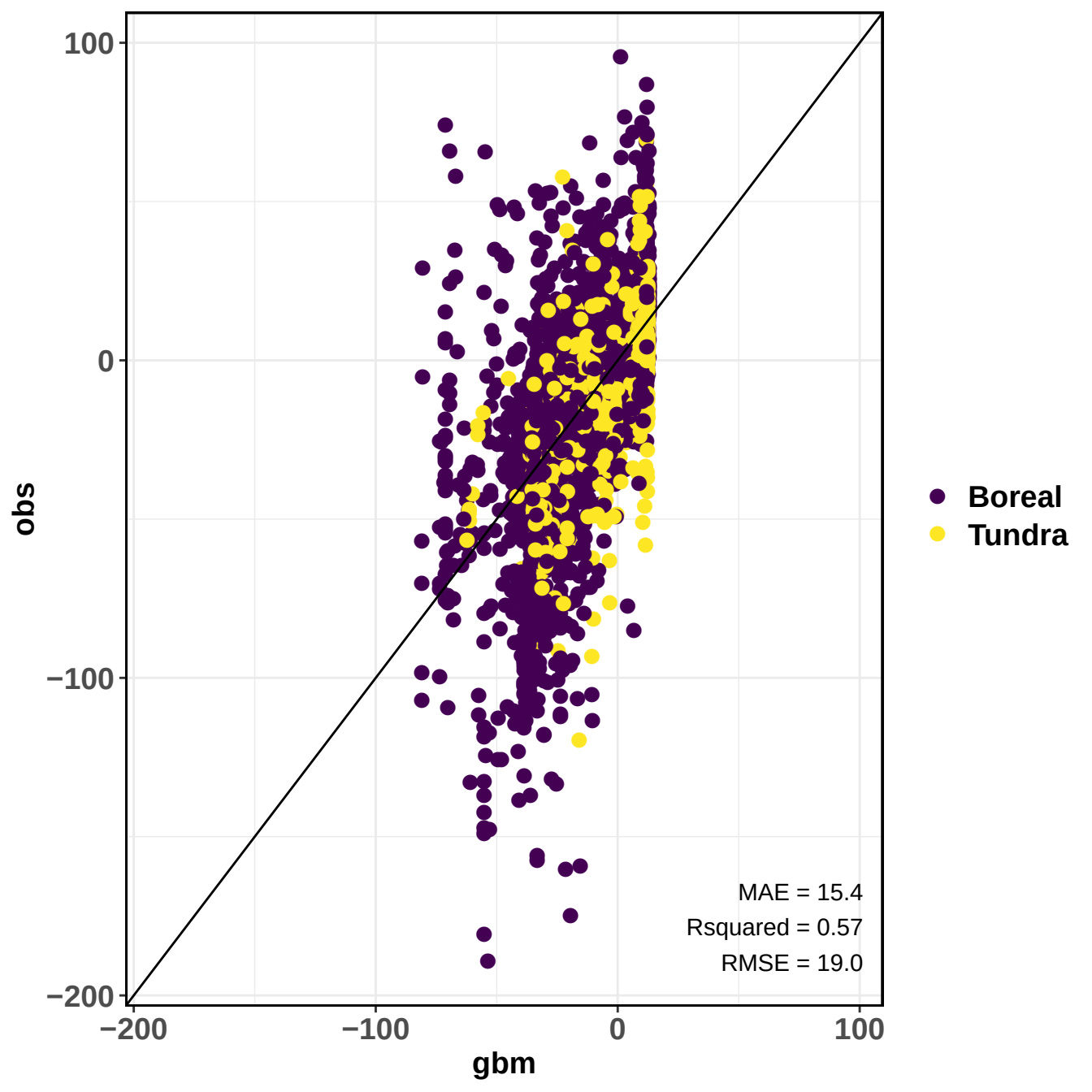
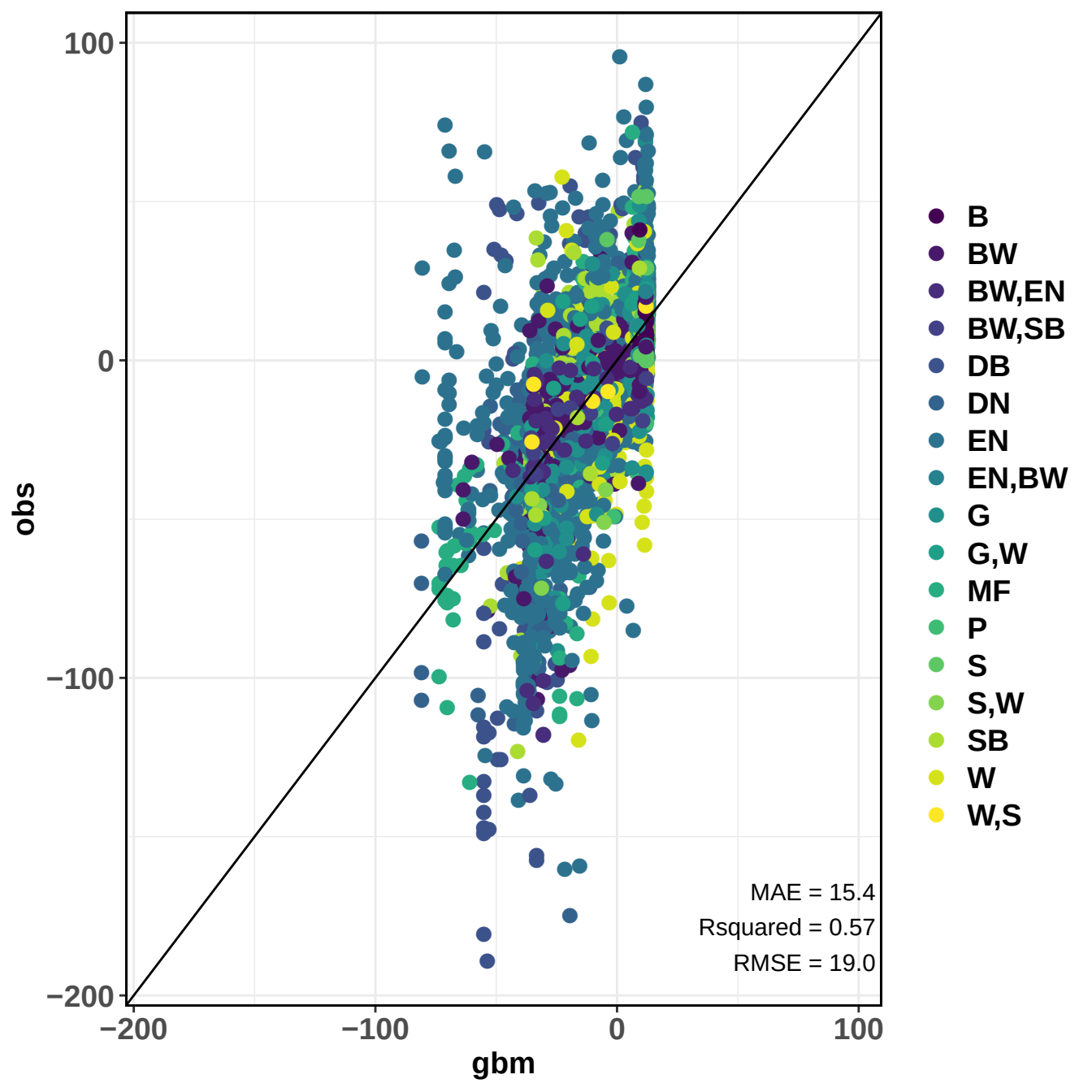
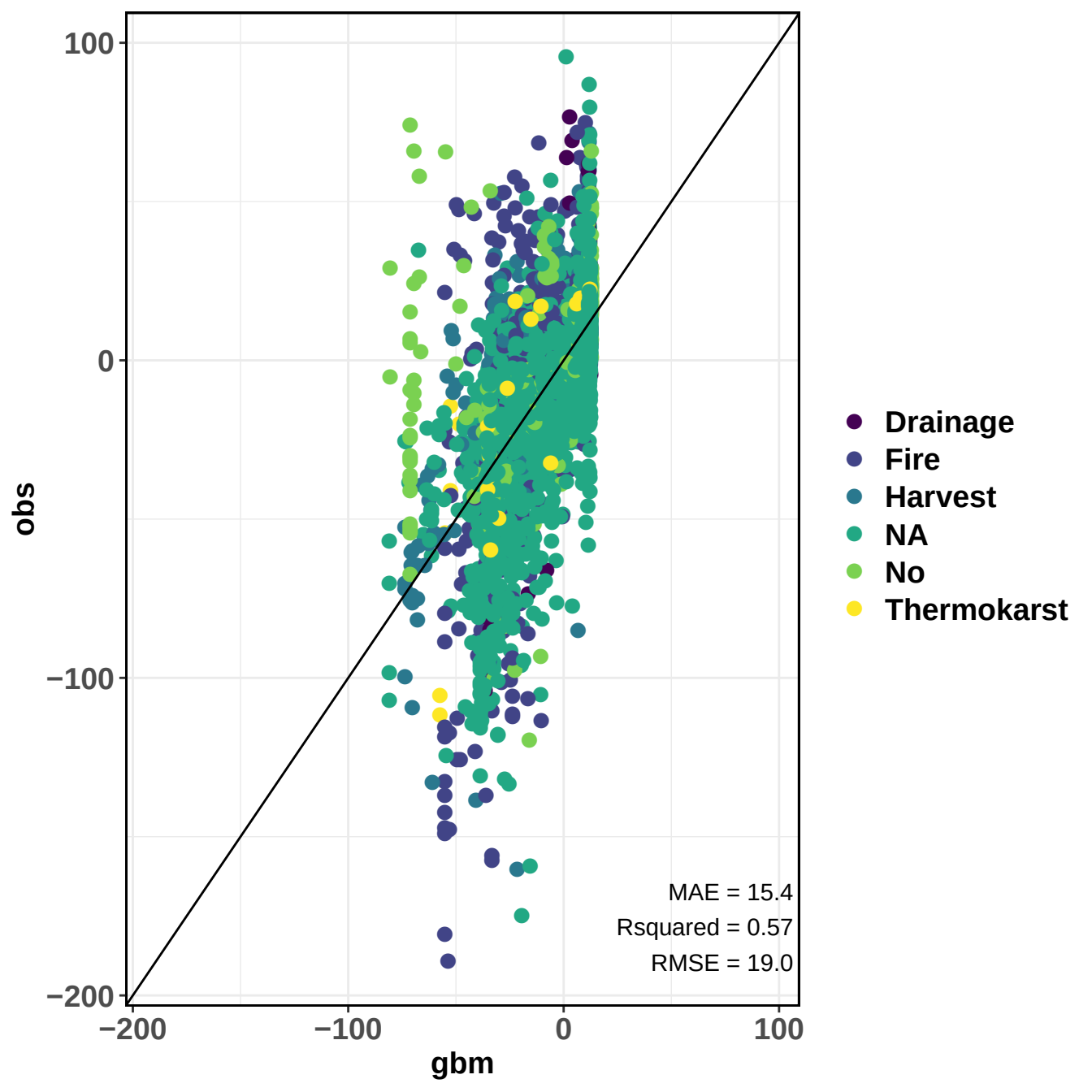
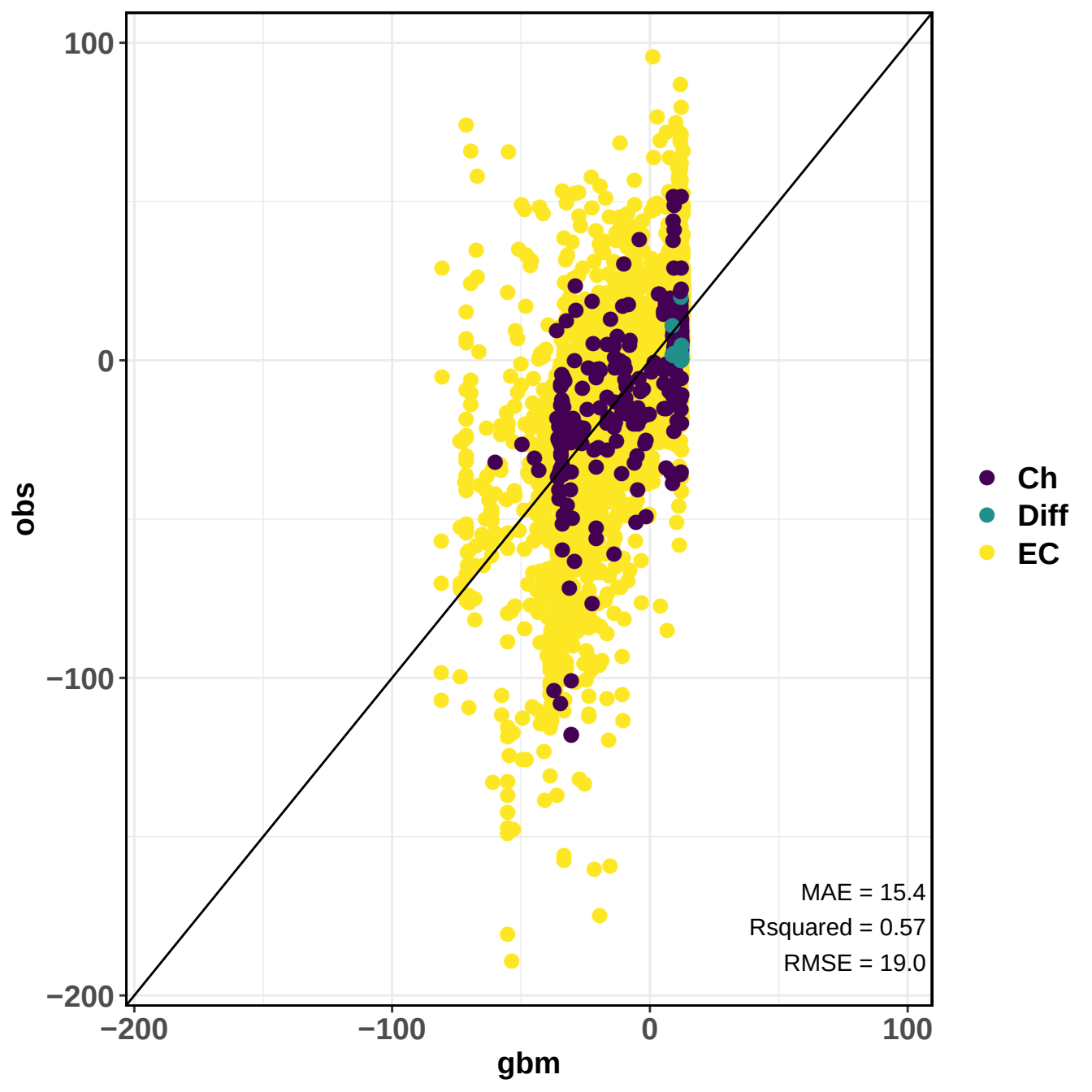
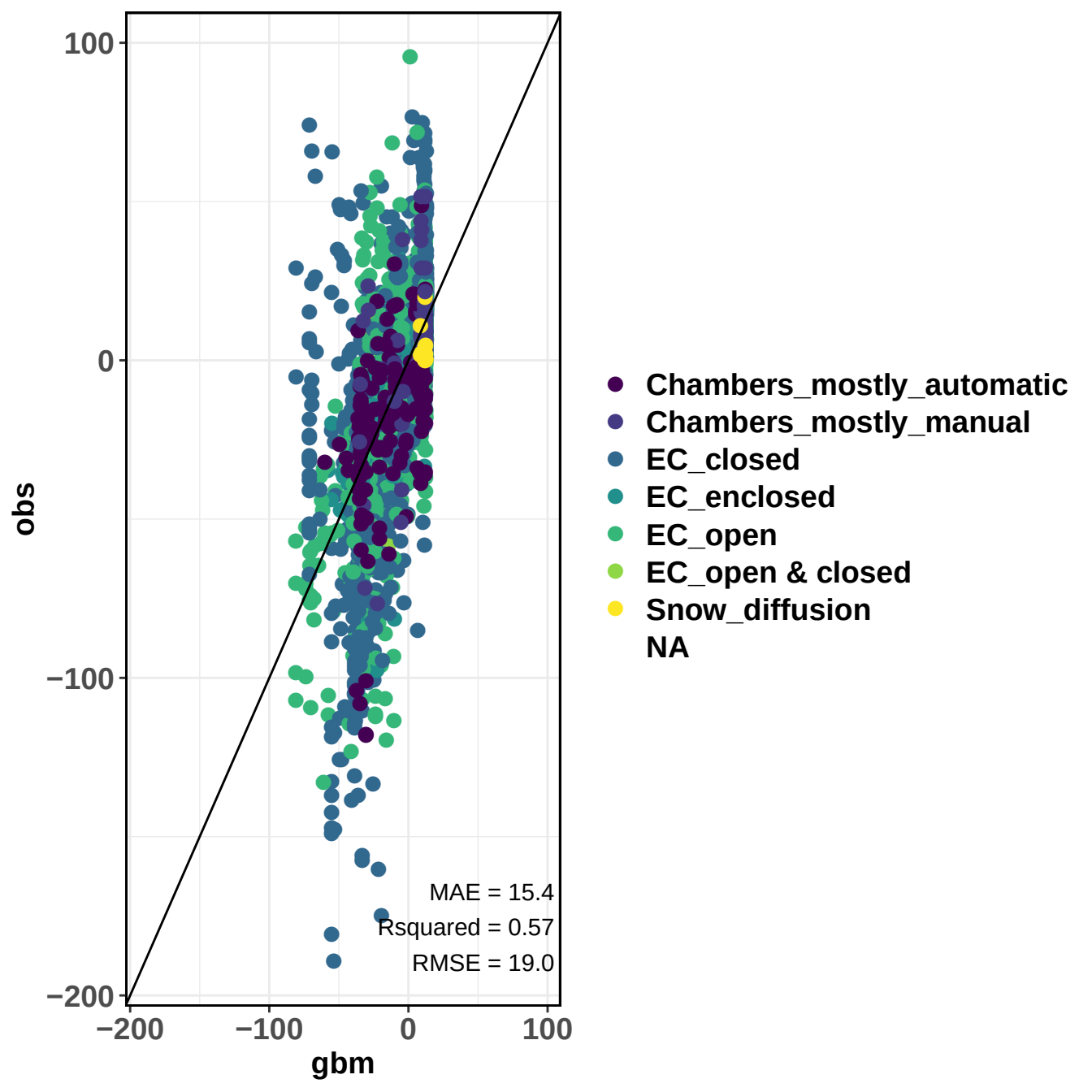
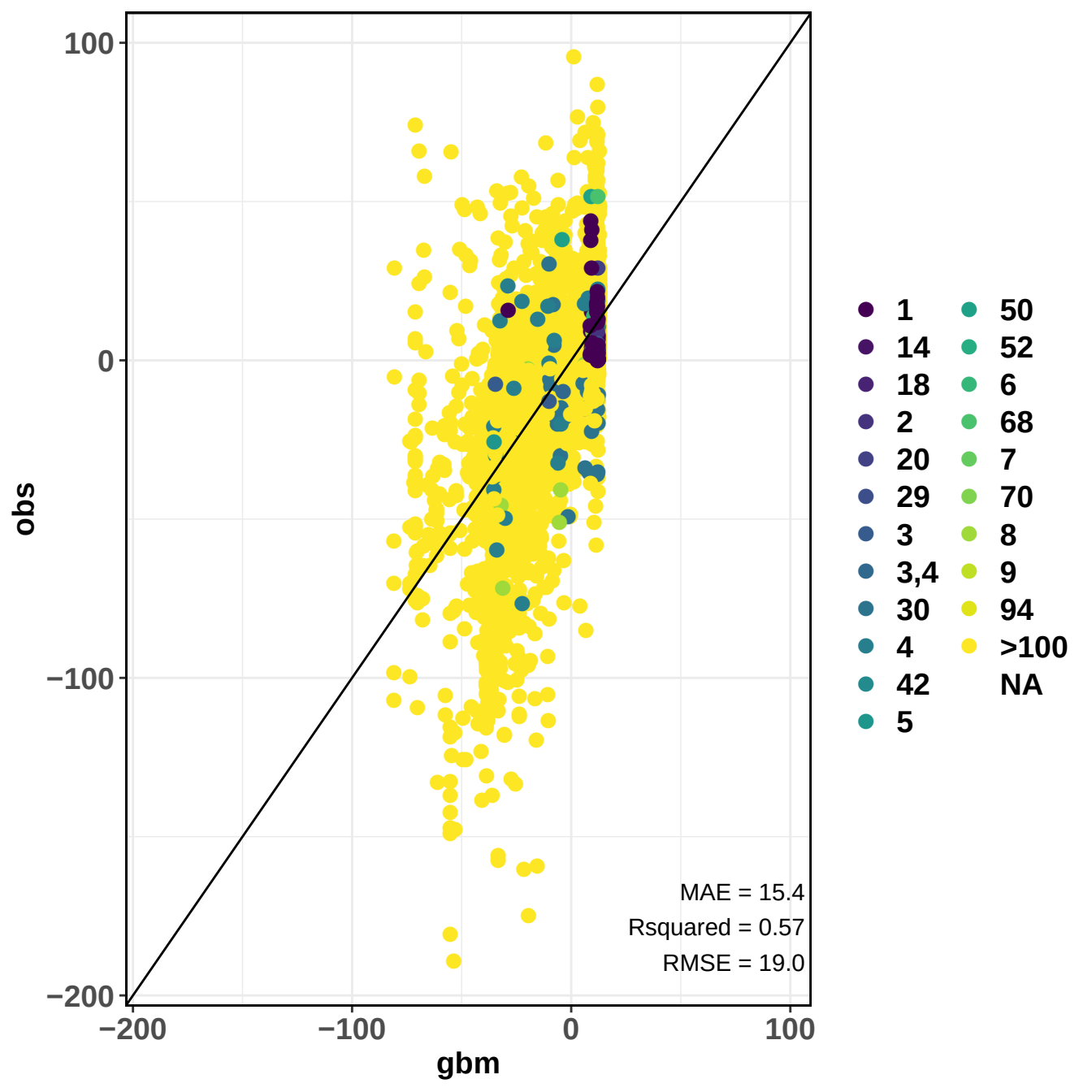

100
0
−100
−200
obs
−200
−100
0
100
gbm
MAE = 15.4
Rsquared = 0.57
RMSE = 19.0
Boreal
Tundra

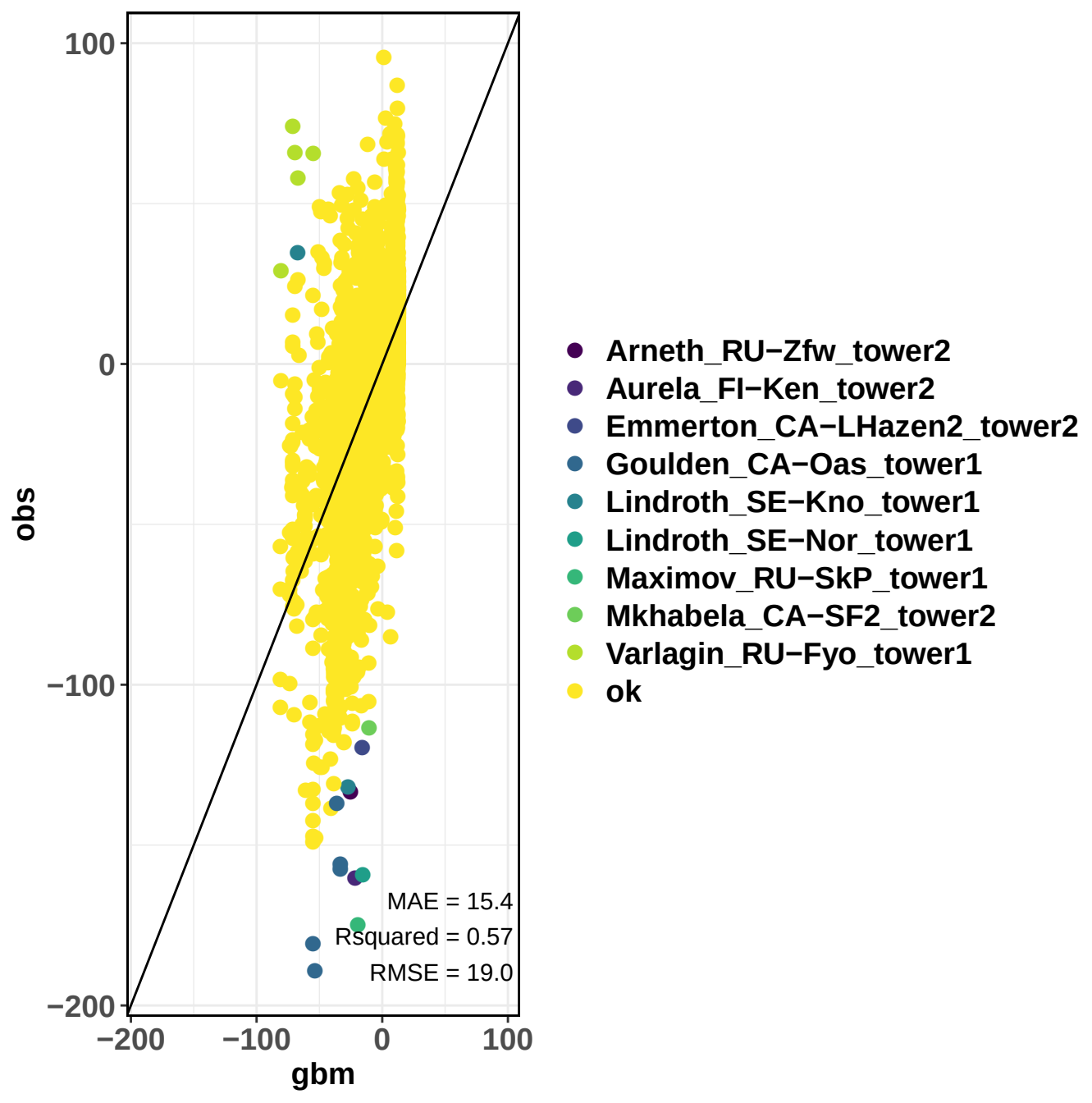

100
0
−100
−200
obs
−200
−100
0
100
gbm
MAE = 15.4
Rsquared = 0.57
RMSE = 19.0
B
BW
BW,EN
BW,SB
DB
DN
EN
EN,BW
G
G,W
MF
P
S
S,W
SB
W
W,S

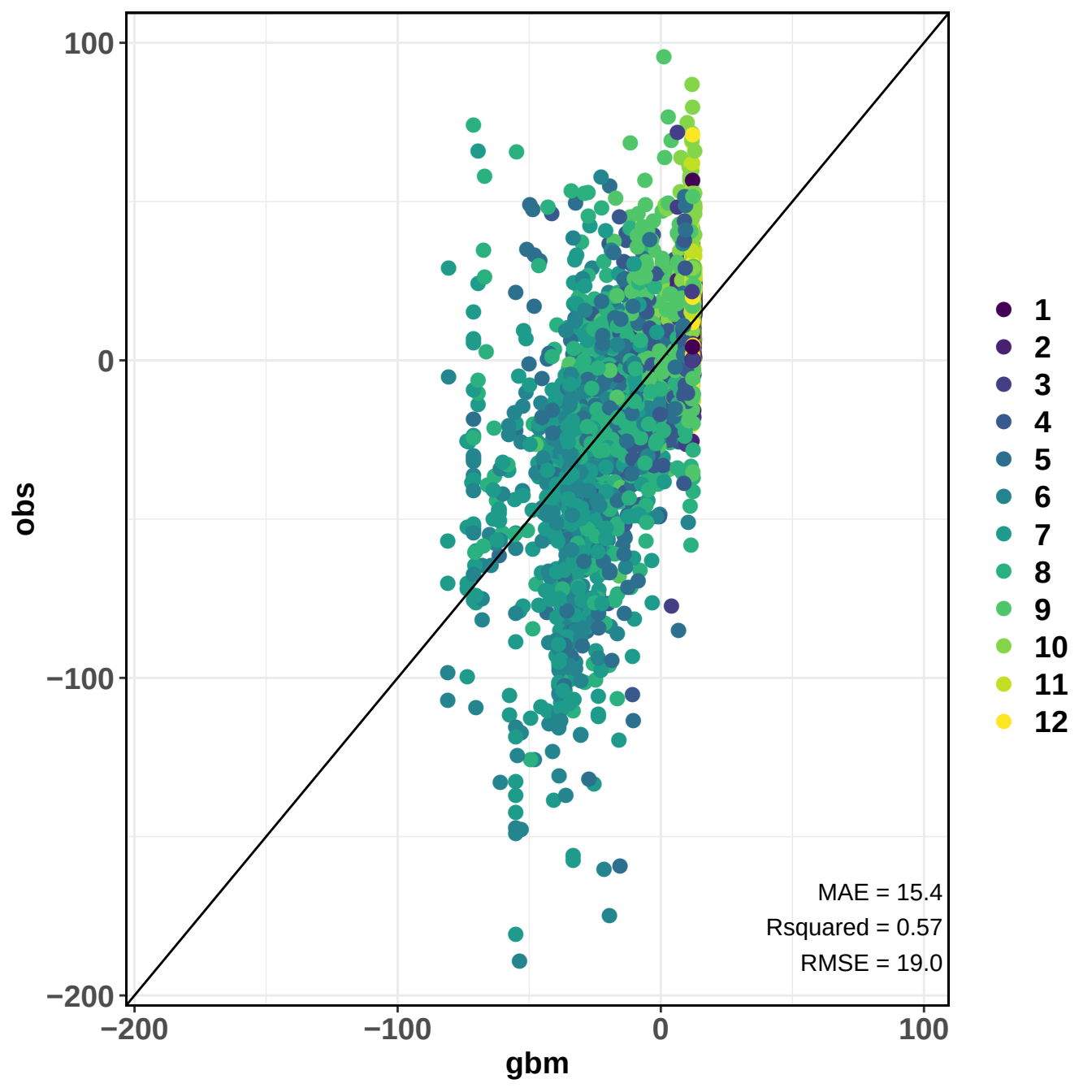

100
0
−100
−200
obs
−200
−100
0
100
gbm
MAE = 15.4
Rsquared = 0.57
RMSE = 19.0
Drainage
Fire
Harvest
NA
No
Thermokarst

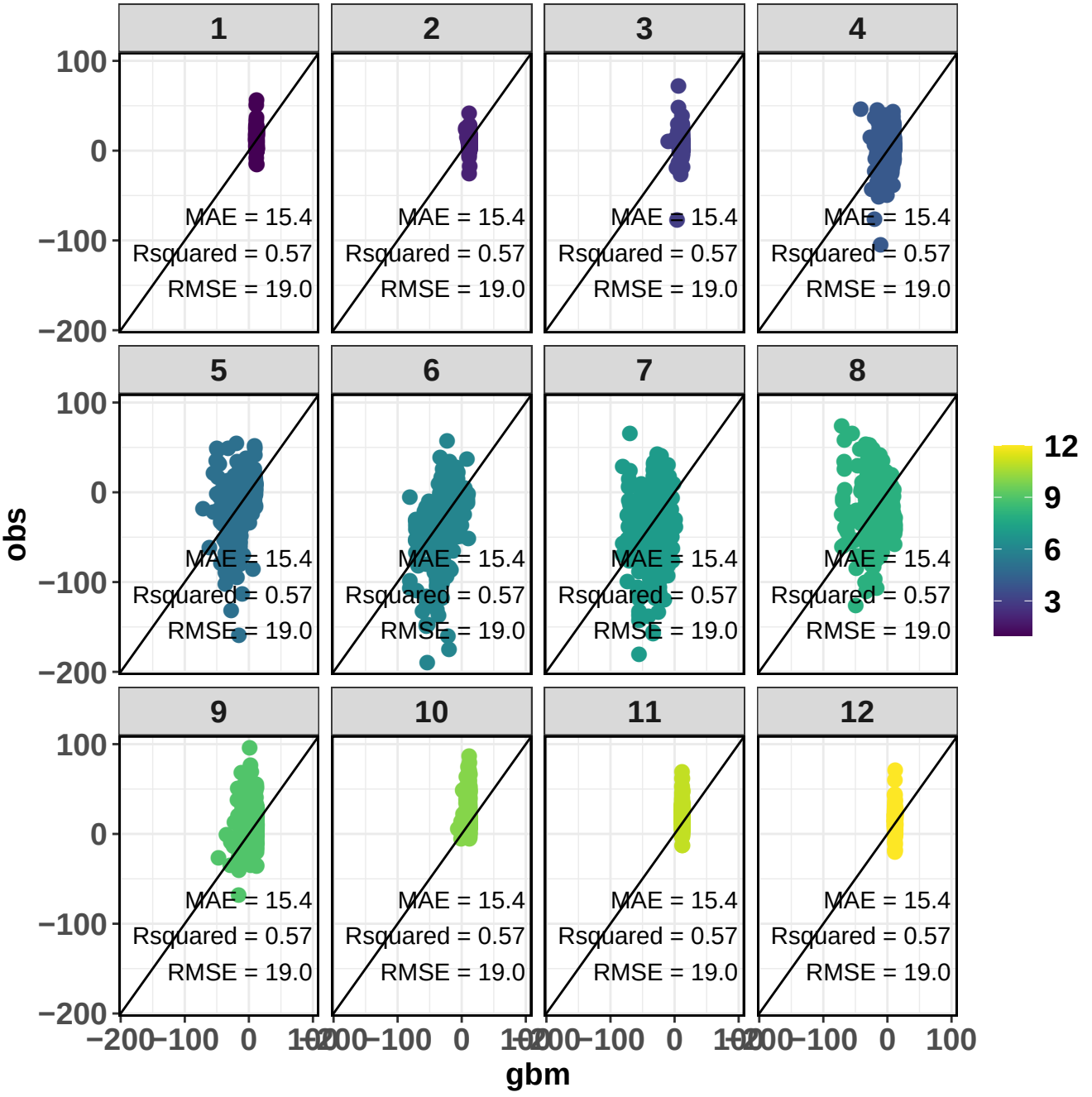

100
0
−100
−200
obs
−200
−100
0
100
gbm
MAE = 15.4
Rsquared = 0.57
RMSE = 19.0
Ch
Diff
EC

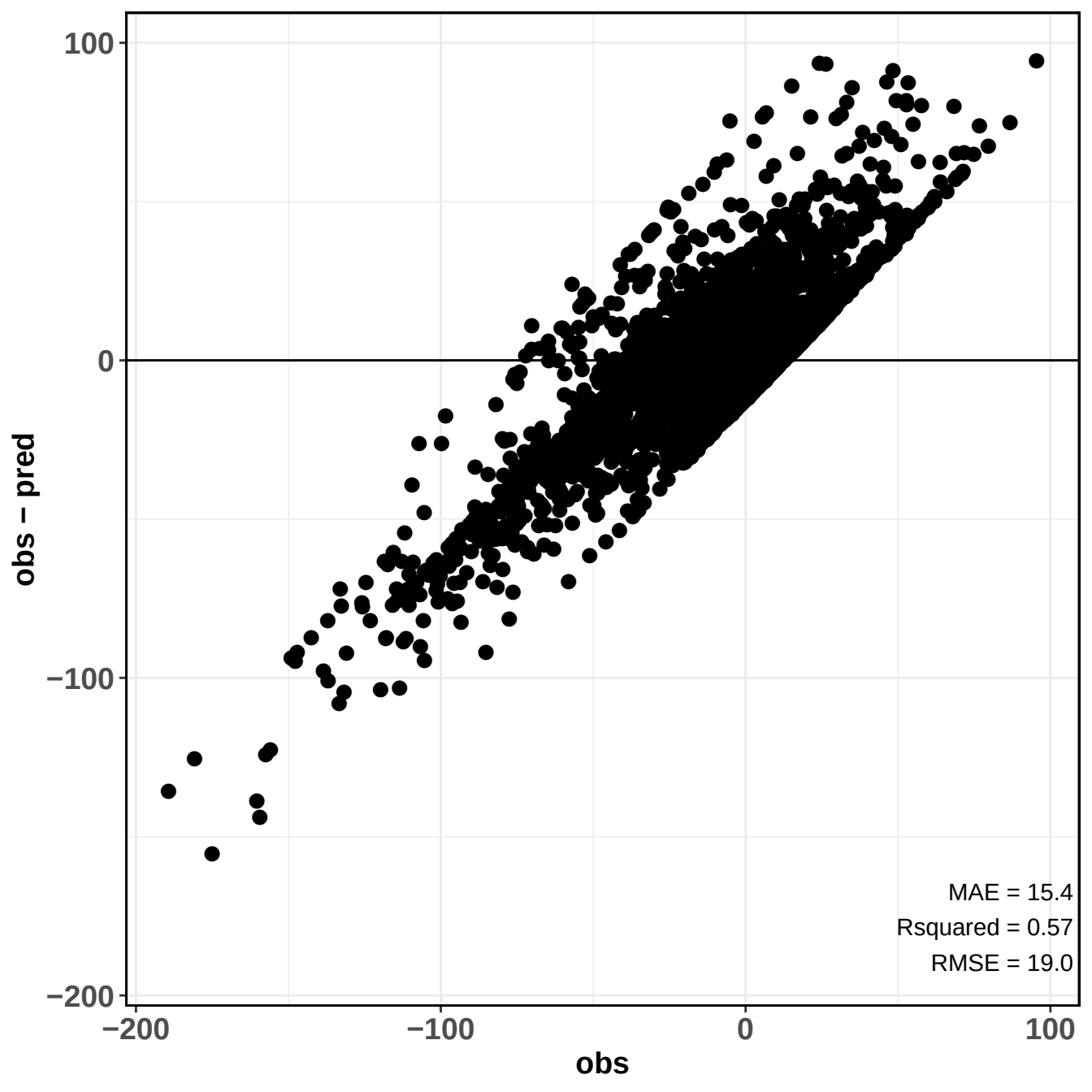

100
0
−100
−200
obs
−200
−100
0
100
gbm
MAE = 15.4
Rsquared = 0.57
RMSE = 19.0
Chambers_mostly_automatic
Chambers_mostly_manual
EC_closed
EC_enclosed
EC_open
EC_open & closed
Snow_diffusion
NA

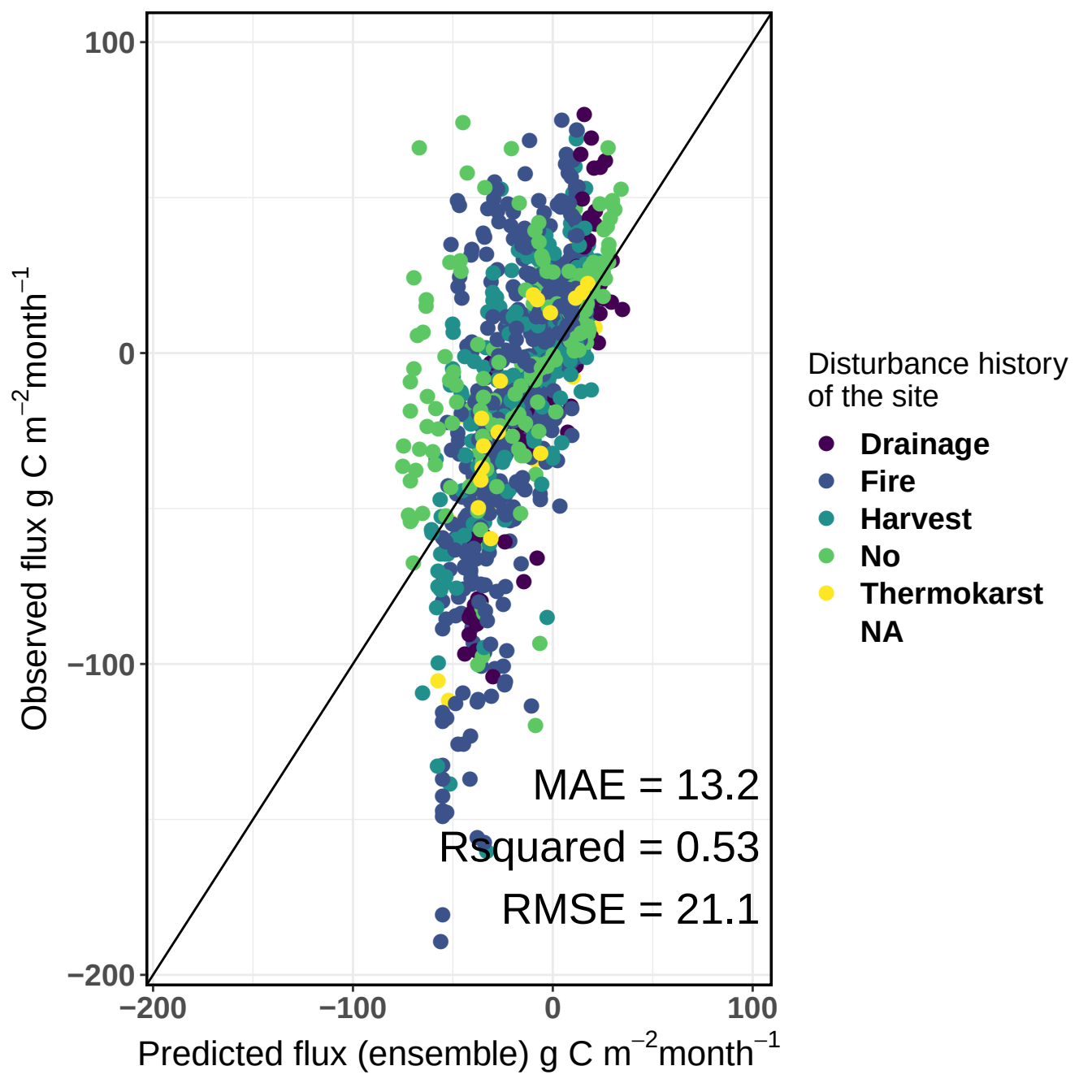

100
0
−100
−200
obs
−200
−100
0
100
gbm
MAE = 15.4
Rsquared = 0.57
RMSE = 19.0
1
14
18
2
20
29
3
3,4
30
4
42
5
50
52
6
68
7
70
8
9
94
>100
NA

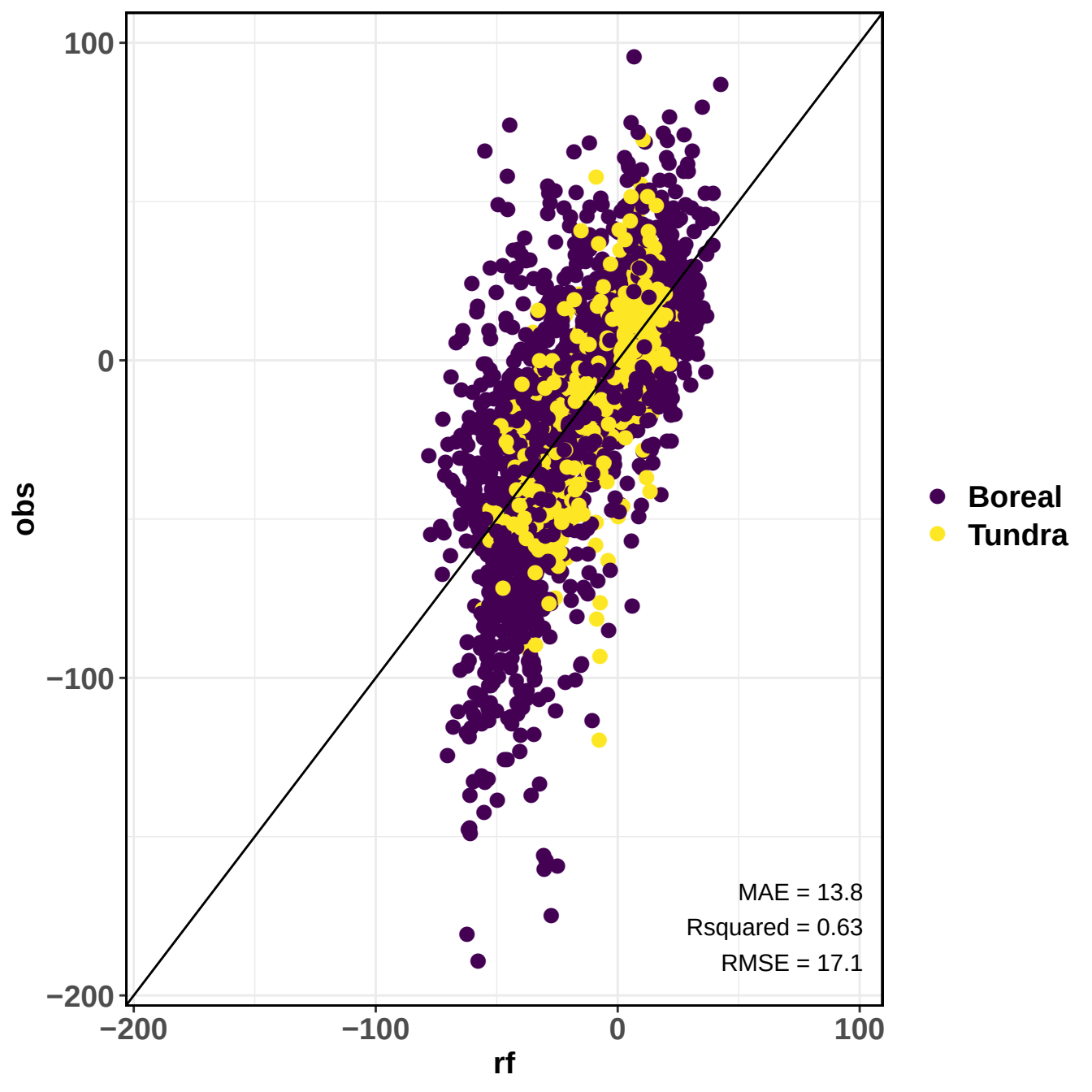

100
0
−100
−200
obs
−200
−100
0
100
gbm
MAE = 15.4
Rsquared = 0.57
RMSE = 19.0
Arneth_RU−Zfw_tower2
Aurela_FI−Ken_tower2
Emmerton_CA−LHazen2_tower2
Goulden_CA−Oas_tower1
Lindroth_SE−Kno_tower1
Lindroth_SE−Nor_tower1
Maximov_RU−SkP_tower1
Mkhabela_CA−SF2_tower2
Varlagin_RU−Fyo_tower1
ok

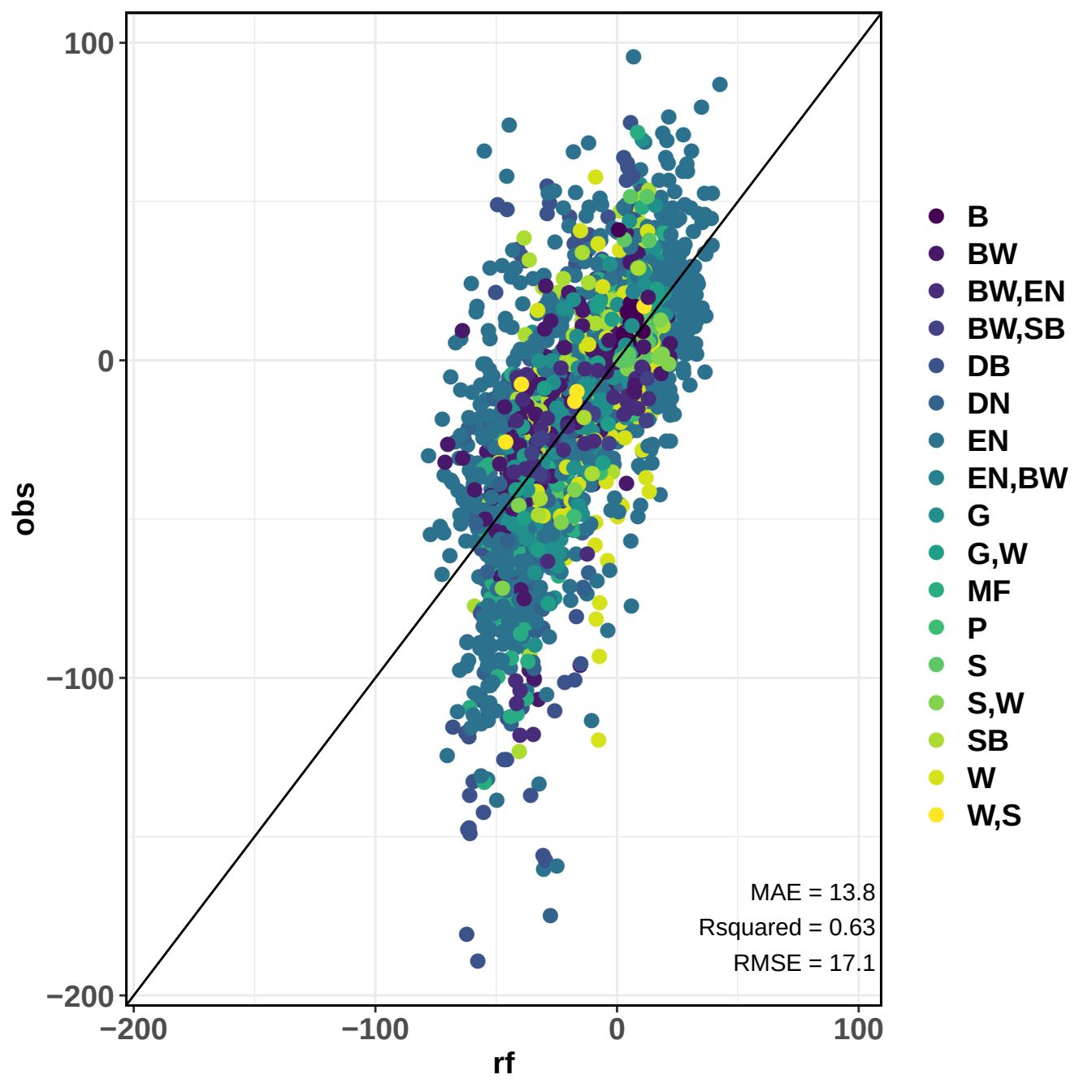

100
0
−100
−200
obs
−200
−100
0
100
gbm
MAE = 15.4
Rsquared = 0.57
RMSE = 19.0
1
2
3
4
5
6
7
8
9
10
11
12

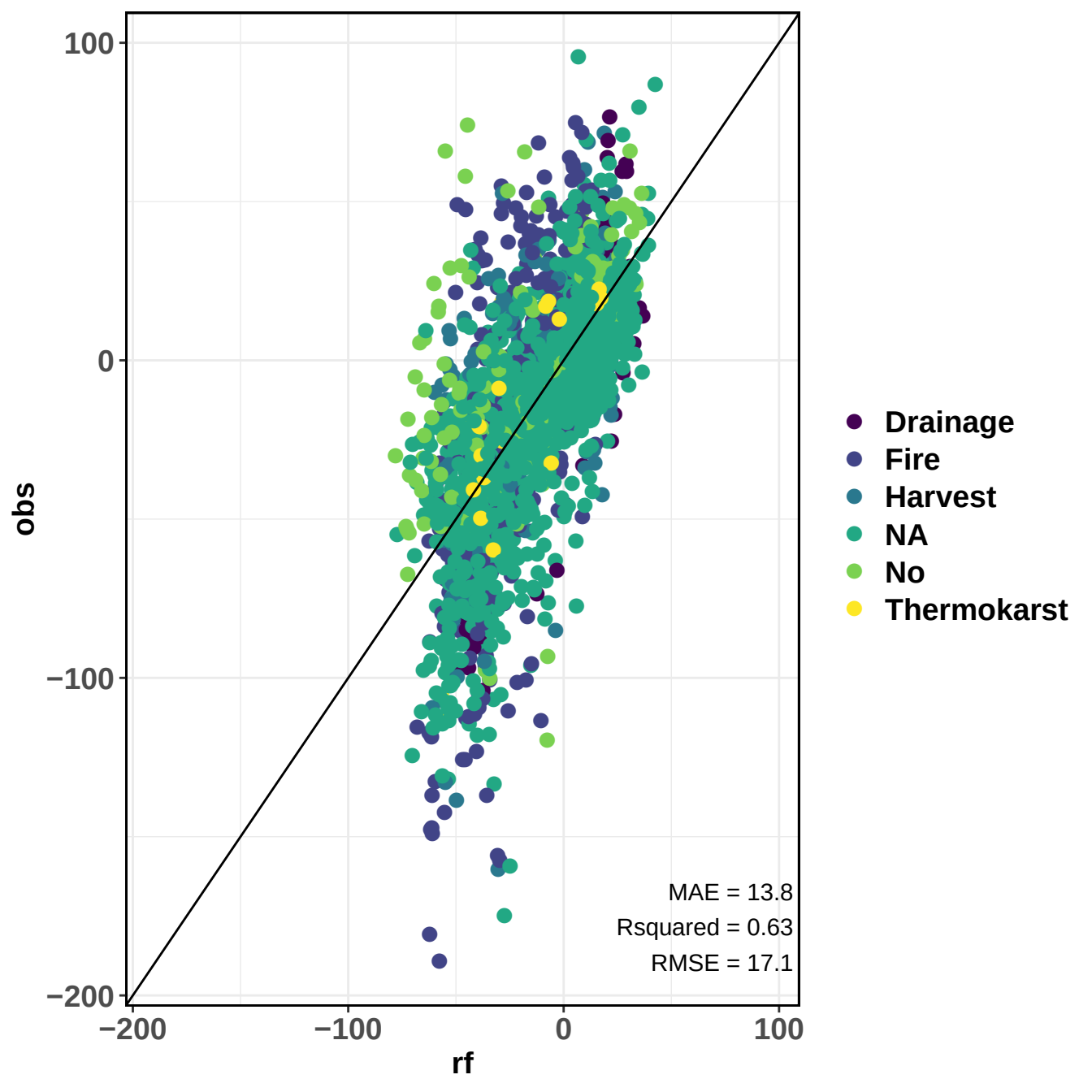

1
2
3
4
5
6
7
8
9
10
11
12
MAE = 15.4
Rsquared = 0.57
RMSE = 19.0
obs
gbm
100
0
−100
−200
12
9
6
3

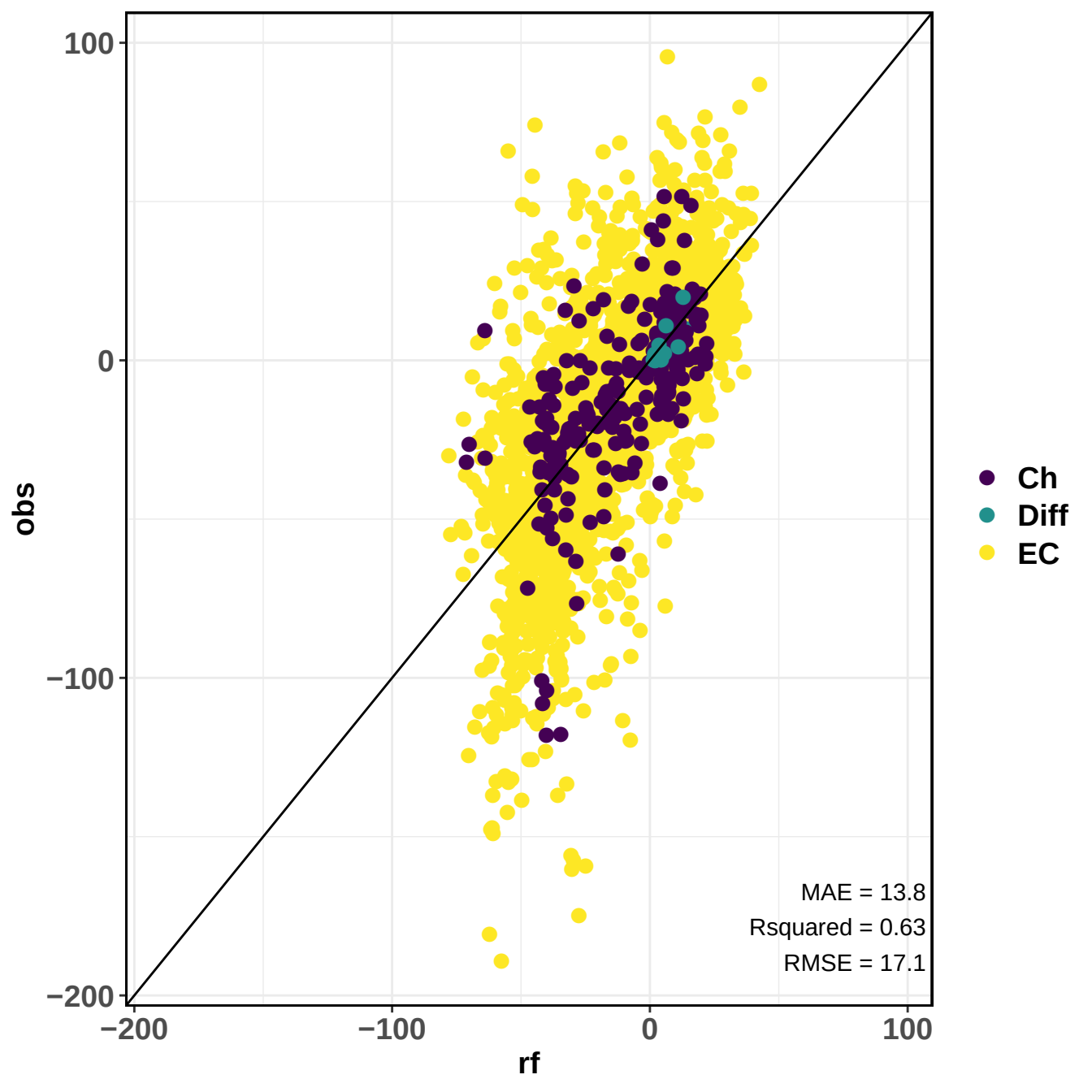

100
0
−100
−200
obs − pred
−200
−100
0
100
obs
MAE = 15.4
Rsquared = 0.57
RMSE = 19.0

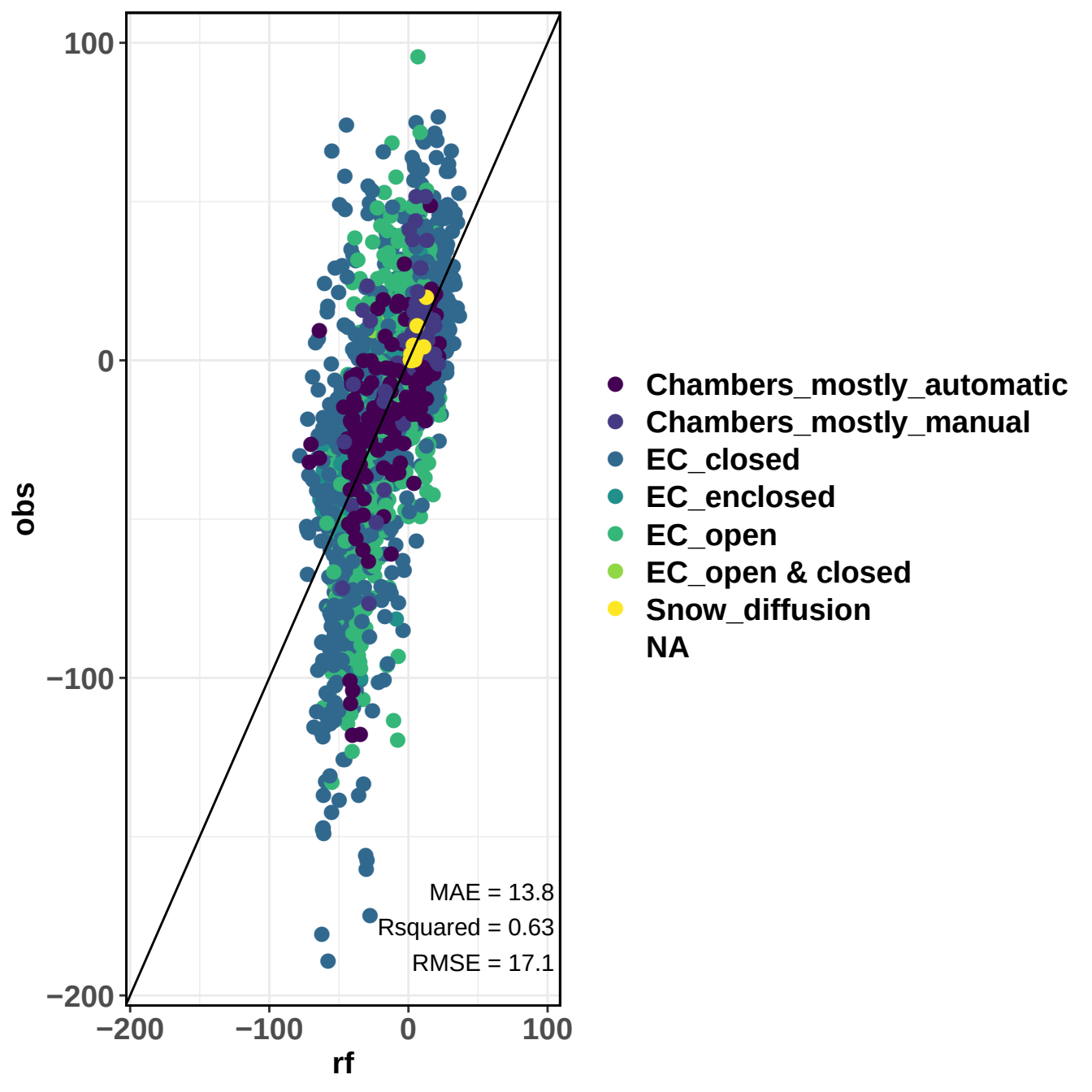

100
0
−100
−200
−200
−100
0
100
Observed flux g C m−2month−1
Predicted flux (ensemble) g C m−2month−1
MAE = 13.2
Rsquared = 0.53
RMSE = 21.1
Disturbance history of the site
Drainage
Fire
Harvest
No
Thermokarst
NA

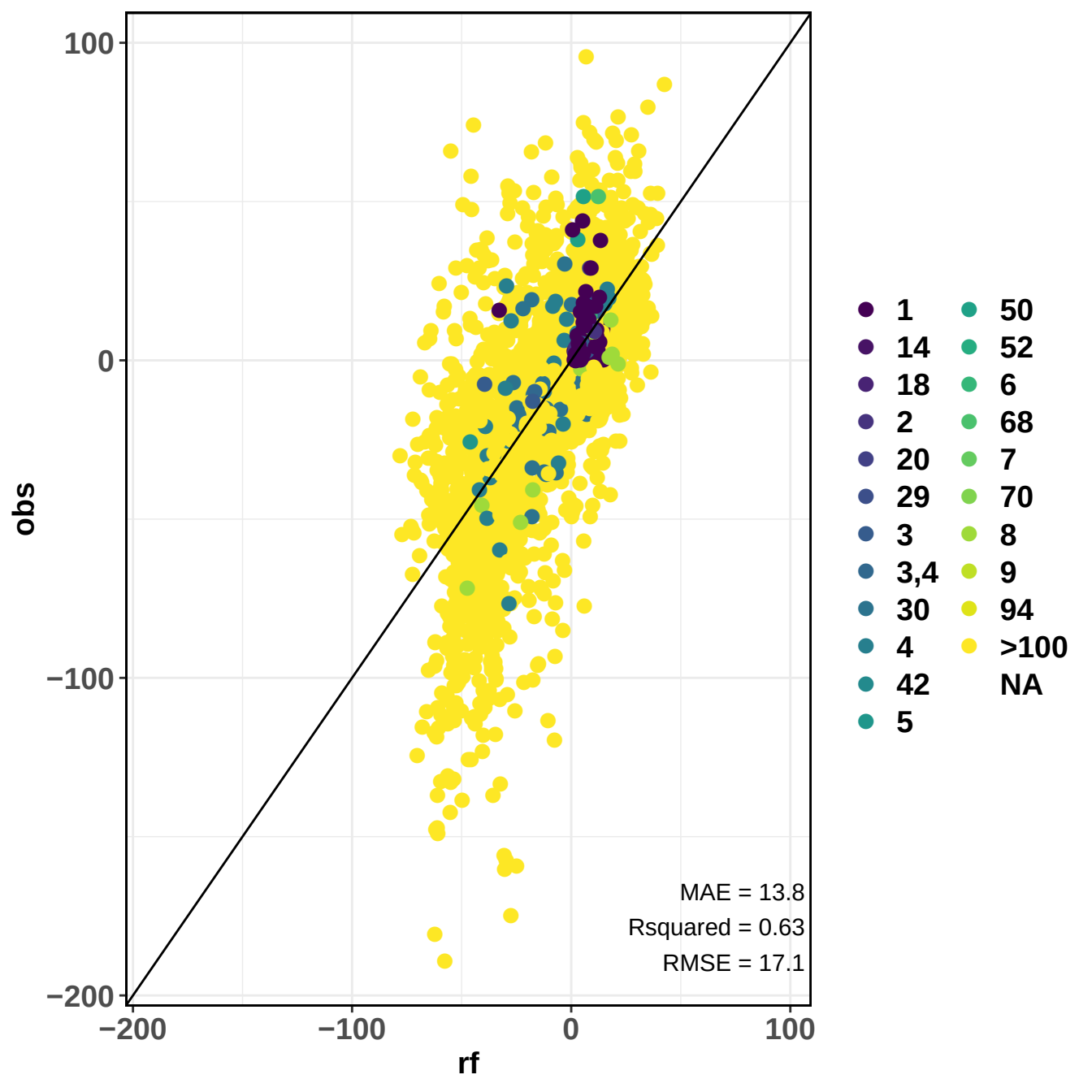

100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.8
Rsquared = 0.63
RMSE = 17.1
Boreal
Tundra

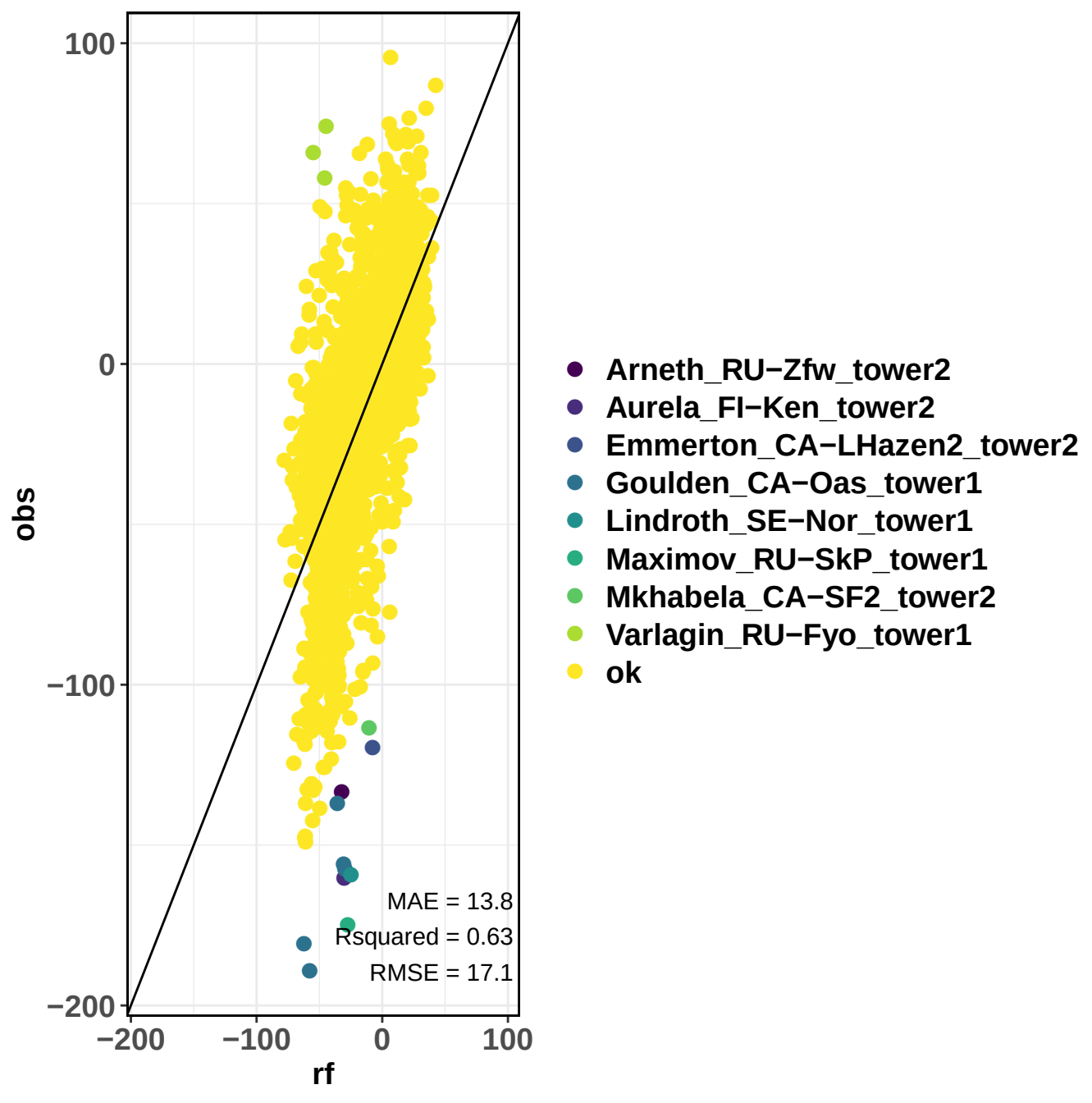

100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.8
Rsquared = 0.63
RMSE = 17.1
B
BW
BW,EN
BW,SB
DB
DN
EN
EN,BW
G
G,W
MF
P
S
S,W
SB
W
W,S

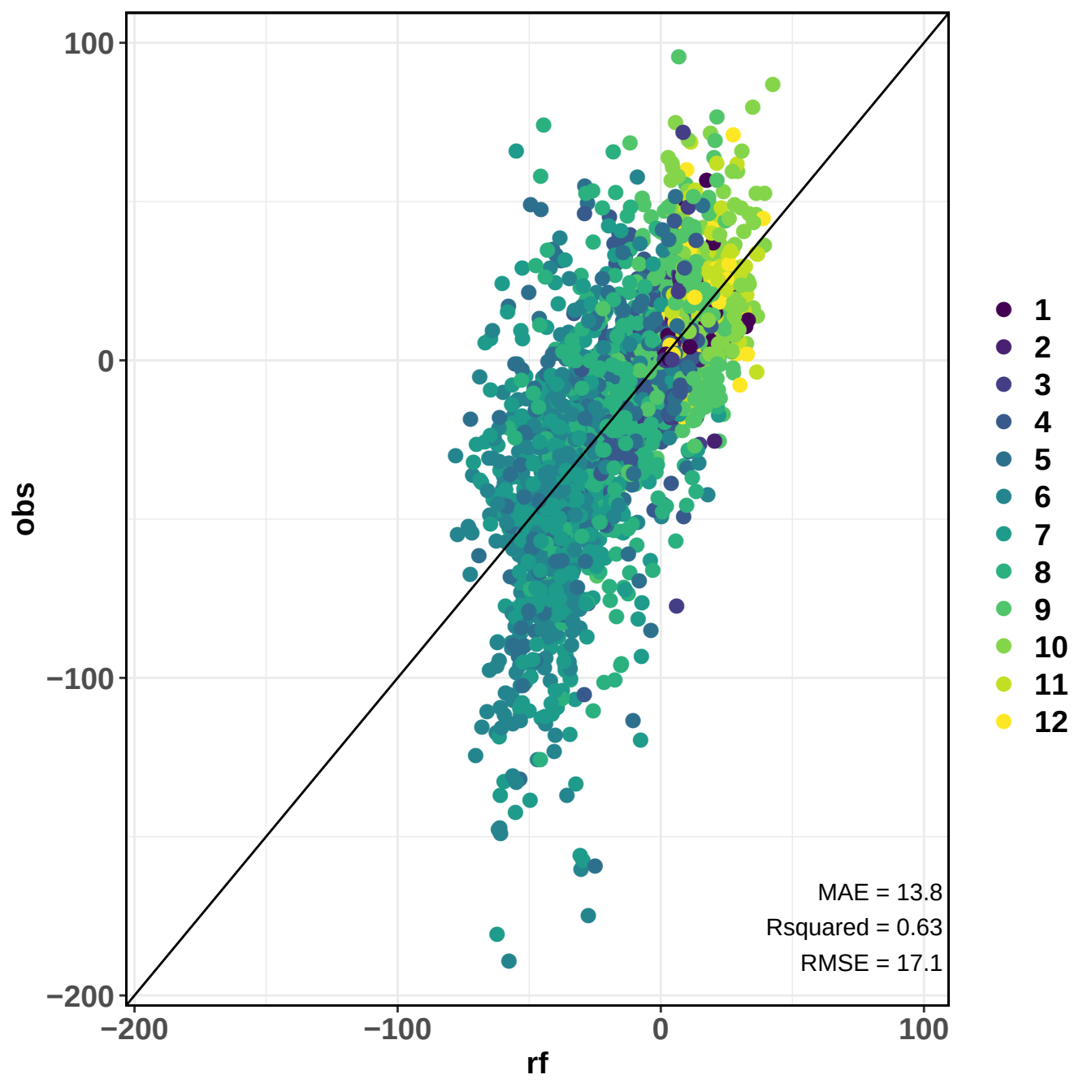

100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.8
Rsquared = 0.63
RMSE = 17.1
Drainage
Fire
Harvest
NA
No
Thermokarst

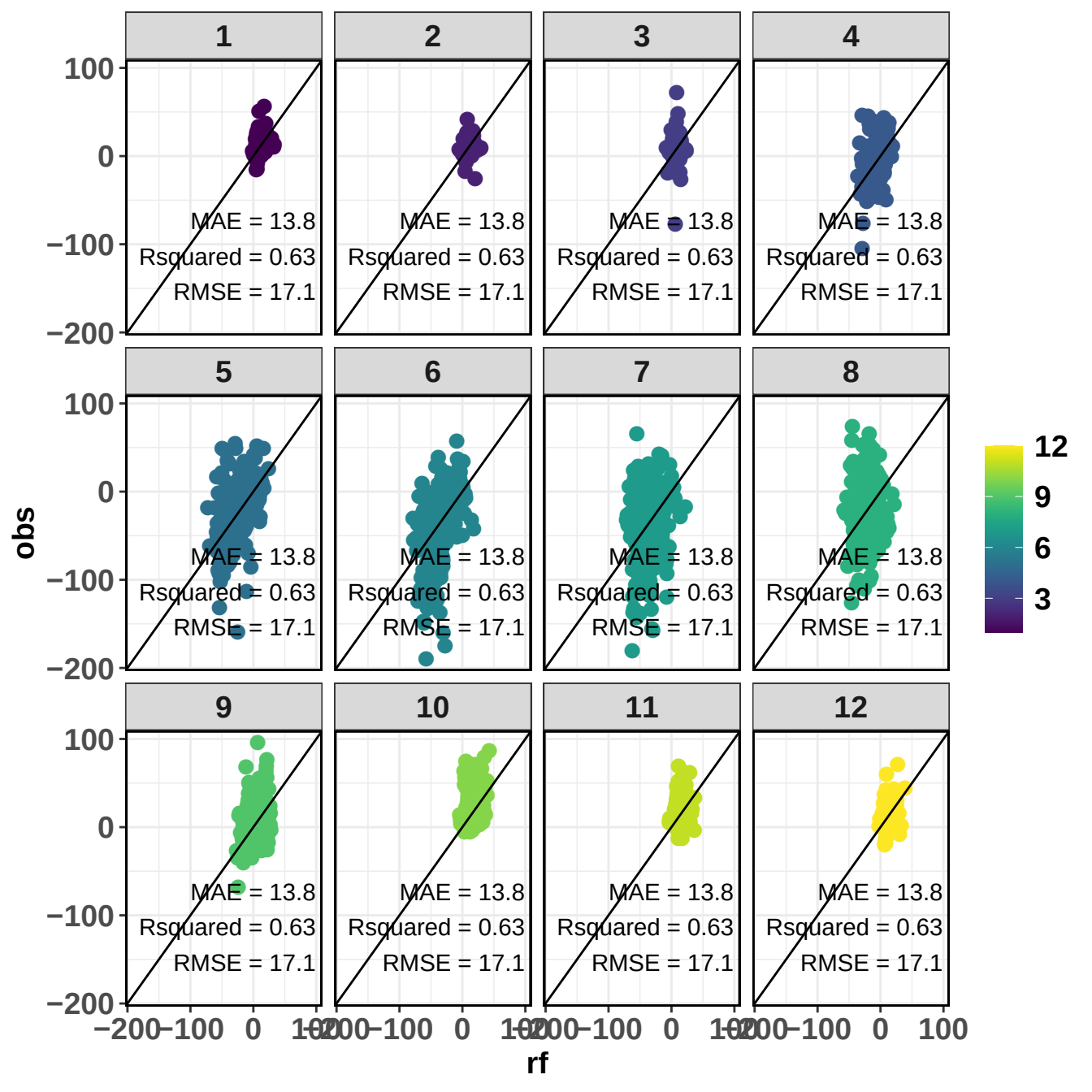

100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.8
Rsquared = 0.63
RMSE = 17.1
Ch
Diff
EC

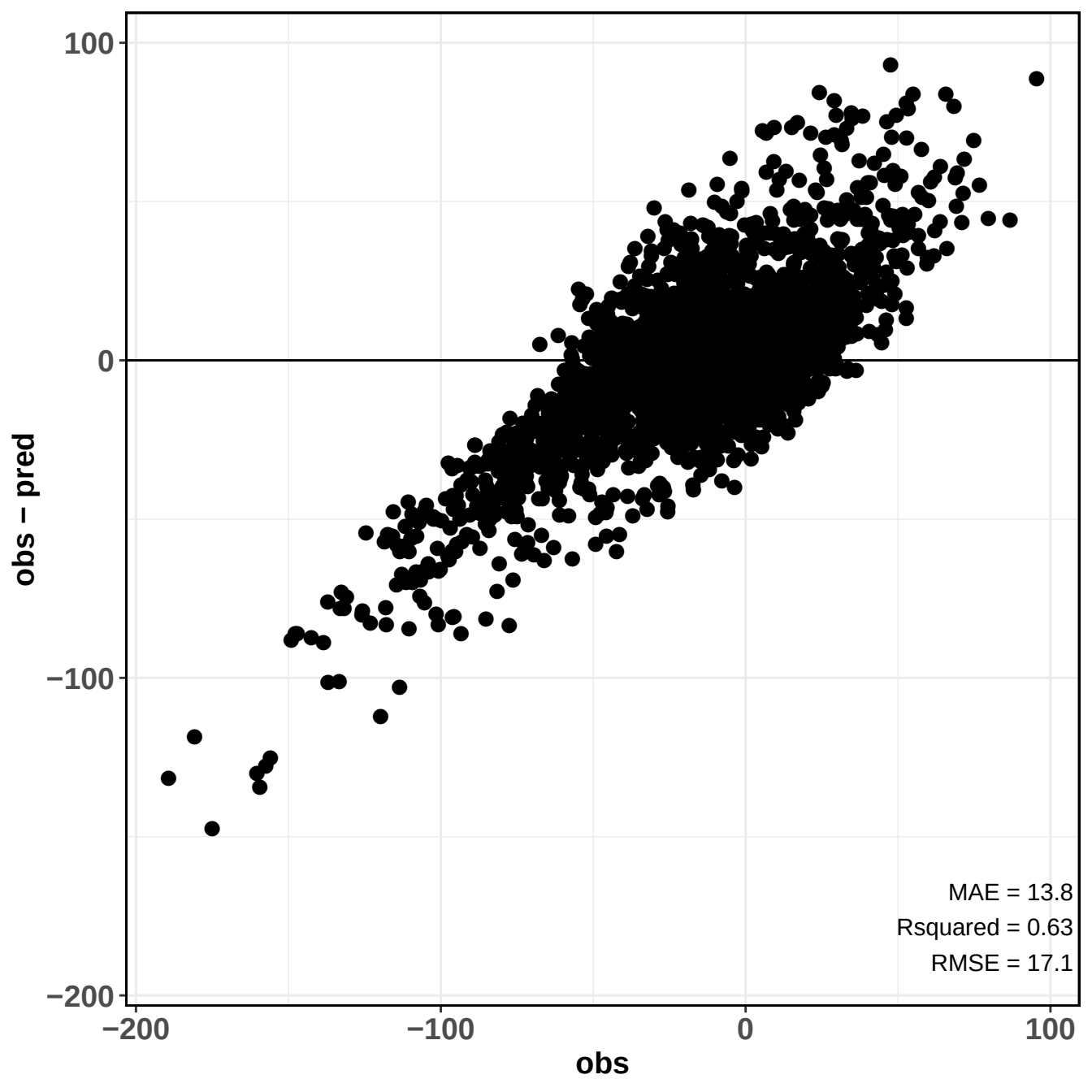

100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.8
Rsquared = 0.63
RMSE = 17.1
Chambers_mostly_automatic
Chambers_mostly_manual
EC_closed
EC_enclosed
EC_open
EC_open & closed
Snow_diffusion
NA

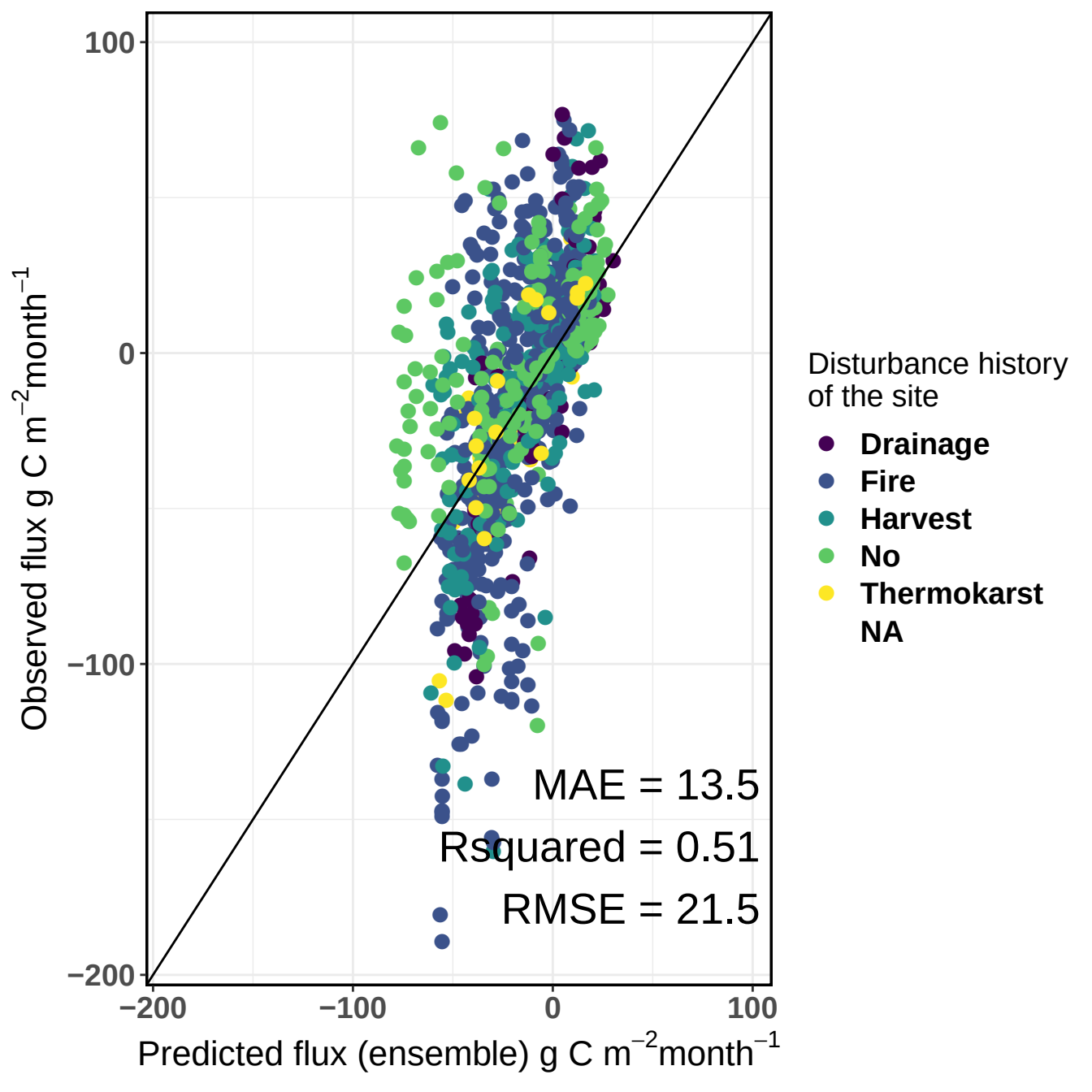

100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.8
Rsquared = 0.63
RMSE = 17.1
1
14
18
2
20
29
3
3,4
30
4
42
5
50
52
6
68
7
70
8
9
94
>100
NA

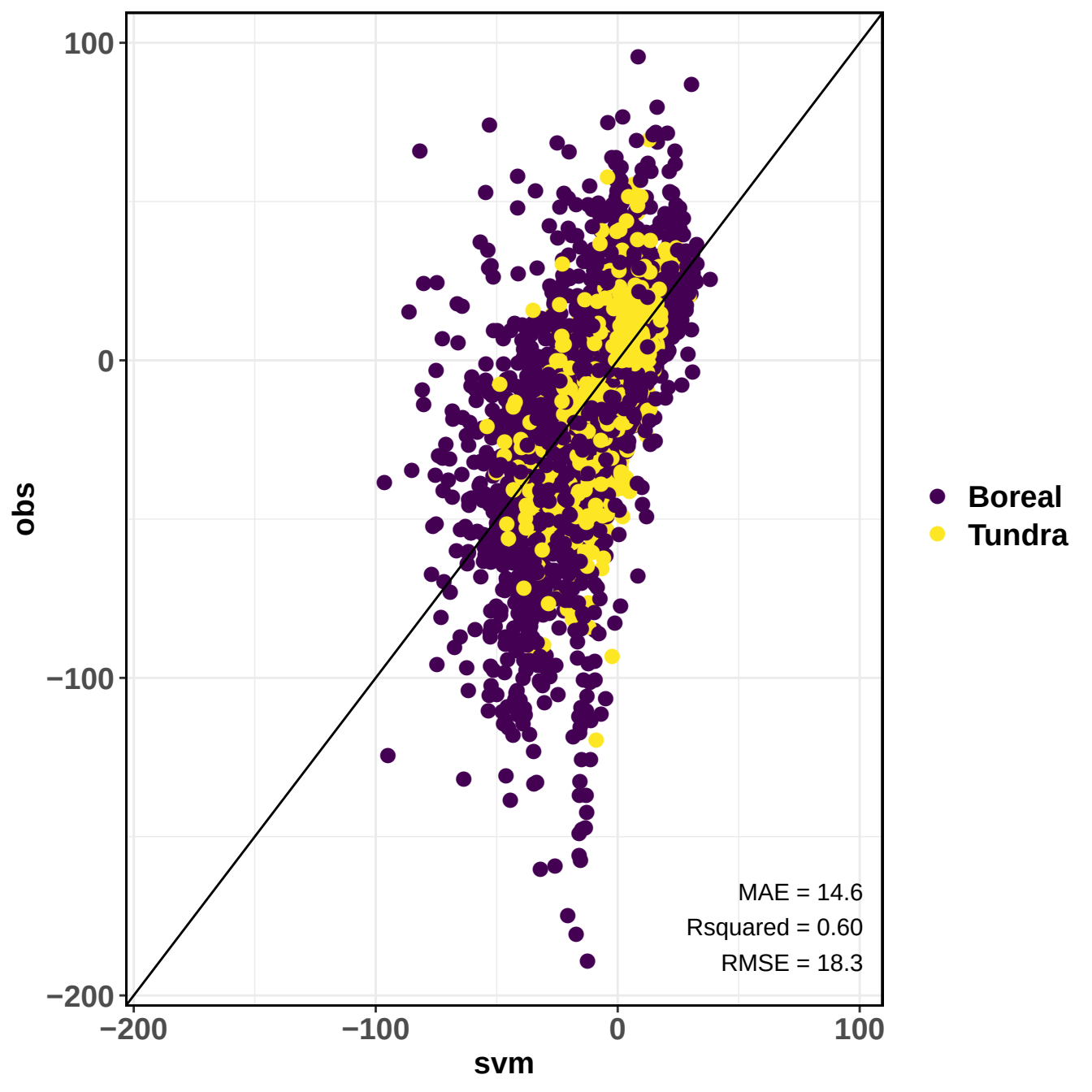

100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.8
Rsquared = 0.63
RMSE = 17.1
Arneth_RU−Zfw_tower2
Aurela_FI−Ken_tower2
Emmerton_CA−LHazen2_tower2
Goulden_CA−Oas_tower1
Lindroth_SE−Nor_tower1
Maximov_RU−SkP_tower1
Mkhabela_CA−SF2_tower2
Varlagin_RU−Fyo_tower1
ok

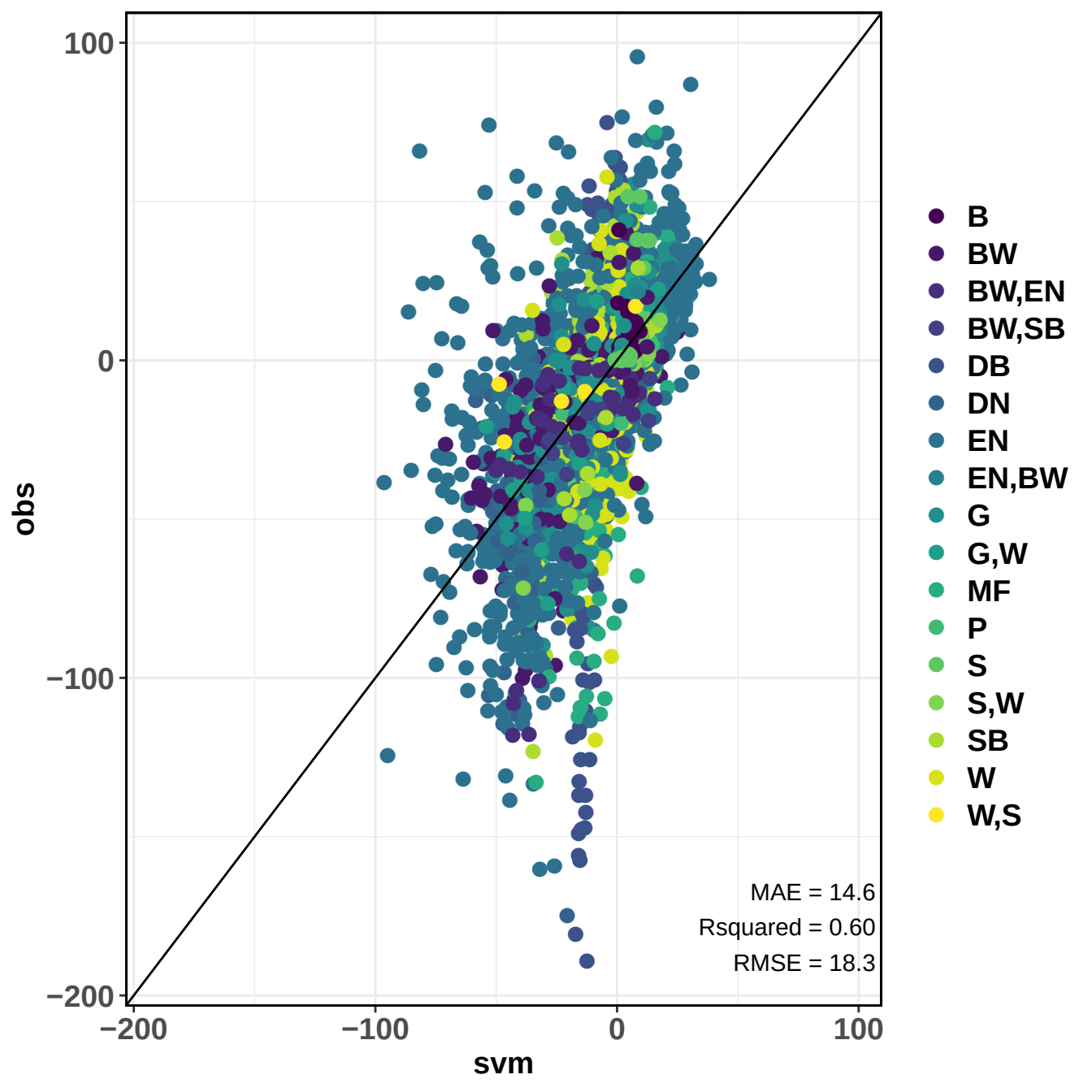

100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.8
Rsquared = 0.63
RMSE = 17.1
1
2
3
4
5
6
7
8
9
10
11
12

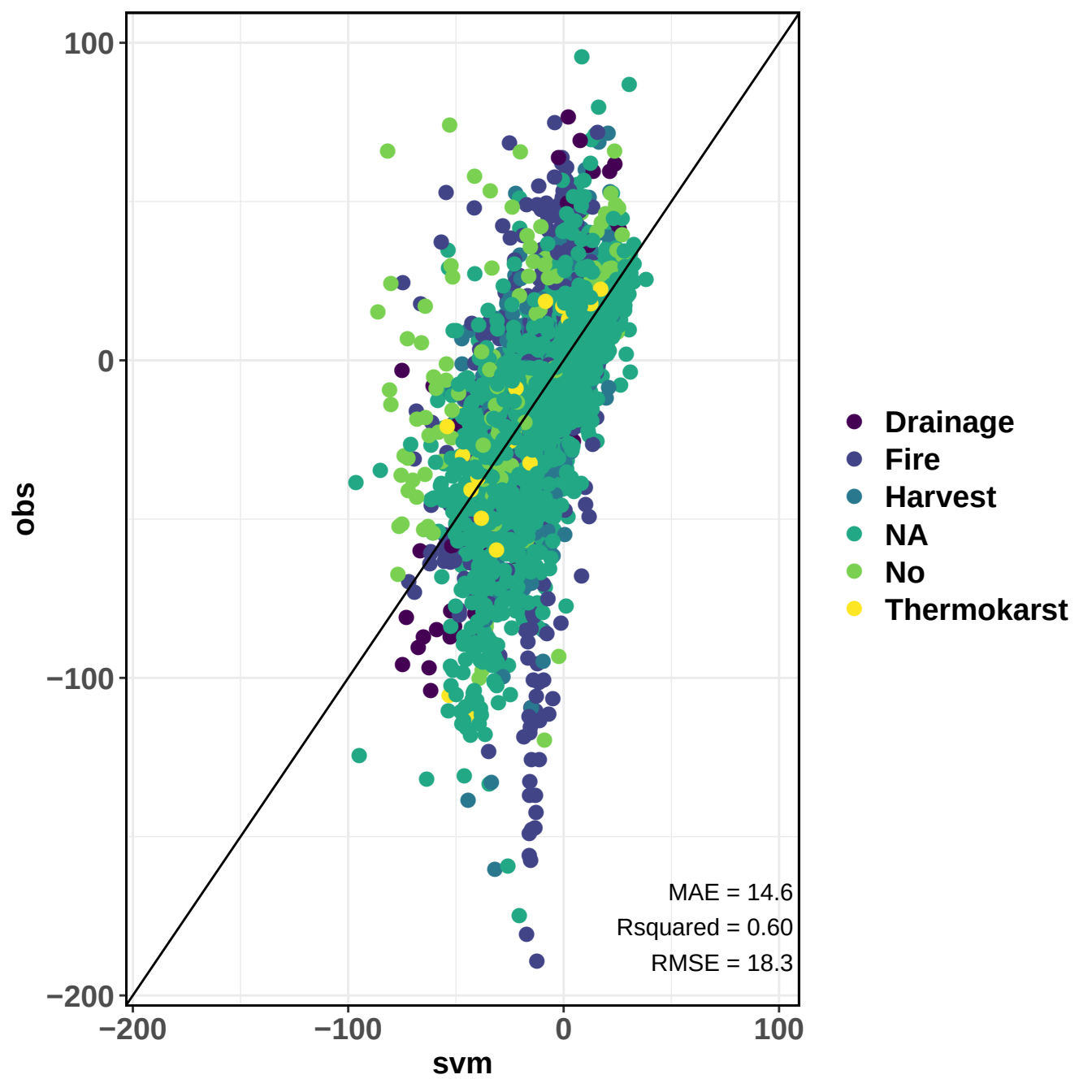

1
2
3
4
5
6
7
8
9
10
11
12
MAE = 13.8
Rsquared = 0.63
RMSE = 17.1
obs
rf
100
0
−100
−200
12
9
6
3

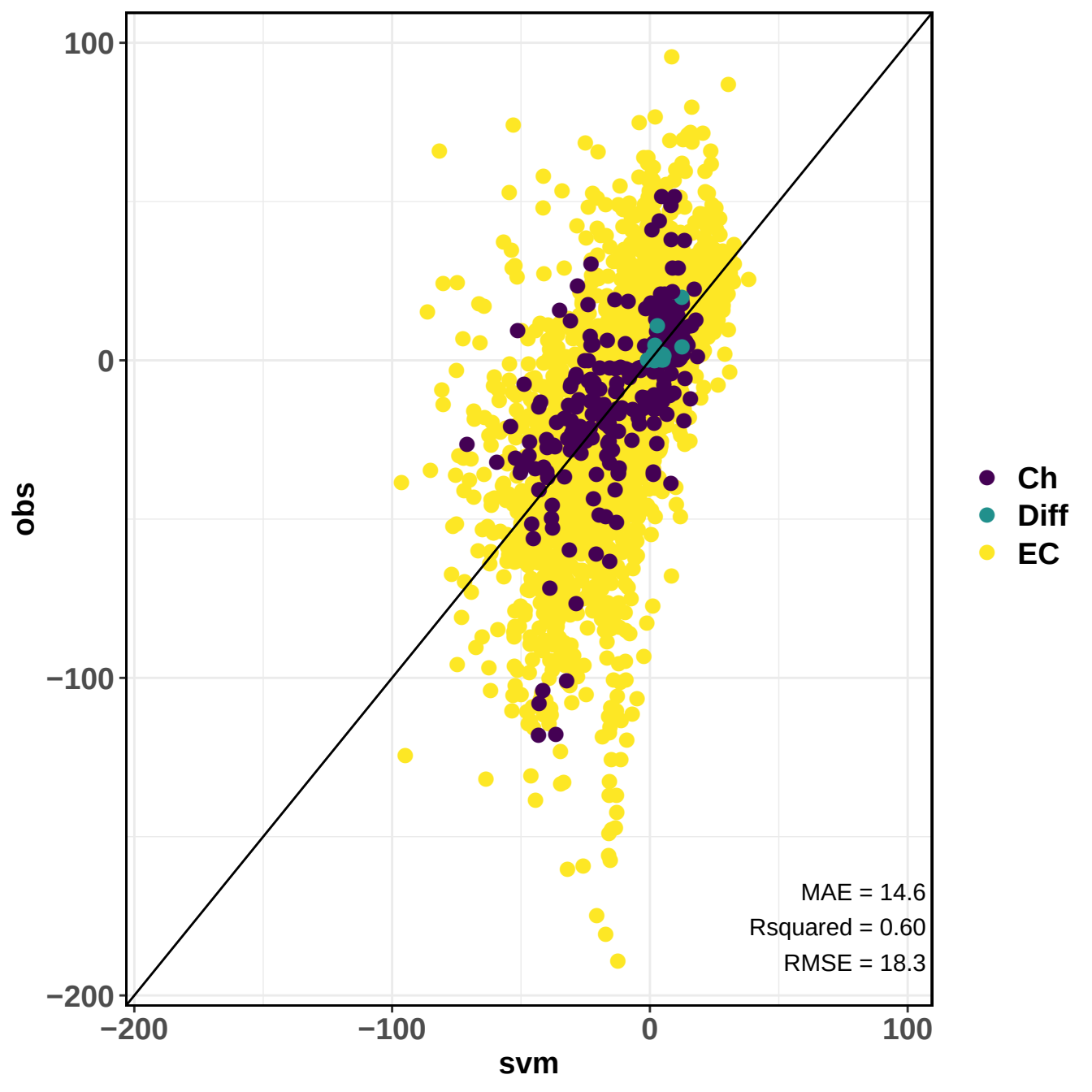

100
0
−100
−200
obs – pred
−200
−100
0
100
obs
MAE = 13.8
Rsquared = 0.63
RMSE = 17.1

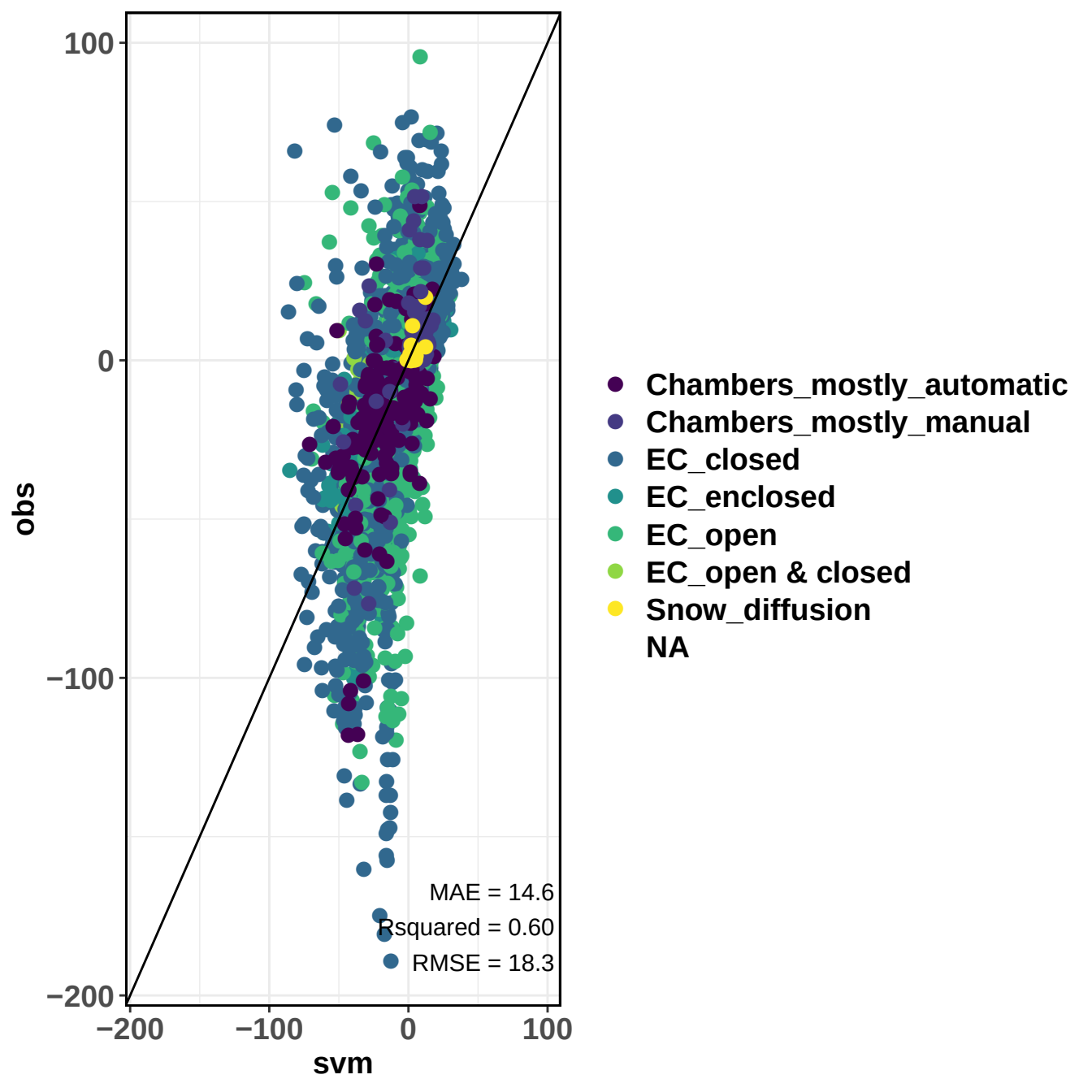

100
0
−100
−200
−200
−100
0
100
Observed flux g C m−2month−1
Predicted flux (ensemble) g C m−2month−1
MAE = 13.5
Rsquared = 0.51
RMSE = 21.5
Disturbance history of the site
Drainage
Fire
Harvest
No
Thermokarst
NA

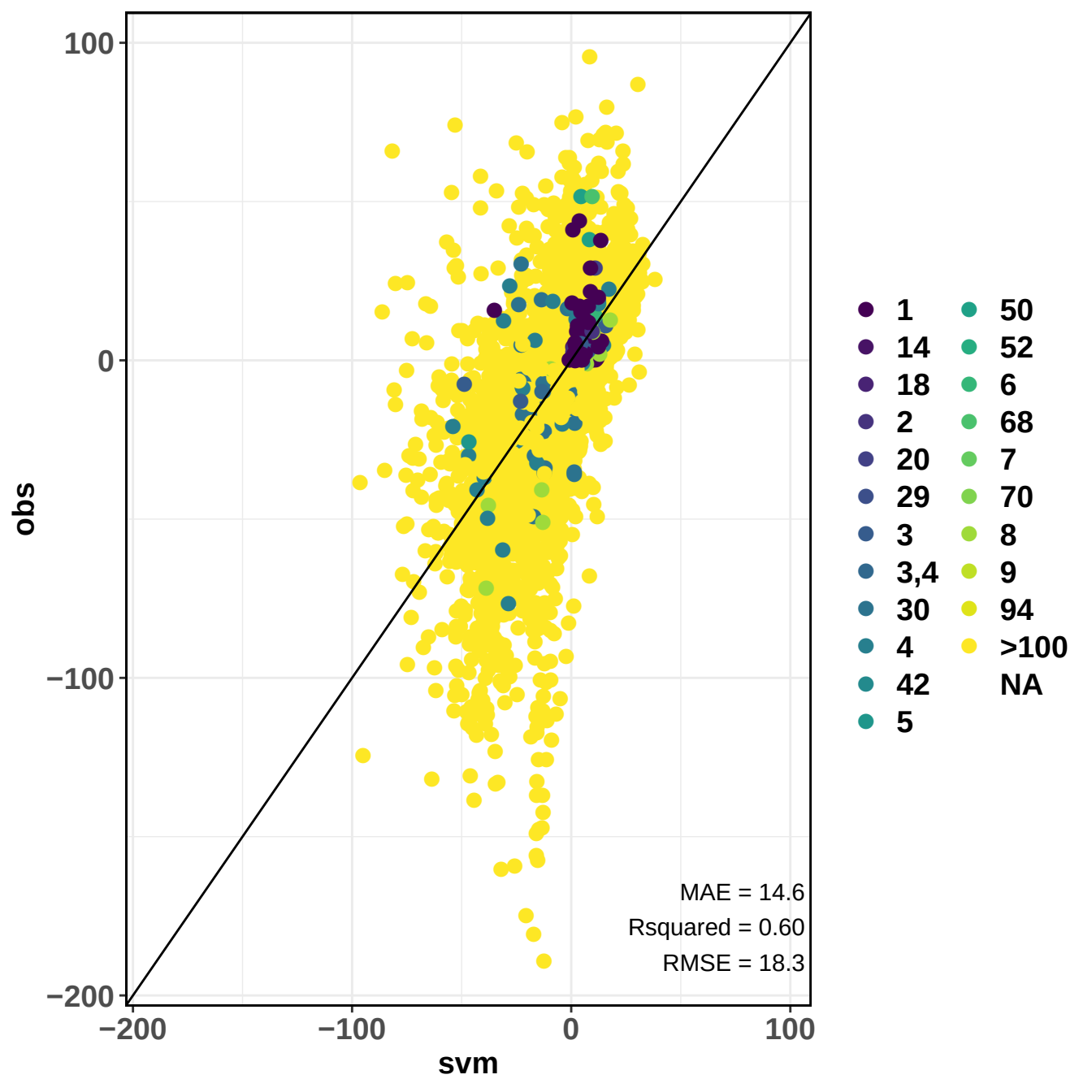

100
0
−100
−200
obs
−200
−100
0
100
svm
MAE = 14.6
Rsquared = 0.60
RMSE = 18.3
Boreal
Tundra

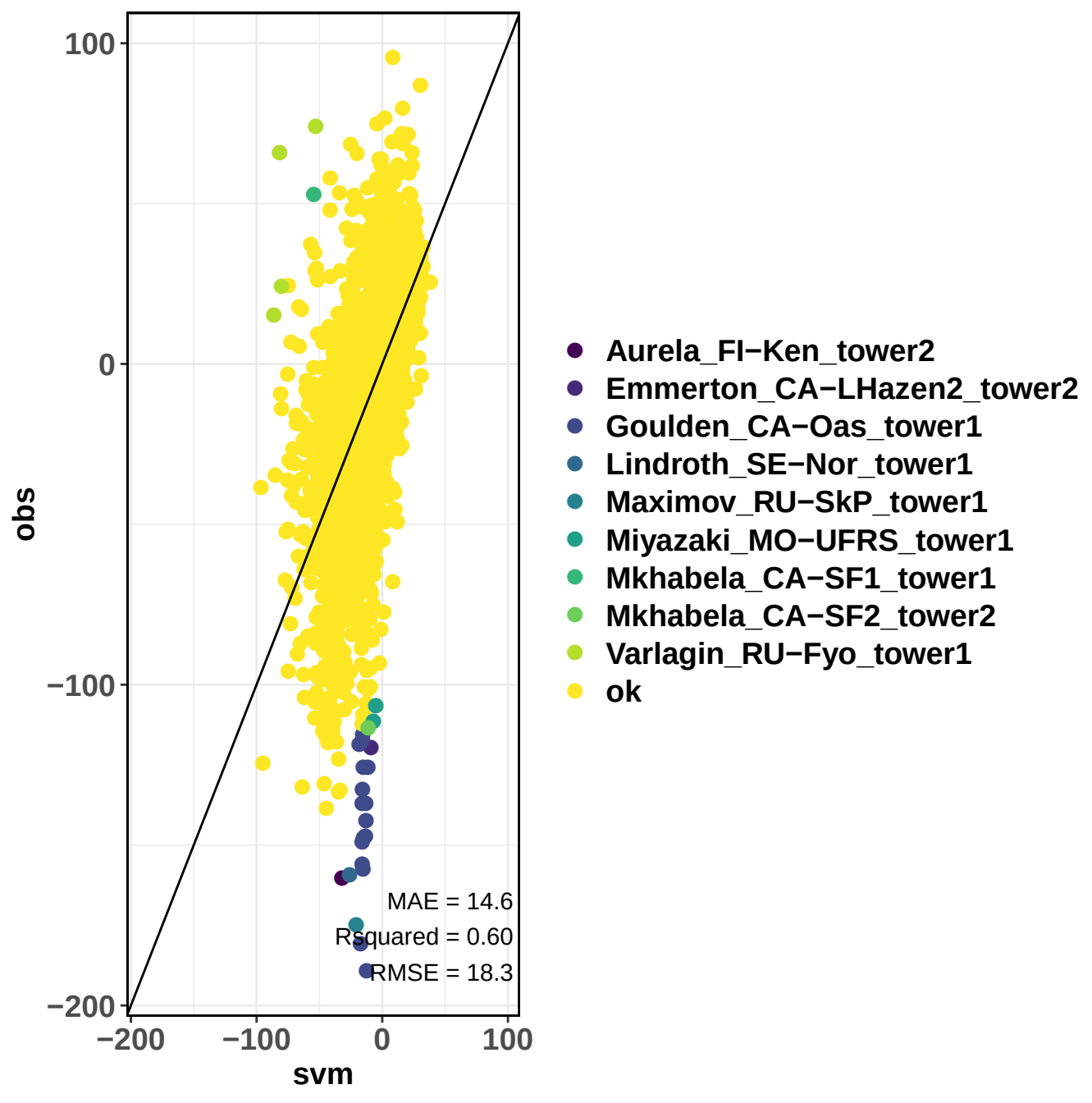

100
0
−100
−200
obs
−200
−100
0
100
svm
MAE = 14.6
Rsquared = 0.60
RMSE = 18.3
B
BW
BW,EN
BW,SB
DB
DN
EN
EN,BW
G
G,W
MF
P
S
S,W
SB
W
W,S

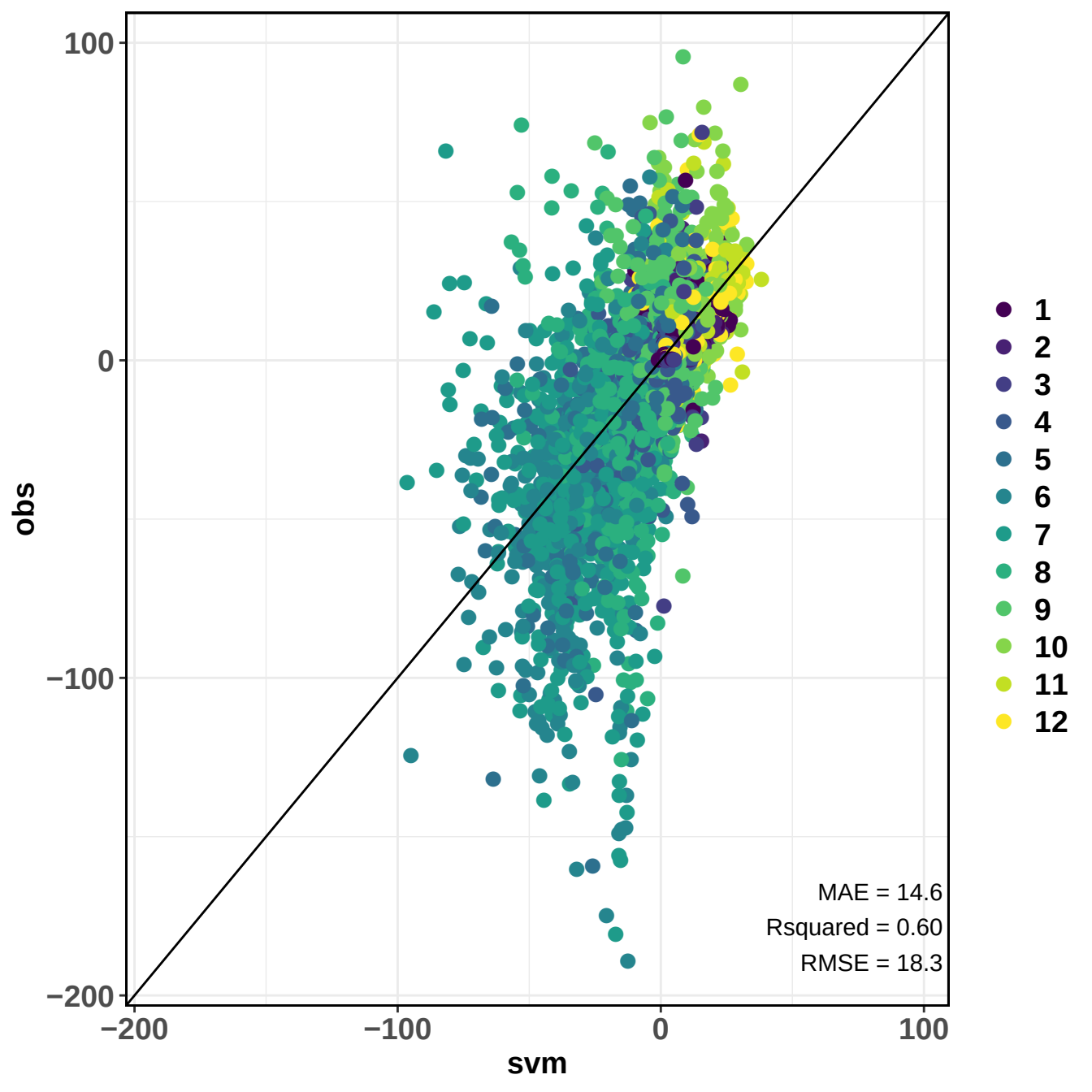

100
0
−100
−200
obs
−200
−100
0
100
svm
MAE = 14.6
Rsquared = 0.60
RMSE = 18.3
Drainage
Fire
Harvest
NA
No
Thermokarst

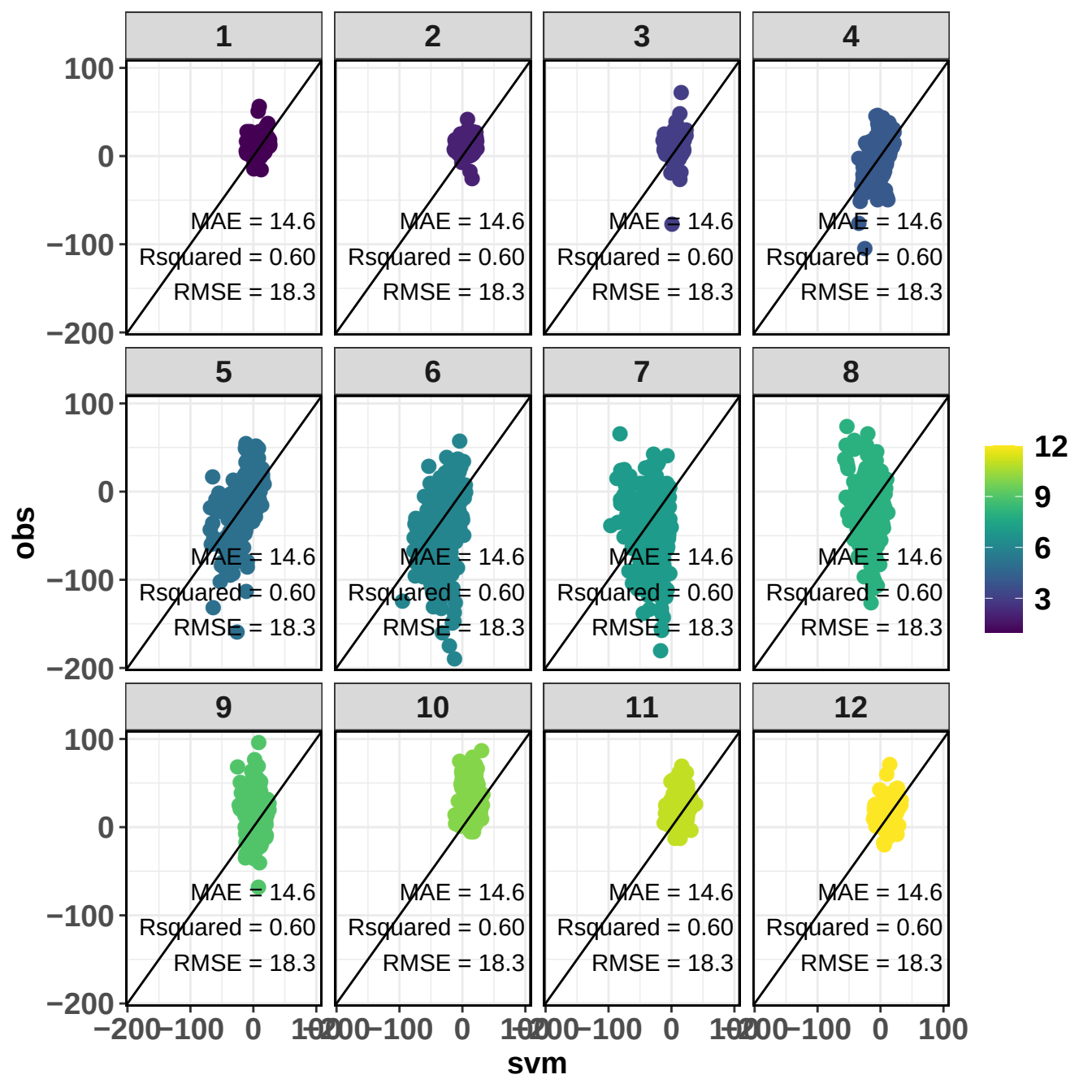

100
0
−100
−200
obs
−200
−100
0
100
svm
Ch
Diff
EC
MAE = 14.6
Rsquared = 0.60
RMSE = 18.3

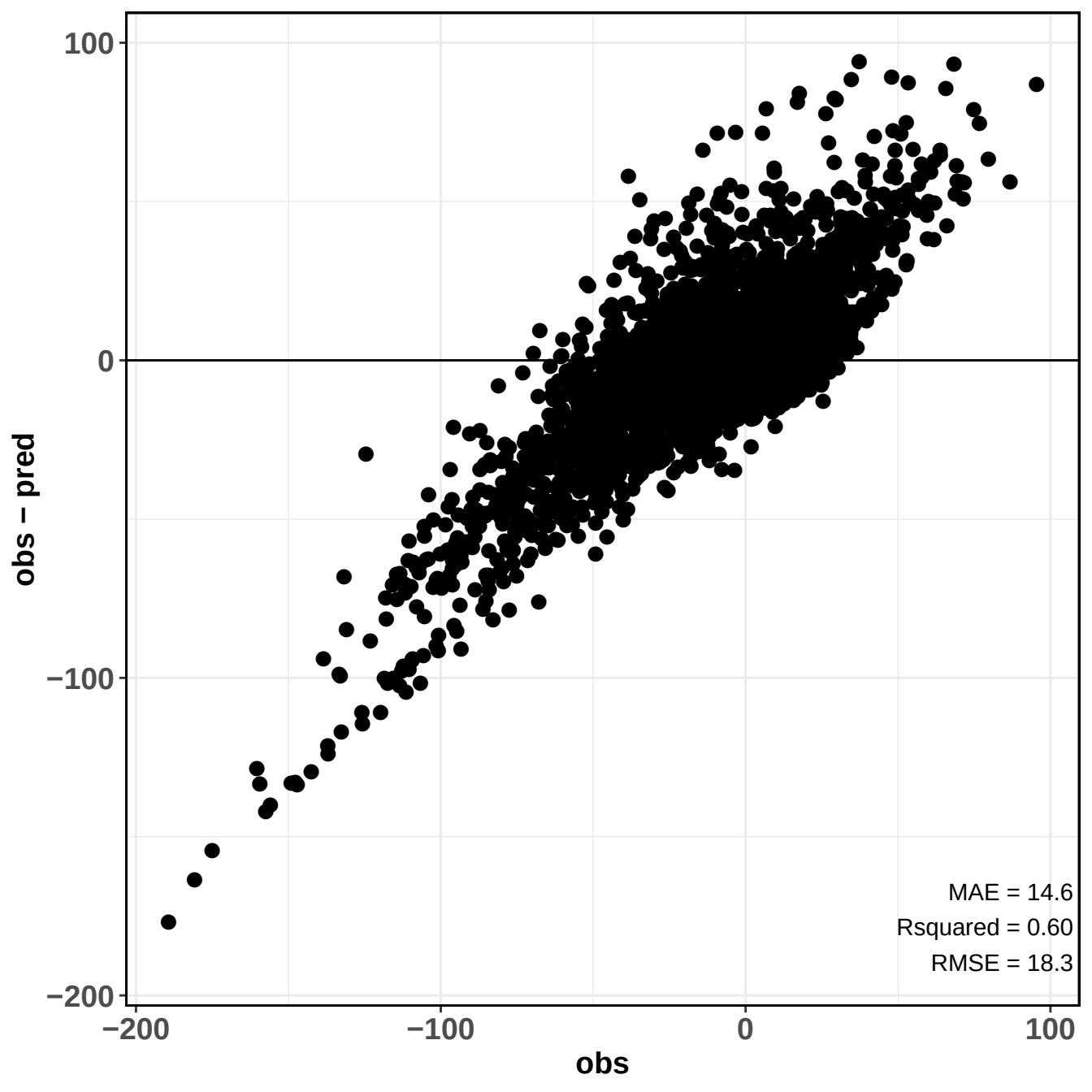

100
0
−100
−200
obs
−200
−100
0
100
svm
MAE = 14.6
Rsquared = 0.60
RMSE = 18.3
Chambers_mostly_automatic
Chambers_mostly_manual
EC_closed
EC_enclosed
EC_open
EC_open & closed
Snow_diffusion
NA

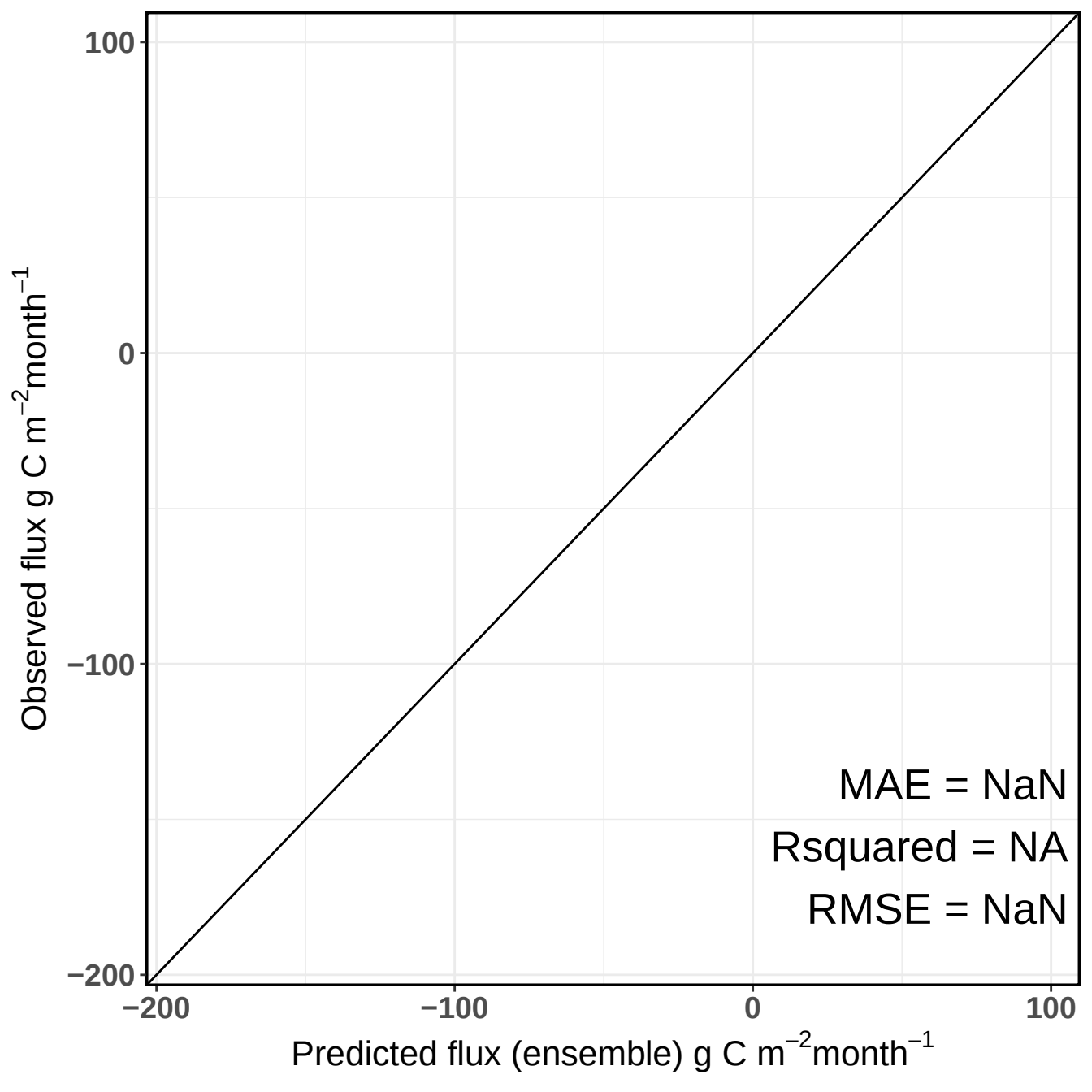

100
0
−100
−200
obs
−200
−100
0
100
svm
MAE = 14.6
Rsquared = 0.60
RMSE = 18.3
1
14
18
2
20
29
3
3,4
30
4
42
5
50
52
6
68
7
70
8
9
94
>100
NA

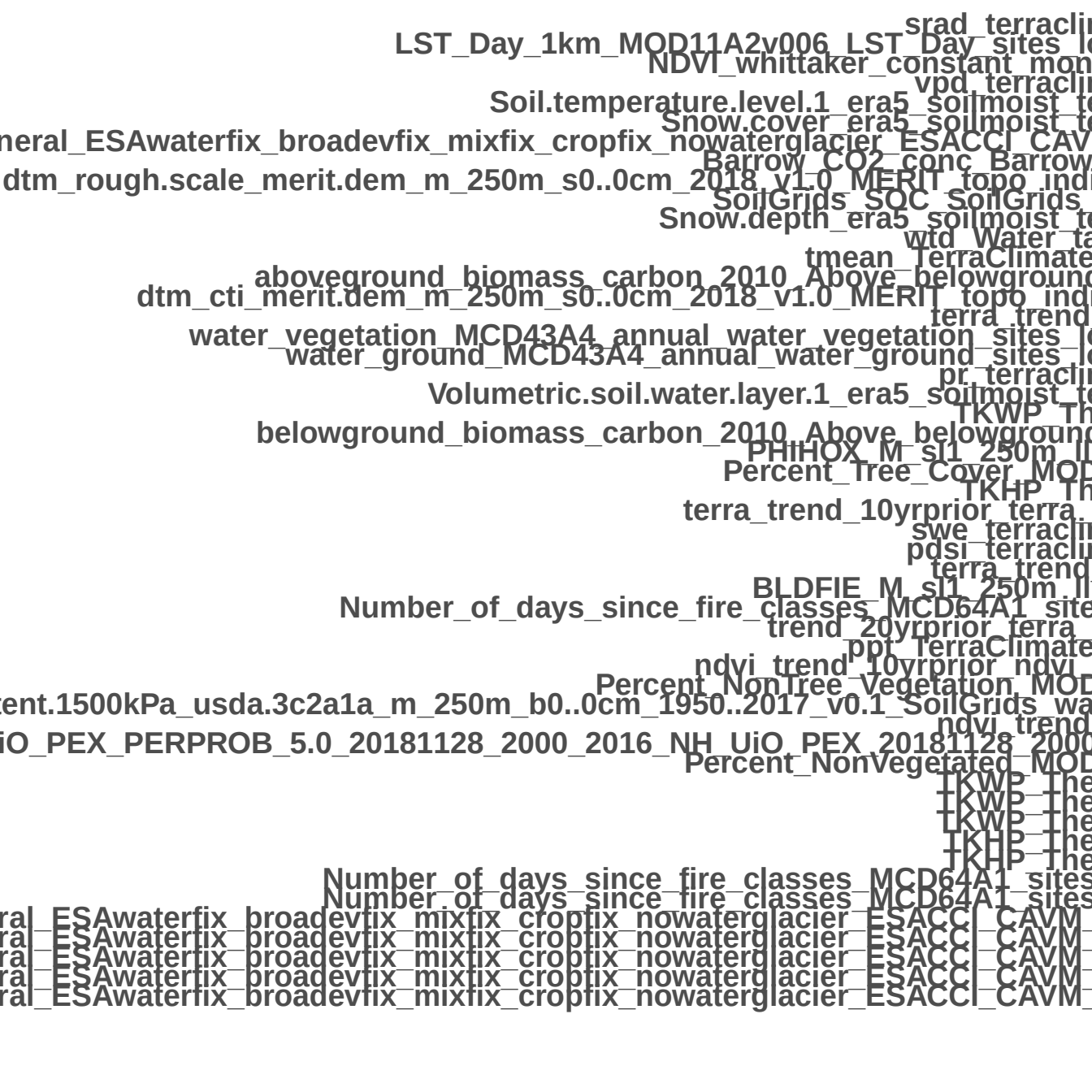

100
0
−100
−200
obs
−200
−100
0
100
svm
MAE = 14.6
Rsquared = 0.60
RMSE = 18.3
Aurela_FI−Ken_tower2
Emmerton_CA−LHazen2_tower2
Goulden_CA−Oas_tower1
Lindroth_SE−Nor_tower1
Maximov_RU−SkP_tower1
Miyazaki_MO−UFRS_tower1
Mkhabela_CA−SF1_tower1
Mkhabela_CA−SF2_tower2
Varlagin_RU−Fyo_tower1
ok


100
0
−100
−200
obs
−200
−100
0
100
svm
MAE = 14.6
Rsquared = 0.60
RMSE = 18.3
1
2
3
4
5
6
7
8
9
10
11
12


1
2
3
4
5
6
7
8
9
10
11
12
MAE = 14.6
Rsquared = 0.60
RMSE = 18.3
obs
svm
100
0
−100
−200
12
9
6
3


100
0
−100
−200
obs − pred
−200
−100
0
100
obs
MAE = 14.6
Rsquared = 0.60
RMSE = 18.3


100
0
−100
−200
−200
−100
0
100
Observed flux g C m−2month−1
Predicted flux (ensemble) g C m−2month−1
MAE = NaN
Rsquared = NA
RMSE = NaN


srad_terracli
LST_Day_1km_MOD11A2v006_LST_Day_sites_l
NDVI_whittaker_constant_mon
vpd_terracli
Soil.temperature.level.1_era5_soilmoist_t
Snow.cover_era5_soilmoist_t
neral_ESAwaterfix_broadevfix_mixfix_cropfix_nowaterglacier_ESACCI_CAV
Barrow_CO2_conc_Barrow
dtm_rough.scale_merit.dem_m_250m_s0..0cm_2018_v1.0_MERIT_topo_indi
SoilGrids_SOC_SoilGrids_
Snow.depth_era5_soilmoist_t
wtd_Water_ta
tmean_TerraClimate
aboveground_biomass_carbon_2010_Above_belowground
dtm_cti_merit.dem_m_250m_s0..0cm_2018_v1.0_MERIT_topo_indi
terra_trend
water_vegetation_MCD43A4_annual_water_vegetation_sites_l
water_ground_MCD43A4_annual_water_ground_sites_l
pr_terracli
Volumetric.soil.water.layer.1_era5_soilmoist_t
TKWP_Th
belowground_biomass_carbon_2010_Above_belowground
PHIHOX_M_sl1_250m_l
Percent_Tree_Cover_MOD
TKHP_Th
terra_trend_10yrprior_terra_
swe_terracli
pdsi_terracli
terra_trend
BLDFIE_M_sl1_250m_l
Number_of_days_since_fire_classes_MCD64A1_site
trend_20yrprior_terra_
ppt_TerraClimate
ndvi_trend_10yrprior_ndvi_
Percent_NonTree_Vegetation_MOD
tent.1500kPa_usda.3c2a1a_m_250m_b0..0cm_1950..2017_v0.1_SoilGrids_wa
ndvi_trend_
iO_PEX_PERPROB_5.0_20181128_2000_2016_NH_UiO_PEX_20181128_2000
Percent_NonVegetated_MOD
TKWP_The
TKWP_The
TKWP_The
TKHP_The
TKHP_The
Number_of_days_since_fire_classes_MCD64A1_sites
Number_of_days_since_fire_classes_MCD64A1_sites
ral_ESAwaterfix_broadevfix_mixfix_cropfix_nowaterglacier_ESACCI_CAVM_
ral_ESAwaterfix_broadevfix_mixfix_cropfix_nowaterglacier_ESACCI_CAVM_
ral_ESAwaterfix_broadevfix_mixfix_cropfix_nowaterglacier_ESACCI_CAVM_
ral_ESAwaterfix_broadevfix_mixfix_cropfix_nowaterglacier_ESACCI_CAVM_
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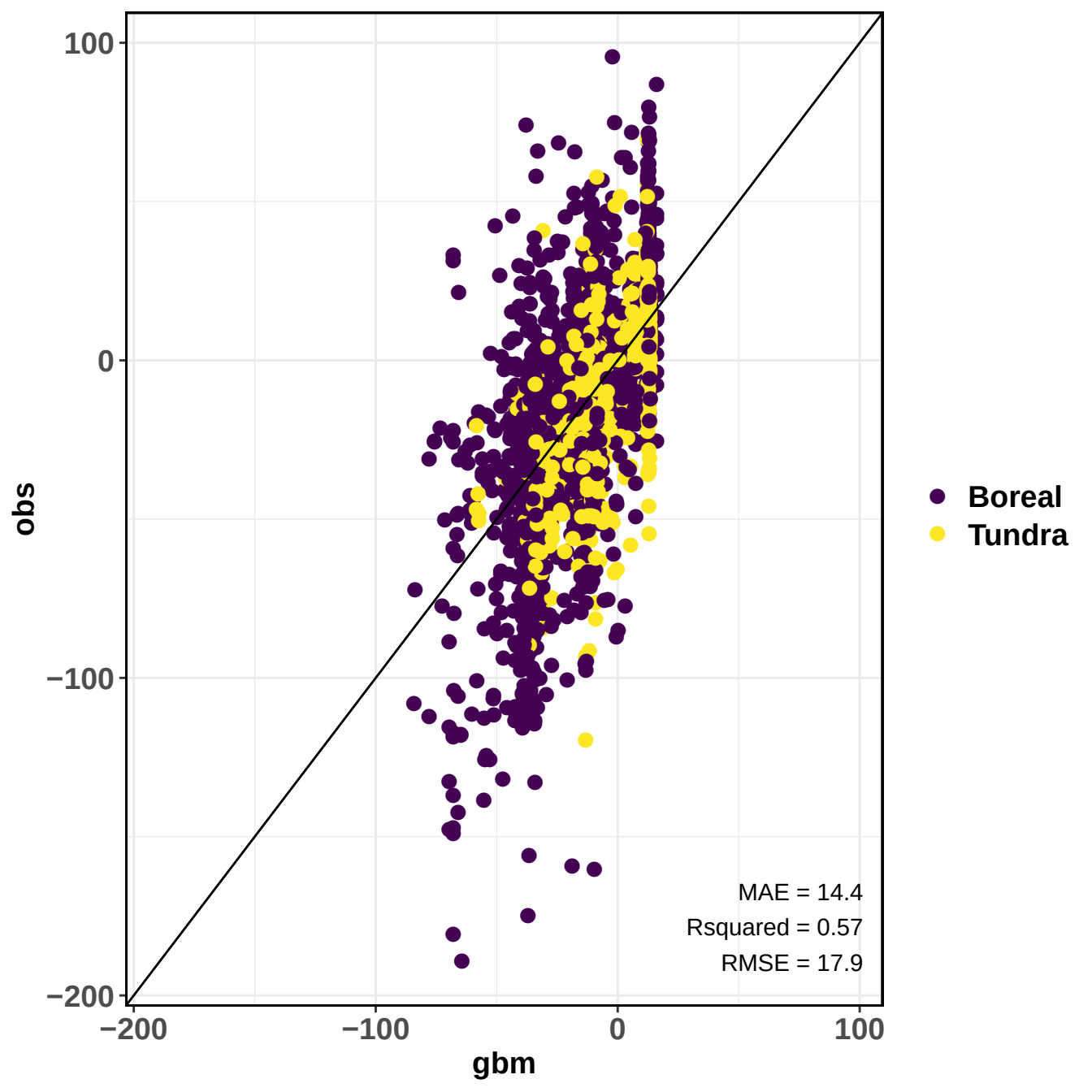
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gbm
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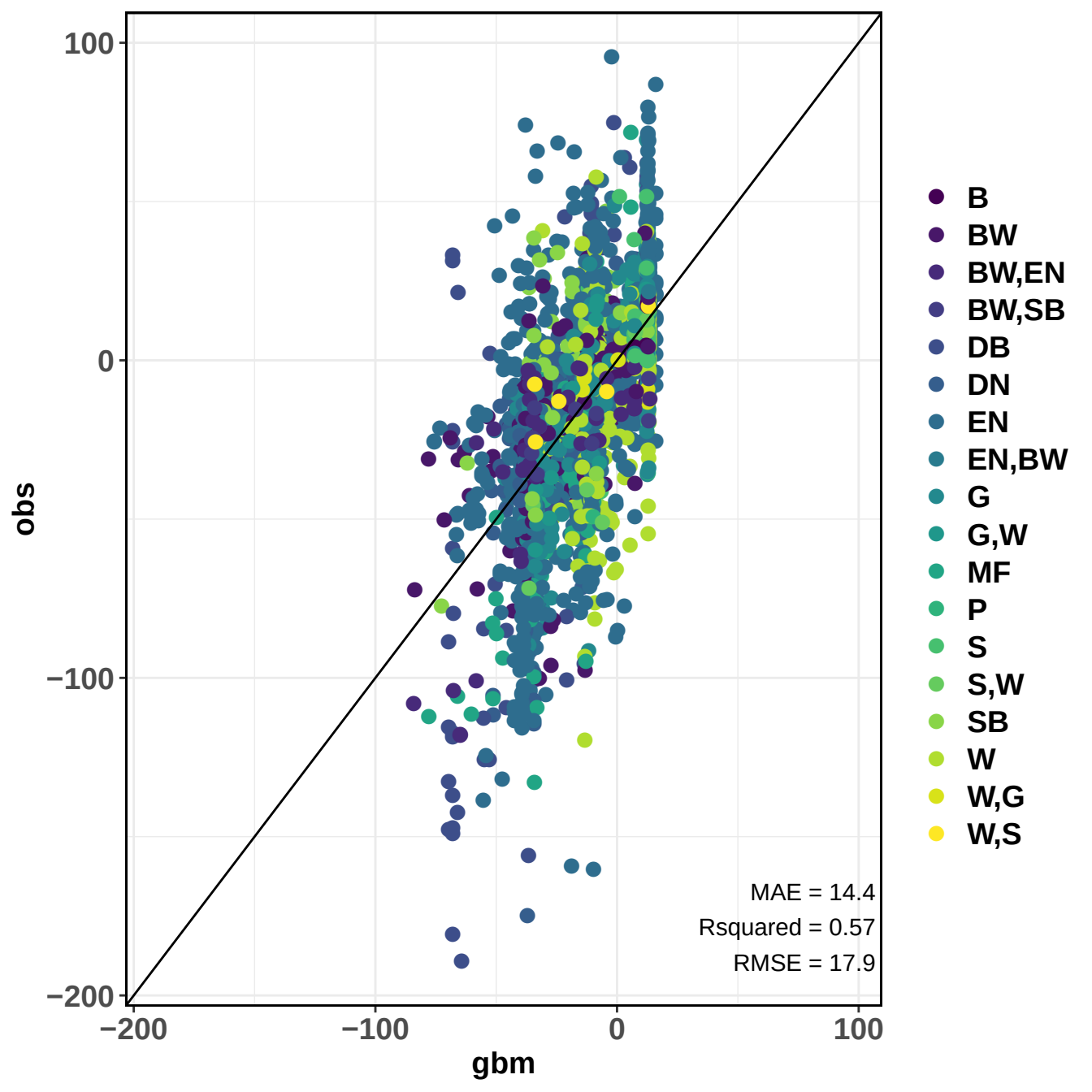
Rsquared = 0.57
RMSE = 17.9
Boreal
Tundra


100
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obs
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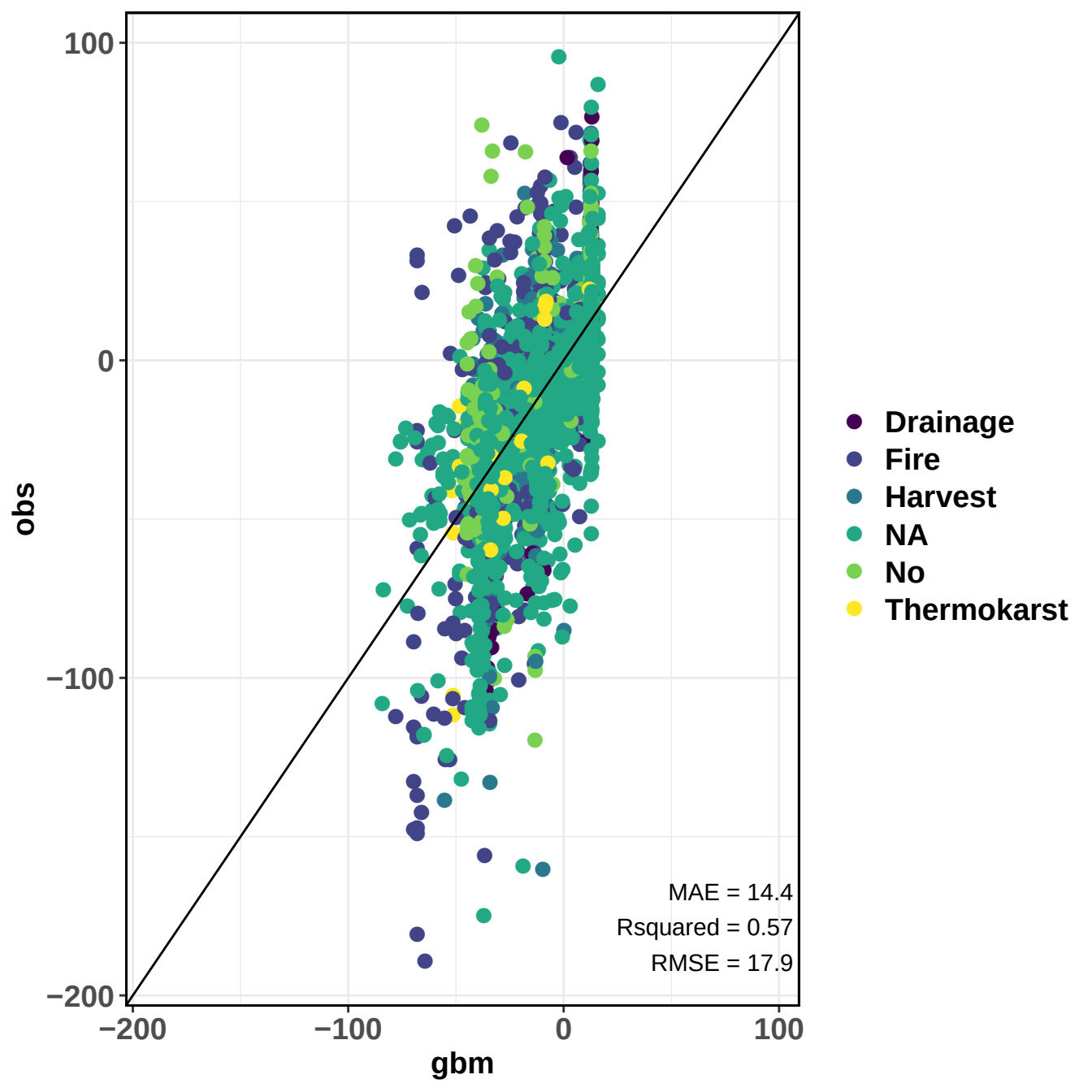
100
gbm
MAE = 14.4
Rsquared = 0.57
RMSE = 17.9
B
BW
BW,EN
BW,SB
DB
DN
EN
EN,BW
G
G,W
MF
P
S
S,W
SB
W
W,G
W,S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−200
obs
−200
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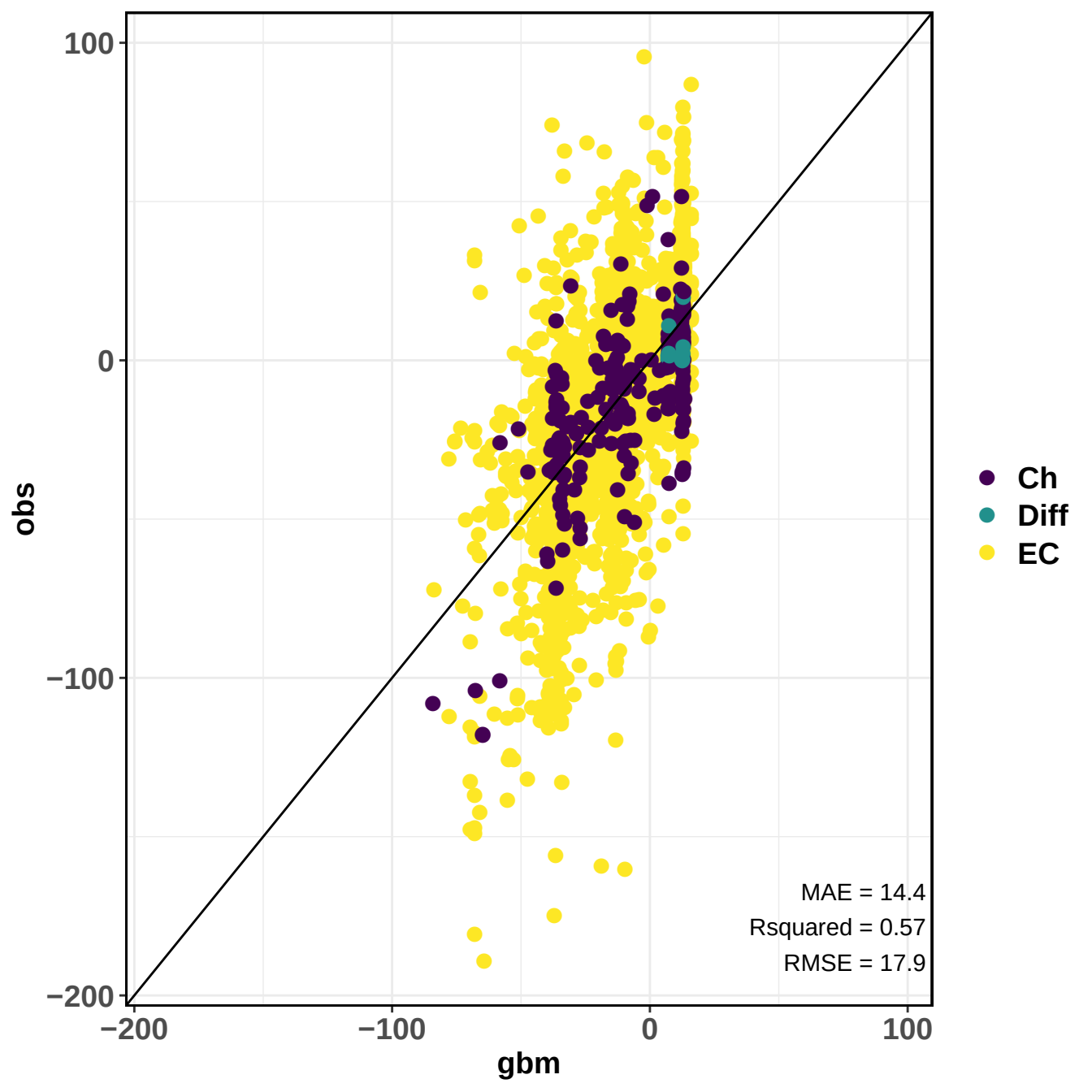
100
gbm
MAE = 14.4
Rsquared = 0.57
RMSE = 17.9
Drainage
Fire
Harvest
NA
No
Thermokarst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0
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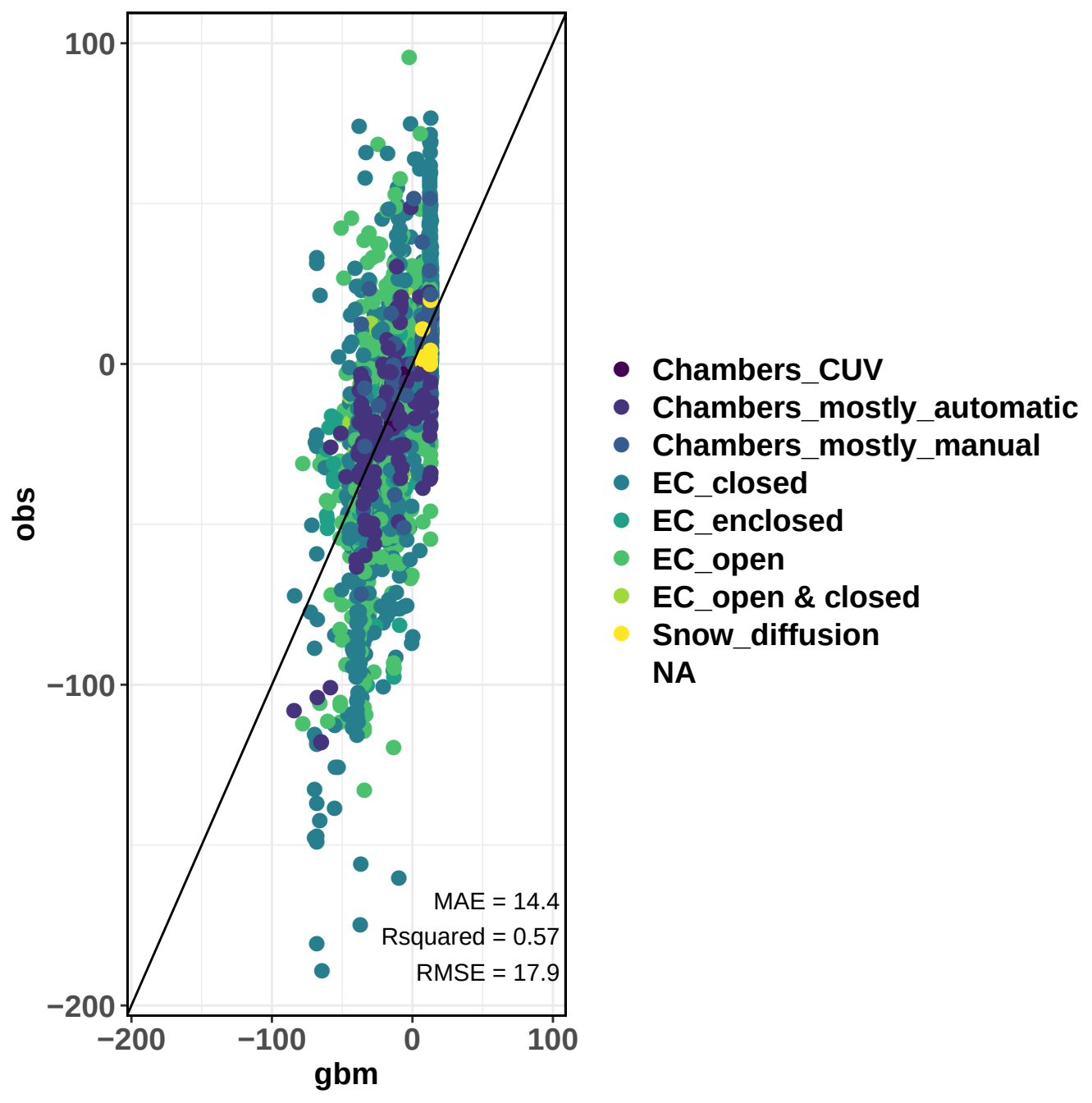
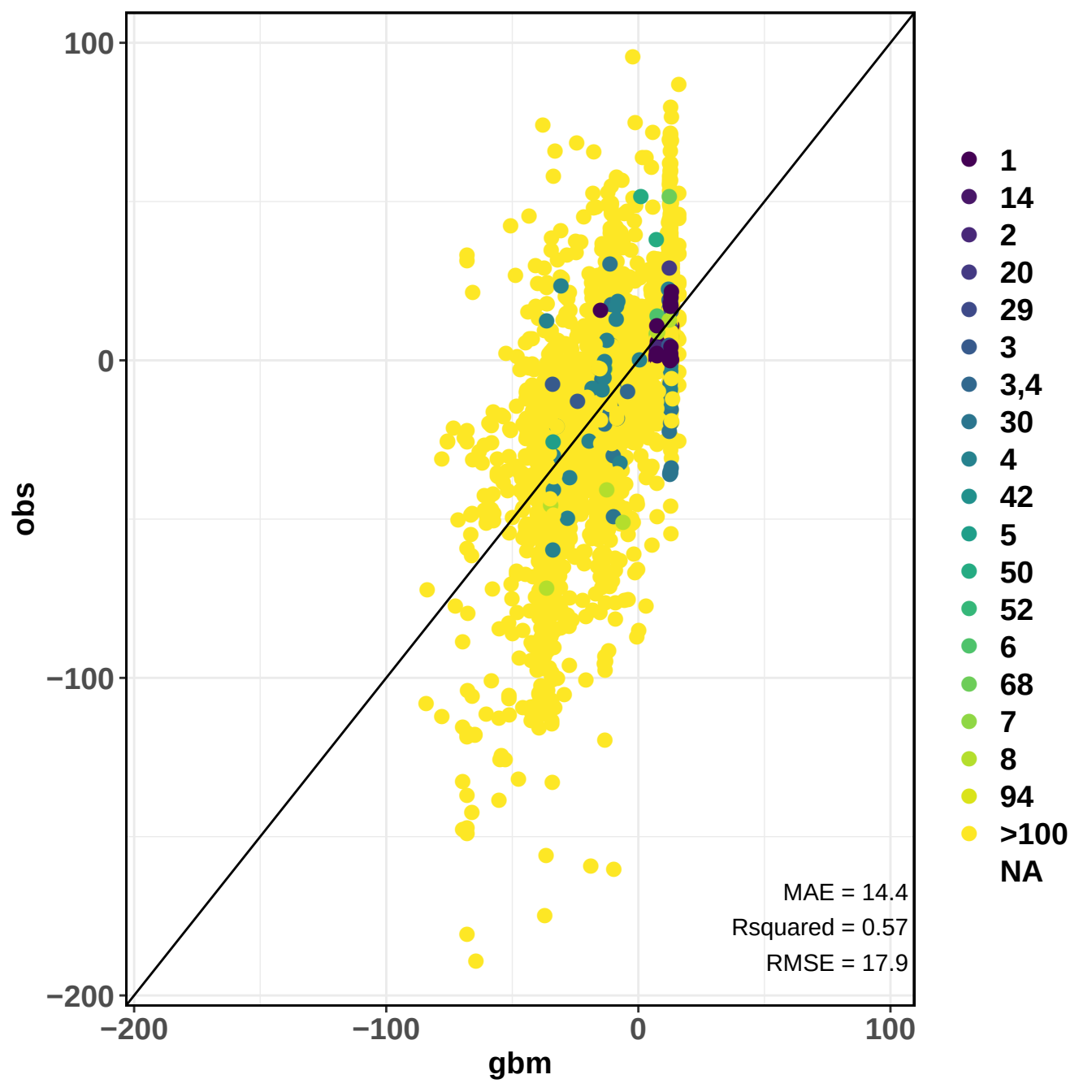
gbm
MAE = 14.4
Rsquared = 0.57
RMSE = 17.9
Ch
Diff
EC


100
0
−100
−200
obs
−200
−100
0
100
gbm
MAE = 14.4
Rsquared = 0.57
RMSE = 17.9
Chambers_CUV
Chambers_mostly_automatic
Chambers_mostly_manual
EC_closed
EC_enclosed
EC_open
EC_open & closed
Snow_diffusion
NA


100
0
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−200
obs
−200
−100
0
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gbm
MAE = 14.4
Rsquared = 0.57
RMSE = 17.9
1
14
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3,4
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4
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52
6
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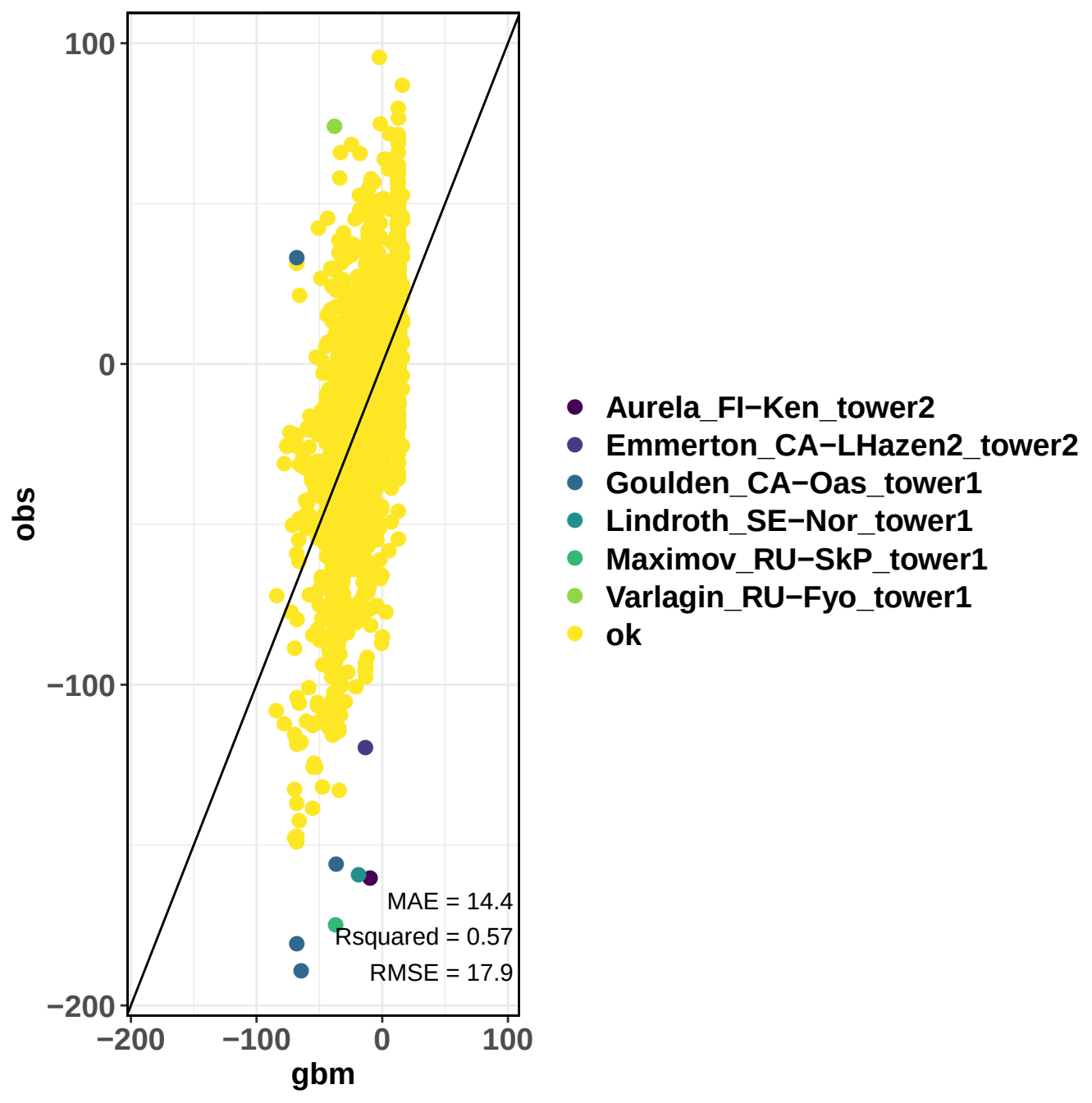
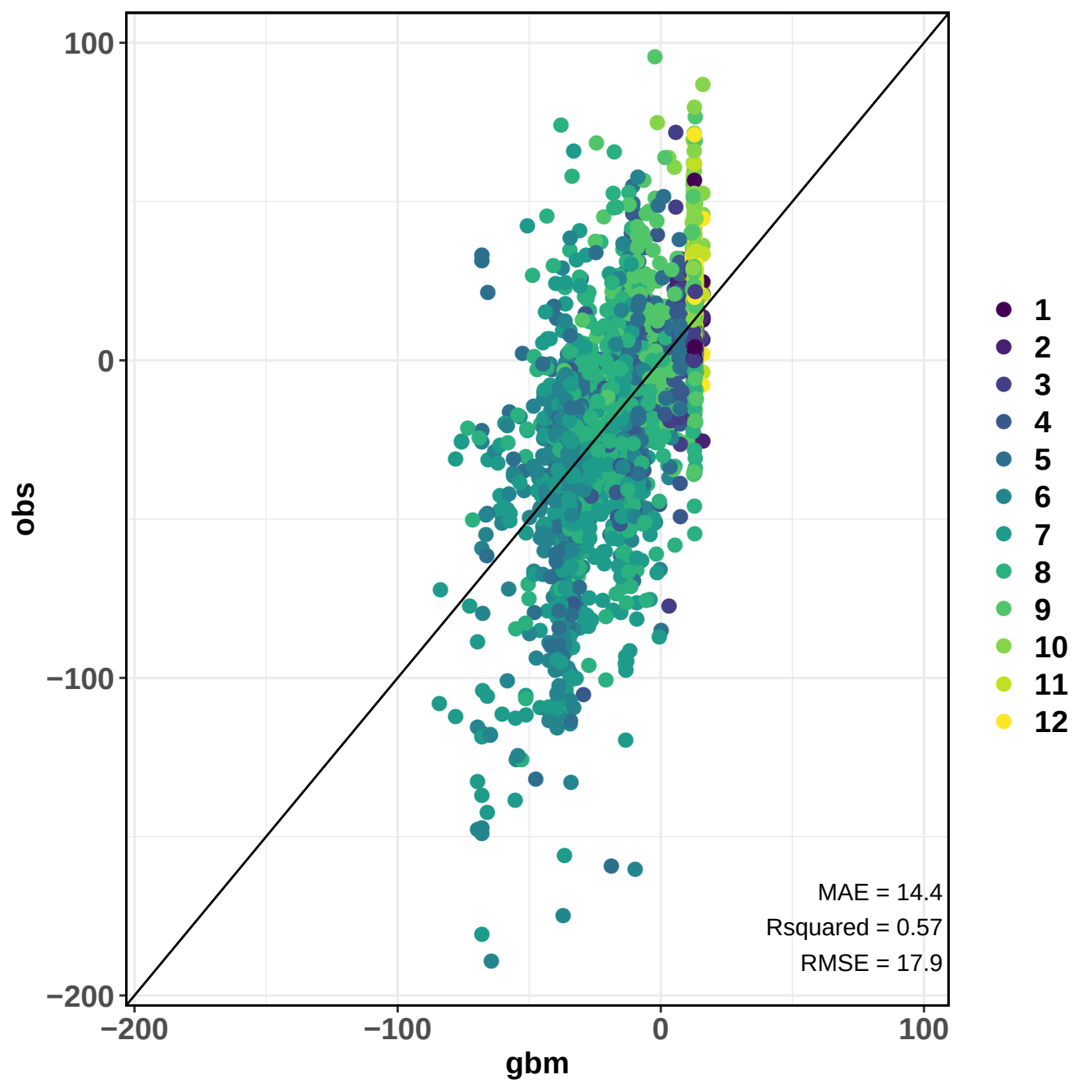
7
8
94
>100
NA


100
0
−100
−200
obs
−200
−100
0
100
gbm
MAE = 14.4
Rsquared = 0.57
RMSE = 17.9
Aurela_FI−Ken_tower2
Emmerton_CA−LHazen2_tower2
Goulden_CA−Oas_tower1
Lindroth_SE−Nor_tower1
Maximov_RU−SkP_tower1
Varlagin_RU−Fyo_tower1
ok


100
0
−100
−200
obs
−200
−100
0
100
gbm
MAE = 14.4
Rsquared = 0.57
RMSE = 17.9
1
2
3
4
5
6
7
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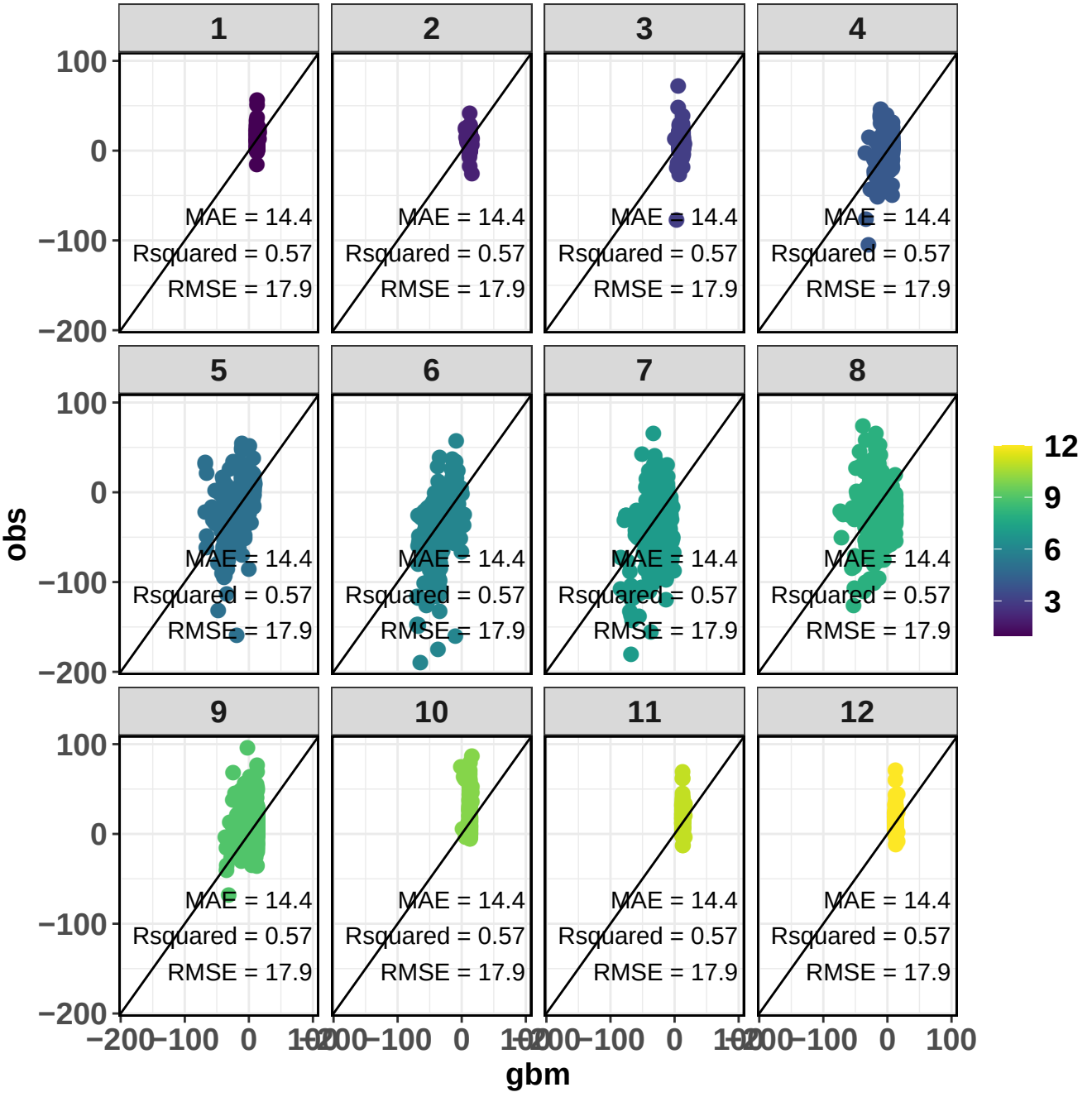
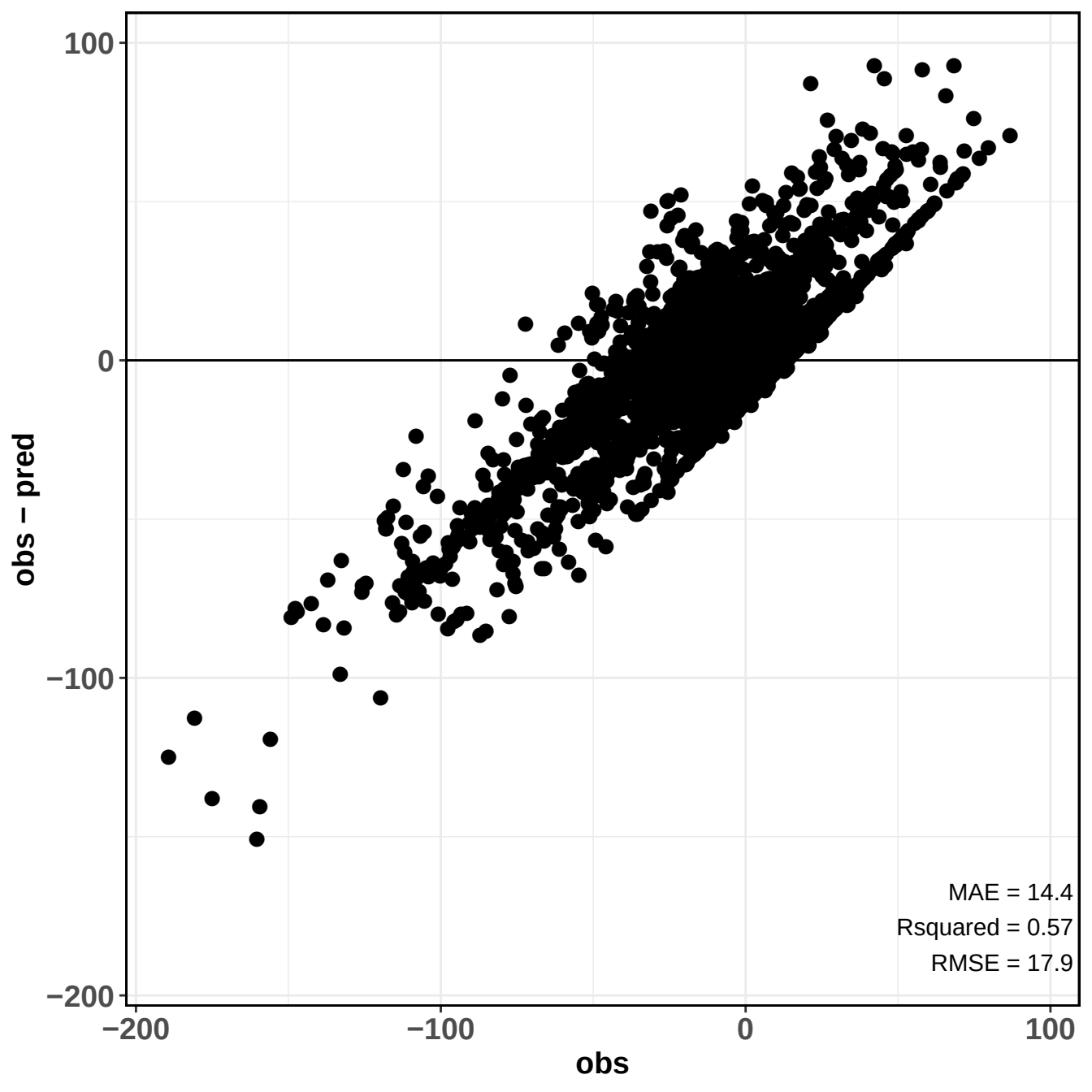
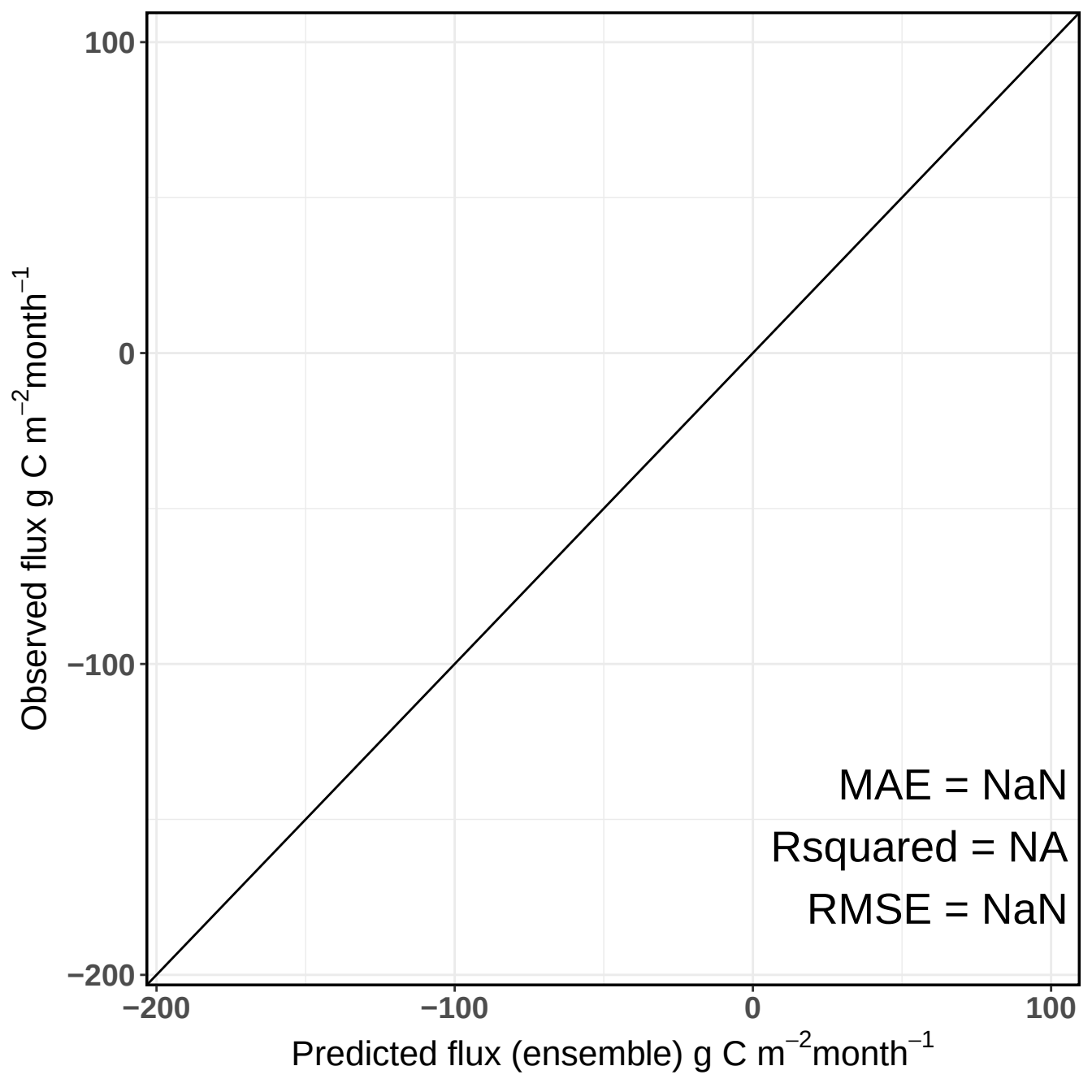
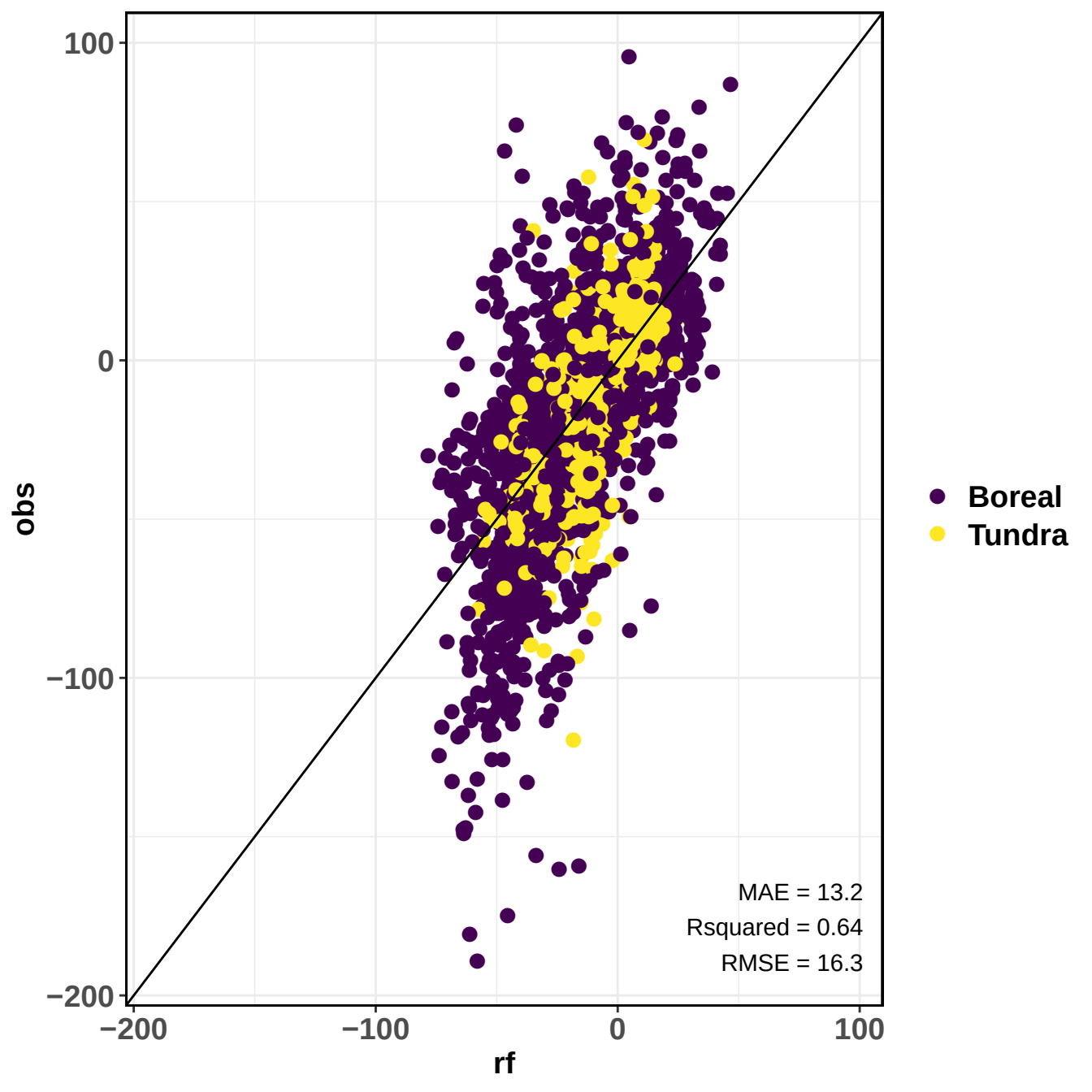
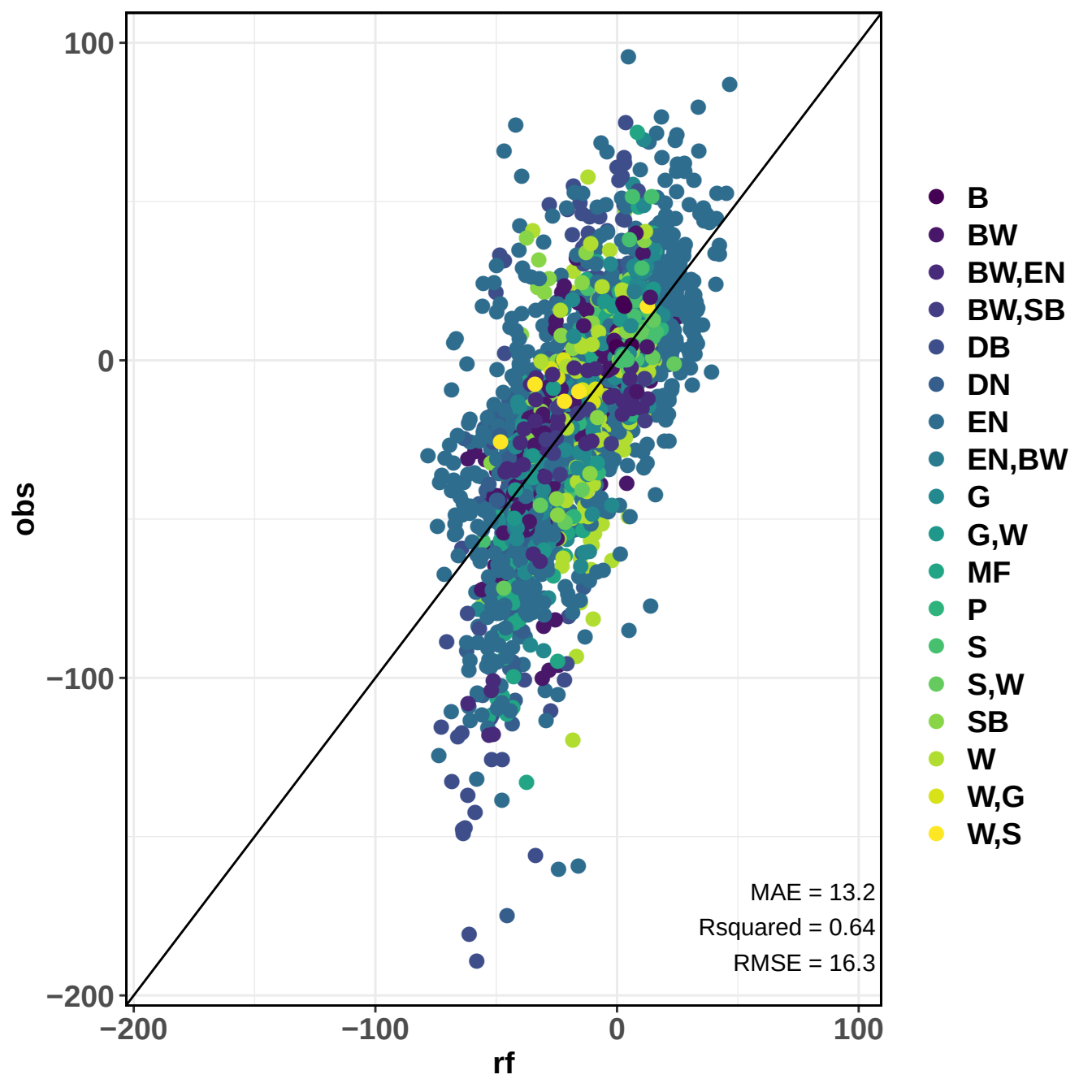
9
10
11
12

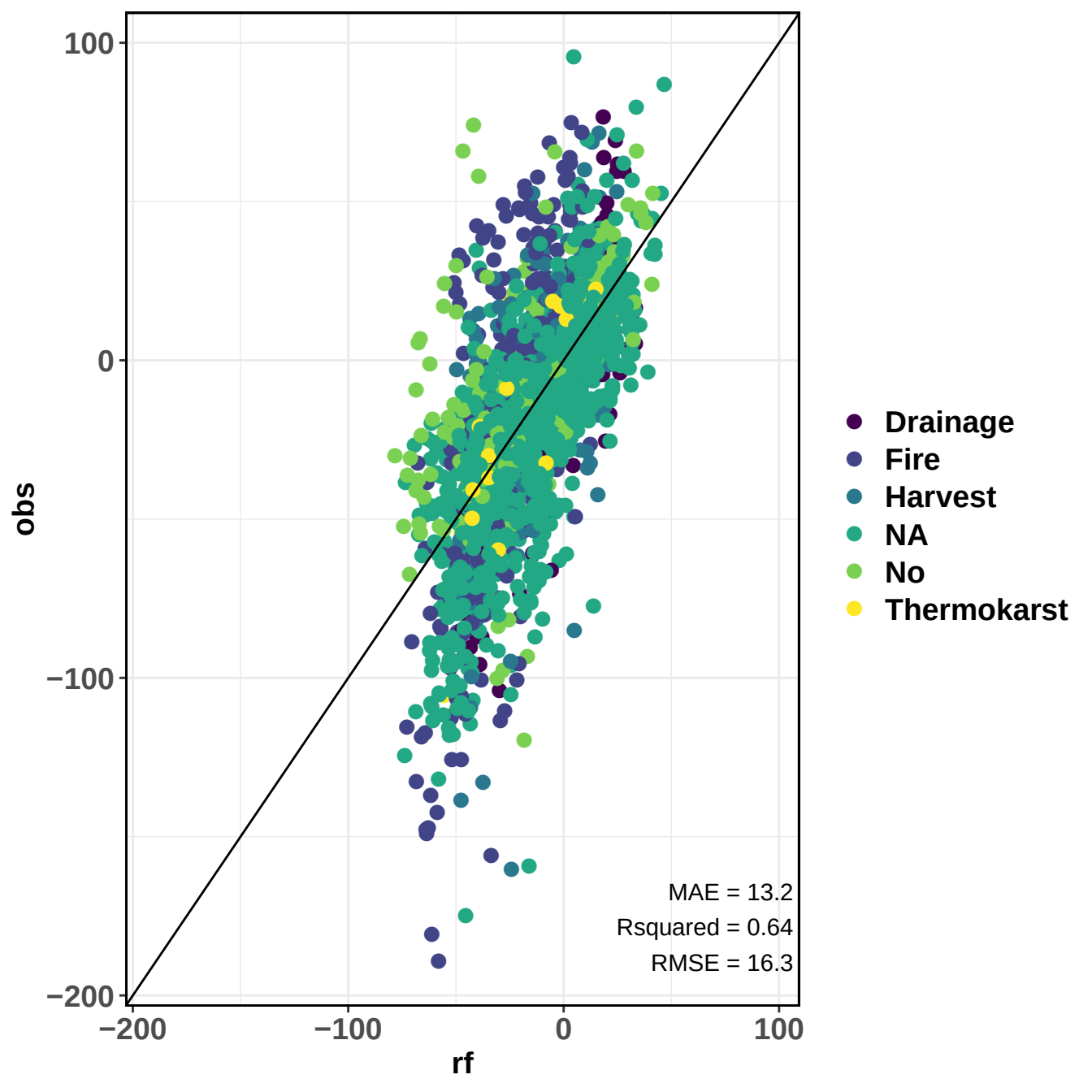

1
2
3
4
5
6
7
8
9
10
11
12
MAE = 14.4
Rsquared = 0.57
RMSE = 17.9
obs
gbm
100
0
−100
−200
12
9
6
3

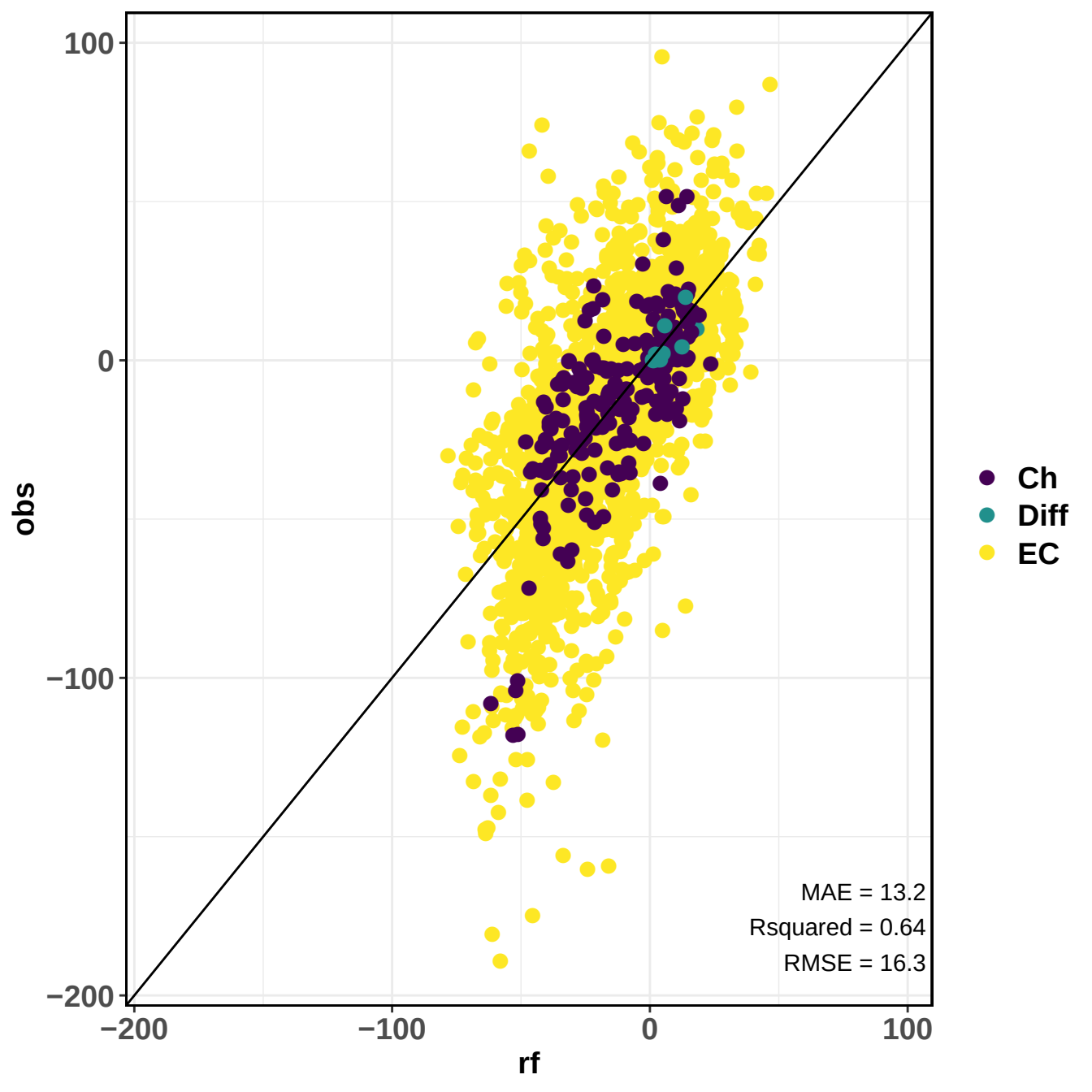

100
0
−100
−200
obs − pred
−200
−100
0
100
obs
MAE = 14.4
Rsquared = 0.57
RMSE = 17.9

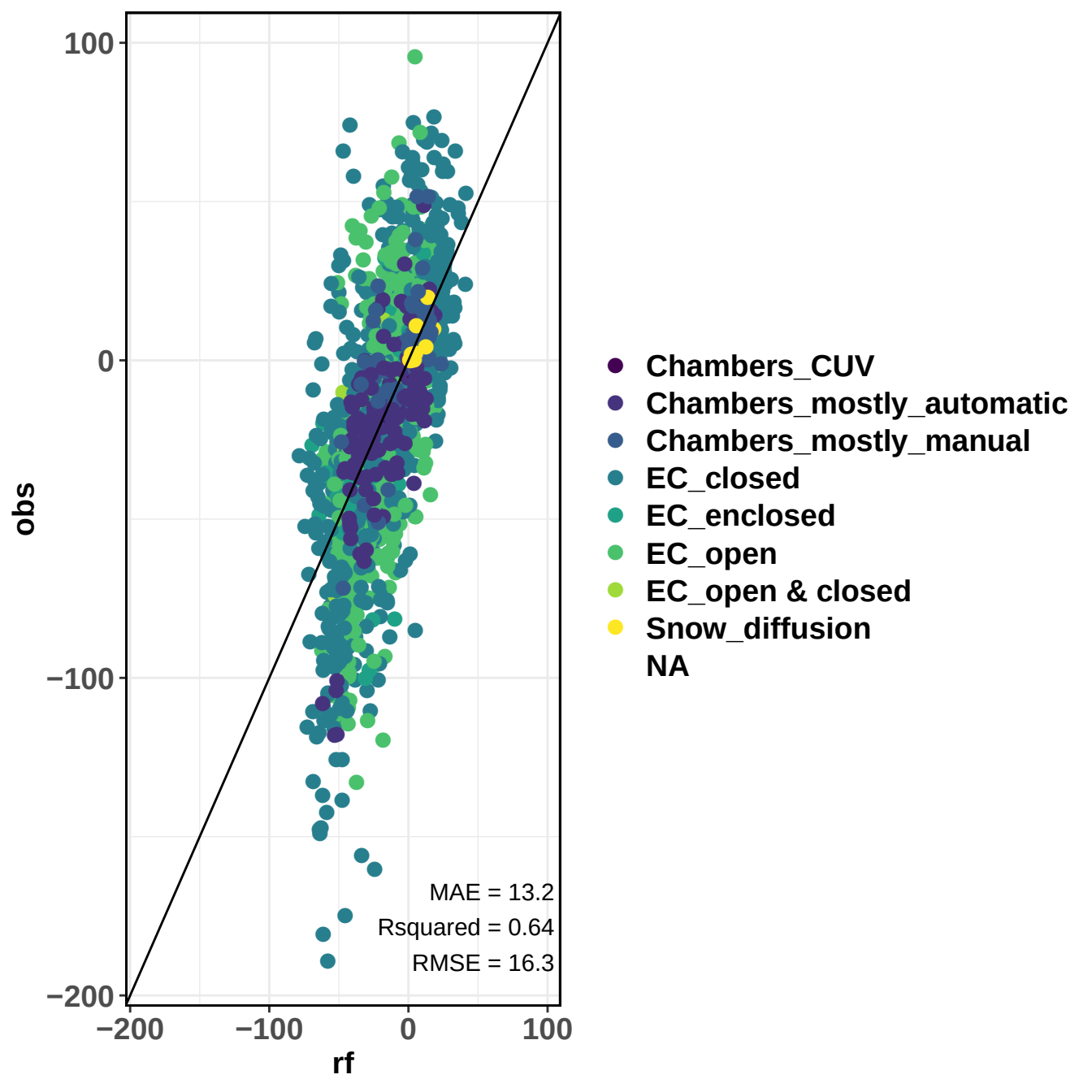

100
0
−100
−200
−200
−100
0
100
Observed flux g C m−2month−1
Predicted flux (ensemble) g C m−2month−1
MAE = NaN
Rsquared = NA
RMSE = NaN

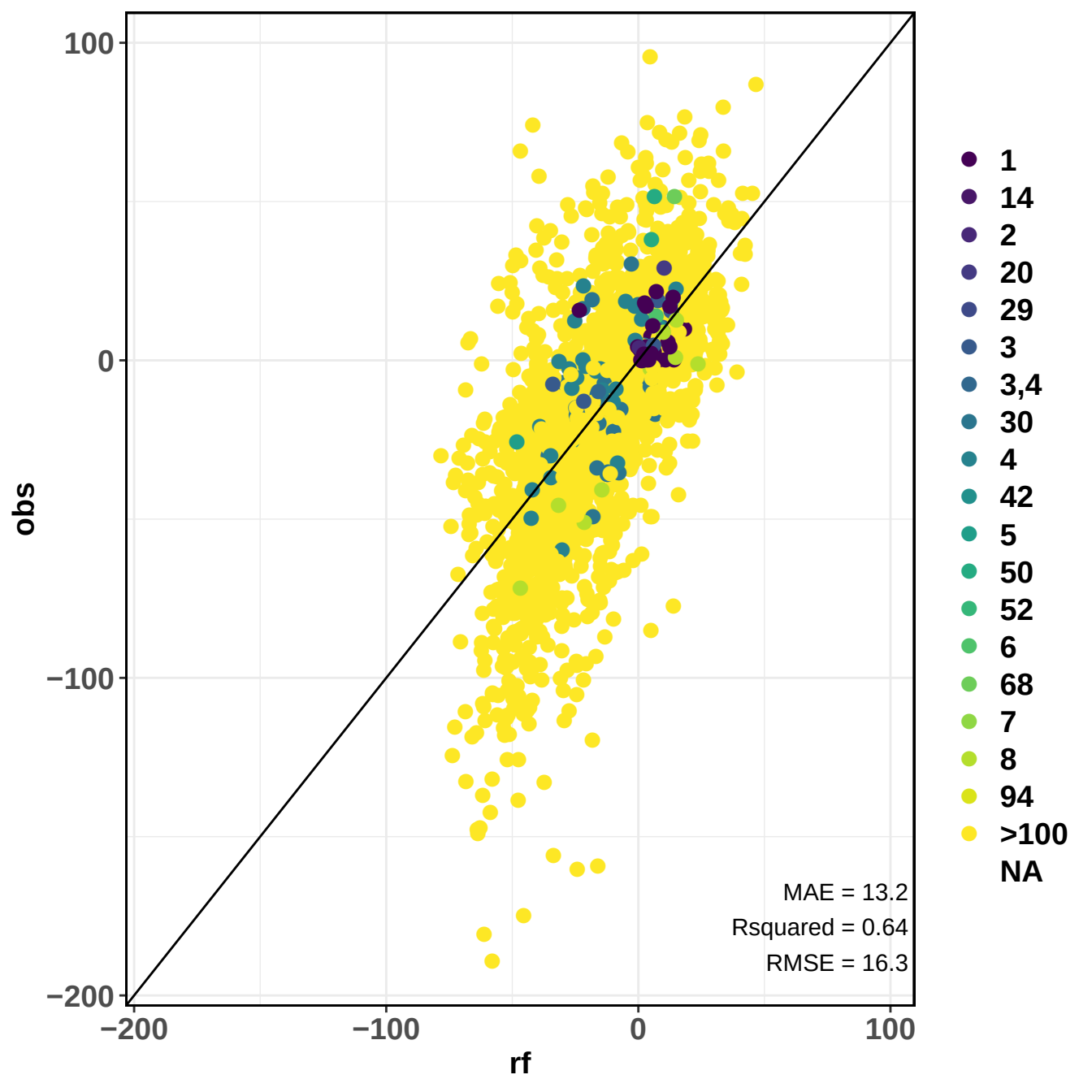

100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.2
Rsquared = 0.64
RMSE = 16.3
Boreal
Tundra


100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.2
Rsquared = 0.64
RMSE = 16.3
B
BW
BW,EN
BW,SB
DB
DN
EN
EN,BW
G
G,W
MF
P
S
S,W
SB
W
W,G
W,S


100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.2
Rsquared = 0.64
RMSE = 16.3
Drainage
Fire
Harvest
NA
No
Thermokarst


100
0
−100
−200
obs
−200
−100
0
100
rf
Ch
Diff
EC
MAE = 13.2
Rsquared = 0.64
RMSE = 16.3


100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.2
Rsquared = 0.64
RMSE = 16.3
Chambers_CUV
Chambers_mostly_automatic
Chambers_mostly_manual
EC_closed
EC_enclosed
EC_open
EC_open & closed
Snow_diffusion
NA


100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.2
Rsquared = 0.64
RMSE = 16.3
1
14
2
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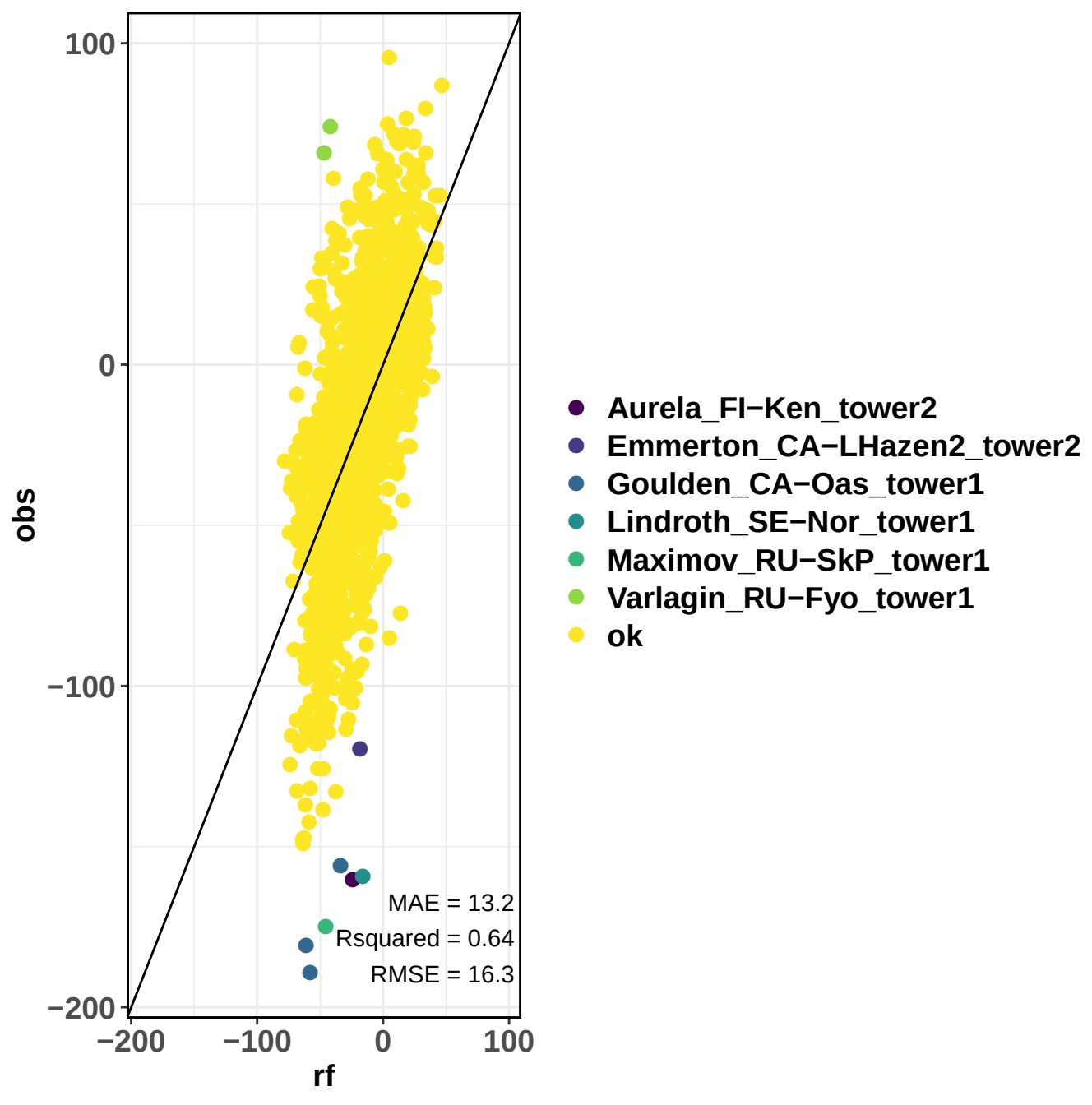
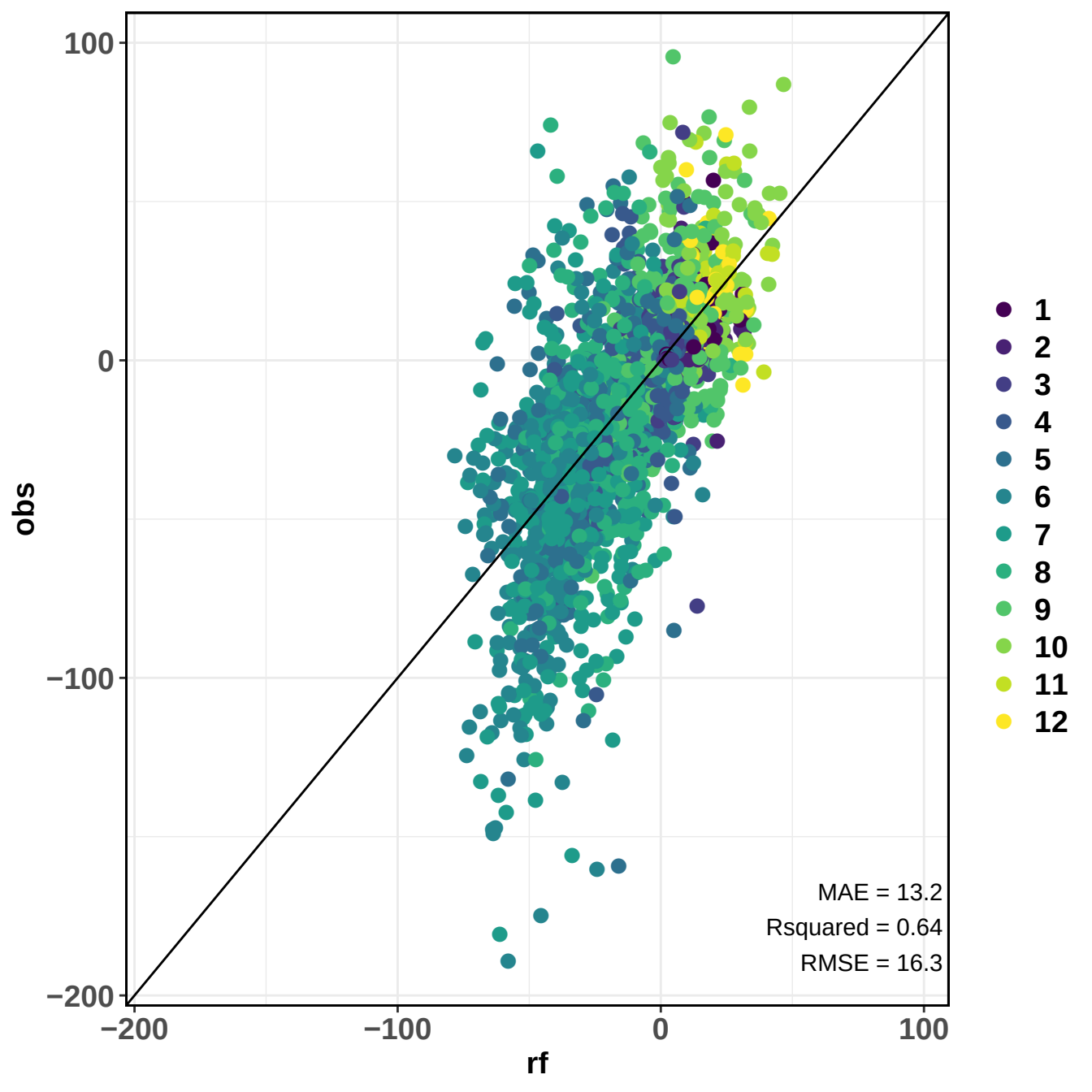
3
3,4
30
4
42
5
50
52
6
68
7
8
94
>100
NA


100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.2
Rsquared = 0.64
RMSE = 16.3
Aurela_FI−Ken_tower2
Emmerton_CA−LHazen2_tower2
Goulden_CA−Oas_tower1
Lindroth_SE−Nor_tower1
Maximov_RU−SkP_tower1
Varlagin_RU−Fyo_tower1
ok


100
0
−100
−200
obs
−200
−100
0
100
rf
MAE = 13.2
Rsquared = 0.64
RMSE = 16.3
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2
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5
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7
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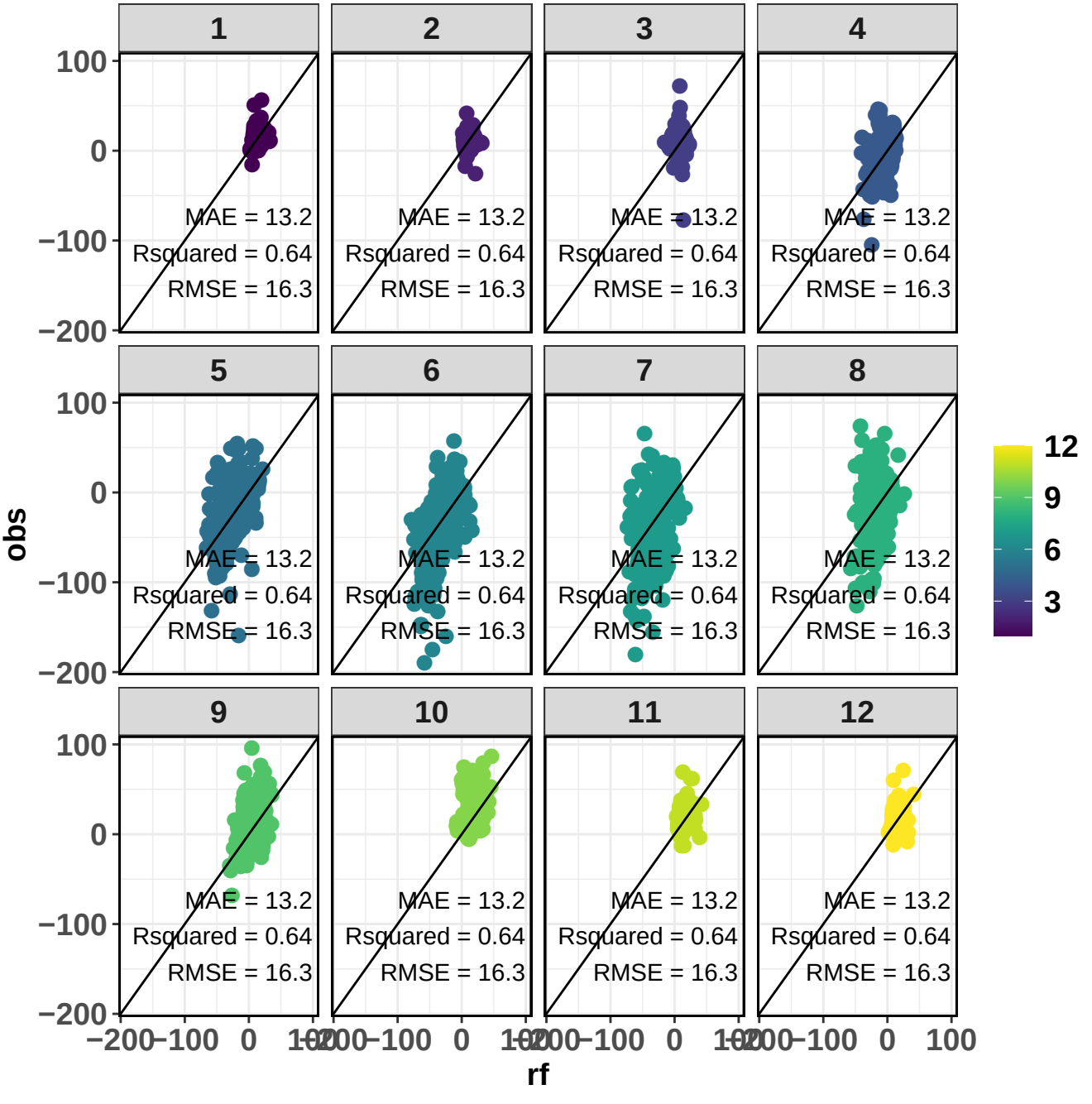
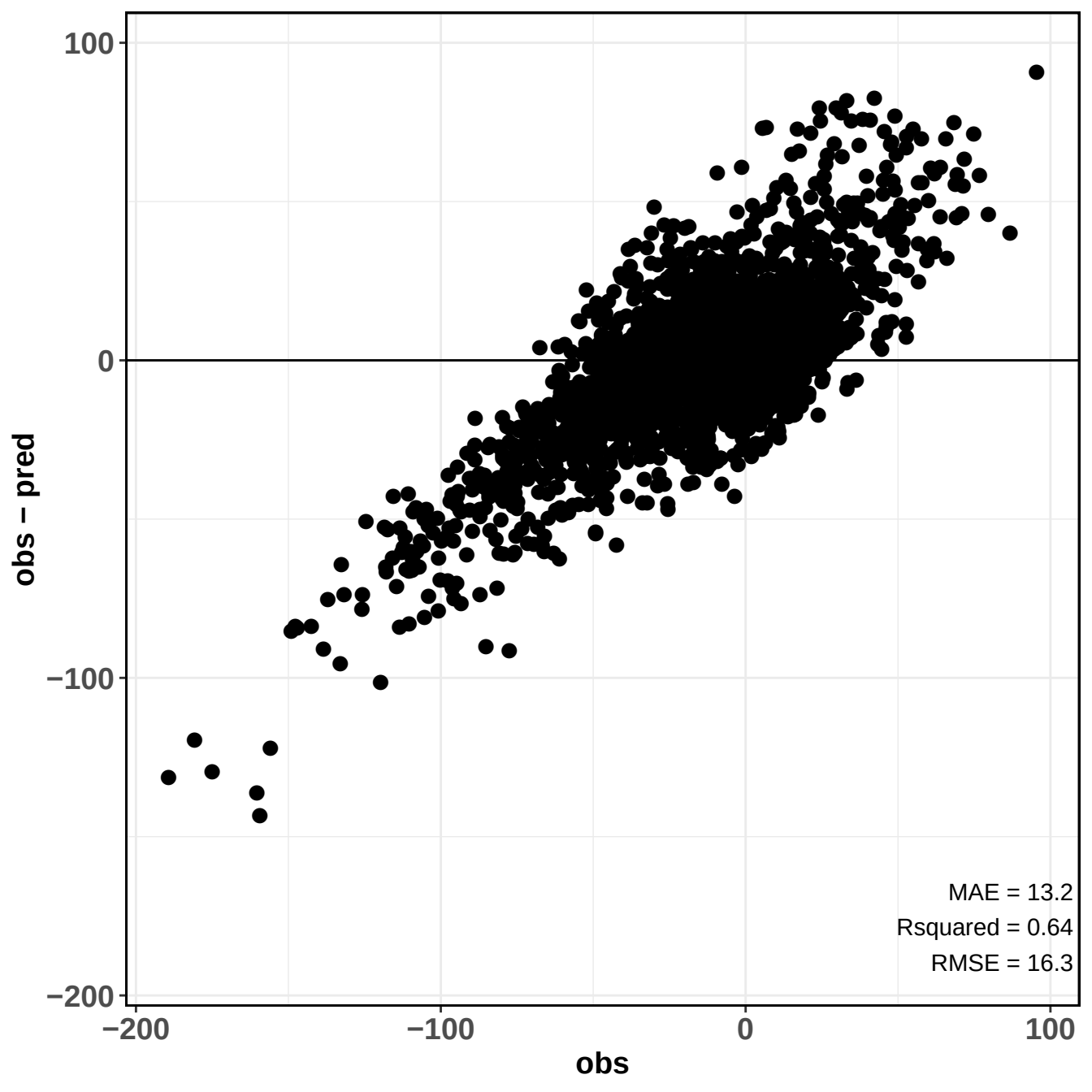
9
10
11
12


1
2
3
4
5
6
7
8
9
10
11
12
MAE = 13.2
Rsquared = 0.64
RMSE = 16.3
obs
rf
100
0
−100
−200
12
9
6
3


100
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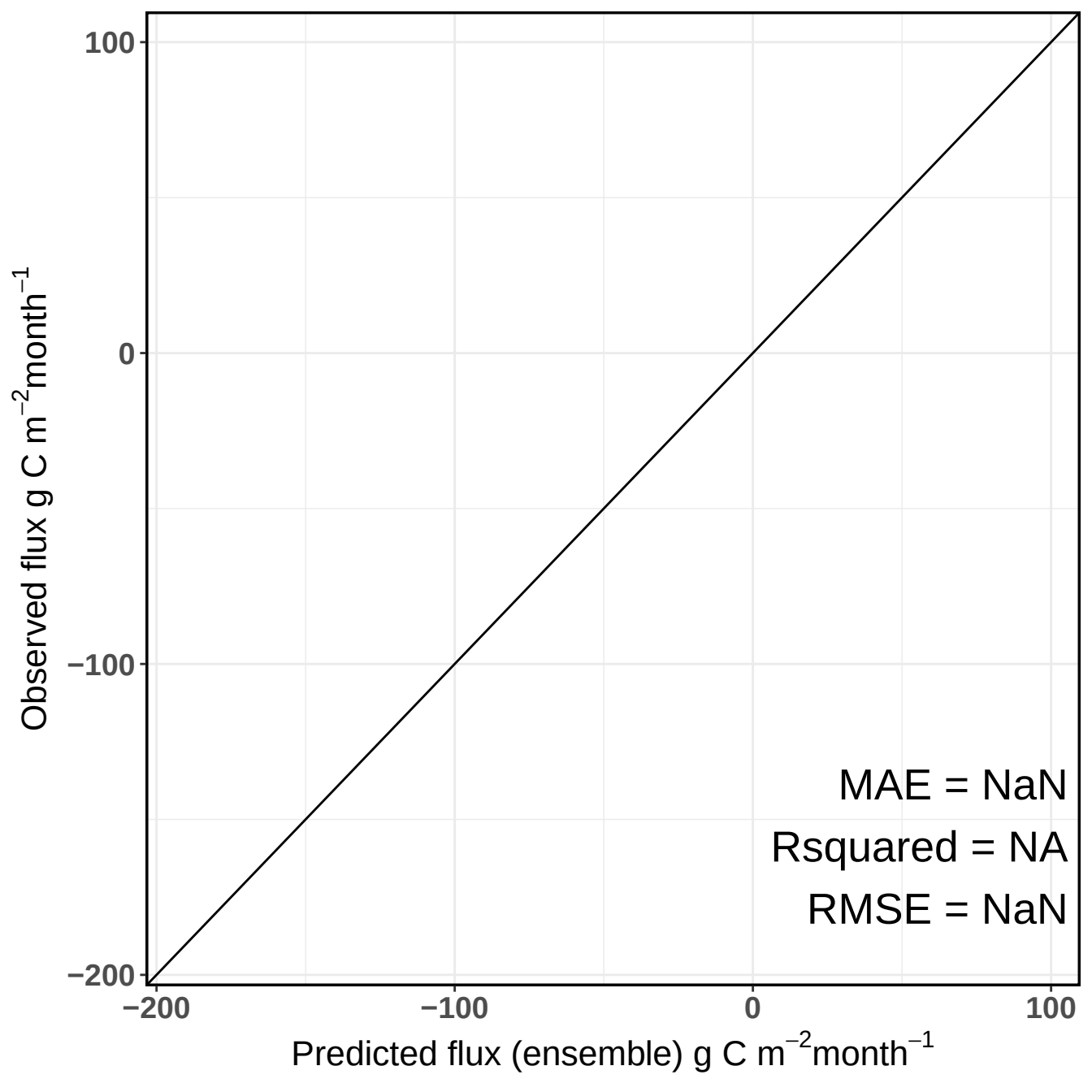
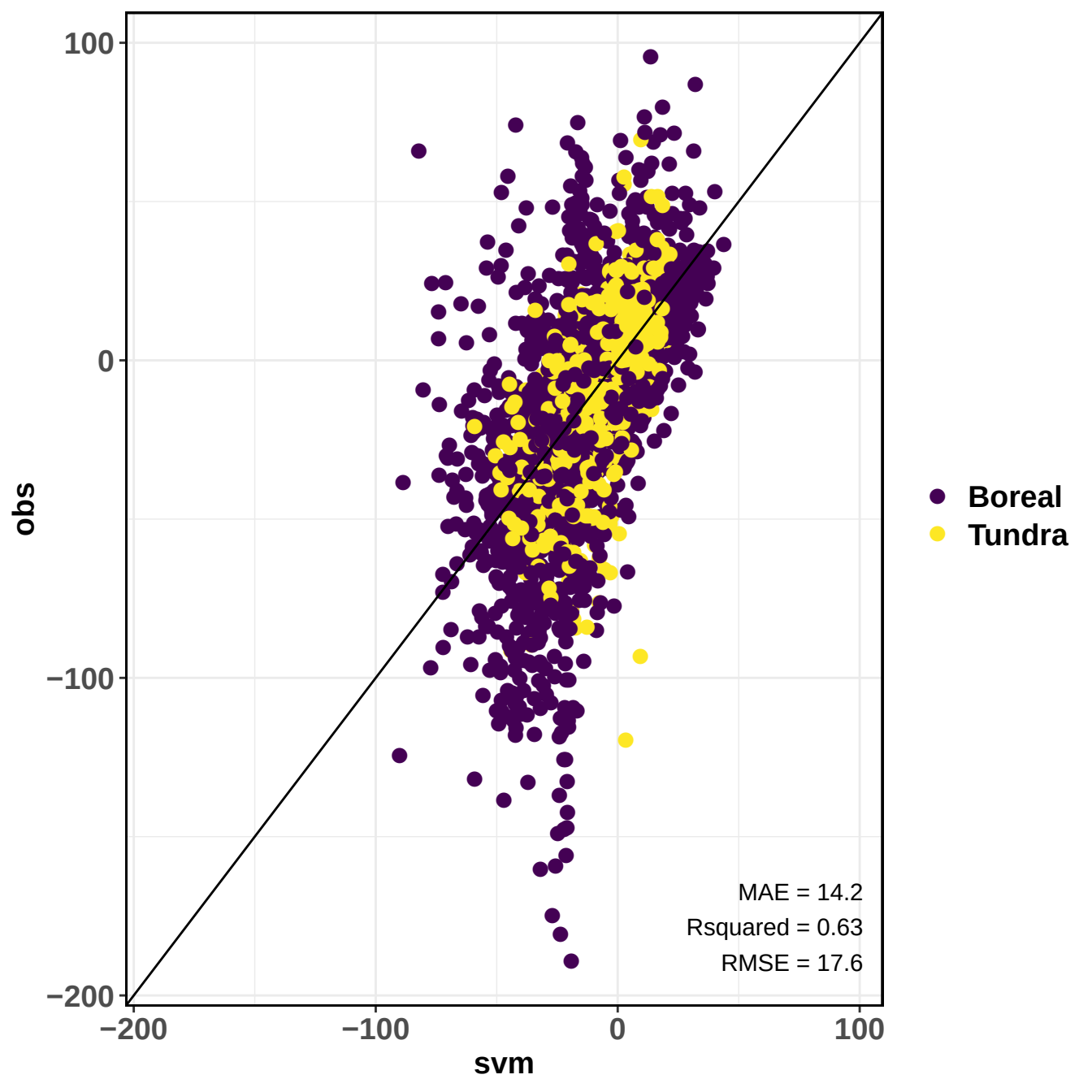
−200
obs − pred
−200
−100
0
100
obs
MAE = 13.2
Rsquared = 0.64
RMSE = 16.3


100
0
−100
−200
−200
−100
0
100
Observed flux g C m−2month−1
Predicted flux (ensemble) g C m−2month−1
MAE = NaN
Rsquared = NA
RMSE = NaN


100
0
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obs
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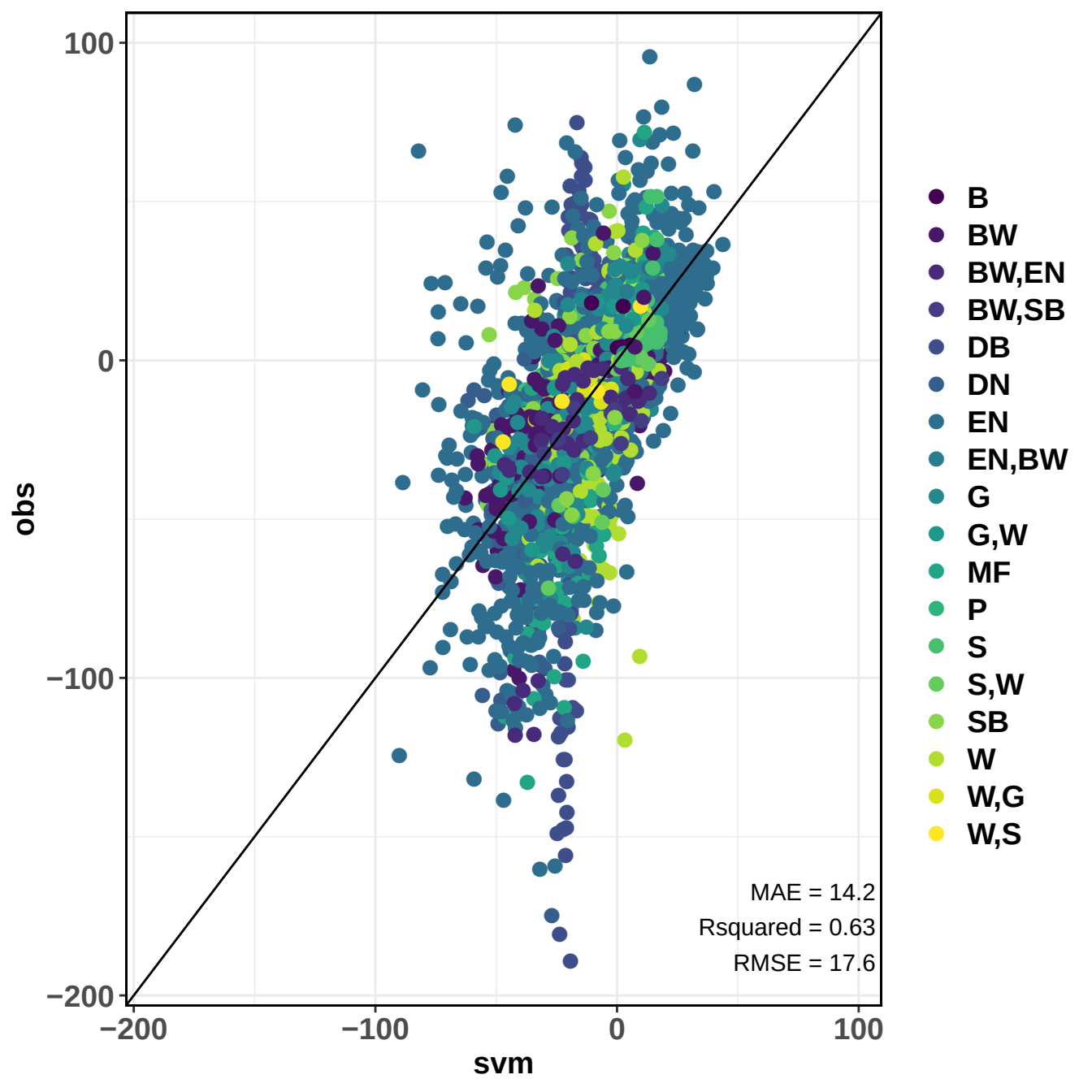
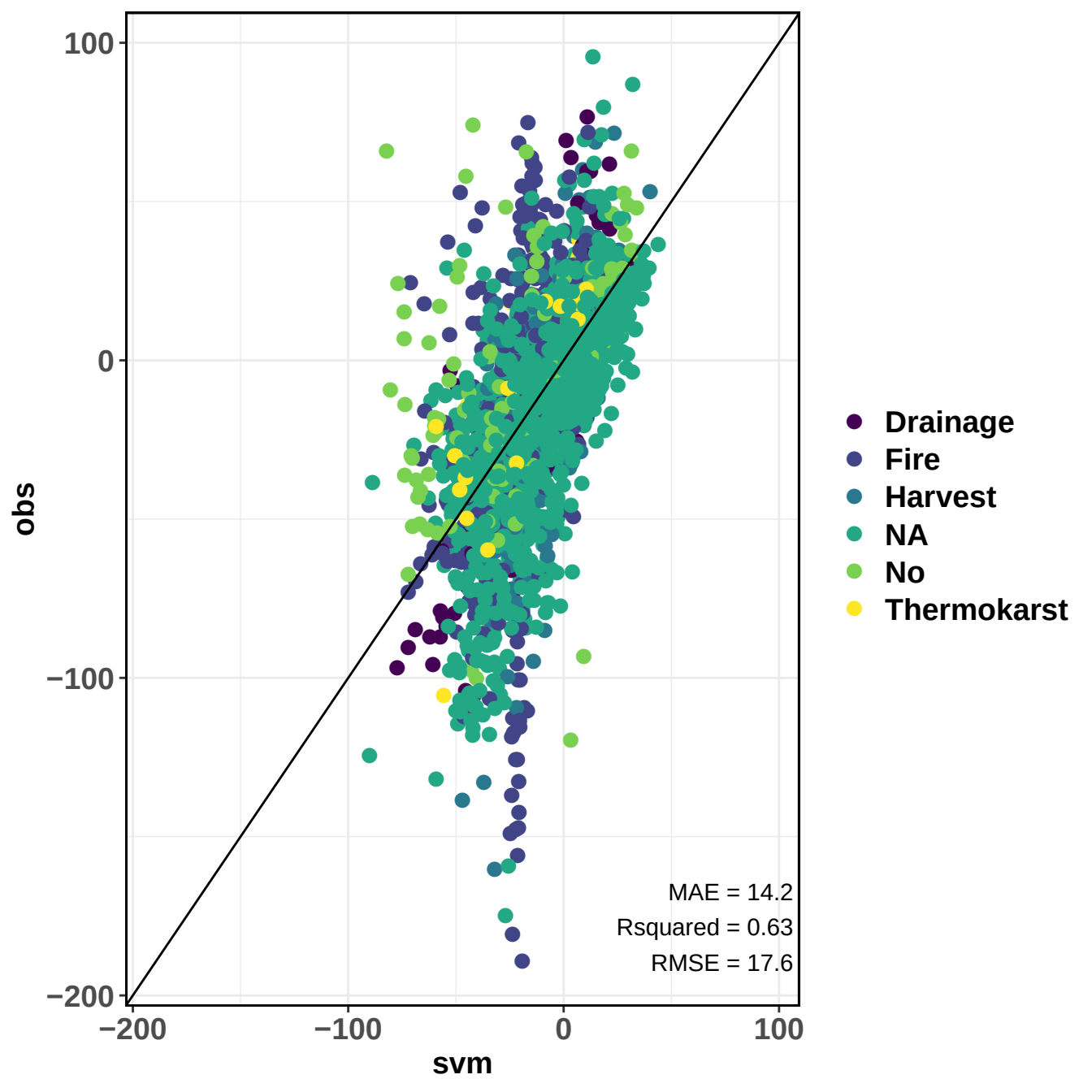
−100
0
100
svm
MAE = 14.2
Rsquared = 0.63
RMSE = 17.6
Boreal
Tundra


100
0
−100
−200
obs
−200
−100
0
100
svm
MAE = 14.2
Rsquared = 0.63
RMSE = 17.6
B
BW
BW,EN
BW,SB
DB
DN
EN
EN,BW
G
G,W
MF
P
S
S,W
SB
W
W,G
W,S


100
0
−100
−200
obs
−200
−100
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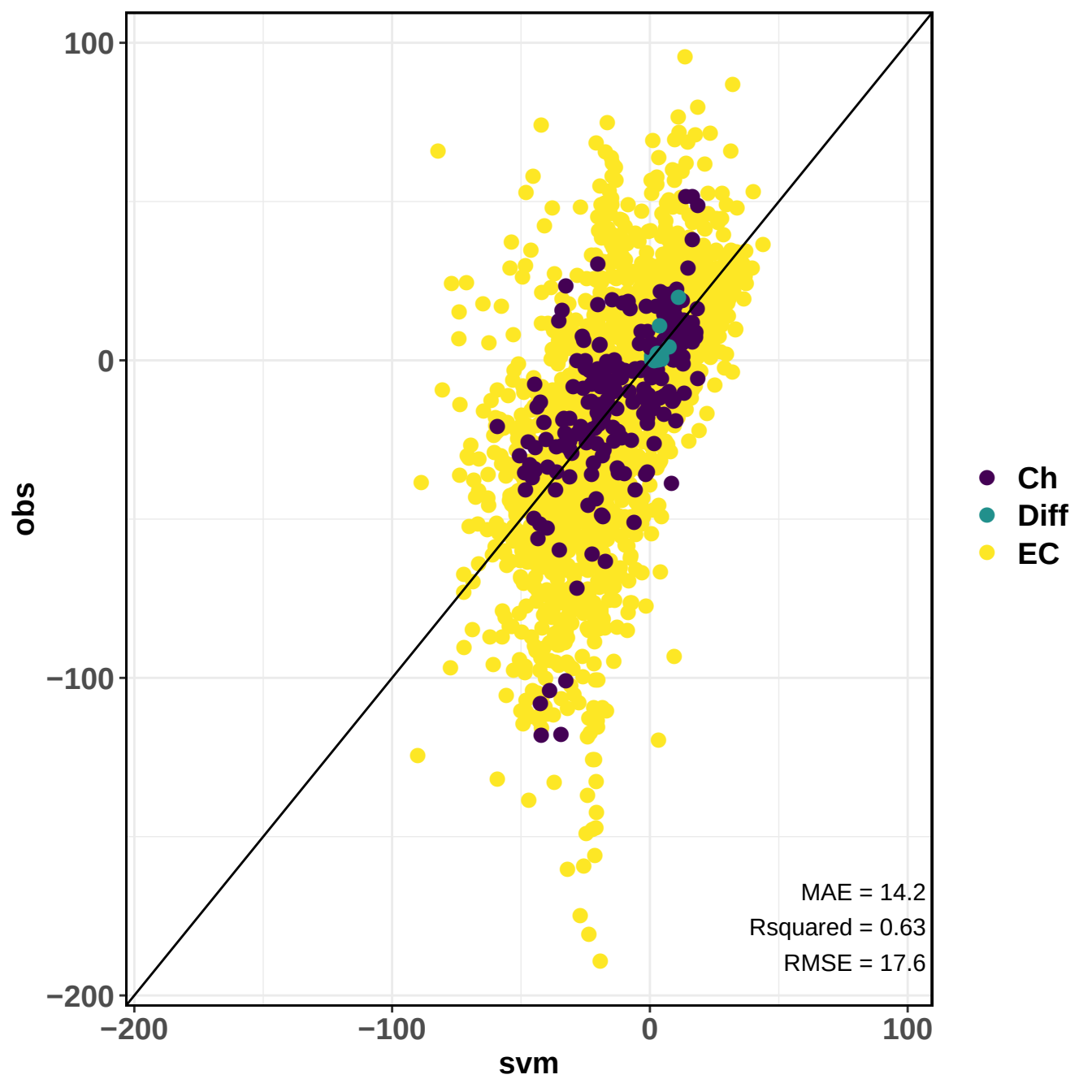
100
svm
MAE = 14.2
Rsquared = 0.63
RMSE = 17.6
Drainage
Fire
Harvest
NA
No
Thermokarst


100
0
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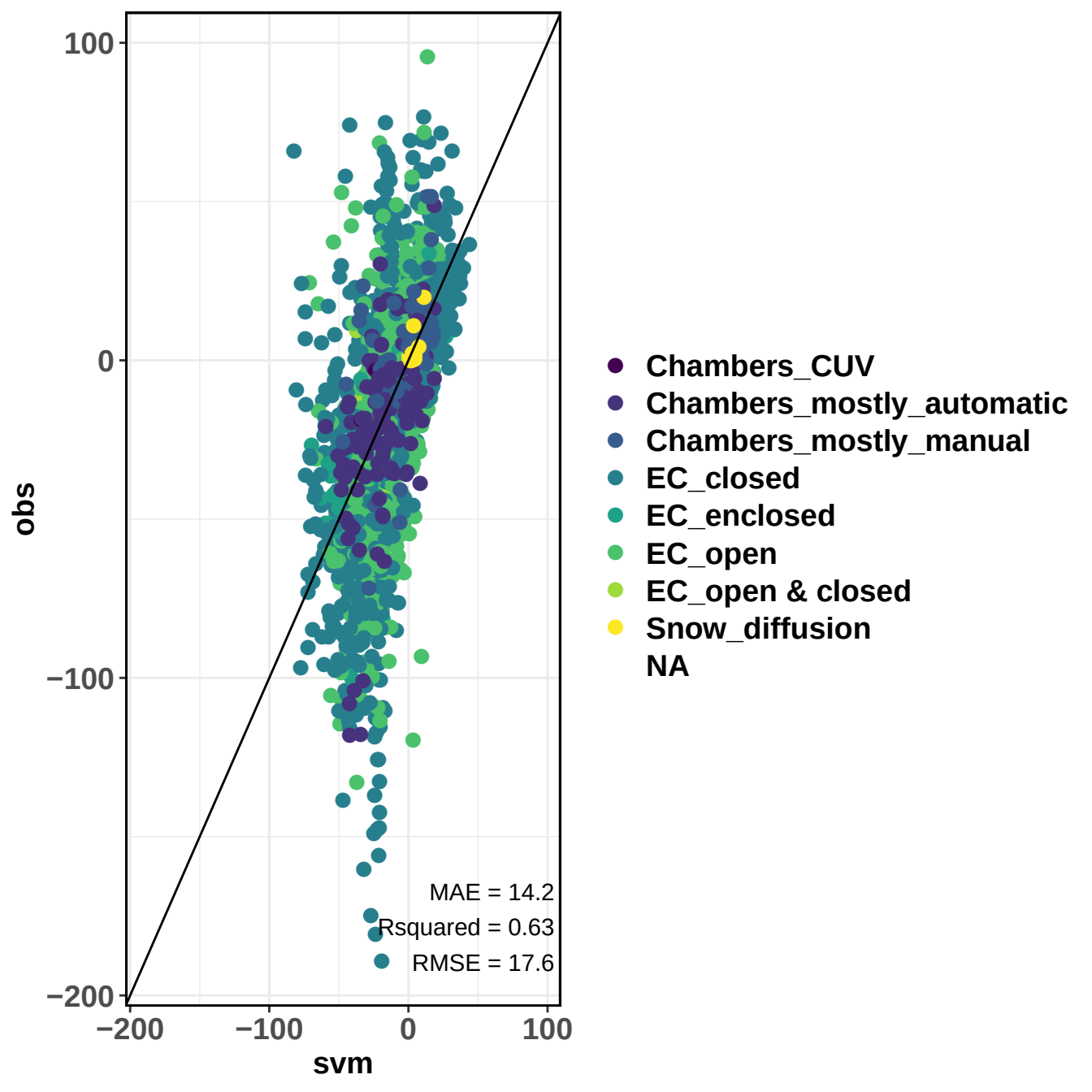
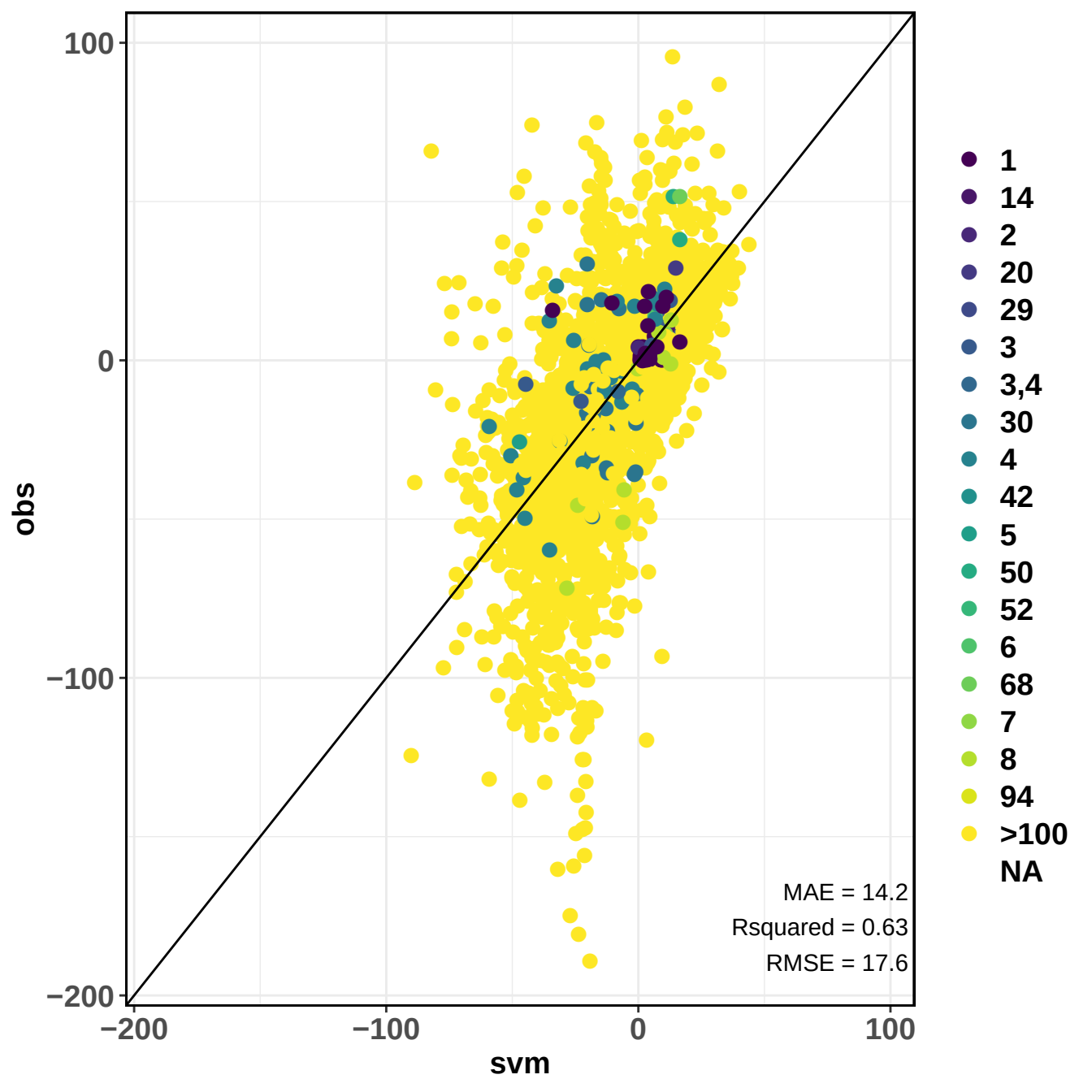
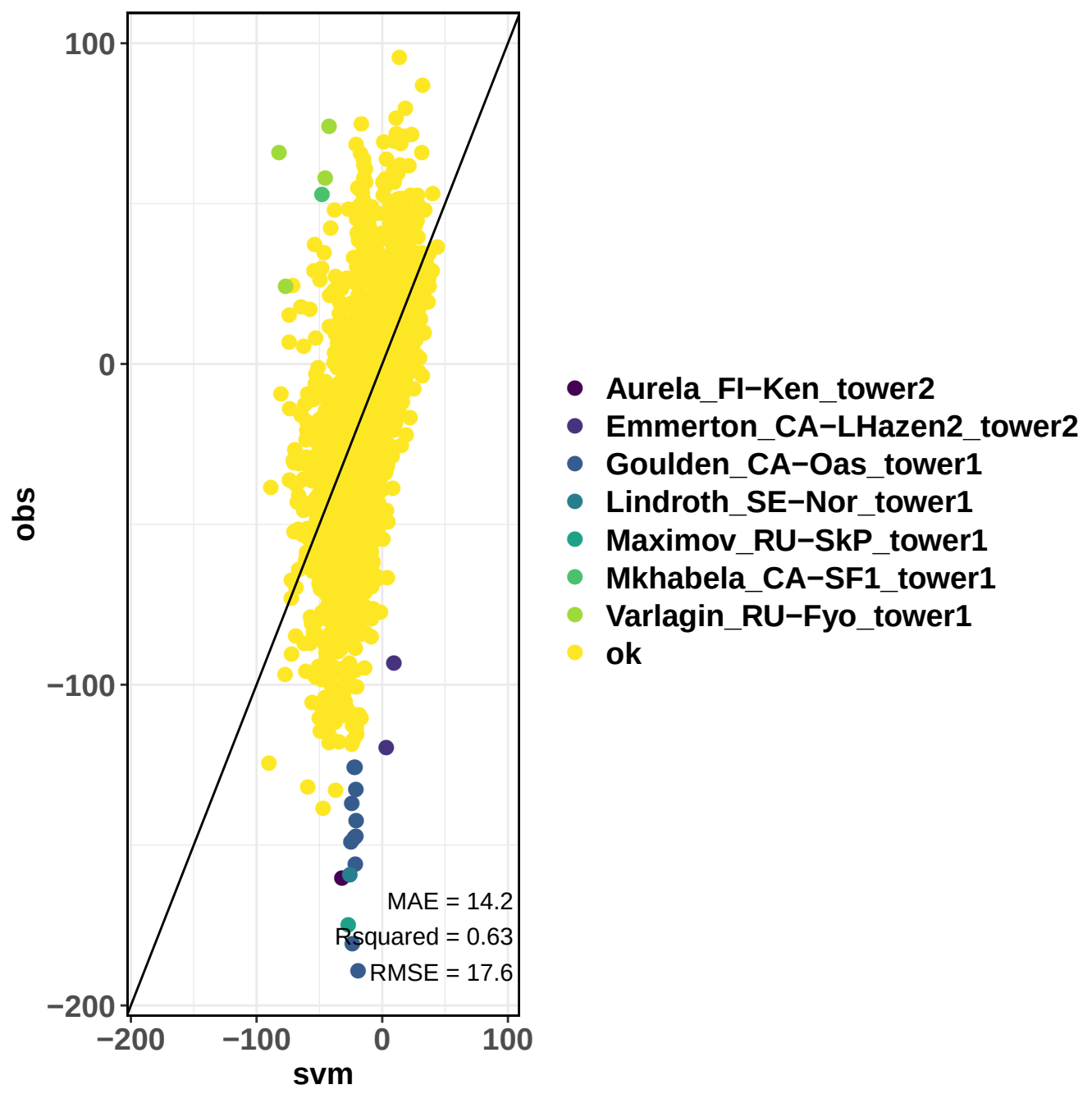
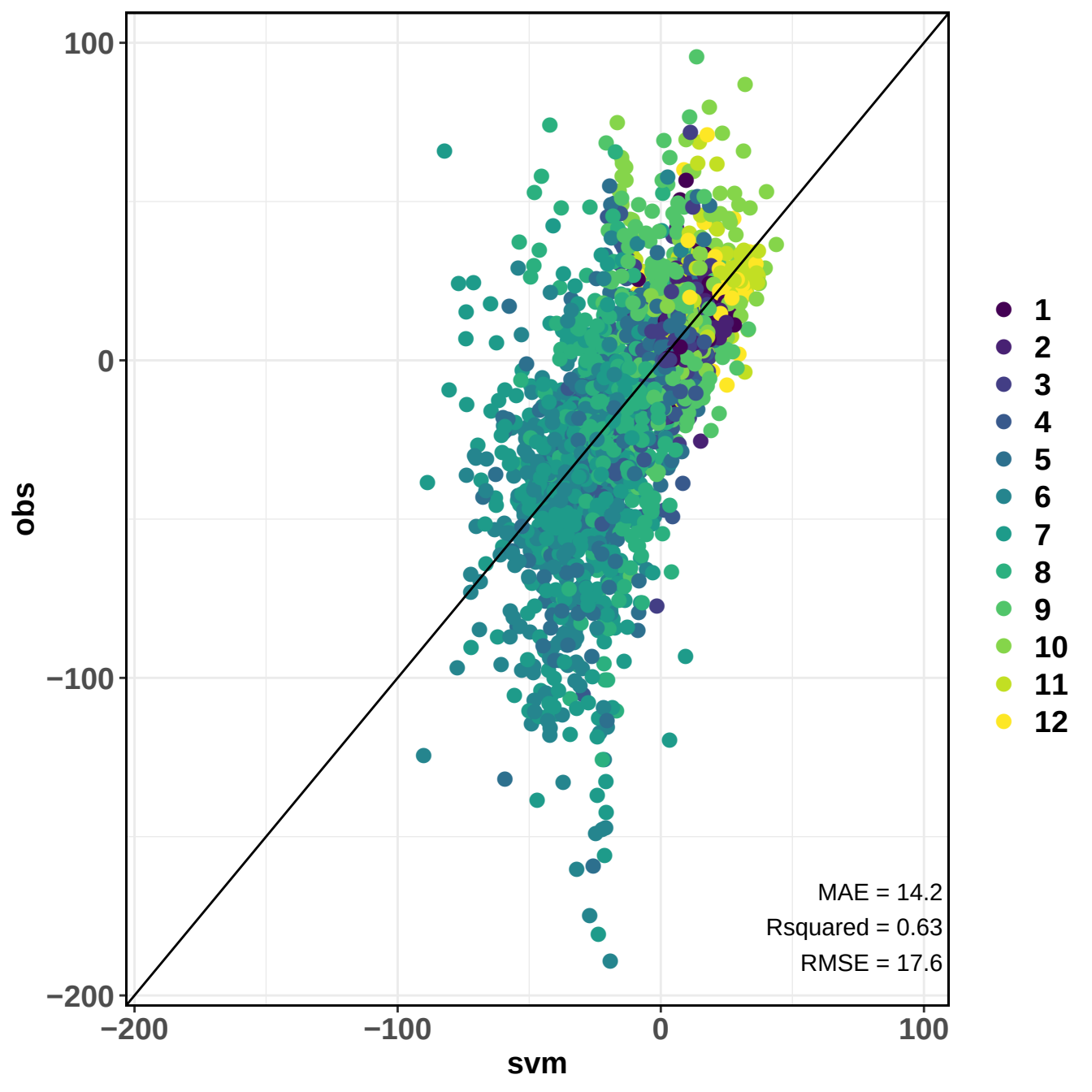
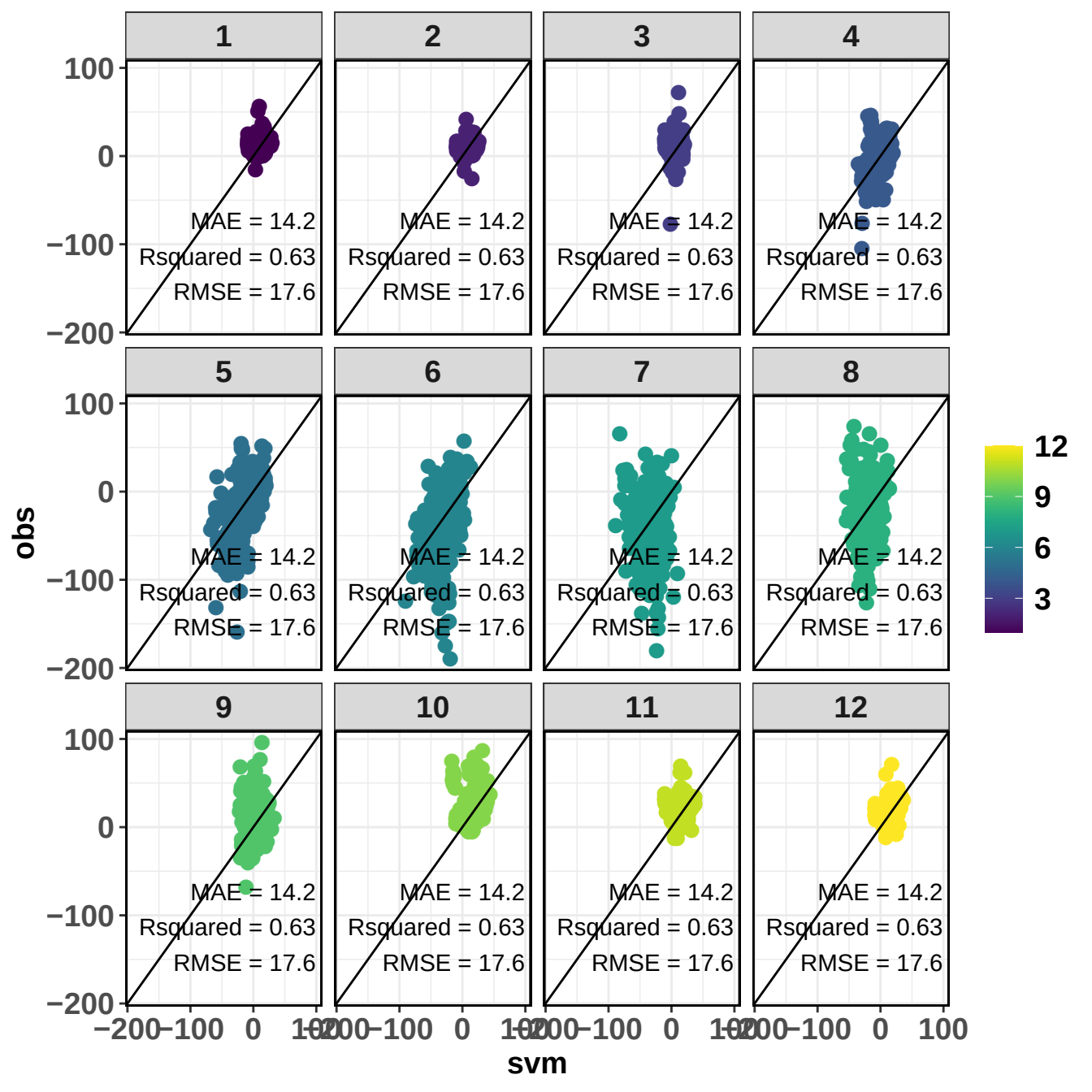
obs
−200
−100
0
100
svm
MAE = 14.2
Rsquared = 0.63
RMSE = 17.6
Ch
Diff
EC

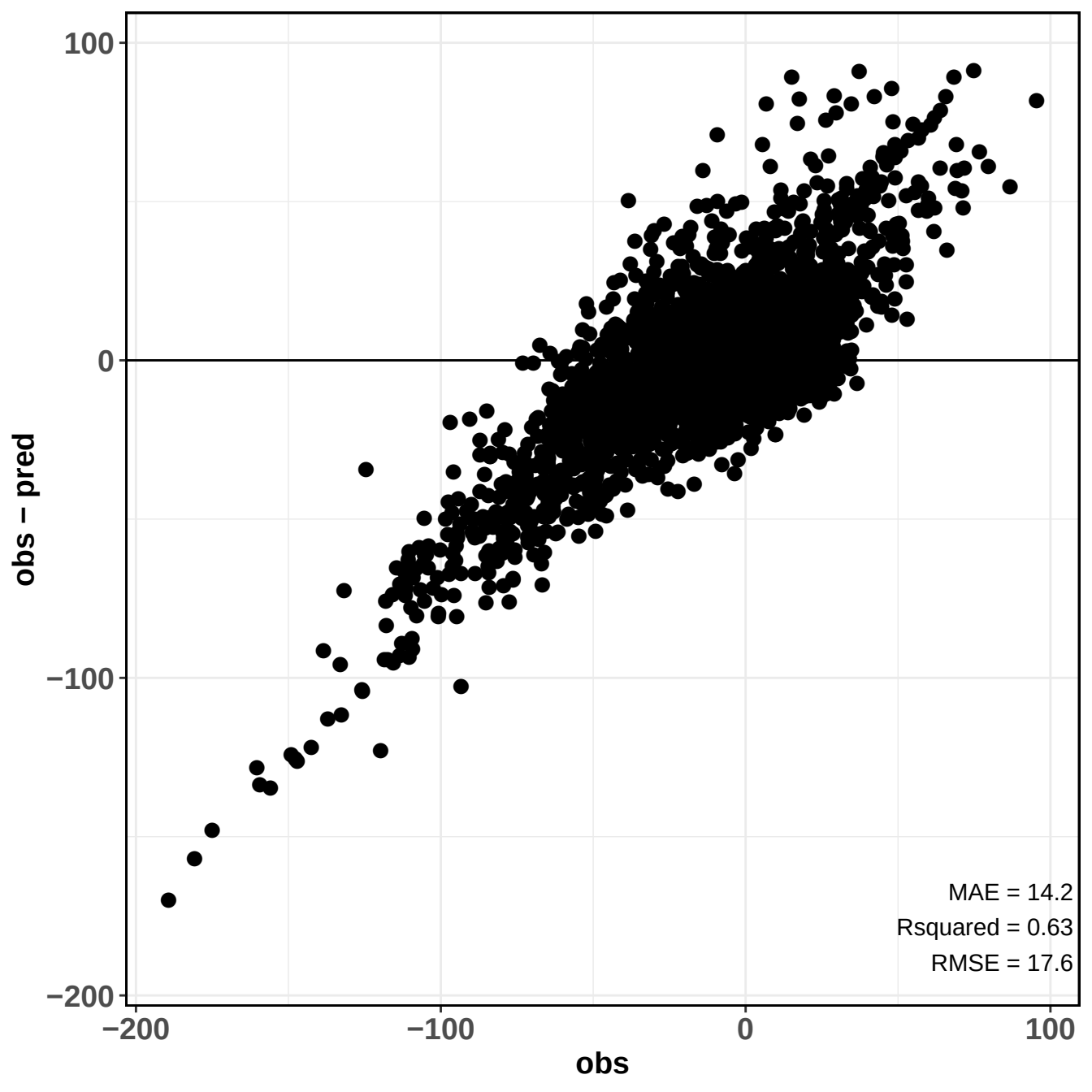

100
0
−100
−200
obs
−200
−100
0
100
svm
MAE = 14.2
Rsquared = 0.63
RMSE = 17.6
Chambers_CUV
Chambers_mostly_automatic
Chambers_mostly_manual
EC_closed
EC_enclosed
EC_open
EC_open & closed
Snow_diffusion
NA

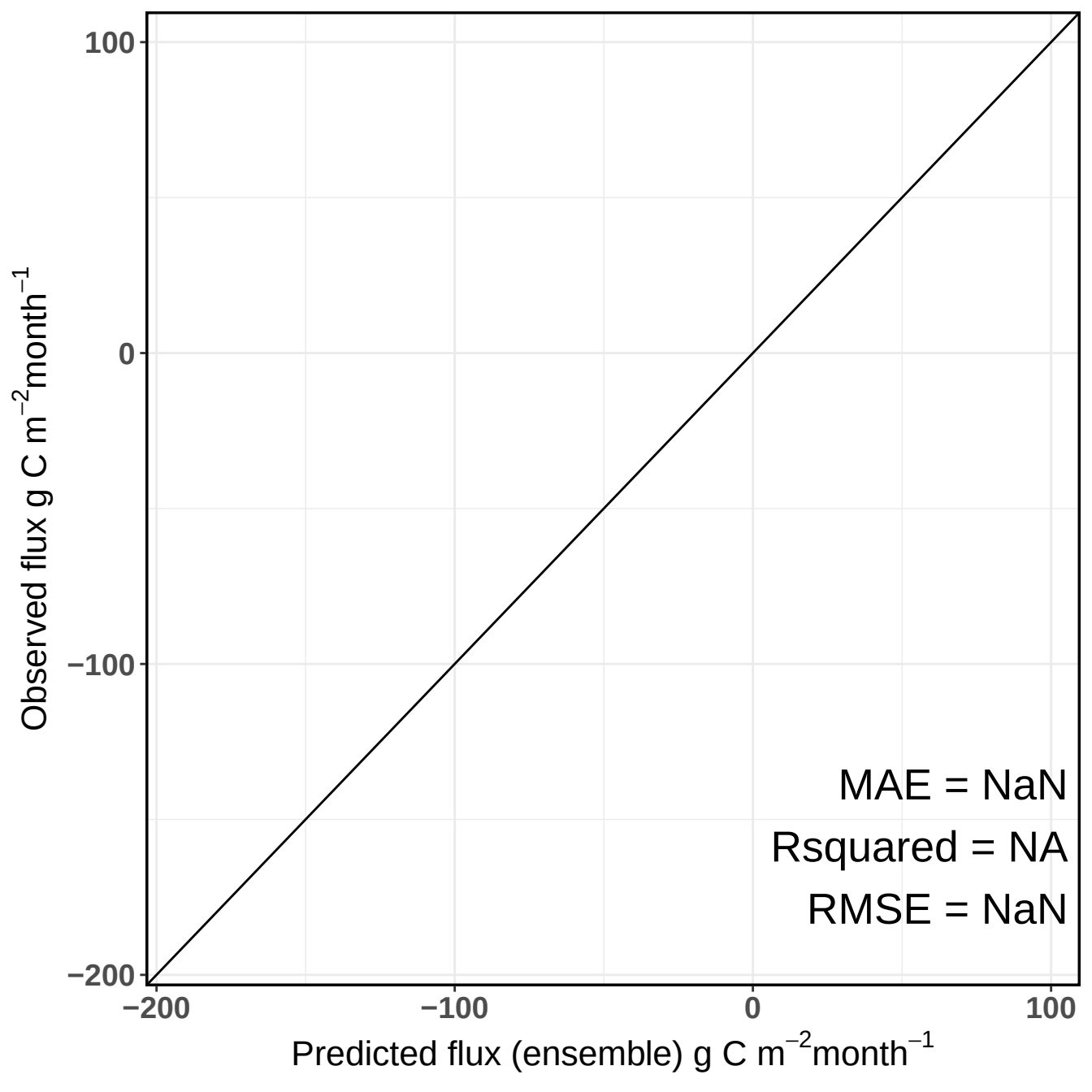

100
0
−100
−200
obs
−200
−100
0
100
svm
MAE = 14.2
Rsquared = 0.63
RMSE = 17.6
1
14
2
20
29
3
3,4
30
4
42
5
50
52
6
68
7
8
94
>100
NA


100
0
−100
−200
obs
−200
−100
0
100
svm
MAE = 14.2
Rsquared = 0.63
RMSE = 17.6
Aurela_FI−Ken_tower2
Emmerton_CA−LHazen2_tower2
Goulden_CA−Oas_tower1
Lindroth_SE−Nor_tower1
Maximov_RU−SkP_tower1
Mkhabela_CA−SF1_tower1
Varlagin_RU−Fyo_tower1
ok


100
0
−100
−200
obs
−200
−100
0
100
svm
MAE = 14.2
Rsquared = 0.63
RMSE = 17.6
1
2
3
4
5
6
7
8
9
10
11
12


1
2
3
4
5
6
7
8
9
10
11
12
MAE = 14.2
Rsquared = 0.63
RMSE = 17.6
obs
svm
100
0
−100
−200
12
9
6
3


100
0
−100
−200
obs − pred
−200
−100
0
100
obs
MAE = 14.2
Rsquared = 0.63
RMSE = 17.6


100
0
−100
−200
−200
−100
0
100
Observed flux g C m−2month−1
Predicted flux (ensemble) g C m−2month−1
MAE = NaN
Rsquared = NA
RMSE = NaN