity

Legacy Code

```
# Get parameter estimates for XGBoost
t <- as_task_regr(
  subset(Dmlr[complete.cases(Dmlr$annual_P_balance)],
    select = c("annual_P_balance", P_var_sets$AAE10_CO2_kPS#, Weather_vars
  )),
  target = "annual_P_balance"
)
```

```

l <- lrn("regr.xgboost",
  nrounds = 500 # More iterations due to lower learning rate
)

# Create search space
ps <- ps(
  max_depth = p_int(2, 4),
  eta = p_dbl(0.001, 0.3, tags = "logscale")
)

# Setup tuning
instance <- ti(
  task = t,
  learner = l,
  resampling = rsmp("cv", folds = 3),
  measure = msr("regr.mse"),
  terminator = trm("none"),
  search_space = ps
)

# Grid search
tuner <- mlr3tuning::tnr("grid_search")
tuner$optimize(instance)
instance$result

```

Ymain_rel max_depth eta learner_param_vals x_domain regr.mse 1: 2 0.067444 <list[5]>
<list[2]> 177.18

P uptake max_depth eta learner_param_vals x_domain regr.mse 1: 2 0.034222 <list[5]>
<list[2]> 137.41

annual_P_balance max_depth eta learner_param_vals x_domain regr.mse 1: 2 0.034222
<list[5]> <list[2]> 145.21

```

# nlme.coef$kPS <- nlme.coef$k * nlme.coef$PS
#
#
# nlme.coef.mrg <- merge(nlme.coef,allP[allP$year>=2017,],by = "uid")
# # add log-transformed versions
# Dmlr$kPS_log <- log(Dmlr$kPS)
# Dmlr$PS_log <- log(Dmlr$PS)
# Dmlr$soil_0_20_P_AAE10_log <- log(Dmlr$soil_0_20_P_AAE10)
# Dmlr$soil_0_20_P_CO2_log <- log(Dmlr$soil_0_20_P_CO2)

```

```
#
# Dmlr$k

subset(Dmlr, select = c("Ymain_rel", P_var_sets$AAE10_CO2_kPS, Weather_vars))
```

	Ymain_rel	soil_0_20_P_AAE10_log	soil_0_20_P_CO2_log	PS_log	k
1	178.42	NA	NA	-2.7715938	0.10467464
2	NA	3.0773123	-1.386294361	-2.7715938	0.10467464
3	179.72	NA	NA	-3.0042091	0.12262173
4	NA	2.9069011	-1.771956842	-3.0042091	0.12262173
5	190.64	NA	NA	-2.7693913	0.10448023
6	NA	2.9601051	-1.469675970	-2.7693913	0.10448023
7	178.51	NA	NA	-2.9077724	0.11568444
8	NA	2.9069011	-1.514127733	-2.9077724	0.11568444
9	210.05	NA	NA	-2.3473051	0.12628437
10	NA	3.9815491	-0.843970070	-2.3473051	0.12628437
11	209.45	NA	NA	-2.1364490	0.11502207
12	NA	3.7954892	-0.941608540	-2.1364490	0.11502207
13	NA	3.5973123	-0.941608540	-2.6235787	0.09040112
14	215.86	NA	NA	-2.6235787	0.09040112
15	218.63	NA	NA	-2.6642037	0.08666599
16	NA	3.5890591	-1.171182982	-2.6642037	0.08666599
17	219.32	NA	NA	-1.3169035	0.08586286
18	NA	4.4485164	-0.105360516	-1.3169035	0.08586286
19	234.23	NA	NA	-1.5753641	0.08620806
20	NA	4.2541933	-0.527632742	-1.5753641	0.08620806
21	NA	3.9926809	-0.562118918	-1.7576162	0.08640235
22	232.41	NA	NA	-1.7576162	0.08640235
23	238.82	NA	NA	-1.5768721	0.08620766
24	NA	4.4578296	-0.248461359	-1.5768721	0.08620766
25	65.60	1.8870696	-1.469675970	-2.9145147	0.20191085
26	72.33	2.1162555	-1.237874356	-2.9145147	0.20191085
27	84.81	2.3321439	-1.272965676	-2.9145147	0.20191085
28	NA	2.2300144	-1.469675970	-2.9145147	0.20191085
29	NA	2.4069451	-1.171182982	-2.9145147	0.20191085
30	NA	2.3321439	-1.272965676	-2.9145147	0.20191085
31	92.91	2.3887628	-1.237874356	-2.9145147	0.20191085
32	189.25	NA	NA	-2.9145147	0.20191085
33	NA	2.1972246	-1.078809661	-2.9145147	0.20191085
34	69.17	1.8245493	-1.347073648	-2.6264148	0.23310593

35	167.07	NA	NA	-2.6264148	0.23310593
36	NA	2.3795461	-1.108662625	-2.6264148	0.23310593
37	106.32	2.4849066	-1.171182982	-2.6264148	0.23310593
38	82.00	2.3223877	-1.021651248	-2.6264148	0.23310593
39	NA	2.3418058	-1.108662625	-2.6264148	0.23310593
40	84.97	2.3418058	-1.108662625	-2.6264148	0.23310593
41	NA	2.1400662	-1.386294361	-2.6264148	0.23310593
42	NA	2.2925348	-0.941608540	-2.6264148	0.23310593
43	74.25	0.8329091	-1.832581464	-3.3408312	0.15014993
44	89.08	1.9878743	-1.514127733	-3.3408312	0.15014993
45	NA	1.7047481	-1.660731207	-3.3408312	0.15014993
46	NA	2.9069011	-1.237874356	-3.3408312	0.15014993
47	81.01	1.7047481	-1.660731207	-3.3408312	0.15014993
48	NA	1.1939225	-2.207274913	-3.3408312	0.15014993
49	NA	1.7917595	-1.609437912	-3.3408312	0.15014993
50	194.54	NA	NA	-3.3408312	0.15014993
51	66.00	1.6292405	-1.272965676	-3.3408312	0.15014993
52	NA	1.7749524	-1.469675970	-3.8896385	0.13492618
53	79.31	2.6461748	-1.237874356	-3.8896385	0.13492618
54	NA	1.4586150	-2.207274913	-3.8896385	0.13492618
55	149.91	NA	NA	-3.8896385	0.13492618
56	92.33	1.9878743	-1.237874356	-3.8896385	0.13492618
57	NA	2.1282317	-1.469675970	-3.8896385	0.13492618
58	NA	2.1162555	-1.386294361	-3.8896385	0.13492618
59	74.44	1.8870696	-1.347073648	-3.8896385	0.13492618
60	80.85	2.1162555	-1.386294361	-3.8896385	0.13492618
61	91.33	3.1441523	-0.248461359	-1.4927360	0.11739091
62	NA	3.4111477	-0.198450939	-1.4927360	0.11739091
63	NA	3.2425924	-0.314710745	-1.4927360	0.11739091
64	203.81	NA	NA	-1.4927360	0.11739091
65	91.61	3.1863526	-0.198450939	-1.4927360	0.11739091
66	109.20	3.4045252	-0.314710745	-1.4927360	0.11739091
67	NA	3.1945831	-0.198450939	-1.4927360	0.11739091
68	NA	3.1863526	-0.198450939	-1.4927360	0.11739091
69	63.16	3.1045867	-0.385662481	-1.4927360	0.11739091
70	198.18	NA	NA	-2.1350669	0.17309044
71	NA	2.7850112	-0.673344553	-2.1350669	0.17309044
72	NA	2.7972813	-0.843970070	-2.1350669	0.17309044
73	NA	2.9014216	-0.356674944	-2.1350669	0.17309044
74	68.61	2.8449094	-0.634878272	-2.1350669	0.17309044
75	73.44	2.8094027	-0.733969175	-2.1350669	0.17309044
76	78.32	2.7850112	-0.673344553	-2.1350669	0.17309044
77	101.92	3.2580965	-0.510825624	-2.1350669	0.17309044

78	NA	3.0007198	-0.562118918	-2.1350669	0.17309044
79	80.26	2.4069451	-1.171182982	-2.2181329	0.17801699
80	95.57	2.6026897	-0.941608540	-2.2181329	0.17801699
81	NA	2.8033604	-0.843970070	-2.2181329	0.17801699
82	NA	2.6026897	-0.941608540	-2.2181329	0.17801699
83	NA	2.5726122	-1.237874356	-2.2181329	0.17801699
84	72.56	2.7663191	-2.525728644	-2.2181329	0.17801699
85	NA	2.7343675	-0.673344553	-2.2181329	0.17801699
86	190.38	NA	NA	-2.2181329	0.17801699
87	107.85	2.9069011	-0.867500568	-2.2181329	0.17801699
88	NA	2.8903718	-0.867500568	-2.2067423	0.17736688
89	204.59	NA	NA	-2.2067423	0.17736688
90	52.11	3.0587071	-0.579818495	-2.2067423	0.17736688
91	NA	2.9069011	-0.733969175	-2.2067423	0.17736688
92	93.51	2.9069011	-0.733969175	-2.2067423	0.17736688
93	72.61	3.1045867	-0.916290732	-2.2067423	0.17736688
94	NA	2.8390785	-0.941608540	-2.2067423	0.17736688
95	69.74	2.6741486	-0.941608540	-2.2067423	0.17736688
96	NA	3.3809947	-0.385662481	-2.2067423	0.17736688
97	62.97	4.2017031	0.765467842	-0.9083699	0.23219455
98	90.42	4.3907386	0.636576829	-0.9083699	0.23219455
99	NA	4.3000028	0.652325186	-0.9083699	0.23219455
100	90.11	4.0412953	0.239016900	-0.9083699	0.23219455
101	222.79	NA	NA	-0.9083699	0.23219455
102	NA	4.1697612	0.604315967	-0.9083699	0.23219455
103	94.15	4.0656021	0.494696242	-0.9083699	0.23219455
104	NA	4.2640873	0.559615788	-0.9083699	0.23219455
105	NA	4.0656021	0.494696242	-0.9083699	0.23219455
106	NA	3.1822118	-0.198450939	-1.6359640	0.15615814
107	97.94	2.6461748	-0.733969175	-1.6359640	0.15615814
108	104.41	3.3809947	-0.342490309	-1.6359640	0.15615814
109	81.58	3.0540012	-0.510825624	-1.6359640	0.15615814
110	204.59	NA	NA	-1.6359640	0.15615814
111	NA	3.0726933	-0.634878272	-1.6359640	0.15615814
112	85.44	3.0955776	-1.171182982	-1.6359640	0.15615814
113	NA	2.6461748	-0.733969175	-1.6359640	0.15615814
114	NA	3.0056826	-0.478035801	-1.6359640	0.15615814
115	195.84	NA	NA	-1.3788326	0.17699689
116	76.88	3.4873751	-0.105360516	-1.3788326	0.17699689
117	NA	3.5945688	0.231111721	-1.3788326	0.17699689
118	83.33	3.7424202	-0.105360516	-1.3788326	0.17699689
119	NA	3.8044378	0.165514438	-1.3788326	0.17699689
120	87.03	3.5945688	0.231111721	-1.3788326	0.17699689

121	47.89	3.4531571	-0.051293294	-1.3788326	0.17699689
122	NA	4.0412953	0.425267735	-1.3788326	0.17699689
123	NA	3.6480575	0.048790164	-1.3788326	0.17699689
124	125.95	2.7013612	-1.272965676	-3.3238864	0.22062441
125	66.48	2.7472709	-1.514127733	-3.3238864	0.22062441
126	83.27	2.8507065	-0.994252273	-3.3238864	0.22062441
127	NA	2.7472709	-1.272965676	-3.3238864	0.22062441
128	139.69	NA	NA	-3.3238864	0.22062441
129	NA	2.6100698	-1.771956842	-3.3238864	0.22062441
130	NA	2.4069451	-1.609437912	-3.3238864	0.22062441
131	132.89	2.6390573	-1.171182982	-3.3238864	0.22062441
132	NA	2.7013612	-1.272965676	-3.3238864	0.22062441
133	NA	3.1223649	-1.108662625	-3.2178905	0.18943117
134	75.56	2.8622009	-1.237874356	-3.2178905	0.18943117
135	140.99	NA	NA	-3.2178905	0.18943117
136	NA	2.9123507	-1.966112856	-3.2178905	0.18943117
137	117.88	3.1223649	-1.108662625	-3.2178905	0.18943117
138	NA	2.8507065	-1.347073648	-3.2178905	0.18943117
139	65.52	3.0106209	-1.386294361	-3.2178905	0.18943117
140	91.54	3.0492730	-1.078809661	-3.2178905	0.18943117
141	NA	2.1860513	-1.386294361	-3.2178905	0.18943117
142	NA	2.9391619	-1.237874356	-3.6548744	0.28439752
143	65.33	2.9014216	-1.609437912	-3.6548744	0.28439752
144	NA	2.9652731	-1.469675970	-3.6548744	0.28439752
145	133.86	2.9391619	-1.237874356	-3.6548744	0.28439752
146	NA	2.8903718	-2.120263536	-3.6548744	0.28439752
147	77.26	3.1570004	-1.108662625	-3.6548744	0.28439752
148	132.58	NA	NA	-3.6548744	0.28439752
149	NA	3.1045867	-1.347073648	-3.6548744	0.28439752
150	93.11	3.1570004	-0.941608540	-3.6548744	0.28439752
151	89.10	2.7972813	-1.272965676	-3.3755708	0.21679430
152	NA	2.4336134	-2.407945609	-3.3755708	0.21679430
153	86.78	2.8033604	-1.609437912	-3.3755708	0.21679430
154	NA	2.7146947	-1.386294361	-3.3755708	0.21679430
155	NA	2.3608540	-1.514127733	-3.3755708	0.21679430
156	54.11	2.2407097	-1.237874356	-3.3755708	0.21679430
157	126.90	2.7146947	-1.386294361	-3.3755708	0.21679430
158	NA	2.3702437	-1.237874356	-3.3755708	0.21679430
159	117.94	NA	NA	-3.3755708	0.21679430
160	NA	3.4468079	-0.916290732	-2.3555262	0.34791259
161	NA	3.2580965	-0.994252273	-2.3555262	0.34791259
162	135.70	NA	NA	-2.3555262	0.34791259
163	109.78	3.4011974	-0.693147181	-2.3555262	0.34791259

164	87.36	3.3534067	-1.078809661	-2.3555262	0.34791259
165	NA	3.3141860	-0.733969175	-2.3555262	0.34791259
166	NA	3.0056826	-0.916290732	-2.3555262	0.34791259
167	90.60	3.5055574	-0.693147181	-2.3555262	0.34791259
168	145.89	3.2580965	-0.994252273	-2.3555262	0.34791259
169	NA	3.1986731	-0.867500568	-2.4402754	0.30702495
170	92.78	3.5025499	-0.673344553	-2.4402754	0.30702495
171	139.72	3.3741687	-0.798507696	-2.4402754	0.30702495
172	NA	3.4812401	-1.108662625	-2.4402754	0.30702495
173	151.13	NA	NA	-2.4402754	0.30702495
174	79.12	3.3741687	-1.108662625	-2.4402754	0.30702495
175	NA	3.3741687	-0.798507696	-2.4402754	0.30702495
176	94.92	3.4750672	-0.579818495	-2.4402754	0.30702495
177	NA	3.3393220	-0.941608540	-2.4402754	0.30702495
178	153.12	NA	NA	-2.5704141	0.25060055
179	87.56	3.6163088	-0.693147181	-2.5704141	0.25060055
180	NA	3.4719665	-0.798507696	-2.5704141	0.25060055
181	92.11	3.6988298	-0.634878272	-2.5704141	0.25060055
182	NA	3.6788291	-1.108662625	-2.5704141	0.25060055
183	NA	3.4242627	-0.867500568	-2.5704141	0.25060055
184	138.29	3.5496174	-0.733969175	-2.5704141	0.25060055
185	NA	3.5496174	-0.733969175	-2.5704141	0.25060055
186	77.97	3.2542430	-1.272965676	-2.5704141	0.25060055
187	125.74	NA	NA	-2.8188200	0.16133292
188	NA	2.7343675	-0.941608540	-2.8188200	0.16133292
189	96.55	3.1223649	-1.171182982	-2.8188200	0.16133292
190	137.97	2.8390785	-1.108662625	-2.8188200	0.16133292
191	90.00	2.8033604	-0.843970070	-2.8188200	0.16133292
192	NA	2.7343675	-1.078809661	-2.8188200	0.16133292
193	NA	2.8390785	-1.108662625	-2.8188200	0.16133292
194	96.80	3.1267605	-0.798507696	-2.8188200	0.16133292
195	NA	2.7972813	-1.771956842	-2.8188200	0.16133292
196	NA	3.2771447	-0.510825624	-2.0165660	0.29038401
197	NA	3.5973123	-0.385662481	-2.0165660	0.29038401
198	148.44	NA	NA	-2.0165660	0.29038401
199	NA	3.5751507	-0.510825624	-2.0165660	0.29038401
200	NA	3.5695327	-0.478035801	-2.0165660	0.29038401
201	134.81	3.5695327	-0.478035801	-2.0165660	0.29038401
202	88.53	3.8712010	-0.430782916	-2.0165660	0.29038401
203	84.67	3.1441523	-0.776528789	-2.0165660	0.29038401
204	58.00	3.6163088	-0.400477567	-2.0165660	0.29038401
205	117.78	4.0741419	-0.094310679	-1.8173600	0.22557569
206	92.53	3.7352858	-0.733969175	-1.8173600	0.22557569

207	NA	3.8329798	-0.579818495	-1.8173600	0.22557569
208	97.18	3.9039908	-0.385662481	-1.8173600	0.22557569
209	NA	3.6584202	-0.478035801	-1.8173600	0.22557569
210	132.12	3.6635616	-0.527632742	-1.8173600	0.22557569
211	NA	3.6635616	-0.527632742	-1.8173600	0.22557569
212	NA	3.7376696	-0.430782916	-1.8173600	0.22557569
213	140.29	NA	NA	-1.8173600	0.22557569
214	91.44	3.8133070	-0.274436846	-1.6506135	0.13768829
215	137.66	3.6963515	-0.478035801	-1.6506135	0.13768829
216	NA	3.6963515	-0.478035801	-1.6506135	0.13768829
217	NA	3.7954892	-0.446287103	-1.6506135	0.13768829
218	NA	3.5890591	-0.400477567	-1.6506135	0.13768829
219	123.83	NA	NA	-1.6506135	0.13768829
220	90.98	3.9512437	-0.162518929	-1.6506135	0.13768829
221	98.28	3.9160150	-0.446287103	-1.6506135	0.13768829
222	NA	3.7773481	-0.314710745	-1.6506135	0.13768829
223	119.84	NA	NA	-1.7109028	0.06500092
224	92.34	3.6737658	-0.693147181	-1.7109028	0.06500092
225	94.74	3.8372995	-0.510825624	-1.7109028	0.06500092
226	108.89	3.7447871	-0.356674944	-1.7109028	0.06500092
227	NA	3.6813512	-0.162518929	-1.7109028	0.06500092
228	NA	3.6838669	-0.579818495	-1.7109028	0.06500092
229	NA	3.4307562	-0.693147181	-1.7109028	0.06500092
230	NA	3.7954892	-0.673344553	-1.7109028	0.06500092
231	132.91	3.6838669	-0.579818495	-1.7109028	0.06500092
232	NA	2.9338569	-0.941608540	-3.0602039	0.22808615
233	98.67	2.4765384	-1.272965676	-3.0602039	0.22808615
234	98.64	2.7911651	-1.021651248	-3.0602039	0.22808615
235	NA	2.7725887	-0.941608540	-3.0602039	0.22808615
236	108.37	2.6741486	-1.108662625	-3.0602039	0.22808615
237	90.23	2.9338569	-0.941608540	-3.0602039	0.22808615
238	NA	2.7725887	-1.108662625	-3.0602039	0.22808615
239	94.74	2.5649494	-1.469675970	-3.0602039	0.22808615
240	123.40	NA	NA	-3.0602039	0.22808615
241	NA	2.6741486	-1.108662625	-3.0602039	0.22808615
242	NA	2.6672282	-1.021651248	-2.9064446	0.20616803
243	81.61	2.9123507	-1.078809661	-2.9064446	0.20616803
244	115.94	2.6878475	-1.108662625	-2.9064446	0.20616803
245	NA	2.7013612	-1.237874356	-2.9064446	0.20616803
246	83.91	2.9704145	-1.078809661	-2.9064446	0.20616803
247	156.85	NA	NA	-2.9064446	0.20616803
248	NA	2.6878475	-1.108662625	-2.9064446	0.20616803
249	89.10	2.6390573	-1.469675970	-2.9064446	0.20616803

250	NA	2.9123507	-1.078809661	-2.9064446	0.20616803
251	82.03	2.7600099	-1.237874356	-2.9064446	0.20616803
252	104.22	2.8213789	-1.078809661	-2.6081966	0.15273297
253	NA	3.0540012	-0.673344553	-2.6081966	0.15273297
254	NA	2.8903718	-1.108662625	-2.6081966	0.15273297
255	NA	3.2228678	-0.941608540	-2.6081966	0.15273297
256	83.28	3.0252911	-0.916290732	-2.6081966	0.15273297
257	152.86	NA	NA	-2.6081966	0.15273297
258	93.87	3.2228678	-0.941608540	-2.6081966	0.15273297
259	92.86	3.2695689	-1.347073648	-2.6081966	0.15273297
260	NA	3.0106209	-1.078809661	-2.6081966	0.15273297
261	113.04	3.0106209	-1.078809661	-2.6081966	0.15273297
262	NA	2.7911651	-1.237874356	-2.5903371	0.14899842
263	164.73	NA	NA	-2.5903371	0.14899842
264	NA	2.4510051	-1.171182982	-2.5903371	0.14899842
265	NA	2.4423470	-0.127833372	-2.5903371	0.14899842
266	96.24	2.2823824	-1.514127733	-2.5903371	0.14899842
267	104.70	2.5416020	-1.237874356	-2.5903371	0.14899842
268	97.49	2.6461748	-1.021651248	-2.5903371	0.14899842
269	NA	2.2823824	-1.078809661	-2.5903371	0.14899842
270	91.95	2.7911651	-1.237874356	-2.5903371	0.14899842
271	110.14	2.4510051	-1.171182982	-2.5903371	0.14899842
272	100.00	3.5174978	-0.527632742	-2.0944336	0.19984180
273	98.85	3.6609943	-0.400477567	-2.0944336	0.19984180
274	92.15	3.9019727	-0.174353387	-2.0944336	0.19984180
275	86.47	3.4843123	-0.562118918	-2.0944336	0.19984180
276	133.02	NA	NA	-2.0944336	0.19984180
277	NA	3.4078419	-0.446287103	-2.0944336	0.19984180
278	NA	3.4372078	-0.342490309	-2.0944336	0.19984180
279	NA	3.9019727	-0.174353387	-2.0944336	0.19984180
280	NA	3.6323091	-0.162518929	-2.0944336	0.19984180
281	107.57	3.4078419	-0.446287103	-2.0944336	0.19984180
282	NA	3.4499875	-0.385662481	-1.6439616	0.10705720
283	NA	3.6813512	-0.301105093	-1.6439616	0.10705720
284	NA	3.3741687	-0.248461359	-1.6439616	0.10705720
285	96.38	3.2733640	-0.400477567	-1.6439616	0.10705720
286	94.92	3.3286267	-0.400477567	-1.6439616	0.10705720
287	134.75	NA	NA	-1.6439616	0.10705720
288	NA	3.3877744	-0.105360516	-1.6439616	0.10705720
289	92.53	3.6813512	-0.301105093	-1.6439616	0.10705720
290	140.42	3.3741687	-0.248461359	-1.6439616	0.10705720
291	100.00	3.4307562	-0.198450939	-1.6439616	0.10705720
292	NA	4.1541846	-0.127833372	-2.1715576	0.21193823

293	NA	3.5263605	-0.385662481	-2.1715576	0.21193823
294	113.27	3.5467397	-0.430782916	-2.1715576	0.21193823
295	160.75	NA	NA	-2.1715576	0.21193823
296	95.02	4.1541846	-0.127833372	-2.1715576	0.21193823
297	NA	3.8649314	-0.020202707	-2.1715576	0.21193823
298	97.18	3.4339872	-0.673344553	-2.1715576	0.21193823
299	NA	3.6296601	-0.430782916	-2.1715576	0.21193823
300	126.25	3.5263605	-0.385662481	-2.1715576	0.21193823
301	96.34	3.8372995	-0.139262067	-2.1715576	0.21193823
302	99.28	3.0955776	-0.733969175	-2.0030331	0.18423357
303	NA	3.2386785	-0.634878272	-2.0030331	0.18423357
304	104.28	3.4594663	-0.430782916	-2.0030331	0.18423357
305	119.16	3.2386785	-0.634878272	-2.0030331	0.18423357
306	NA	3.3178158	-0.673344553	-2.0030331	0.18423357
307	NA	3.4339872	-0.094310679	-2.0030331	0.18423357
308	102.07	3.1484534	-0.673344553	-2.0030331	0.18423357
309	NA	3.6712245	-0.478035801	-2.0030331	0.18423357
310	94.25	3.6712245	-0.478035801	-2.0030331	0.18423357
311	158.67	NA	NA	-2.0030331	0.18423357
312	NA	3.7062281	-0.210721031	-1.5511331	0.13120470
313	NA	3.6349511	0.019802627	-1.5511331	0.13120470
314	100.75	3.6428355	-0.162518929	-1.5511331	0.13120470
315	96.66	3.7977339	0.039220713	-1.5511331	0.13120470
316	93.30	4.2766661	0.357674444	-1.5511331	0.13120470
317	161.09	NA	NA	-1.5511331	0.13120470
318	130.60	3.6349511	0.019802627	-1.5511331	0.13120470
319	108.69	3.7424202	-0.040821995	-1.5511331	0.13120470
320	NA	4.2766661	0.357674444	-1.5511331	0.13120470
321	NA	3.8607297	0.343589704	-1.5511331	0.13120470
322	NA	3.6712245	0.122217633	-1.2221855	0.10473925
323	157.02	NA	NA	-1.2221855	0.10473925
324	NA	3.4339872	-0.162518929	-1.2221855	0.10473925
325	99.69	3.7208625	0.048790164	-1.2221855	0.10473925
326	NA	3.7352858	0.277631737	-1.2221855	0.10473925
327	85.16	3.6323091	0.076961041	-1.2221855	0.10473925
328	97.51	3.9569964	-0.040821995	-1.2221855	0.10473925
329	111.65	3.5174978	-0.094310679	-1.2221855	0.10473925
330	128.34	3.4339872	-0.162518929	-1.2221855	0.10473925
331	NA	3.9569964	-0.040821995	-1.2221855	0.10473925
332	NA	3.4688560	-0.235722334	-1.2647377	0.13141530
333	NA	4.1125119	0.148420005	-1.2647377	0.13141530
334	93.42	3.5204608	-0.385662481	-1.2647377	0.13141530
335	NA	3.6661225	0.009950331	-1.2647377	0.13141530

336	88.06	3.6082116	-0.235722334	-1.2647377	0.13141530
337	NA	3.7887248	-0.040821995	-1.2647377	0.13141530
338	130.43	3.4688560	-0.235722334	-1.2647377	0.13141530
339	94.44	4.1125119	0.148420005	-1.2647377	0.13141530
340	169.15	NA	NA	-1.2647377	0.13141530
341	106.17	3.6270041	-0.210721031	-1.2647377	0.13141530
342	NA	4.0758411	0.239016900	-1.2757306	0.21076772
343	106.02	4.0621657	-0.051293294	-1.2757306	0.21076772
344	NA	4.1447208	-0.198450939	-1.2757306	0.21076772
345	158.15	NA	NA	-1.2757306	0.21076772
346	133.49	3.9627161	-0.105360516	-1.2757306	0.21076772
347	100.42	3.9926809	-0.105360516	-1.2757306	0.21076772
348	NA	3.9627161	-0.105360516	-1.2757306	0.21076772
349	94.25	4.1447208	-0.198450939	-1.2757306	0.21076772
350	NA	4.2556127	0.300104592	-1.2757306	0.21076772
351	96.86	4.0360090	0.076961041	-1.2757306	0.21076772
352	91.63	2.9856819	-1.272965676	-3.8181685	0.18211399
353	86.01	2.5095993	-1.660731207	-3.8181685	0.18211399
354	69.73	3.0301337	-1.272965676	-3.8181685	0.18211399
355	164.56	NA	NA	-3.8181685	0.18211399
356	NA	3.0301337	-1.272965676	-3.8181685	0.18211399
357	NA	2.7013612	-1.660731207	-3.8181685	0.18211399
358	104.08	2.7212954	-1.237874356	-3.8181685	0.18211399
359	NA	2.8094027	-1.272965676	-3.8181685	0.18211399
360	80.08	2.6810215	-1.771956842	-3.8181685	0.18211399
361	NA	2.9856819	-1.272965676	-3.8181685	0.18211399
362	67.05	2.9177707	-1.609437912	-3.7414147	0.22288952
363	NA	2.7408400	-1.609437912	-3.7414147	0.22288952
364	153.73	NA	NA	-3.7414147	0.22288952
365	81.18	2.8213789	-1.832581464	-3.7414147	0.22288952
366	NA	2.9177707	-1.609437912	-3.7414147	0.22288952
367	61.28	3.0155349	-1.771956842	-3.7414147	0.22288952
368	NA	2.9549103	-1.609437912	-3.7414147	0.22288952
369	NA	2.5572273	-1.832581464	-3.7414147	0.22288952
370	66.34	2.9549103	-1.609437912	-3.7414147	0.22288952
371	94.25	2.9014216	-1.469675970	-3.7414147	0.22288952
372	75.10	3.5263605	-1.108662625	-3.8931747	0.14517478
373	166.64	NA	NA	-3.8931747	0.14517478
374	NA	3.6136170	-0.693147181	-3.8931747	0.14517478
375	NA	3.4563167	-1.108662625	-3.8931747	0.14517478
376	NA	3.2958369	-1.660731207	-3.8931747	0.14517478
377	129.31	3.4563167	-1.108662625	-3.8931747	0.14517478
378	110.97	3.6216707	-0.867500568	-3.8931747	0.14517478

379	94.92	3.5234150	-1.347073648	-3.8931747	0.14517478
380	NA	3.5263605	-1.108662625	-3.8931747	0.14517478
381	98.91	3.3286267	-1.469675970	-3.8931747	0.14517478
382	88.90	2.9014216	-1.469675970	-3.6735278	0.26166020
383	NA	2.9391619	-1.386294361	-3.6735278	0.26166020
384	NA	2.7663191	-1.469675970	-3.6735278	0.26166020
385	65.52	2.9391619	-1.386294361	-3.6735278	0.26166020
386	NA	2.6246686	-1.966112856	-3.6735278	0.26166020
387	64.66	2.8390785	-1.832581464	-3.6735278	0.26166020
388	NA	2.5014360	-1.771956842	-3.6735278	0.26166020
389	75.85	2.7663191	-1.469675970	-3.6735278	0.26166020
390	165.68	NA	NA	-3.6735278	0.26166020
391	71.26	3.1696856	-1.272965676	-3.6735278	0.26166020
392	86.78	4.1383614	0.067658648	-2.0697768	0.21782370
393	153.64	NA	NA	-2.0697768	0.21782370
394	106.63	3.8501476	-0.478035801	-2.0697768	0.21782370
395	NA	4.1141472	0.009950331	-2.0697768	0.21782370
396	NA	4.0342406	0.190620360	-2.0697768	0.21782370
397	135.27	4.1141472	0.009950331	-2.0697768	0.21782370
398	NA	4.1383614	0.067658648	-2.0697768	0.21782370
399	NA	3.9759363	-0.446287103	-2.0697768	0.21782370
400	100.10	3.9239516	-0.072570693	-2.0697768	0.21782370
401	114.85	4.2253728	-0.235722334	-2.0697768	0.21782370
402	105.43	3.9180051	-0.478035801	-2.3967665	0.21384349
403	162.91	NA	NA	-2.3967665	0.21384349
404	NA	3.8351420	-0.693147181	-2.3967665	0.21384349
405	97.89	4.2061840	0.173953307	-2.3967665	0.21384349
406	99.69	3.9796817	-0.235722334	-2.3967665	0.21384349
407	109.77	3.9376908	-0.579818495	-2.3967665	0.21384349
408	NA	3.8774316	-0.072570693	-2.3967665	0.21384349
409	NA	4.2061840	0.173953307	-2.3967665	0.21384349
410	145.25	3.9852735	-0.301105093	-2.3967665	0.21384349
411	NA	3.9852735	-0.301105093	-2.3967665	0.21384349
412	88.12	3.6686767	-0.634878272	-2.6575735	0.21147919
413	129.95	3.5723456	-0.798507696	-2.6575735	0.21147919
414	NA	3.6686767	-0.634878272	-2.6575735	0.21147919
415	97.83	3.2228678	-1.272965676	-2.6575735	0.21147919
416	NA	3.5695327	-1.171182982	-2.6575735	0.21147919
417	108.05	3.3568971	-0.733969175	-2.6575735	0.21147919
418	NA	3.2347492	-0.994252273	-2.6575735	0.21147919
419	168.54	NA	NA	-2.6575735	0.21147919
420	108.65	3.5582011	-0.994252273	-2.6575735	0.21147919
421	NA	3.5723456	-0.798507696	-2.6575735	0.21147919

422	NA	3.7037681	-0.385662481	-2.6521244	0.21152273
423	NA	4.2106450	0.418710335	-2.6521244	0.21152273
424	NA	3.6054978	-0.634878272	-2.6521244	0.21152273
425	117.23	3.8066625	-0.356674944	-2.6521244	0.21152273
426	110.24	3.8416005	-0.356674944	-2.6521244	0.21152273
427	102.63	3.7013020	-0.634878272	-2.6521244	0.21152273
428	NA	3.8066625	-0.356674944	-2.6521244	0.21152273
429	81.61	4.2106450	0.418710335	-2.6521244	0.21152273
430	168.54	NA	NA	-2.6521244	0.21152273
431	109.17	3.5582011	-0.579818495	-2.6521244	0.21152273
432	NA	4.3832759	0.190620360	-1.4624073	0.18550740
433	89.46	4.6288867	0.703097511	-1.4624073	0.18550740
434	NA	4.3502779	-0.094310679	-1.4624073	0.18550740
435	113.99	4.2499228	-0.174353387	-1.4624073	0.18550740
436	98.22	4.3956830	0.438254931	-1.4624073	0.18550740
437	131.88	4.3832759	0.190620360	-1.4624073	0.18550740
438	NA	4.3254563	0.262364264	-1.4624073	0.18550740
439	166.55	NA	NA	-1.4624073	0.18550740
440	NA	4.6288867	0.703097511	-1.4624073	0.18550740
441	106.02	4.3385971	0.076961041	-1.4624073	0.18550740
442	NA	4.3770141	0.683096845	-1.2422076	0.13496530
443	99.62	4.5358201	0.900161350	-1.2422076	0.13496530
444	111.18	4.3081110	0.488580015	-1.2422076	0.13496530
445	103.50	4.2282925	0.067658648	-1.2422076	0.13496530
446	177.90	NA	NA	-1.2422076	0.13496530
447	NA	4.3515674	0.451075619	-1.2422076	0.13496530
448	143.00	4.3515674	0.451075619	-1.2422076	0.13496530
449	NA	4.5358201	0.900161350	-1.2422076	0.13496530
450	113.35	4.5174313	0.678033543	-1.2422076	0.13496530
451	NA	4.4601444	0.357674444	-1.2422076	0.13496530
452	NA	4.2668963	0.165514438	-1.5757798	0.20749743
453	134.86	4.1972019	-0.105360516	-1.5757798	0.20749743
454	NA	4.2456340	0.254642218	-1.5757798	0.20749743
455	NA	4.3294167	0.703097511	-1.5757798	0.20749743
456	89.85	4.3993753	0.963174318	-1.5757798	0.20749743
457	NA	4.3993753	0.963174318	-1.5757798	0.20749743
458	132.21	4.2456340	0.254642218	-1.5757798	0.20749743
459	114.85	4.2668963	0.113328685	-1.5757798	0.20749743
460	163.00	NA	NA	-1.5757798	0.20749743
461	92.89	4.1287460	0.076961041	-1.5757798	0.20749743
462	125.60	3.9702919	0.425267735	-2.1617951	0.28873132
463	NA	3.7376696	-0.274436846	-2.1617951	0.28873132
464	NA	3.9702919	0.425267735	-2.1617951	0.28873132

465	110.14		4.0758411	0.717839793	-2.1617951	0.28873132
466	128.47		3.9039908	0.398776120	-2.1617951	0.28873132
467	107.89		4.0656021	0.536493371	-2.1617951	0.28873132
468	NA		4.1972019	0.457424847	-2.1617951	0.28873132
469	177.56		NA	NA	-2.1617951	0.28873132
470	NA		3.9473901	0.542324291	-2.1617951	0.28873132
471	81.03		4.1972019	0.457424847	-2.1617951	0.28873132
	kPS_log	anavg_temp	ansum_prec	juvdev_prec	juvdev_sun	ansum_sun
1	-5.028492	13.3	1784.4	-0.22	-0.02	2195.9
2	-5.028492	NA	NA	NA	NA	NA
3	-5.102860	13.3	1784.4	-0.22	-0.02	2195.9
4	-5.102860	NA	NA	NA	NA	NA
5	-5.028149	13.3	1784.4	-0.22	-0.02	2195.9
6	-5.028149	NA	NA	NA	NA	NA
7	-5.064662	13.3	1784.4	-0.22	-0.02	2195.9
8	-5.064662	NA	NA	NA	NA	NA
9	-4.416524	13.3	1784.4	-0.22	-0.02	2195.9
10	-4.416524	NA	NA	NA	NA	NA
11	-4.299080	13.3	1784.4	-0.22	-0.02	2195.9
12	-4.299080	NA	NA	NA	NA	NA
13	-5.027077	NA	NA	NA	NA	NA
14	-5.027077	13.3	1784.4	-0.22	-0.02	2195.9
15	-5.109897	13.3	1784.4	-0.22	-0.02	2195.9
16	-5.109897	NA	NA	NA	NA	NA
17	-3.771907	13.3	1784.4	-0.22	-0.02	2195.9
18	-3.771907	NA	NA	NA	NA	NA
19	-4.026356	13.3	1784.4	-0.22	-0.02	2195.9
20	-4.026356	NA	NA	NA	NA	NA
21	-4.206357	NA	NA	NA	NA	NA
22	-4.206357	13.3	1784.4	-0.22	-0.02	2195.9
23	-4.027868	13.3	1784.4	-0.22	-0.02	2195.9
24	-4.027868	NA	NA	NA	NA	NA
25	-4.514444	11.3	725.8	-0.38	0.42	2019.7
26	-4.514444	10.1	1035.6	0.23	0.22	1960.0
27	-4.514444	10.5	993.9	-0.25	0.44	1862.4
28	-4.514444	NA	NA	NA	NA	NA
29	-4.514444	10.7	870.9	-0.35	0.18	1886.0
30	-4.514444	10.5	993.9	-0.25	0.44	1862.4
31	-4.514444	11.2	752.6	-0.36	-0.02	2105.7
32	-4.514444	11.3	1060.6	-0.26	0.14	1721.4
33	-4.514444	9.5	1029.7	0.23	0.13	1692.1
34	-4.082677	11.3	725.8	-0.38	0.42	2019.7
35	-4.082677	11.3	1060.6	-0.26	0.14	1721.4

36	-4.082677	10.7	870.9	-0.35	0.18	1886.0
37	-4.082677	11.2	752.6	-0.36	-0.02	2105.7
38	-4.082677	10.1	1035.6	0.23	0.22	1960.0
39	-4.082677	10.5	993.9	-0.25	0.44	1862.4
40	-4.082677	10.5	993.9	-0.25	0.44	1862.4
41	-4.082677	NA	NA	NA	NA	NA
42	-4.082677	9.5	1029.7	0.23	0.13	1692.1
43	-5.236952	11.3	725.8	-0.38	0.42	2019.7
44	-5.236952	11.2	752.6	-0.36	-0.02	2105.7
45	-5.236952	10.5	993.9	-0.25	0.44	1862.4
46	-5.236952	9.5	1029.7	0.23	0.13	1692.1
47	-5.236952	10.5	993.9	-0.25	0.44	1862.4
48	-5.236952	NA	NA	NA	NA	NA
49	-5.236952	10.7	870.9	-0.35	0.18	1886.0
50	-5.236952	11.3	1060.6	-0.26	0.14	1721.4
51	-5.236952	10.1	1035.6	0.23	0.22	1960.0
52	-5.892666	9.5	1029.7	0.23	0.13	1692.1
53	-5.892666	11.2	752.6	-0.36	-0.02	2105.7
54	-5.892666	NA	NA	NA	NA	NA
55	-5.892666	11.3	1060.6	-0.26	0.14	1721.4
56	-5.892666	10.1	1035.6	0.23	0.22	1960.0
57	-5.892666	10.7	870.9	-0.35	0.18	1886.0
58	-5.892666	10.5	993.9	-0.25	0.44	1862.4
59	-5.892666	11.3	725.8	-0.38	0.42	2019.7
60	-5.892666	10.5	993.9	-0.25	0.44	1862.4
61	-3.634982	10.1	1035.6	0.23	0.22	1960.0
62	-3.634982	10.7	870.9	-0.35	0.18	1886.0
63	-3.634982	NA	NA	NA	NA	NA
64	-3.634982	11.3	1060.6	-0.26	0.14	1721.4
65	-3.634982	10.5	993.9	-0.25	0.44	1862.4
66	-3.634982	11.2	752.6	-0.36	-0.02	2105.7
67	-3.634982	9.5	1029.7	0.23	0.13	1692.1
68	-3.634982	10.5	993.9	-0.25	0.44	1862.4
69	-3.634982	11.3	725.8	-0.38	0.42	2019.7
70	-3.889008	11.3	1060.6	-0.26	0.14	1721.4
71	-3.889008	10.5	993.9	-0.25	0.44	1862.4
72	-3.889008	NA	NA	NA	NA	NA
73	-3.889008	9.5	1029.7	0.23	0.13	1692.1
74	-3.889008	11.3	725.8	-0.38	0.42	2019.7
75	-3.889008	10.1	1035.6	0.23	0.22	1960.0
76	-3.889008	10.5	993.9	-0.25	0.44	1862.4
77	-3.889008	11.2	752.6	-0.36	-0.02	2105.7
78	-3.889008	10.7	870.9	-0.35	0.18	1886.0

79	-3.944009	11.3	725.8	-0.38	0.42	2019.7
80	-3.944009	10.5	993.9	-0.25	0.44	1862.4
81	-3.944009	10.7	870.9	-0.35	0.18	1886.0
82	-3.944009	10.5	993.9	-0.25	0.44	1862.4
83	-3.944009	NA	NA	NA	NA	NA
84	-3.944009	10.1	1035.6	0.23	0.22	1960.0
85	-3.944009	9.5	1029.7	0.23	0.13	1692.1
86	-3.944009	11.3	1060.6	-0.26	0.14	1721.4
87	-3.944009	11.2	752.6	-0.36	-0.02	2105.7
88	-3.936277	NA	NA	NA	NA	NA
89	-3.936277	11.3	1060.6	-0.26	0.14	1721.4
90	-3.936277	10.1	1035.6	0.23	0.22	1960.0
91	-3.936277	10.5	993.9	-0.25	0.44	1862.4
92	-3.936277	10.5	993.9	-0.25	0.44	1862.4
93	-3.936277	11.2	752.6	-0.36	-0.02	2105.7
94	-3.936277	10.7	870.9	-0.35	0.18	1886.0
95	-3.936277	11.3	725.8	-0.38	0.42	2019.7
96	-3.936277	9.5	1029.7	0.23	0.13	1692.1
97	-2.368550	11.3	725.8	-0.38	0.42	2019.7
98	-2.368550	11.2	752.6	-0.36	-0.02	2105.7
99	-2.368550	NA	NA	NA	NA	NA
100	-2.368550	10.1	1035.6	0.23	0.22	1960.0
101	-2.368550	11.3	1060.6	-0.26	0.14	1721.4
102	-2.368550	9.5	1029.7	0.23	0.13	1692.1
103	-2.368550	10.5	993.9	-0.25	0.44	1862.4
104	-2.368550	10.7	870.9	-0.35	0.18	1886.0
105	-2.368550	10.5	993.9	-0.25	0.44	1862.4
106	-3.492850	10.7	870.9	-0.35	0.18	1886.0
107	-3.492850	10.5	993.9	-0.25	0.44	1862.4
108	-3.492850	11.2	752.6	-0.36	-0.02	2105.7
109	-3.492850	11.3	725.8	-0.38	0.42	2019.7
110	-3.492850	11.3	1060.6	-0.26	0.14	1721.4
111	-3.492850	NA	NA	NA	NA	NA
112	-3.492850	10.1	1035.6	0.23	0.22	1960.0
113	-3.492850	10.5	993.9	-0.25	0.44	1862.4
114	-3.492850	9.5	1029.7	0.23	0.13	1692.1
115	-3.110456	11.3	1060.6	-0.26	0.14	1721.4
116	-3.110456	11.3	725.8	-0.38	0.42	2019.7
117	-3.110456	10.5	993.9	-0.25	0.44	1862.4
118	-3.110456	11.2	752.6	-0.36	-0.02	2105.7
119	-3.110456	NA	NA	NA	NA	NA
120	-3.110456	10.5	993.9	-0.25	0.44	1862.4
121	-3.110456	10.1	1035.6	0.23	0.22	1960.0

122	-3.110456	9.5	1029.7	0.23	0.13	1692.1
123	-3.110456	10.7	870.9	-0.35	0.18	1886.0
124	-4.835180	10.2	1063.5	-0.25	0.28	1758.6
125	-4.835180	10.8	1013.6	-0.45	-0.24	1768.3
126	-4.835180	11.2	1047.7	-0.08	0.50	2022.8
127	-4.835180	10.6	980.7	-0.25	0.35	1890.3
128	-4.835180	11.2	1210.1	-0.35	0.13	1742.3
129	-4.835180	NA	NA	NA	NA	NA
130	-4.835180	9.3	1390.5	0.52	0.07	1589.4
131	-4.835180	9.9	1076.4	-0.10	0.19	1748.2
132	-4.835180	10.2	1063.5	-0.25	0.28	1758.6
133	-4.881620	10.2	1063.5	-0.25	0.28	1758.6
134	-4.881620	9.9	1076.4	-0.10	0.19	1748.2
135	-4.881620	11.2	1210.1	-0.35	0.13	1742.3
136	-4.881620	NA	NA	NA	NA	NA
137	-4.881620	10.2	1063.5	-0.25	0.28	1758.6
138	-4.881620	10.6	980.7	-0.25	0.35	1890.3
139	-4.881620	10.8	1013.6	-0.45	-0.24	1768.3
140	-4.881620	11.2	1047.7	-0.08	0.50	2022.8
141	-4.881620	9.3	1390.5	0.52	0.07	1589.4
142	-4.912257	10.2	1063.5	-0.25	0.28	1758.6
143	-4.912257	10.8	1013.6	-0.45	-0.24	1768.3
144	-4.912257	9.3	1390.5	0.52	0.07	1589.4
145	-4.912257	10.2	1063.5	-0.25	0.28	1758.6
146	-4.912257	NA	NA	NA	NA	NA
147	-4.912257	11.2	1047.7	-0.08	0.50	2022.8
148	-4.912257	11.2	1210.1	-0.35	0.13	1742.3
149	-4.912257	10.6	980.7	-0.25	0.35	1890.3
150	-4.912257	9.9	1076.4	-0.10	0.19	1748.2
151	-4.904377	11.2	1047.7	-0.08	0.50	2022.8
152	-4.904377	NA	NA	NA	NA	NA
153	-4.904377	10.8	1013.6	-0.45	-0.24	1768.3
154	-4.904377	10.2	1063.5	-0.25	0.28	1758.6
155	-4.904377	10.6	980.7	-0.25	0.35	1890.3
156	-4.904377	9.9	1076.4	-0.10	0.19	1748.2
157	-4.904377	10.2	1063.5	-0.25	0.28	1758.6
158	-4.904377	9.3	1390.5	0.52	0.07	1589.4
159	-4.904377	11.2	1210.1	-0.35	0.13	1742.3
160	-3.411330	NA	NA	NA	NA	NA
161	-3.411330	10.2	1063.5	-0.25	0.28	1758.6
162	-3.411330	11.2	1210.1	-0.35	0.13	1742.3
163	-3.411330	9.9	1076.4	-0.10	0.19	1748.2
164	-3.411330	10.8	1013.6	-0.45	-0.24	1768.3

165	-3.411330	10.6	980.7	-0.25	0.35	1890.3
166	-3.411330	9.3	1390.5	0.52	0.07	1589.4
167	-3.411330	11.2	1047.7	-0.08	0.50	2022.8
168	-3.411330	10.2	1063.5	-0.25	0.28	1758.6
169	-3.621102	9.3	1390.5	0.52	0.07	1589.4
170	-3.621102	9.9	1076.4	-0.10	0.19	1748.2
171	-3.621102	10.2	1063.5	-0.25	0.28	1758.6
172	-3.621102	NA	NA	NA	NA	NA
173	-3.621102	11.2	1210.1	-0.35	0.13	1742.3
174	-3.621102	10.8	1013.6	-0.45	-0.24	1768.3
175	-3.621102	10.2	1063.5	-0.25	0.28	1758.6
176	-3.621102	11.2	1047.7	-0.08	0.50	2022.8
177	-3.621102	10.6	980.7	-0.25	0.35	1890.3
178	-3.954309	11.2	1210.1	-0.35	0.13	1742.3
179	-3.954309	9.9	1076.4	-0.10	0.19	1748.2
180	-3.954309	9.3	1390.5	0.52	0.07	1589.4
181	-3.954309	11.2	1047.7	-0.08	0.50	2022.8
182	-3.954309	NA	NA	NA	NA	NA
183	-3.954309	10.6	980.7	-0.25	0.35	1890.3
184	-3.954309	10.2	1063.5	-0.25	0.28	1758.6
185	-3.954309	10.2	1063.5	-0.25	0.28	1758.6
186	-3.954309	10.8	1013.6	-0.45	-0.24	1768.3
187	-4.643105	11.2	1210.1	-0.35	0.13	1742.3
188	-4.643105	9.3	1390.5	0.52	0.07	1589.4
189	-4.643105	10.8	1013.6	-0.45	-0.24	1768.3
190	-4.643105	10.2	1063.5	-0.25	0.28	1758.6
191	-4.643105	9.9	1076.4	-0.10	0.19	1748.2
192	-4.643105	10.6	980.7	-0.25	0.35	1890.3
193	-4.643105	10.2	1063.5	-0.25	0.28	1758.6
194	-4.643105	11.2	1047.7	-0.08	0.50	2022.8
195	-4.643105	NA	NA	NA	NA	NA
196	-3.253117	9.3	1390.5	0.52	0.07	1589.4
197	-3.253117	10.6	980.7	-0.25	0.35	1890.3
198	-3.253117	11.2	1210.1	-0.35	0.13	1742.3
199	-3.253117	NA	NA	NA	NA	NA
200	-3.253117	10.2	1063.5	-0.25	0.28	1758.6
201	-3.253117	10.2	1063.5	-0.25	0.28	1758.6
202	-3.253117	11.2	1047.7	-0.08	0.50	2022.8
203	-3.253117	10.8	1013.6	-0.45	-0.24	1768.3
204	-3.253117	9.9	1076.4	-0.10	0.19	1748.2
205	-3.306459	9.9	1076.4	-0.10	0.19	1748.2
206	-3.306459	10.8	1013.6	-0.45	-0.24	1768.3
207	-3.306459	NA	NA	NA	NA	NA

208	-3.306459	11.2	1047.7	-0.08	0.50	2022.8
209	-3.306459	9.3	1390.5	0.52	0.07	1589.4
210	-3.306459	10.2	1063.5	-0.25	0.28	1758.6
211	-3.306459	10.2	1063.5	-0.25	0.28	1758.6
212	-3.306459	10.6	980.7	-0.25	0.35	1890.3
213	-3.306459	11.2	1210.1	-0.35	0.13	1742.3
214	-3.633376	9.9	1076.4	-0.10	0.19	1748.2
215	-3.633376	10.2	1063.5	-0.25	0.28	1758.6
216	-3.633376	10.2	1063.5	-0.25	0.28	1758.6
217	-3.633376	NA	NA	NA	NA	NA
218	-3.633376	10.6	980.7	-0.25	0.35	1890.3
219	-3.633376	11.2	1210.1	-0.35	0.13	1742.3
220	-3.633376	11.2	1047.7	-0.08	0.50	2022.8
221	-3.633376	10.8	1013.6	-0.45	-0.24	1768.3
222	-3.633376	9.3	1390.5	0.52	0.07	1589.4
223	-4.444257	11.2	1210.1	-0.35	0.13	1742.3
224	-4.444257	10.8	1013.6	-0.45	-0.24	1768.3
225	-4.444257	11.2	1047.7	-0.08	0.50	2022.8
226	-4.444257	9.9	1076.4	-0.10	0.19	1748.2
227	-4.444257	9.3	1390.5	0.52	0.07	1589.4
228	-4.444257	10.2	1063.5	-0.25	0.28	1758.6
229	-4.444257	10.6	980.7	-0.25	0.35	1890.3
230	-4.444257	NA	NA	NA	NA	NA
231	-4.444257	10.2	1063.5	-0.25	0.28	1758.6
232	-4.538236	11.2	900.8	-0.46	-0.09	1855.8
233	-4.538236	10.6	972.1	-0.19	0.05	1828.8
234	-4.538236	10.3	919.3	-0.25	0.18	1748.3
235	-4.538236	9.6	1072.9	0.21	0.14	1674.8
236	-4.538236	10.9	856.3	-0.03	0.55	1974.4
237	-4.538236	11.2	900.8	-0.46	-0.09	1855.8
238	-4.538236	NA	NA	NA	NA	NA
239	-4.538236	11.4	836.8	-0.21	0.43	2078.9
240	-4.538236	11.5	1097.9	-0.26	0.11	1745.3
241	-4.538236	10.9	856.3	-0.03	0.55	1974.4
242	-4.485508	9.6	1072.9	0.21	0.14	1674.8
243	-4.485508	11.2	900.8	-0.46	-0.09	1855.8
244	-4.485508	10.9	856.3	-0.03	0.55	1974.4
245	-4.485508	NA	NA	NA	NA	NA
246	-4.485508	10.3	919.3	-0.25	0.18	1748.3
247	-4.485508	11.5	1097.9	-0.26	0.11	1745.3
248	-4.485508	10.9	856.3	-0.03	0.55	1974.4
249	-4.485508	11.4	836.8	-0.21	0.43	2078.9
250	-4.485508	11.2	900.8	-0.46	-0.09	1855.8

251	-4.485508	10.6	972.1	-0.19	0.05	1828.8
252	-4.487261	10.6	972.1	-0.19	0.05	1828.8
253	-4.487261	9.6	1072.9	0.21	0.14	1674.8
254	-4.487261	NA	NA	NA	NA	NA
255	-4.487261	11.2	900.8	-0.46	-0.09	1855.8
256	-4.487261	10.3	919.3	-0.25	0.18	1748.3
257	-4.487261	11.5	1097.9	-0.26	0.11	1745.3
258	-4.487261	11.2	900.8	-0.46	-0.09	1855.8
259	-4.487261	11.4	836.8	-0.21	0.43	2078.9
260	-4.487261	10.9	856.3	-0.03	0.55	1974.4
261	-4.487261	10.9	856.3	-0.03	0.55	1974.4
262	-4.494157	11.2	900.8	-0.46	-0.09	1855.8
263	-4.494157	11.5	1097.9	-0.26	0.11	1745.3
264	-4.494157	10.9	856.3	-0.03	0.55	1974.4
265	-4.494157	NA	NA	NA	NA	NA
266	-4.494157	11.4	836.8	-0.21	0.43	2078.9
267	-4.494157	10.6	972.1	-0.19	0.05	1828.8
268	-4.494157	10.3	919.3	-0.25	0.18	1748.3
269	-4.494157	9.6	1072.9	0.21	0.14	1674.8
270	-4.494157	11.2	900.8	-0.46	-0.09	1855.8
271	-4.494157	10.9	856.3	-0.03	0.55	1974.4
272	-3.704663	10.6	972.1	-0.19	0.05	1828.8
273	-3.704663	10.3	919.3	-0.25	0.18	1748.3
274	-3.704663	11.2	900.8	-0.46	-0.09	1855.8
275	-3.704663	11.4	836.8	-0.21	0.43	2078.9
276	-3.704663	11.5	1097.9	-0.26	0.11	1745.3
277	-3.704663	10.9	856.3	-0.03	0.55	1974.4
278	-3.704663	NA	NA	NA	NA	NA
279	-3.704663	11.2	900.8	-0.46	-0.09	1855.8
280	-3.704663	9.6	1072.9	0.21	0.14	1674.8
281	-3.704663	10.9	856.3	-0.03	0.55	1974.4
282	-3.878354	NA	NA	NA	NA	NA
283	-3.878354	11.2	900.8	-0.46	-0.09	1855.8
284	-3.878354	10.9	856.3	-0.03	0.55	1974.4
285	-3.878354	10.6	972.1	-0.19	0.05	1828.8
286	-3.878354	11.4	836.8	-0.21	0.43	2078.9
287	-3.878354	11.5	1097.9	-0.26	0.11	1745.3
288	-3.878354	9.6	1072.9	0.21	0.14	1674.8
289	-3.878354	11.2	900.8	-0.46	-0.09	1855.8
290	-3.878354	10.9	856.3	-0.03	0.55	1974.4
291	-3.878354	10.3	919.3	-0.25	0.18	1748.3
292	-3.723018	11.2	900.8	-0.46	-0.09	1855.8
293	-3.723018	10.9	856.3	-0.03	0.55	1974.4

294	-3.723018	10.6	972.1	-0.19	0.05	1828.8
295	-3.723018	11.5	1097.9	-0.26	0.11	1745.3
296	-3.723018	11.2	900.8	-0.46	-0.09	1855.8
297	-3.723018	9.6	1072.9	0.21	0.14	1674.8
298	-3.723018	11.4	836.8	-0.21	0.43	2078.9
299	-3.723018	NA	NA	NA	NA	NA
300	-3.723018	10.9	856.3	-0.03	0.55	1974.4
301	-3.723018	10.3	919.3	-0.25	0.18	1748.3
302	-3.694584	10.6	972.1	-0.19	0.05	1828.8
303	-3.694584	10.9	856.3	-0.03	0.55	1974.4
304	-3.694584	10.3	919.3	-0.25	0.18	1748.3
305	-3.694584	10.9	856.3	-0.03	0.55	1974.4
306	-3.694584	NA	NA	NA	NA	NA
307	-3.694584	9.6	1072.9	0.21	0.14	1674.8
308	-3.694584	11.4	836.8	-0.21	0.43	2078.9
309	-3.694584	11.2	900.8	-0.46	-0.09	1855.8
310	-3.694584	11.2	900.8	-0.46	-0.09	1855.8
311	-3.694584	11.5	1097.9	-0.26	0.11	1745.3
312	-3.582130	NA	NA	NA	NA	NA
313	-3.582130	10.9	856.3	-0.03	0.55	1974.4
314	-3.582130	11.4	836.8	-0.21	0.43	2078.9
315	-3.582130	10.3	919.3	-0.25	0.18	1748.3
316	-3.582130	11.2	900.8	-0.46	-0.09	1855.8
317	-3.582130	11.5	1097.9	-0.26	0.11	1745.3
318	-3.582130	10.9	856.3	-0.03	0.55	1974.4
319	-3.582130	10.6	972.1	-0.19	0.05	1828.8
320	-3.582130	11.2	900.8	-0.46	-0.09	1855.8
321	-3.582130	9.6	1072.9	0.21	0.14	1674.8
322	-3.478467	NA	NA	NA	NA	NA
323	-3.478467	11.5	1097.9	-0.26	0.11	1745.3
324	-3.478467	10.9	856.3	-0.03	0.55	1974.4
325	-3.478467	10.3	919.3	-0.25	0.18	1748.3
326	-3.478467	9.6	1072.9	0.21	0.14	1674.8
327	-3.478467	10.6	972.1	-0.19	0.05	1828.8
328	-3.478467	11.2	900.8	-0.46	-0.09	1855.8
329	-3.478467	11.4	836.8	-0.21	0.43	2078.9
330	-3.478467	10.9	856.3	-0.03	0.55	1974.4
331	-3.478467	11.2	900.8	-0.46	-0.09	1855.8
332	-3.294130	10.9	856.3	-0.03	0.55	1974.4
333	-3.294130	11.2	900.8	-0.46	-0.09	1855.8
334	-3.294130	11.4	836.8	-0.21	0.43	2078.9
335	-3.294130	9.6	1072.9	0.21	0.14	1674.8
336	-3.294130	10.6	972.1	-0.19	0.05	1828.8

337	-3.294130	NA	NA	NA	NA	NA
338	-3.294130	10.9	856.3	-0.03	0.55	1974.4
339	-3.294130	11.2	900.8	-0.46	-0.09	1855.8
340	-3.294130	11.5	1097.9	-0.26	0.11	1745.3
341	-3.294130	10.3	919.3	-0.25	0.18	1748.3
342	-2.832729	9.6	1072.9	0.21	0.14	1674.8
343	-2.832729	11.4	836.8	-0.21	0.43	2078.9
344	-2.832729	11.2	900.8	-0.46	-0.09	1855.8
345	-2.832729	11.5	1097.9	-0.26	0.11	1745.3
346	-2.832729	10.9	856.3	-0.03	0.55	1974.4
347	-2.832729	10.3	919.3	-0.25	0.18	1748.3
348	-2.832729	10.9	856.3	-0.03	0.55	1974.4
349	-2.832729	11.2	900.8	-0.46	-0.09	1855.8
350	-2.832729	NA	NA	NA	NA	NA
351	-2.832729	10.6	972.1	-0.19	0.05	1828.8
352	-5.521291	10.9	856.3	-0.03	0.55	1974.4
353	-5.521291	10.6	972.1	-0.19	0.05	1828.8
354	-5.521291	11.2	900.8	-0.46	-0.09	1855.8
355	-5.521291	11.5	1097.9	-0.26	0.11	1745.3
356	-5.521291	11.2	900.8	-0.46	-0.09	1855.8
357	-5.521291	NA	NA	NA	NA	NA
358	-5.521291	10.3	919.3	-0.25	0.18	1748.3
359	-5.521291	9.6	1072.9	0.21	0.14	1674.8
360	-5.521291	11.4	836.8	-0.21	0.43	2078.9
361	-5.521291	10.9	856.3	-0.03	0.55	1974.4
362	-5.242494	11.2	900.8	-0.46	-0.09	1855.8
363	-5.242494	9.6	1072.9	0.21	0.14	1674.8
364	-5.242494	11.5	1097.9	-0.26	0.11	1745.3
365	-5.242494	10.6	972.1	-0.19	0.05	1828.8
366	-5.242494	11.2	900.8	-0.46	-0.09	1855.8
367	-5.242494	11.4	836.8	-0.21	0.43	2078.9
368	-5.242494	10.9	856.3	-0.03	0.55	1974.4
369	-5.242494	NA	NA	NA	NA	NA
370	-5.242494	10.9	856.3	-0.03	0.55	1974.4
371	-5.242494	10.3	919.3	-0.25	0.18	1748.3
372	-5.822992	11.2	900.8	-0.46	-0.09	1855.8
373	-5.822992	11.5	1097.9	-0.26	0.11	1745.3
374	-5.822992	9.6	1072.9	0.21	0.14	1674.8
375	-5.822992	10.9	856.3	-0.03	0.55	1974.4
376	-5.822992	NA	NA	NA	NA	NA
377	-5.822992	10.9	856.3	-0.03	0.55	1974.4
378	-5.822992	10.3	919.3	-0.25	0.18	1748.3
379	-5.822992	11.4	836.8	-0.21	0.43	2078.9

380	-5.822992	11.2	900.8	-0.46	-0.09	1855.8
381	-5.822992	10.6	972.1	-0.19	0.05	1828.8
382	-5.014236	10.6	972.1	-0.19	0.05	1828.8
383	-5.014236	11.2	900.8	-0.46	-0.09	1855.8
384	-5.014236	10.9	856.3	-0.03	0.55	1974.4
385	-5.014236	11.2	900.8	-0.46	-0.09	1855.8
386	-5.014236	9.6	1072.9	0.21	0.14	1674.8
387	-5.014236	11.4	836.8	-0.21	0.43	2078.9
388	-5.014236	NA	NA	NA	NA	NA
389	-5.014236	10.9	856.3	-0.03	0.55	1974.4
390	-5.014236	11.5	1097.9	-0.26	0.11	1745.3
391	-5.014236	10.3	919.3	-0.25	0.18	1748.3
392	-3.593846	11.2	900.8	-0.46	-0.09	1855.8
393	-3.593846	11.5	1097.9	-0.26	0.11	1745.3
394	-3.593846	10.6	972.1	-0.19	0.05	1828.8
395	-3.593846	10.9	856.3	-0.03	0.55	1974.4
396	-3.593846	9.6	1072.9	0.21	0.14	1674.8
397	-3.593846	10.9	856.3	-0.03	0.55	1974.4
398	-3.593846	11.2	900.8	-0.46	-0.09	1855.8
399	-3.593846	NA	NA	NA	NA	NA
400	-3.593846	10.3	919.3	-0.25	0.18	1748.3
401	-3.593846	11.4	836.8	-0.21	0.43	2078.9
402	-3.939277	10.6	972.1	-0.19	0.05	1828.8
403	-3.939277	11.5	1097.9	-0.26	0.11	1745.3
404	-3.939277	NA	NA	NA	NA	NA
405	-3.939277	11.2	900.8	-0.46	-0.09	1855.8
406	-3.939277	10.3	919.3	-0.25	0.18	1748.3
407	-3.939277	11.4	836.8	-0.21	0.43	2078.9
408	-3.939277	9.6	1072.9	0.21	0.14	1674.8
409	-3.939277	11.2	900.8	-0.46	-0.09	1855.8
410	-3.939277	10.9	856.3	-0.03	0.55	1974.4
411	-3.939277	10.9	856.3	-0.03	0.55	1974.4
412	-4.211202	11.2	900.8	-0.46	-0.09	1855.8
413	-4.211202	10.9	856.3	-0.03	0.55	1974.4
414	-4.211202	11.2	900.8	-0.46	-0.09	1855.8
415	-4.211202	10.6	972.1	-0.19	0.05	1828.8
416	-4.211202	NA	NA	NA	NA	NA
417	-4.211202	10.3	919.3	-0.25	0.18	1748.3
418	-4.211202	9.6	1072.9	0.21	0.14	1674.8
419	-4.211202	11.5	1097.9	-0.26	0.11	1745.3
420	-4.211202	11.4	836.8	-0.21	0.43	2078.9
421	-4.211202	10.9	856.3	-0.03	0.55	1974.4
422	-4.205547	9.6	1072.9	0.21	0.14	1674.8

423	-4.205547	11.2	900.8	-0.46	-0.09	1855.8
424	-4.205547	NA	NA	NA	NA	NA
425	-4.205547	10.9	856.3	-0.03	0.55	1974.4
426	-4.205547	10.3	919.3	-0.25	0.18	1748.3
427	-4.205547	11.4	836.8	-0.21	0.43	2078.9
428	-4.205547	10.9	856.3	-0.03	0.55	1974.4
429	-4.205547	11.2	900.8	-0.46	-0.09	1855.8
430	-4.205547	11.5	1097.9	-0.26	0.11	1745.3
431	-4.205547	10.6	972.1	-0.19	0.05	1828.8
432	-3.147068	10.9	856.3	-0.03	0.55	1974.4
433	-3.147068	11.2	900.8	-0.46	-0.09	1855.8
434	-3.147068	NA	NA	NA	NA	NA
435	-3.147068	10.6	972.1	-0.19	0.05	1828.8
436	-3.147068	10.3	919.3	-0.25	0.18	1748.3
437	-3.147068	10.9	856.3	-0.03	0.55	1974.4
438	-3.147068	9.6	1072.9	0.21	0.14	1674.8
439	-3.147068	11.5	1097.9	-0.26	0.11	1745.3
440	-3.147068	11.2	900.8	-0.46	-0.09	1855.8
441	-3.147068	11.4	836.8	-0.21	0.43	2078.9
442	-3.244945	9.6	1072.9	0.21	0.14	1674.8
443	-3.244945	11.2	900.8	-0.46	-0.09	1855.8
444	-3.244945	10.3	919.3	-0.25	0.18	1748.3
445	-3.244945	10.6	972.1	-0.19	0.05	1828.8
446	-3.244945	11.5	1097.9	-0.26	0.11	1745.3
447	-3.244945	10.9	856.3	-0.03	0.55	1974.4
448	-3.244945	10.9	856.3	-0.03	0.55	1974.4
449	-3.244945	11.2	900.8	-0.46	-0.09	1855.8
450	-3.244945	11.4	836.8	-0.21	0.43	2078.9
451	-3.244945	NA	NA	NA	NA	NA
452	-3.148416	NA	NA	NA	NA	NA
453	-3.148416	10.6	972.1	-0.19	0.05	1828.8
454	-3.148416	10.9	856.3	-0.03	0.55	1974.4
455	-3.148416	9.6	1072.9	0.21	0.14	1674.8
456	-3.148416	11.2	900.8	-0.46	-0.09	1855.8
457	-3.148416	11.2	900.8	-0.46	-0.09	1855.8
458	-3.148416	10.9	856.3	-0.03	0.55	1974.4
459	-3.148416	11.4	836.8	-0.21	0.43	2078.9
460	-3.148416	11.5	1097.9	-0.26	0.11	1745.3
461	-3.148416	10.3	919.3	-0.25	0.18	1748.3
462	-3.404054	10.9	856.3	-0.03	0.55	1974.4
463	-3.404054	NA	NA	NA	NA	NA
464	-3.404054	10.9	856.3	-0.03	0.55	1974.4
465	-3.404054	10.3	919.3	-0.25	0.18	1748.3

466	-3.404054	10.6	972.1	-0.19	0.05	1828.8
467	-3.404054	11.4	836.8	-0.21	0.43	2078.9
468	-3.404054	11.2	900.8	-0.46	-0.09	1855.8
469	-3.404054	11.5	1097.9	-0.26	0.11	1745.3
470	-3.404054	9.6	1072.9	0.21	0.14	1674.8
471	-3.404054	11.2	900.8	-0.46	-0.09	1855.8
	juvdev_temp					
1	1.07					
2	NA					
3	1.07					
4	NA					
5	1.07					
6	NA					
7	1.07					
8	NA					
9	1.07					
10	NA					
11	1.07					
12	NA					
13	NA					
14	1.07					
15	1.07					
16	NA					
17	1.07					
18	NA					
19	1.07					
20	NA					
21	NA					
22	1.07					
23	1.07					
24	NA					
25	1.00					
26	1.37					
27	1.60					
28	NA					
29	1.10					
30	1.60					
31	0.40					
32	1.37					
33	-0.34					
34	1.00					
35	1.37					
36	1.10					

37	0.40
38	1.37
39	1.60
40	1.60
41	NA
42	-0.34
43	1.00
44	0.40
45	1.60
46	-0.34
47	1.60
48	NA
49	1.10
50	1.37
51	1.37
52	-0.34
53	0.40
54	NA
55	1.37
56	1.37
57	1.10
58	1.60
59	1.00
60	1.60
61	1.37
62	1.10
63	NA
64	1.37
65	1.60
66	0.40
67	-0.34
68	1.60
69	1.00
70	1.37
71	1.60
72	NA
73	-0.34
74	1.00
75	1.37
76	1.60
77	0.40
78	1.10
79	1.00

80	1.60
81	1.10
82	1.60
83	NA
84	1.37
85	-0.34
86	1.37
87	0.40
88	NA
89	1.37
90	1.37
91	1.60
92	1.60
93	0.40
94	1.10
95	1.00
96	-0.34
97	1.00
98	0.40
99	NA
100	1.37
101	1.37
102	-0.34
103	1.60
104	1.10
105	1.60
106	1.10
107	1.60
108	0.40
109	1.00
110	1.37
111	NA
112	1.37
113	1.60
114	-0.34
115	1.37
116	1.00
117	1.60
118	0.40
119	NA
120	1.60
121	1.37
122	-0.34

123	1.10
124	1.27
125	0.43
126	1.10
127	1.24
128	1.67
129	NA
130	-0.14
131	1.70
132	1.27
133	1.27
134	1.70
135	1.67
136	NA
137	1.27
138	1.24
139	0.43
140	1.10
141	-0.14
142	1.27
143	0.43
144	-0.14
145	1.27
146	NA
147	1.10
148	1.67
149	1.24
150	1.70
151	1.10
152	NA
153	0.43
154	1.27
155	1.24
156	1.70
157	1.27
158	-0.14
159	1.67
160	NA
161	1.27
162	1.67
163	1.70
164	0.43
165	1.24

166	-0.14
167	1.10
168	1.27
169	-0.14
170	1.70
171	1.27
172	NA
173	1.67
174	0.43
175	1.27
176	1.10
177	1.24
178	1.67
179	1.70
180	-0.14
181	1.10
182	NA
183	1.24
184	1.27
185	1.27
186	0.43
187	1.67
188	-0.14
189	0.43
190	1.27
191	1.70
192	1.24
193	1.27
194	1.10
195	NA
196	-0.14
197	1.24
198	1.67
199	NA
200	1.27
201	1.27
202	1.10
203	0.43
204	1.70
205	1.70
206	0.43
207	NA
208	1.10

209	-0.14
210	1.27
211	1.27
212	1.24
213	1.67
214	1.70
215	1.27
216	1.27
217	NA
218	1.24
219	1.67
220	1.10
221	0.43
222	-0.14
223	1.67
224	0.43
225	1.10
226	1.70
227	-0.14
228	1.27
229	1.24
230	NA
231	1.27
232	0.30
233	0.43
234	2.00
235	-0.28
236	3.07
237	0.30
238	NA
239	1.03
240	1.50
241	3.07
242	-0.28
243	0.30
244	3.07
245	NA
246	2.00
247	1.50
248	3.07
249	1.03
250	0.30
251	0.43

252	0.43
253	-0.28
254	NA
255	0.30
256	2.00
257	1.50
258	0.30
259	1.03
260	3.07
261	3.07
262	0.30
263	1.50
264	3.07
265	NA
266	1.03
267	0.43
268	2.00
269	-0.28
270	0.30
271	3.07
272	0.43
273	2.00
274	0.30
275	1.03
276	1.50
277	3.07
278	NA
279	0.30
280	-0.28
281	3.07
282	NA
283	0.30
284	3.07
285	0.43
286	1.03
287	1.50
288	-0.28
289	0.30
290	3.07
291	2.00
292	0.30
293	3.07
294	0.43

295	1.50
296	0.30
297	-0.28
298	1.03
299	NA
300	3.07
301	2.00
302	0.43
303	3.07
304	2.00
305	3.07
306	NA
307	-0.28
308	1.03
309	0.30
310	0.30
311	1.50
312	NA
313	3.07
314	1.03
315	2.00
316	0.30
317	1.50
318	3.07
319	0.43
320	0.30
321	-0.28
322	NA
323	1.50
324	3.07
325	2.00
326	-0.28
327	0.43
328	0.30
329	1.03
330	3.07
331	0.30
332	3.07
333	0.30
334	1.03
335	-0.28
336	0.43
337	NA

338	3.07
339	0.30
340	1.50
341	2.00
342	-0.28
343	1.03
344	0.30
345	1.50
346	3.07
347	2.00
348	3.07
349	0.30
350	NA
351	0.43
352	3.07
353	0.43
354	0.30
355	1.50
356	0.30
357	NA
358	2.00
359	-0.28
360	1.03
361	3.07
362	0.30
363	-0.28
364	1.50
365	0.43
366	0.30
367	1.03
368	3.07
369	NA
370	3.07
371	2.00
372	0.30
373	1.50
374	-0.28
375	3.07
376	NA
377	3.07
378	2.00
379	1.03
380	0.30

381	0.43
382	0.43
383	0.30
384	3.07
385	0.30
386	-0.28
387	1.03
388	NA
389	3.07
390	1.50
391	2.00
392	0.30
393	1.50
394	0.43
395	3.07
396	-0.28
397	3.07
398	0.30
399	NA
400	2.00
401	1.03
402	0.43
403	1.50
404	NA
405	0.30
406	2.00
407	1.03
408	-0.28
409	0.30
410	3.07
411	3.07
412	0.30
413	3.07
414	0.30
415	0.43
416	NA
417	2.00
418	-0.28
419	1.50
420	1.03
421	3.07
422	-0.28
423	0.30

424	NA
425	3.07
426	2.00
427	1.03
428	3.07
429	0.30
430	1.50
431	0.43
432	3.07
433	0.30
434	NA
435	0.43
436	2.00
437	3.07
438	-0.28
439	1.50
440	0.30
441	1.03
442	-0.28
443	0.30
444	2.00
445	0.43
446	1.50
447	3.07
448	3.07
449	0.30
450	1.03
451	NA
452	NA
453	0.43
454	3.07
455	-0.28
456	0.30
457	0.30
458	3.07
459	1.03
460	1.50
461	2.00
462	3.07
463	NA
464	3.07
465	2.00
466	0.43

467	1.03
468	0.30
469	1.50
470	-0.28
471	0.30

Methods

we used machine learning methods to assess how much information different sets of variables (c.f. `P_var_sets`) have each on the dependent variable (Puptake, Y-rel, P-balance), how redundant this information is. The machine learning methods to quantify the predictive power of different variable sets are: i) ordinary least squares (OLS) as a baseline; ii) XGBoost (gradient boosting with tree-based models and hyperparameter tuning for learning rate and tree depth) (arxiv:1603.02754); iii) Random Forests (with default parameters) (doi:10.1023/A:1010933404324). Computations were performed using the `mlr3` framework (doi:10.21105/joss.01903). Performance was measured as percentage of explained variance on hold-out data via 5-fold cross-validation, calculated as $(1 - \text{MSE}/\text{Variance}(y))$, where MSE represents mean squared error.

We tried adjusting for weather variables but it seems that the ML-methods rather reconstruct the site-specific patterns....