

Foundations of Functional Programming with purrr_More complex iterations

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Working with unnamed lists

```
library(repurrrsive)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##   filter, lag

## The following objects are masked from 'package:base':
##
##   intersect, setdiff, setequal, union
```

```
library(purrr)
data(sw_films)
str(sw_films)
```

```
## List of 7
## $ :List of 14
##   ..$ title      : chr "A New Hope"
##   ..$ episode_id : int 4
##   ..$ opening_crawl: chr "It is a period of civil war.\r\nRebel spaceships, striking\r\nfrom a hidden
##   ..$ director   : chr "George Lucas"
##   ..$ producer   : chr "Gary Kurtz, Rick McCallum"
##   ..$ release_date : chr "1977-05-25"
##   ..$ characters  : chr [1:18] "http://swapi.co/api/people/1/" "http://swapi.co/api/people/2/" "http
##   ..$ planets     : chr [1:3] "http://swapi.co/api/planets/2/" "http://swapi.co/api/planets/3/" "ht
##   ..$ starships   : chr [1:8] "http://swapi.co/api/starships/2/" "http://swapi.co/api/starships/3/"
##   ..$ vehicles     : chr [1:4] "http://swapi.co/api/vehicles/4/" "http://swapi.co/api/vehicles/6/" "1
##   ..$ species     : chr [1:5] "http://swapi.co/api/species/5/" "http://swapi.co/api/species/3/" "ht
##   ..$ created      : chr "2014-12-10T14:23:31.880000Z"
##   ..$ edited       : chr "2015-04-11T09:46:52.774897Z"
##   ..$ url          : chr "http://swapi.co/api/films/1/"
## $ :List of 14
```

```

## ..$ title      : chr "Attack of the Clones"
## ..$ episode_id  : int 2
## ..$ opening_crawl: chr "There is unrest in the Galactic\r\nSenate. Several thousand solar\r\nsystems
## ..$ director    : chr "George Lucas"
## ..$ producer    : chr "Rick McCallum"
## ..$ release_date : chr "2002-05-16"
## ..$ characters   : chr [1:40] "http://swapi.co/api/people/2/" "http://swapi.co/api/people/3/" "http://swapi.co/api/people/4/"
## ..$ planets      : chr [1:5] "http://swapi.co/api/planets/8/" "http://swapi.co/api/planets/9/" "http://swapi.co/api/planets/10/"
## ..$ starships    : chr [1:9] "http://swapi.co/api/starships/21/" "http://swapi.co/api/starships/39/" "http://swapi.co/api/starships/40/"
## ..$ vehicles     : chr [1:11] "http://swapi.co/api/vehicles/4/" "http://swapi.co/api/vehicles/44/" "http://swapi.co/api/vehicles/45/"
## ..$ species      : chr [1:14] "http://swapi.co/api/species/32/" "http://swapi.co/api/species/33/" "http://swapi.co/api/species/34/"
## ..$ created      : chr "2014-12-20T10:57:57.886000Z"
## ..$ edited       : chr "2015-04-11T09:45:01.623982Z"
## ..$ url          : chr "http://swapi.co/api/films/5/"
## $ :List of 14
## ..$ title      : chr "The Phantom Menace"
## ..$ episode_id  : int 1
## ..$ opening_crawl: chr "Turmoil has engulfed the\r\nGalactic Republic. The taxation\r\nof trade routes and
## ..$ director    : chr "George Lucas"
## ..$ producer    : chr "Rick McCallum"
## ..$ release_date : chr "1999-05-19"
## ..$ characters   : chr [1:34] "http://swapi.co/api/people/2/" "http://swapi.co/api/people/3/" "http://swapi.co/api/people/4/"
## ..$ planets      : chr [1:3] "http://swapi.co/api/planets/8/" "http://swapi.co/api/planets/9/" "http://swapi.co/api/planets/10/"
## ..$ starships    : chr [1:5] "http://swapi.co/api/starships/40/" "http://swapi.co/api/starships/41/" "http://swapi.co/api/starships/42/"
## ..$ vehicles     : chr [1:7] "http://swapi.co/api/vehicles/33/" "http://swapi.co/api/vehicles/34/" "http://swapi.co/api/vehicles/35/"
## ..$ species      : chr [1:20] "http://swapi.co/api/species/1/" "http://swapi.co/api/species/2/" "http://swapi.co/api/species/3/"
## ..$ created      : chr "2014-12-19T16:52:55.740000Z"
## ..$ edited       : chr "2015-04-11T09:45:18.689301Z"
## ..$ url          : chr "http://swapi.co/api/films/4/"
## $ :List of 14
## ..$ title      : chr "Revenge of the Sith"
## ..$ episode_id  : int 3
## ..$ opening_crawl: chr "War! The Republic is crumbling\r\nunder attacks by the ruthless\r\nSith Lord
## ..$ director    : chr "George Lucas"
## ..$ producer    : chr "Rick McCallum"
## ..$ release_date : chr "2005-05-19"
## ..$ characters   : chr [1:34] "http://swapi.co/api/people/1/" "http://swapi.co/api/people/2/" "http://swapi.co/api/people/3/"
## ..$ planets      : chr [1:13] "http://swapi.co/api/planets/2/" "http://swapi.co/api/planets/5/" "http://swapi.co/api/planets/6/"
## ..$ starships    : chr [1:12] "http://swapi.co/api/starships/48/" "http://swapi.co/api/starships/50/" "http://swapi.co/api/starships/51/"
## ..$ vehicles     : chr [1:13] "http://swapi.co/api/vehicles/33/" "http://swapi.co/api/vehicles/50/" "http://swapi.co/api/vehicles/51/"
## ..$ species      : chr [1:20] "http://swapi.co/api/species/19/" "http://swapi.co/api/species/33/" "http://swapi.co/api/species/34/"
## ..$ created      : chr "2014-12-20T18:49:38.403000Z"
## ..$ edited       : chr "2015-04-11T09:45:44.862122Z"
## ..$ url          : chr "http://swapi.co/api/films/6/"
## $ :List of 14
## ..$ title      : chr "Return of the Jedi"
## ..$ episode_id  : int 6
## ..$ opening_crawl: chr "Luke Skywalker has returned to\r\nhis home planet of Tatooine in\r\nan attempt to
## ..$ director    : chr "Richard Marquand"
## ..$ producer    : chr "Howard G. Kazanjian, George Lucas, Rick McCallum"
## ..$ release_date : chr "1983-05-25"
## ..$ characters   : chr [1:20] "http://swapi.co/api/people/1/" "http://swapi.co/api/people/2/" "http://swapi.co/api/people/3/"
## ..$ planets      : chr [1:5] "http://swapi.co/api/planets/5/" "http://swapi.co/api/planets/7/" "http://swapi.co/api/planets/8/"
## ..$ starships    : chr [1:12] "http://swapi.co/api/starships/10/" "http://swapi.co/api/starships/11/" "http://swapi.co/api/starships/12/"

```

```
## ..$ vehicles      : chr [1:8] "http://swapi.co/api/vehicles/8/" "http://swapi.co/api/vehicles/16/"
## ..$ species       : chr [1:9] "http://swapi.co/api/species/5/" "http://swapi.co/api/species/6/" "ht
## ..$ created        : chr "2014-12-18T10:39:33.255000Z"
## ..$ edited         : chr "2015-04-11T09:46:05.220365Z"
## ..$ url            : chr "http://swapi.co/api/films/3/"
## $ :List of 14
## ..$ title          : chr "The Empire Strikes Back"
## ..$ episode_id     : int 5
## ..$ opening_crawl  : chr "It is a dark time for the\r\nRebellion. Although the Death\r\nStar has been
## ..$ director       : chr "Irvin Kershner"
## ..$ producer       : chr "Gary Kutz, Rick McCallum"
## ..$ release_date   : chr "1980-05-17"
## ..$ characters     : chr [1:16] "http://swapi.co/api/people/1/" "http://swapi.co/api/people/2/" "http
## ..$ planets        : chr [1:4] "http://swapi.co/api/planets/4/" "http://swapi.co/api/planets/5/" "ht
## ..$ starships      : chr [1:9] "http://swapi.co/api/starships/10/" "http://swapi.co/api/starships/11
## ..$ vehicles       : chr [1:6] "http://swapi.co/api/vehicles/8/" "http://swapi.co/api/vehicles/14/"
## ..$ species        : chr [1:5] "http://swapi.co/api/species/6/" "http://swapi.co/api/species/7/" "ht
## ..$ created        : chr "2014-12-12T11:26:24.656000Z"
## ..$ edited         : chr "2015-04-11T09:46:31.433607Z"
## ..$ url            : chr "http://swapi.co/api/films/2/"
## $ :List of 13
## ..$ title          : chr "The Force Awakens"
## ..$ episode_id     : int 7
## ..$ opening_crawl  : chr "Luke Skywalker has vanished.\r\nIn his absence, the sinister\r\nFIRST ORDER
## ..$ director       : chr "J. J. Abrams"
## ..$ producer       : chr "Kathleen Kennedy, J. J. Abrams, Bryan Burk"
## ..$ release_date   : chr "2015-12-11"
## ..$ characters     : chr [1:11] "http://swapi.co/api/people/1/" "http://swapi.co/api/people/3/" "http
## ..$ planets        : chr "http://swapi.co/api/planets/61/"
## ..$ starships      : chr [1:2] "http://swapi.co/api/starships/77/" "http://swapi.co/api/starships/10
## ..$ species        : chr [1:3] "http://swapi.co/api/species/3/" "http://swapi.co/api/species/2/" "ht
## ..$ created        : chr "2015-04-17T06:51:30.504780Z"
## ..$ edited         : chr "2015-12-17T14:31:47.617768Z"
## ..$ url            : chr "http://swapi.co/api/films/7/"
```

```
# Use pipes to check for names in sw_films
sw_films %>%
  names()
```

```
## NULL
```

```
# sw_films[[1]] %>%
#   names()
```

```
# Set names so each element of the list is named for the film title
sw_films_named <- sw_films %>%
  set_names(map_chr(sw_films, "title"))

# Check to see if the names worked/are correct
names(sw_films_named)
```

```
## [1] "A New Hope"           "Attack of the Clones"
## [3] "The Phantom Menace"   "Revenge of the Sith"
```

```
## [5] "Return of the Jedi"      "The Empire Strikes Back"
## [7] "The Force Awakens"
```

```
# Create a list of values from 1 through 10
numlist <- list(1,2,3,4,5,6,7,8,9,10)

# Iterate over the numlist
map(numlist, ~.x %>% sqrt() %>% sin())
```

```
## [[1]]
## [1] 0.841471
##
## [[2]]
## [1] 0.9877659
##
## [[3]]
## [1] 0.9870266
##
## [[4]]
## [1] 0.9092974
##
## [[5]]
## [1] 0.7867491
##
## [[6]]
## [1] 0.6381576
##
## [[7]]
## [1] 0.4757718
##
## [[8]]
## [1] 0.3080717
##
## [[9]]
## [1] 0.14112
##
## [[10]]
## [1] -0.02068353
```

More map()

```
# List of sites north, east, and west
sites <- list("north", "east", "west")

# Create a list of dataframes, each with a years, a, and b column
list_of_df <- map(sites,
  ~data.frame(sites = .x,
    a = rnorm(mean = 5, n = 200, sd = (5/2)),
    b = rnorm(mean = 200, n = 200, sd = 15)))

list_of_df
```

```

## [[1]]
##      sites      a      b
## 1  north 4.315575190 180.4307
## 2  north 8.502965778 171.5805
## 3  north 3.809216671 203.3765
## 4  north 8.611704541 204.8061
## 5  north 7.404639329 203.7251
## 6  north 6.876594884 191.6804
## 7  north 0.398245633 217.6383
## 8  north 5.400204272 201.6681
## 9  north 7.267435811 230.4245
## 10 north 4.281307066 198.0682
## 11 north 7.249346763 206.7465
## 12 north 3.658914860 190.5535
## 13 north 5.516798135 193.6493
## 14 north 4.195905561 190.2226
## 15 north 9.001256016 170.1695
## 16 north 4.008485171 191.4749
## 17 north 4.530420180 208.7424
## 18 north 6.715451637 200.4454
## 19 north 4.521483619 202.2757
## 20 north 5.833328900 213.7860
## 21 north 6.587568707 187.3430
## 22 north 4.359175589 183.2820
## 23 north 4.321728019 203.1239
## 24 north 5.989259328 195.5851
## 25 north 3.850301060 200.6392
## 26 north 0.804344396 236.6788
## 27 north 10.090062940 201.3848
## 28 north 4.174565874 197.0871
## 29 north 6.147035346 206.9239
## 30 north 4.802438124 187.1176
## 31 north 4.805298900 213.8348
## 32 north 8.471270410 205.7008
## 33 north 4.131227657 182.0591
## 34 north 2.974977240 205.2221
## 35 north 10.635042001 228.3058
## 36 north 7.855923778 191.1888
## 37 north 1.398181607 204.3036
## 38 north 6.048393915 208.3349
## 39 north 9.306267949 184.1326
## 40 north 2.124098300 206.0180
## 41 north 6.762380185 193.5036
## 42 north 8.442220352 203.5902
## 43 north 3.636881330 203.5305
## 44 north 6.661005682 220.3177
## 45 north 3.416653917 201.7814
## 46 north 3.422359715 198.0529
## 47 north 2.343331238 218.2938
## 48 north 0.046512455 196.0894
## 49 north 4.663793860 227.4206
## 50 north 4.938628003 164.2551
## 51 north 3.664986121 226.1370
## 52 north 2.879722118 188.6203

```

## 53	north	4.902759421	209.3925
## 54	north	3.822981126	199.9368
## 55	north	2.257266379	229.9647
## 56	north	6.178324940	188.7131
## 57	north	6.155267641	220.9344
## 58	north	2.694192142	193.4725
## 59	north	5.975052043	200.9571
## 60	north	7.547651710	204.2587
## 61	north	6.559310026	206.9332
## 62	north	5.363011539	200.7548
## 63	north	7.966799854	211.1637
## 64	north	3.019202679	195.7291
## 65	north	0.789865232	200.0491
## 66	north	4.354867772	223.0262
## 67	north	5.264756348	190.5408
## 68	north	3.105238726	209.7512
## 69	north	2.378247507	191.9489
## 70	north	1.025625130	200.8240
## 71	north	1.924619201	209.5673
## 72	north	2.000628720	201.6776
## 73	north	3.076503393	189.2689
## 74	north	10.175466441	197.4952
## 75	north	5.218065825	187.3319
## 76	north	7.517045970	192.5956
## 77	north	9.316462040	181.3776
## 78	north	5.117902570	187.6484
## 79	north	5.661959501	193.6463
## 80	north	3.329812142	197.4295
## 81	north	3.654041804	216.1276
## 82	north	4.095714965	189.4960
## 83	north	1.260071905	192.2646
## 84	north	5.075441331	172.6738
## 85	north	8.087635299	175.6164
## 86	north	7.232829409	173.3700
## 87	north	2.078418026	216.0828
## 88	north	2.221274285	193.7709
## 89	north	7.743093949	202.3037
## 90	north	4.540303447	189.6361
## 91	north	5.737106081	184.0957
## 92	north	9.386744620	210.9459
## 93	north	4.803544550	216.8702
## 94	north	7.655643177	175.0711
## 95	north	7.759634949	199.5834
## 96	north	5.949908340	204.5204
## 97	north	8.333732186	184.2181
## 98	north	5.822866965	212.1122
## 99	north	6.418460052	204.6858
## 100	north	5.001630940	203.8640
## 101	north	5.728416862	213.8761
## 102	north	8.412299241	190.7126
## 103	north	5.834605520	185.4970
## 104	north	5.583267542	192.2595
## 105	north	7.169754462	204.9527
## 106	north	4.488961163	208.9648

107 north 5.980552165 194.7728
108 north 1.392645111 241.2506
109 north 7.545328158 187.4823
110 north 7.014874211 204.2135
111 north 3.182749143 218.5261
112 north 4.822479939 221.2186
113 north 2.988202497 210.6411
114 north 0.113270372 204.6634
115 north 4.168646270 206.5905
116 north 4.890455082 194.9307
117 north 5.756660949 215.5643
118 north 3.970459371 211.7773
119 north 5.142264812 194.6059
120 north 4.547995940 206.8757
121 north 4.738192056 208.2213
122 north 7.798861962 228.5180
123 north 11.146490830 198.7946
124 north 4.390554785 192.7089
125 north 3.284964989 204.8196
126 north 2.557353914 228.9342
127 north 6.565750255 205.1012
128 north 1.999457590 185.2265
129 north 5.889360385 191.4181
130 north 2.679991702 210.7916
131 north 1.805106542 197.2541
132 north 0.007143301 195.8468
133 north 3.392075355 195.2019
134 north 4.885358380 188.4373
135 north 2.553271868 208.4232
136 north 6.601906382 216.6000
137 north 6.152755858 204.6927
138 north 4.328896182 211.4322
139 north 5.301072123 222.8638
140 north 4.278236733 185.8345
141 north 4.392774228 210.0995
142 north -0.779020850 244.6985
143 north 4.557436747 208.8099
144 north 2.739497479 183.7979
145 north 7.211352464 196.1369
146 north 7.620706461 216.8437
147 north 8.461069266 183.4419
148 north 3.034661686 183.3089
149 north 6.083086618 183.6561
150 north 1.558716941 171.9695
151 north 4.651217284 196.5065
152 north 3.519006568 199.3593
153 north 7.580445884 197.9453
154 north 4.655614313 189.8030
155 north 3.236730442 238.1628
156 north 2.611150301 203.3022
157 north 0.669828580 186.3514
158 north 1.899774576 210.5855
159 north 6.284414290 186.9652
160 north 3.522891847 215.5634

```

## 161 north 4.770858782 207.2690
## 162 north 3.445340543 199.3603
## 163 north 3.657315528 191.2550
## 164 north 8.136903937 181.7401
## 165 north 2.869300335 183.8154
## 166 north 4.829613540 220.7650
## 167 north 3.320580571 188.6127
## 168 north 6.110538969 190.0884
## 169 north 6.006586006 192.4777
## 170 north 6.178912901 211.8721
## 171 north 7.941271043 181.6093
## 172 north 1.222382223 202.6067
## 173 north 1.423729011 200.1645
## 174 north 1.288809211 218.4088
## 175 north 3.210394168 207.2016
## 176 north 6.799329389 199.7362
## 177 north 3.612765464 224.8152
## 178 north 6.124181894 186.0569
## 179 north 6.269892046 200.0818
## 180 north 4.250099856 176.5799
## 181 north 8.130435192 181.1557
## 182 north 7.450171403 189.3079
## 183 north 1.905821546 207.3102
## 184 north 6.343329590 185.6602
## 185 north 3.358312213 181.5579
## 186 north 1.681152667 205.6646
## 187 north 7.040199208 180.3533
## 188 north 5.619837447 194.3052
## 189 north 6.645549286 189.5886
## 190 north 5.068860546 180.2638
## 191 north 0.747255557 192.1897
## 192 north 3.098927698 187.7905
## 193 north 4.657019131 195.2189
## 194 north 5.454867865 215.2287
## 195 north 3.491365271 182.8892
## 196 north 0.429750463 205.6535
## 197 north 2.290969624 200.3395
## 198 north 1.827270318 195.1286
## 199 north 6.030834435 200.3872
## 200 north 2.702437799 194.0334
##
## [[2]]
##      sites      a      b
## 1    east 8.141487907 194.5387
## 2    east 8.917962750 185.8653
## 3    east 2.357716322 172.5124
## 4    east 5.827725039 215.9454
## 5    east 6.742999454 197.2469
## 6    east 6.768262746 187.3864
## 7    east 6.496925356 198.7514
## 8    east 2.394653536 214.1844
## 9    east 4.296112410 209.5216
## 10   east 8.202398169 202.6401
## 11   east 2.098247651 196.9973

```


## 12	east	6.039144302	174.7011
## 13	east	9.866170854	210.8734
## 14	east	3.358712063	230.2225
## 15	east	4.517800184	179.6159
## 16	east	9.805298841	222.3378
## 17	east	0.550267889	177.2312
## 18	east	7.394427550	189.0547
## 19	east	2.531487503	199.7752
## 20	east	11.483989787	202.9481
## 21	east	3.709261177	212.2722
## 22	east	8.050079858	209.3144
## 23	east	7.325508335	210.6544
## 24	east	7.456534799	179.0727
## 25	east	3.014629509	181.1002
## 26	east	4.615215124	194.9482
## 27	east	0.504699485	217.9669
## 28	east	7.045138009	212.4827
## 29	east	4.597917624	180.6157
## 30	east	4.427716562	180.9258
## 31	east	3.596454511	206.6228
## 32	east	3.029225713	213.4886
## 33	east	6.085473933	224.6129
## 34	east	7.738056243	202.2178
## 35	east	4.647290647	197.8878
## 36	east	3.751479210	196.9502
## 37	east	1.554398765	188.1030
## 38	east	4.687781631	175.2506
## 39	east	3.511693161	198.3231
## 40	east	7.258123707	235.6001
## 41	east	7.458349985	181.2074
## 42	east	8.013698130	204.2028
## 43	east	6.205710406	194.3369
## 44	east	7.072863821	176.1180
## 45	east	8.202375078	186.5275
## 46	east	3.292418808	233.2662
## 47	east	9.112275111	190.8164
## 48	east	3.057779661	219.4222
## 49	east	4.358607512	199.9554
## 50	east	2.968269922	206.1349
## 51	east	7.359143172	182.3794
## 52	east	4.156939654	189.5222
## 53	east	6.855619406	191.8206
## 54	east	1.629797726	217.0892
## 55	east	0.375292788	203.3836
## 56	east	8.875858949	194.1323
## 57	east	3.297714906	202.0639
## 58	east	7.854756386	215.0591
## 59	east	4.996855805	209.7338
## 60	east	0.788035192	195.3000
## 61	east	1.289616069	185.9108
## 62	east	6.330101467	171.2593
## 63	east	8.689570187	220.2281
## 64	east	9.857158065	216.1911
## 65	east	2.127689076	159.2089

## 66	east	2.417128449	196.7651
## 67	east	6.369853132	174.9202
## 68	east	6.859195584	220.4187
## 69	east	1.460095470	201.1827
## 70	east	5.490015798	173.4775
## 71	east	4.440301852	181.0894
## 72	east	6.847004736	212.7173
## 73	east	3.644080950	183.4160
## 74	east	5.030147760	191.3080
## 75	east	2.338290186	202.2575
## 76	east	3.634654545	186.2978
## 77	east	4.573454205	213.5627
## 78	east	8.551682727	220.7781
## 79	east	4.379342997	201.5089
## 80	east	5.682176057	227.3912
## 81	east	6.014839950	214.7611
## 82	east	-0.008005907	178.3758
## 83	east	8.407424706	184.2984
## 84	east	2.969189677	195.1718
## 85	east	0.285967612	181.8612
## 86	east	2.813937579	188.3466
## 87	east	2.725581177	194.1616
## 88	east	4.610680087	216.3827
## 89	east	2.506362370	202.2698
## 90	east	7.947093406	193.4270
## 91	east	4.163747440	210.3151
## 92	east	6.459612964	218.2678
## 93	east	4.801475499	172.0244
## 94	east	5.100939180	216.5166
## 95	east	3.325791957	170.6908
## 96	east	3.329499255	215.3260
## 97	east	5.708255827	236.3908
## 98	east	6.243029618	206.5340
## 99	east	7.858826210	174.0102
## 100	east	5.519496200	191.1800
## 101	east	6.506275387	215.9102
## 102	east	7.786810450	183.1880
## 103	east	3.220345403	192.3039
## 104	east	0.106693901	190.4508
## 105	east	12.596934836	177.5736
## 106	east	4.458317546	211.9658
## 107	east	1.689977935	222.3493
## 108	east	4.537935009	210.3661
## 109	east	1.344509348	182.9216
## 110	east	4.882153396	205.2152
## 111	east	3.233410551	217.3057
## 112	east	3.611364145	222.0652
## 113	east	7.662445911	209.0017
## 114	east	5.936429036	217.3718
## 115	east	5.138428586	192.2133
## 116	east	7.457356846	173.1287
## 117	east	5.955590651	194.1857
## 118	east	-0.180078924	214.0957
## 119	east	1.021584376	209.0791

```

## 120 east 4.309587959 207.2140
## 121 east 2.031450274 205.0131
## 122 east 1.186479276 219.3766
## 123 east 7.894178867 209.5471
## 124 east 7.352278626 205.9905
## 125 east -0.994865385 191.5743
## 126 east 3.324723396 197.2677
## 127 east 7.590390415 189.9030
## 128 east 8.113146353 219.1694
## 129 east 5.326902934 161.6274
## 130 east 8.055580104 209.6022
## 131 east 3.119379745 198.5806
## 132 east 4.246992494 213.4785
## 133 east 7.467395612 200.4740
## 134 east 5.157999835 178.2904
## 135 east 9.031761880 207.5519
## 136 east 3.415167535 218.9643
## 137 east 3.086420470 197.7719
## 138 east 8.684530210 187.5325
## 139 east 4.765271107 160.2918
## 140 east 2.440147012 164.3157
## 141 east 8.065303277 213.8369
## 142 east 8.117336678 197.8834
## 143 east 1.815611864 216.3267
## 144 east 5.365111777 204.9807
## 145 east 6.075502054 232.4391
## 146 east 5.632602702 178.7000
## 147 east -0.561538576 187.3531
## 148 east 8.632276717 207.1284
## 149 east 4.588177683 198.0236
## 150 east 7.001172110 181.2411
## 151 east 5.614942237 214.0468
## 152 east 4.467130127 200.2652
## 153 east 9.442916487 175.8948
## 154 east 2.929954912 202.0730
## 155 east 11.006704174 216.9522
## 156 east 2.930244202 195.0206
## 157 east 4.055991645 214.0459
## 158 east 0.664399249 208.2135
## 159 east 2.852683354 192.3351
## 160 east 2.705424882 171.7807
## 161 east 2.582705589 185.6812
## 162 east 7.261204346 234.7991
## 163 east 9.919384671 196.9419
## 164 east 2.242462306 202.6159
## 165 east 5.761112980 192.5947
## 166 east 6.546511920 183.2277
## 167 east 1.075702623 207.9527
## 168 east 4.942851075 205.1589
## 169 east 3.338597696 196.2767
## 170 east 4.525953807 181.6858
## 171 east 7.568146803 183.6375
## 172 east 4.675120637 172.8521
## 173 east 8.877703701 206.6486

```

```

## 174 east 3.014339991 181.4172
## 175 east 2.089556519 198.6505
## 176 east 5.544302845 197.9482
## 177 east 3.546815861 186.6855
## 178 east 8.877580074 189.0707
## 179 east 2.148083668 196.6296
## 180 east 5.960637332 211.0578
## 181 east 7.541250105 196.3934
## 182 east 2.712148516 194.2827
## 183 east 3.916607545 200.4024
## 184 east 6.201024340 188.7571
## 185 east 7.623556321 195.9582
## 186 east 6.582036703 171.2609
## 187 east 2.749179843 216.5133
## 188 east 3.917933826 216.4050
## 189 east 7.036246685 167.0998
## 190 east 4.296348670 207.2270
## 191 east 4.750441612 202.4783
## 192 east 6.202624096 187.0657
## 193 east 3.620562249 192.1687
## 194 east 7.494470119 220.4349
## 195 east 9.670942103 191.6830
## 196 east 7.063656899 210.2394
## 197 east 6.067013874 181.2715
## 198 east 6.184398027 183.6437
## 199 east 7.142598236 185.1743
## 200 east 4.324925733 195.2992
##
## [[3]]
##      sites      a      b
## 1  west 6.69619086 206.2403
## 2  west 0.35711160 197.7125
## 3  west 2.32148034 207.0239
## 4  west 5.47465694 171.3107
## 5  west 3.88861965 214.8186
## 6  west 6.41280413 204.2078
## 7  west 0.02855108 184.6139
## 8  west 2.77424434 223.5947
## 9  west 2.36182222 186.8732
## 10 west 4.33729589 199.6896
## 11 west 1.37286855 198.1588
## 12 west 5.01400347 188.6054
## 13 west 8.47547305 225.1806
## 14 west 2.20577252 201.1070
## 15 west 2.64003761 213.8462
## 16 west 4.80010745 208.4834
## 17 west 8.65451693 219.6155
## 18 west 5.94921921 215.8125
## 19 west 1.77659463 192.6712
## 20 west 3.13979310 210.6696
## 21 west 6.03947689 217.8062
## 22 west 0.38083649 195.5995
## 23 west 4.16053970 193.1488
## 24 west 2.60570476 203.5376

```

## 25	west	4.84470301	177.9895
## 26	west	2.48012942	201.3436
## 27	west	3.70256044	184.1162
## 28	west	3.97916330	206.2955
## 29	west	6.21533886	203.9100
## 30	west	7.63936959	192.4593
## 31	west	1.08743379	193.0783
## 32	west	5.65722800	208.3629
## 33	west	4.06477606	177.6201
## 34	west	6.34395584	215.0220
## 35	west	3.78156158	197.6347
## 36	west	4.44148409	221.3184
## 37	west	0.03447590	191.5942
## 38	west	6.35253512	206.2989
## 39	west	3.09460151	195.6485
## 40	west	5.93472461	227.6565
## 41	west	6.78213899	178.0240
## 42	west	6.15528498	195.8442
## 43	west	2.11890457	176.2970
## 44	west	3.99786531	219.8047
## 45	west	3.72341801	205.1352
## 46	west	5.80430773	191.5341
## 47	west	10.86945631	227.3437
## 48	west	1.54768806	212.4780
## 49	west	4.94911188	181.0595
## 50	west	5.70327716	220.2049
## 51	west	3.59177428	203.5792
## 52	west	5.77433598	210.9903
## 53	west	4.33413740	213.7500
## 54	west	1.59283148	204.4936
## 55	west	4.56727086	217.3847
## 56	west	2.98012199	166.7681
## 57	west	7.93042679	186.7005
## 58	west	2.65988288	186.8649
## 59	west	5.26490090	189.6540
## 60	west	2.87400460	201.3676
## 61	west	3.80337637	191.2576
## 62	west	-0.04312603	201.5609
## 63	west	5.30595954	215.0951
## 64	west	6.90367748	192.7940
## 65	west	7.42880200	167.0771
## 66	west	6.89095889	194.0659
## 67	west	7.24832112	189.4225
## 68	west	3.56034136	216.7843
## 69	west	8.65862963	214.5106
## 70	west	3.94666407	213.4486
## 71	west	4.44024902	179.6021
## 72	west	4.97075801	180.8918
## 73	west	5.17294407	212.0304
## 74	west	9.57130130	221.2068
## 75	west	8.15474416	199.2280
## 76	west	1.13483016	202.1400
## 77	west	3.78927166	194.2757
## 78	west	5.23644803	213.0601

## 79	west	5.61714367	183.0391
## 80	west	5.99524471	195.2278
## 81	west	2.72440910	197.8832
## 82	west	5.47709220	202.7932
## 83	west	6.41721557	189.5313
## 84	west	6.04792640	216.1540
## 85	west	9.98259541	188.1738
## 86	west	2.63319432	200.0800
## 87	west	5.27388599	212.7128
## 88	west	6.14627858	205.2368
## 89	west	6.80049486	183.6087
## 90	west	8.06133586	206.8421
## 91	west	9.17563850	172.1981
## 92	west	5.76910842	206.1537
## 93	west	8.92461285	218.8698
## 94	west	4.63018646	202.8842
## 95	west	8.92603117	208.0588
## 96	west	5.37637019	180.3191
## 97	west	5.17048170	204.9715
## 98	west	5.62372212	215.8852
## 99	west	7.60065692	188.7066
## 100	west	1.53844677	209.0426
## 101	west	1.60879983	213.4533
## 102	west	3.80319638	176.7708
## 103	west	4.00552866	188.9235
## 104	west	-0.40630416	195.3305
## 105	west	5.43399101	198.3944
## 106	west	3.50342143	182.8063
## 107	west	7.66873645	197.3149
## 108	west	2.65928926	224.4675
## 109	west	5.25844529	189.4552
## 110	west	2.34960668	205.5064
## 111	west	3.91668955	209.2399
## 112	west	3.94959603	192.3202
## 113	west	5.19824713	190.4588
## 114	west	6.17732161	222.6647
## 115	west	1.32750910	191.9233
## 116	west	5.86695217	198.3597
## 117	west	4.01706625	200.3298
## 118	west	5.44747880	205.6886
## 119	west	10.78024206	192.2520
## 120	west	5.47853722	208.5484
## 121	west	3.07128961	191.6480
## 122	west	4.01820580	205.7497
## 123	west	10.93378912	195.4788
## 124	west	6.80727116	193.6545
## 125	west	5.22877616	211.5521
## 126	west	6.42402971	221.1405
## 127	west	4.36765540	209.5643
## 128	west	4.28401842	203.4585
## 129	west	6.85709732	187.4850
## 130	west	6.24876332	212.0744
## 131	west	6.34942500	219.1264
## 132	west	2.55172156	193.7672

## 133	west	4.84882308	204.2022
## 134	west	5.82897800	190.2955
## 135	west	10.69032557	203.1116
## 136	west	9.84218970	182.0582
## 137	west	0.71543624	221.3387
## 138	west	8.94472136	199.6007
## 139	west	9.55605202	183.0239
## 140	west	6.35450318	220.0484
## 141	west	6.99410143	180.6281
## 142	west	4.90263869	193.7279
## 143	west	9.12701456	168.4786
## 144	west	4.94792792	189.8833
## 145	west	6.13326293	210.8501
## 146	west	4.89435592	197.7660
## 147	west	5.62238494	201.2981
## 148	west	5.86414030	194.1572
## 149	west	7.10605425	175.9239
## 150	west	9.85011718	207.9867
## 151	west	4.25836882	163.8587
## 152	west	4.41795889	195.3261
## 153	west	5.57524355	189.6521
## 154	west	5.24708608	189.6862
## 155	west	10.50281333	191.3373
## 156	west	6.15473243	197.8270
## 157	west	3.43480296	207.5316
## 158	west	2.91577238	196.5257
## 159	west	1.30110439	196.7089
## 160	west	2.80891437	199.5108
## 161	west	8.51586370	197.3464
## 162	west	4.26262872	196.5251
## 163	west	5.99336076	180.1722
## 164	west	3.88928547	214.0505
## 165	west	8.69969830	210.6105
## 166	west	4.64980392	219.7558
## 167	west	4.92239797	209.8991
## 168	west	3.11757702	201.6960
## 169	west	-0.93308940	215.9040
## 170	west	4.19126224	221.7521
## 171	west	4.29854519	223.4969
## 172	west	2.32065198	191.5856
## 173	west	6.86379873	240.8961
## 174	west	4.10486323	201.3312
## 175	west	2.95024497	209.2075
## 176	west	5.38870455	208.3418
## 177	west	2.86768473	182.4073
## 178	west	5.04111829	196.0413
## 179	west	5.79194959	172.4309
## 180	west	6.51103022	192.8845
## 181	west	4.91939674	195.4517
## 182	west	6.78757411	181.1695
## 183	west	6.68624066	185.9334
## 184	west	5.98587621	176.0703
## 185	west	4.19275497	208.9242
## 186	west	4.15485822	183.9865

```
## 187 west 4.00314267 201.9676
## 188 west 7.93387816 220.2476
## 189 west 7.44710844 178.9795
## 190 west 3.63582011 195.9528
## 191 west 9.58166912 200.1158
## 192 west 2.61062844 192.1653
## 193 west 7.31823058 201.2089
## 194 west 2.24937221 194.8067
## 195 west 6.82621156 187.4948
## 196 west 5.38677038 220.4106
## 197 west 2.55460648 191.0114
## 198 west 6.91796401 195.1627
## 199 west 2.53321679 181.3270
## 200 west 3.08121782 192.2866
```

```
# Map over the models to look at the relationship of a vs b
list_of_df %>%
  map(~ lm(a ~ b, data = .)) %>%
  map(summary)
```

```
## [[1]]
##
## Call:
## lm(formula = a ~ b, data = .)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -4.9562 -1.5839 -0.0787  1.5372  6.7334
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 11.36928    2.29239   4.960 1.52e-06 ***
## b           -0.03271    0.01143  -2.861  0.00468 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.304 on 198 degrees of freedom
## Multiple R-squared:  0.0397, Adjusted R-squared:  0.03485
## F-statistic: 8.185 on 1 and 198 DF, p-value: 0.004676
##
##
## [[2]]
##
## Call:
## lm(formula = a ~ b, data = .)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -6.067 -1.991 -0.186  2.083  7.590
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.187609    2.281639   1.835   0.068 .
## b            0.004616    0.011462   0.403   0.688
```



```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.618 on 198 degrees of freedom
## Multiple R-squared:  0.0008185, Adjusted R-squared:  -0.004228
## F-statistic: 0.1622 on 1 and 198 DF,  p-value: 0.6876
##
##
## [[3]]
##
## Call:
## lm(formula = a ~ b, data = .)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -5.953 -1.481 -0.015  1.347  5.894
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  5.2287993   2.4338028    2.148  0.0329 *
## b           -0.0009685   0.0121668   -0.080  0.9366
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.409 on 198 degrees of freedom
## Multiple R-squared:  3.2e-05, Adjusted R-squared:  -0.005018
## F-statistic: 0.006336 on 1 and 198 DF,  p-value: 0.9366
```

```
# Pull out the director element of sw_films in a list and character vector
map(sw_films, ~.x[["director"]])
```

```
## [[1]]
## [1] "George Lucas"
##
## [[2]]
## [1] "George Lucas"
##
## [[3]]
## [1] "George Lucas"
##
## [[4]]
## [1] "George Lucas"
##
## [[5]]
## [1] "Richard Marquand"
##
## [[6]]
## [1] "Irvin Kershner"
##
## [[7]]
## [1] "J. J. Abrams"
```

```
map_chr(sw_films, ~.x[["director"]])
```

```
## [1] "George Lucas"      "George Lucas"      "George Lucas"      "George Lucas"
## [5] "Richard Marquand"   "Irvin Kershner"    "J. J. Abrams"
```

```
# Compare outputs when checking if director is George Lucas
map(sw_films, ~.x[["director"]] == "George Lucas")
```

```
## [[1]]
## [1] TRUE
##
## [[2]]
## [1] TRUE
##
## [[3]]
## [1] TRUE
##
## [[4]]
## [1] TRUE
##
## [[5]]
## [1] FALSE
##
## [[6]]
## [1] FALSE
##
## [[7]]
## [1] FALSE
```

```
map_lgl(sw_films, ~.x[["director"]] == "George Lucas")
```

```
## [1] TRUE TRUE TRUE TRUE FALSE FALSE FALSE
```

```
# Pull out episode_id element as list
map(sw_films, ~.x[["episode_id"]])
```

```
## [[1]]
## [1] 4
##
## [[2]]
## [1] 2
##
## [[3]]
## [1] 1
##
## [[4]]
## [1] 3
##
## [[5]]
## [1] 6
##
```

```
## [[6]]
## [1] 5
##
## [[7]]
## [1] 7

# Pull out episode_id element as double vector
map_dbl(sw_films, ~.x[["episode_id"]])
```

```
## [1] 4 2 1 3 6 5 7
```

```
# Pull out episode_id element as list
map(sw_films, ~.x[["episode_id"]])
```

```
## [[1]]
## [1] 4
##
## [[2]]
## [1] 2
##
## [[3]]
## [1] 1
##
## [[4]]
## [1] 3
##
## [[5]]
## [1] 6
##
## [[6]]
## [1] 5
##
## [[7]]
## [1] 7
```

```
# Pull out episode_id element as integer vector
map_int(sw_films, ~.x[["episode_id"]])
```

```
## [1] 4 2 1 3 6 5 7
```

map2() and pmap()

```
# List of 1, 2 and 3
means <- list(1,2,3)

# Create sites list
sites <- list("north","west","east")

# Map over two arguments: sites and means
list_of_files_map2 <- map2(sites, means, ~data.frame(sites = .x,
```

```
a = rnorm(mean = .y, n = 200, sd = (5/2)))
```

```
list_of_files_map2
```

```
## [[1]]
```

```
##      sites      a
## 1  north  0.8268112
## 2  north  1.1760913
## 3  north  3.9052869
## 4  north  2.4056949
## 5  north  1.1457279
## 6  north  0.8552561
## 7  north  0.8100079
## 8  north  2.9004892
## 9  north  4.2147707
## 10 north  8.2145690
## 11 north  2.7448109
## 12 north -0.5278082
## 13 north  3.1526227
## 14 north -1.0525528
## 15 north  1.8361905
## 16 north  1.0492400
## 17 north -1.3035248
## 18 north  1.3423842
## 19 north  2.9242740
## 20 north  0.7738992
## 21 north  5.8149410
## 22 north  5.2404396
## 23 north -0.6605503
## 24 north  1.8986826
## 25 north  0.8040786
## 26 north  1.0000742
## 27 north  1.0212302
## 28 north  2.8807082
## 29 north  4.4041157
## 30 north  3.2322795
## 31 north -1.5114939
## 32 north  3.7123313
## 33 north  5.8066889
## 34 north  1.7229859
## 35 north  4.7186134
## 36 north  1.1489904
## 37 north  0.6597594
## 38 north -0.9144942
## 39 north  5.6918484
## 40 north  1.0907806
## 41 north  1.4483855
## 42 north -0.6340390
## 43 north  3.0166419
## 44 north  3.5493672
## 45 north -0.2712485
## 46 north  1.6591102
## 47 north  4.4729729
```

```
## 48 north -3.4068049
## 49 north -1.8248514
## 50 north 3.0981908
## 51 north 5.8697965
## 52 north 2.1099989
## 53 north 1.4607819
## 54 north 0.7061095
## 55 north 6.2780593
## 56 north 4.4985483
## 57 north -2.0250109
## 58 north 1.0954358
## 59 north -0.3140575
## 60 north -0.2007221
## 61 north 2.4283615
## 62 north 0.5087097
## 63 north -0.7413945
## 64 north 1.7485089
## 65 north -0.1127475
## 66 north 2.9816738
## 67 north 1.1597257
## 68 north -0.1140684
## 69 north 1.3266439
## 70 north 0.5475162
## 71 north 7.5857214
## 72 north 4.5737001
## 73 north 3.4451898
## 74 north -1.7755664
## 75 north -0.2757340
## 76 north 3.5597301
## 77 north 3.5497576
## 78 north -0.4555740
## 79 north 0.3542886
## 80 north 2.6171103
## 81 north 0.9058504
## 82 north -1.8445935
## 83 north 2.0099370
## 84 north 4.6047775
## 85 north -4.7712831
## 86 north 1.7512377
## 87 north 1.9419267
## 88 north -0.9990487
## 89 north 1.4022226
## 90 north 6.3764886
## 91 north -1.2398939
## 92 north 3.4544032
## 93 north 0.8904933
## 94 north 3.8077315
## 95 north -3.4229555
## 96 north 1.2197090
## 97 north 1.3083595
## 98 north 1.3272583
## 99 north 3.3284130
## 100 north -4.0902819
## 101 north 2.3399695
```

102 north 4.1832075
103 north 1.2014721
104 north 4.0435273
105 north 3.1842923
106 north -0.8415644
107 north 2.8012968
108 north 0.2170617
109 north 2.9971947
110 north 0.7100176
111 north 0.3318887
112 north 5.8726517
113 north 1.1352157
114 north 2.8052620
115 north 1.2992446
116 north 3.7208007
117 north -0.4554585
118 north 3.4686386
119 north -0.5578258
120 north -0.5118025
121 north -0.3263677
122 north 1.9165847
123 north -3.2129635
124 north -3.5685590
125 north 2.4792469
126 north 4.6045931
127 north -0.8419097
128 north -0.4454885
129 north 1.1925697
130 north 4.1299676
131 north 3.5836689
132 north 0.8094944
133 north 0.8017796
134 north 4.6490024
135 north 0.9295937
136 north 4.6520896
137 north 0.7599685
138 north 0.8992421
139 north 0.9482668
140 north 5.1545313
141 north -0.3498818
142 north 4.9630790
143 north 2.0120989
144 north 0.5935191
145 north 2.2071478
146 north -1.2078666
147 north 6.0743121
148 north -0.1356446
149 north 1.2072010
150 north 1.1470785
151 north -3.0675824
152 north 2.6782247
153 north 1.7697980
154 north 5.8473827
155 north -1.2708060

```

## 156 north -2.5641862
## 157 north  1.1734761
## 158 north -1.1407346
## 159 north  2.1670726
## 160 north -5.7722824
## 161 north -7.6516310
## 162 north  3.4559053
## 163 north  1.8801457
## 164 north -2.8911628
## 165 north -0.7606776
## 166 north  1.3262024
## 167 north  0.4100877
## 168 north  2.8838113
## 169 north  3.0101428
## 170 north  5.2907600
## 171 north  1.3904189
## 172 north  7.5646302
## 173 north  1.3687203
## 174 north -0.4508450
## 175 north -1.1590687
## 176 north  4.7526816
## 177 north  0.8760429
## 178 north  1.6768483
## 179 north  1.2288124
## 180 north -0.8578384
## 181 north  2.9576668
## 182 north  3.5625207
## 183 north  0.3098280
## 184 north -0.5912255
## 185 north  7.1504162
## 186 north -1.2284022
## 187 north -1.3854416
## 188 north  5.5214978
## 189 north  2.1086811
## 190 north  4.0372861
## 191 north  6.7326850
## 192 north  2.9749163
## 193 north -3.0002555
## 194 north  2.1838539
## 195 north -0.7042166
## 196 north  3.2039744
## 197 north  0.6333817
## 198 north  1.0368470
## 199 north -4.7498466
## 200 north -0.3911172
##
## [[2]]
##      sites      a
## 1    west 2.70346039
## 2    west 4.12505375
## 3    west 2.14680721
## 4    west 1.57300841
## 5    west 0.47474589
## 6    west 5.58342986

```

## 7	west	7.18841520
## 8	west	3.63832392
## 9	west	1.60128599
## 10	west	4.61268394
## 11	west	-0.08573658
## 12	west	2.54930038
## 13	west	1.52849318
## 14	west	4.99938889
## 15	west	-3.49811407
## 16	west	-1.80830241
## 17	west	2.08209703
## 18	west	-0.35333331
## 19	west	5.50952045
## 20	west	1.27815187
## 21	west	2.05812217
## 22	west	3.13659033
## 23	west	-5.34495530
## 24	west	-0.01992509
## 25	west	-1.14447271
## 26	west	-1.08828781
## 27	west	-0.96707103
## 28	west	0.97049300
## 29	west	-1.28921533
## 30	west	2.71363660
## 31	west	3.86953293
## 32	west	1.12488505
## 33	west	2.21457703
## 34	west	1.27517679
## 35	west	5.25525077
## 36	west	0.20701289
## 37	west	0.78630316
## 38	west	2.91317545
## 39	west	4.03505166
## 40	west	2.14844289
## 41	west	3.18338924
## 42	west	2.90477379
## 43	west	2.33475655
## 44	west	-0.30629012
## 45	west	2.82989306
## 46	west	0.92061784
## 47	west	0.80483587
## 48	west	3.32225671
## 49	west	-0.43051299
## 50	west	2.69433691
## 51	west	-4.19879140
## 52	west	-1.05724428
## 53	west	6.03689729
## 54	west	-1.00195218
## 55	west	-0.35894682
## 56	west	2.18512963
## 57	west	0.75558426
## 58	west	-0.14471540
## 59	west	5.41979616
## 60	west	-0.08607532

## 61	west	3.43363301
## 62	west	2.40818946
## 63	west	2.50640217
## 64	west	1.75221048
## 65	west	1.72158466
## 66	west	1.80605718
## 67	west	3.08635827
## 68	west	2.45480990
## 69	west	-0.59051432
## 70	west	0.34078642
## 71	west	4.70405867
## 72	west	-0.80278719
## 73	west	1.16990999
## 74	west	2.72093648
## 75	west	4.09309883
## 76	west	7.64581652
## 77	west	-1.85385325
## 78	west	2.33048197
## 79	west	-1.33171028
## 80	west	-0.43002242
## 81	west	2.11545382
## 82	west	2.74682784
## 83	west	1.17339216
## 84	west	-0.60614936
## 85	west	-0.96761142
## 86	west	2.96708737
## 87	west	0.52466635
## 88	west	2.09996398
## 89	west	2.47371168
## 90	west	1.77061964
## 91	west	0.52308243
## 92	west	0.94814849
## 93	west	7.70586935
## 94	west	-0.07316484
## 95	west	2.70626517
## 96	west	1.90960834
## 97	west	-3.43050583
## 98	west	5.98598647
## 99	west	3.36103950
## 100	west	3.26480763
## 101	west	3.68216647
## 102	west	7.99714817
## 103	west	-1.17431562
## 104	west	-1.32719150
## 105	west	-0.18379644
## 106	west	3.24795562
## 107	west	4.02936742
## 108	west	3.19627845
## 109	west	1.75080760
## 110	west	3.71601794
## 111	west	0.79937864
## 112	west	6.46685563
## 113	west	4.26770963
## 114	west	4.28297633

##	115	west	4.50503934
##	116	west	4.93251338
##	117	west	5.20689160
##	118	west	0.05149660
##	119	west	2.17988103
##	120	west	3.38604587
##	121	west	1.86665059
##	122	west	2.65521920
##	123	west	-2.87486001
##	124	west	1.25628438
##	125	west	6.01549411
##	126	west	3.68250743
##	127	west	3.16410180
##	128	west	3.05288977
##	129	west	1.22404594
##	130	west	5.16875701
##	131	west	1.72625807
##	132	west	5.38984299
##	133	west	2.96616357
##	134	west	0.85712841
##	135	west	2.37459846
##	136	west	8.05699828
##	137	west	3.23546455
##	138	west	1.07520486
##	139	west	0.70827363
##	140	west	4.70344630
##	141	west	5.42193422
##	142	west	1.97996704
##	143	west	2.72860025
##	144	west	-3.20828030
##	145	west	3.30475155
##	146	west	-0.44047288
##	147	west	-0.02820455
##	148	west	0.57837535
##	149	west	6.28405080
##	150	west	1.04892414
##	151	west	0.20762876
##	152	west	1.95266334
##	153	west	3.13149955
##	154	west	3.61608793
##	155	west	-1.28713481
##	156	west	2.09507644
##	157	west	-1.68713220
##	158	west	5.72691129
##	159	west	5.32772853
##	160	west	0.13584469
##	161	west	3.27050355
##	162	west	-4.47932640
##	163	west	4.86949598
##	164	west	2.47272164
##	165	west	2.98357555
##	166	west	4.59098448
##	167	west	0.43745962
##	168	west	2.76324864

```

## 169 west 5.86396874
## 170 west 1.12461255
## 171 west 1.85645826
## 172 west 2.71572455
## 173 west -1.00997266
## 174 west -1.06620449
## 175 west 5.41705882
## 176 west -1.07724564
## 177 west -0.40281167
## 178 west -0.07553235
## 179 west 0.75053423
## 180 west 6.39191347
## 181 west 3.34878396
## 182 west 1.70441492
## 183 west -3.34323411
## 184 west 2.99704069
## 185 west 3.80243365
## 186 west -0.39311625
## 187 west -0.07688906
## 188 west 0.59803328
## 189 west 3.03936571
## 190 west 5.74655860
## 191 west -0.16794558
## 192 west 2.30945499
## 193 west 0.32079124
## 194 west 1.61888433
## 195 west 0.55329869
## 196 west 0.61989890
## 197 west 3.51098122
## 198 west 5.36879003
## 199 west -0.36153111
## 200 west 2.62312131
##
## [[3]]
##      sites      a
## 1      east -1.05073251
## 2      east 1.30057895
## 3      east -0.08403655
## 4      east -3.59440627
## 5      east 0.16086321
## 6      east 1.77702806
## 7      east 4.96417719
## 8      east 1.98309655
## 9      east 4.24184631
## 10     east 3.02483874
## 11     east -0.34958956
## 12     east 2.23979617
## 13     east 4.24681182
## 14     east 3.22245000
## 15     east 2.63498394
## 16     east 3.32510394
## 17     east 2.04812257
## 18     east 3.37066354
## 19     east -1.18672577

```

20 east -1.01864957
21 east 3.67415765
22 east 0.81940967
23 east 0.41293003
24 east 1.00984967
25 east 4.08291915
26 east 3.57786814
27 east 3.49420286
28 east 7.57394247
29 east 2.53270079
30 east -3.52271635
31 east 3.88889424
32 east 2.75206349
33 east 3.45846485
34 east -0.91147521
35 east 4.54622137
36 east 4.14955835
37 east 2.03311932
38 east 2.08818399
39 east 3.42070703
40 east 3.38485276
41 east 4.09478223
42 east 3.68167149
43 east 0.16294601
44 east 4.18291336
45 east 2.17809656
46 east 3.11996811
47 east 4.59763734
48 east 6.22224620
49 east -4.91103329
50 east 4.42817285
51 east 3.94799989
52 east 6.21360555
53 east 4.08745939
54 east 3.95765961
55 east 6.33031645
56 east 5.38352672
57 east 5.05605466
58 east 3.77663250
59 east 4.94267158
60 east 3.48635567
61 east 1.85274417
62 east 3.76221260
63 east 3.85973948
64 east 6.29967308
65 east 2.32519294
66 east 2.03151288
67 east 3.78055361
68 east 4.12980327
69 east -0.28913638
70 east 3.69677495
71 east 3.88550562
72 east 0.66462566
73 east 1.42398953

74 east -1.00156765
75 east 6.78734383
76 east 1.69060569
77 east 4.31854703
78 east 4.23434825
79 east 3.62985419
80 east 5.12118474
81 east 1.76634022
82 east 2.49609204
83 east -0.96384061
84 east 7.41825152
85 east 0.08820066
86 east -3.50740237
87 east 3.17338600
88 east -0.31586230
89 east 6.02025801
90 east 3.53587896
91 east 2.06560361
92 east 3.14710112
93 east 3.29351206
94 east 5.21409896
95 east 3.20934640
96 east 5.37347522
97 east 2.22544788
98 east 4.29112602
99 east 1.75505600
100 east 3.59505251
101 east -1.82385972
102 east 4.28436343
103 east 4.59931586
104 east 1.53167920
105 east 4.53402169
106 east 2.51388631
107 east 3.69028345
108 east 6.36939865
109 east 6.37100000
110 east 4.99802213
111 east 2.42104234
112 east 7.03420024
113 east 5.25862636
114 east -0.47637233
115 east 3.35792587
116 east -0.11457519
117 east -0.09024805
118 east 2.52874711
119 east 0.45056202
120 east 2.00781519
121 east 5.02515691
122 east 2.77908277
123 east 0.96299904
124 east 4.62980116
125 east 2.19871598
126 east 2.88920361
127 east 6.34187482

128 east 2.47947226
129 east 4.13599513
130 east 6.11017760
131 east 2.18917379
132 east -0.01782843
133 east 2.97174291
134 east 0.29786448
135 east 3.50008999
136 east -0.18671302
137 east 1.58423255
138 east 2.73986868
139 east 6.99982555
140 east 1.80182574
141 east 3.53018372
142 east -0.16922934
143 east -2.56000687
144 east 4.80592876
145 east 5.27640266
146 east 2.79532499
147 east 4.81889050
148 east 6.61682779
149 east 3.49845941
150 east -0.99151094
151 east 1.03610406
152 east 0.30046988
153 east -2.36462181
154 east 4.28508795
155 east 7.43298891
156 east 4.05509058
157 east 1.08691724
158 east 4.70103620
159 east 4.91275293
160 east 8.38670780
161 east 1.94722342
162 east -0.31814945
163 east -2.34229714
164 east 6.84144665
165 east -0.69878042
166 east 7.61238132
167 east -2.44724956
168 east 5.95504267
169 east -2.47050519
170 east 3.38321941
171 east 3.88551870
172 east 5.74533860
173 east 7.86479523
174 east 5.78866061
175 east 3.17798068
176 east 1.89609482
177 east 2.15890501
178 east 1.87487942
179 east 4.33680099
180 east 1.30733254
181 east 1.42674513

```
## 182 east 1.13467113
## 183 east 4.59954931
## 184 east 5.63225484
## 185 east 2.44798333
## 186 east 3.86397751
## 187 east 0.49971923
## 188 east 6.69811818
## 189 east -0.36825962
## 190 east -1.54014966
## 191 east 3.30059689
## 192 east 5.00620753
## 193 east 5.55755272
## 194 east 4.05783683
## 195 east 0.22452278
## 196 east 2.84917856
## 197 east 0.66526781
## 198 east 1.60932134
## 199 east -1.03120154
## 200 east 0.61917262
```

```
sigma <- means
means2 <- as.numeric(means)/2
sigma2 <- means2

# Create a master list, a list of lists
pmapinputs <- list(sites = sites, means = means, sigma = sigma,
                  means2 = means2, sigma2 = sigma2)

# Map over the master list
list_of_files_pmap <- pmap(pmapinputs,
  function(sites, means, sigma, means2, sigma2)
    data.frame(sites = sites,
      a = rnorm(mean = means, n = 200, sd = sigma),
      b = rnorm(mean = means2, n = 200, sd = sigma2)))

list_of_files_pmap
```

```
## [[1]]
##      sites      a      b
## 1  north 1.20895430 0.395764587
## 2  north 1.37697923 0.768221026
## 3  north 0.02132484 0.890651116
## 4  north -0.54895862 0.021993141
## 5  north 1.55338650 1.127115800
## 6  north 1.05182524 0.751552327
## 7  north 1.16015188 -0.746274324
## 8  north 0.58394546 0.355019380
## 9  north 2.93585217 0.536529182
## 10 north 0.93098399 1.081558351
## 11 north -0.13238103 0.202184506
## 12 north -0.21059279 0.716252519
## 13 north 1.56902582 0.131291881
## 14 north 1.76647818 0.949919873
## 15 north 1.04806138 0.064681044
```

## 16	north	1.81566501	0.036631758
## 17	north	2.26496786	0.942282623
## 18	north	-0.03079710	0.447376536
## 19	north	0.64431213	0.096243157
## 20	north	0.70690624	0.583802439
## 21	north	1.52575308	0.995192257
## 22	north	-0.01058069	0.569911687
## 23	north	1.04693478	0.324174649
## 24	north	2.23320849	0.978566883
## 25	north	1.08162196	0.241433702
## 26	north	1.00376218	0.401129355
## 27	north	0.81843155	0.334127627
## 28	north	-0.08797110	0.475294190
## 29	north	1.57317080	0.809234350
## 30	north	1.43212905	0.162172142
## 31	north	0.91390210	0.376362882
## 32	north	0.21621179	0.160465592
## 33	north	-0.29365982	0.774031910
## 34	north	2.08745516	-0.669747721
## 35	north	1.30994614	0.710640538
## 36	north	0.49906440	1.009547053
## 37	north	0.57225608	0.682522312
## 38	north	2.03678913	0.601640324
## 39	north	1.36408163	0.206566843
## 40	north	0.70022130	0.628889403
## 41	north	0.97297521	0.918693070
## 42	north	2.85182811	0.629541695
## 43	north	0.67000950	1.483514866
## 44	north	0.02389502	0.042534479
## 45	north	0.66770971	-0.317069216
## 46	north	-1.42224881	0.427403546
## 47	north	1.10723033	0.658372631
## 48	north	0.16578416	0.869319989
## 49	north	0.48743871	0.361740170
## 50	north	0.28194703	0.695198143
## 51	north	2.42447358	0.653863453
## 52	north	3.95920926	0.355524247
## 53	north	1.55637106	0.163797824
## 54	north	0.72953526	1.280310906
## 55	north	-0.77032632	0.314385908
## 56	north	0.55355630	0.302462512
## 57	north	1.18275620	0.257308389
## 58	north	0.35396449	-0.218498494
## 59	north	0.95216556	0.519643793
## 60	north	-0.07059214	-0.252406201
## 61	north	0.23197903	0.524973931
## 62	north	1.10070457	0.521348966
## 63	north	1.48540964	1.038816530
## 64	north	1.81972605	0.822032851
## 65	north	2.52286314	0.409006495
## 66	north	0.60591785	0.356710068
## 67	north	1.60905332	0.741483889
## 68	north	-1.03172974	1.474479775
## 69	north	0.57498525	0.219067086


```

## 70 north 0.83220430 0.887812068
## 71 north 0.00351930 0.636601877
## 72 north 2.96138510 0.727050319
## 73 north 0.62243592 0.327381695
## 74 north 3.81759019 1.260075835
## 75 north 1.48685096 0.188951428
## 76 north 1.11655387 0.055619408
## 77 north -0.54272883 0.867720584
## 78 north 0.70095809 0.257659536
## 79 north 0.38173870 1.083801937
## 80 north -0.26729121 0.921935118
## 81 north 0.25390934 -0.472439757
## 82 north 1.53775993 0.542576187
## 83 north 0.61865496 1.216295316
## 84 north 1.39438035 0.714476998
## 85 north 1.89247211 -0.138623037
## 86 north 3.15075796 -0.312376760
## 87 north 0.52020969 0.105125126
## 88 north -0.47036110 0.010791502
## 89 north 0.45681271 0.508052082
## 90 north 0.20289534 0.134128969
## 91 north 1.14192675 0.511726847
## 92 north 3.20079312 0.031166841
## 93 north 0.74530285 -0.242214230
## 94 north 2.50270758 -0.363316551
## 95 north -0.13280901 -0.043338273
## 96 north 1.33309789 0.978182409
## 97 north -0.90766947 0.712218238
## 98 north 1.06273987 0.156202287
## 99 north 1.19626953 0.085430715
## 100 north 1.04917922 -0.208154594
## 101 north 0.91383276 0.055848529
## 102 north 1.48554939 0.236717754
## 103 north 0.78455774 -0.191816714
## 104 north -1.32730133 0.874494792
## 105 north 1.03678414 1.692815533
## 106 north 2.44520702 0.295217462
## 107 north 0.80128151 0.135586450
## 108 north 0.77379035 0.752760415
## 109 north 1.17195011 0.650537430
## 110 north 3.35983424 0.136681902
## 111 north -0.63934075 0.705101310
## 112 north -0.17953158 0.182111795
## 113 north 1.87133109 0.886233358
## 114 north 2.78138396 0.042974699
## 115 north -0.69680089 0.482289333
## 116 north 0.73546820 0.741982987
## 117 north -0.47404992 0.147837467
## 118 north 1.86323316 0.974509987
## 119 north -1.08002949 0.661616631
## 120 north 0.21742753 0.415139876
## 121 north 0.12130666 0.638469425
## 122 north 0.42237314 -0.163698422
## 123 north 1.00998117 1.241093695

```

```

## 124 north 2.50137251 0.010580429
## 125 north -0.16978334 0.484333980
## 126 north 0.49043882 0.614210011
## 127 north 1.20582394 -0.674376786
## 128 north 1.73515803 0.924567294
## 129 north 1.01618179 -0.352165235
## 130 north 0.38381998 0.052265292
## 131 north -0.02954591 0.561558005
## 132 north 0.19226615 0.631426902
## 133 north 1.32252251 0.799384282
## 134 north 0.81553911 -0.288080222
## 135 north 1.03789881 0.988772022
## 136 north 1.32345047 0.523832393
## 137 north 0.60955179 0.945120136
## 138 north 1.08994787 1.128334081
## 139 north 1.00366310 1.166564966
## 140 north 1.06363841 1.665974759
## 141 north 0.67708631 -0.691997758
## 142 north 0.74527144 0.389311901
## 143 north 0.21206260 0.944055707
## 144 north 0.97884957 -0.801484683
## 145 north 1.88622888 1.092233841
## 146 north 1.97616207 1.412674364
## 147 north 0.37085362 -0.165493626
## 148 north 1.79642817 -0.009607828
## 149 north 1.64060286 0.004697056
## 150 north 1.12408017 0.991484265
## 151 north 0.04567038 0.170142582
## 152 north 0.66169353 0.298578658
## 153 north 1.71473747 1.130932311
## 154 north 0.21465152 0.528863755
## 155 north 1.80607737 0.627374615
## 156 north -0.10724958 0.886315285
## 157 north 0.47432524 0.189779631
## 158 north 1.44676391 0.614730034
## 159 north 0.11431355 0.639589850
## 160 north 0.47278943 0.050237137
## 161 north 1.38233823 1.345516790
## 162 north 0.84618213 0.801973072
## 163 north 1.87264557 -0.226250253
## 164 north 0.85390969 0.173246003
## 165 north 0.58952001 1.036270854
## 166 north 1.94959609 0.138853647
## 167 north 2.81794071 1.203061563
## 168 north 1.23606538 -0.394896147
## 169 north -0.31730151 -0.120146039
## 170 north 0.88356937 -0.355812909
## 171 north 1.07812140 1.530994056
## 172 north 0.63637288 0.909159763
## 173 north 0.42364714 0.344080207
## 174 north 1.42633942 1.126837894
## 175 north 0.08489835 -0.427047916
## 176 north 0.74960340 0.716069501
## 177 north 1.88464960 0.973781330

```

```

## 178 north 1.14287031 0.187491993
## 179 north 0.95236070 0.879435274
## 180 north 0.66493873 0.062572394
## 181 north 0.64308232 -0.273554917
## 182 north 0.92278728 0.932114655
## 183 north 0.32905017 1.158276360
## 184 north -0.73544654 0.723210097
## 185 north 0.38546150 0.073197856
## 186 north 1.76105135 -0.154254187
## 187 north 1.80195621 0.565119200
## 188 north 1.85492510 -0.412460549
## 189 north 1.32218851 -0.159734717
## 190 north 0.35368243 0.742101781
## 191 north 1.37317234 0.719677998
## 192 north 0.19177068 0.177530793
## 193 north 0.79843308 1.198807838
## 194 north 0.25906280 -0.059064165
## 195 north 2.13634297 0.750658813
## 196 north 0.43503096 0.444733839
## 197 north 0.41541870 0.909954827
## 198 north 0.70662678 1.146494497
## 199 north 0.59151308 0.552984409
## 200 north 0.41721721 0.916278260
##
## [[2]]
##      sites      a      b
## 1  west 2.34466789 1.35237407
## 2  west 1.69627658 1.14858320
## 3  west -3.02817429 2.29264703
## 4  west 3.74647498 0.70965468
## 5  west 2.67909264 -0.40725212
## 6  west 4.46303811 1.49404434
## 7  west 0.42799544 1.87000723
## 8  west -0.32887966 0.01496255
## 9  west -1.08132395 1.33995182
## 10 west -0.41740521 1.91971166
## 11 west -1.41350607 0.44874553
## 12 west 0.16891355 1.26390957
## 13 west 2.37451550 -0.56482709
## 14 west 1.49896833 0.82698866
## 15 west -0.06335757 -0.47908938
## 16 west 0.57422666 -0.43548757
## 17 west 2.65918395 0.10253984
## 18 west 3.08600448 0.13919646
## 19 west 2.83344522 0.41454449
## 20 west 2.25018252 -0.19832205
## 21 west 2.38130272 0.63354325
## 22 west 0.79316975 0.57436740
## 23 west 2.00053263 1.60204331
## 24 west 2.72919129 1.13491464
## 25 west 0.14724501 2.68966468
## 26 west 4.73759717 0.80646146
## 27 west 0.06228372 1.62651698
## 28 west 2.26527644 2.92935971

```

## 29	west	0.88724085	0.48902688
## 30	west	3.51733312	-0.35682884
## 31	west	7.01096856	2.49960915
## 32	west	2.26303699	-0.20578024
## 33	west	4.63921013	0.47156363
## 34	west	3.10824740	1.03886554
## 35	west	2.12205666	0.34685405
## 36	west	2.89989192	1.82279264
## 37	west	0.96390518	-0.12039066
## 38	west	3.94804922	1.68077751
## 39	west	0.55984648	-0.94314902
## 40	west	2.12493105	1.21429821
## 41	west	1.87025250	0.22587592
## 42	west	0.31524597	1.63465880
## 43	west	0.74575325	2.08174002
## 44	west	1.38169946	-0.41451210
## 45	west	3.97043387	1.69834943
## 46	west	0.55768828	-0.84338147
## 47	west	4.58859870	0.42387998
## 48	west	2.16924417	2.23724417
## 49	west	1.68869339	-1.48923729
## 50	west	5.35557429	1.36607462
## 51	west	-2.01599441	0.18817899
## 52	west	0.40274112	1.67347508
## 53	west	-0.47370418	1.36528253
## 54	west	1.87024628	1.61293604
## 55	west	1.94173046	0.75316615
## 56	west	3.51677387	1.54113763
## 57	west	3.13669033	-0.15553968
## 58	west	-0.20852923	1.68762709
## 59	west	1.43455098	0.58001686
## 60	west	0.83073820	-2.58013628
## 61	west	4.11654265	1.27897227
## 62	west	4.06591063	-0.35606029
## 63	west	3.29736440	0.75603685
## 64	west	-0.39417083	0.39017117
## 65	west	2.47151524	-0.20851394
## 66	west	4.12322869	1.99585600
## 67	west	3.66441812	1.06683530
## 68	west	3.05072369	0.48221980
## 69	west	-0.85186462	1.40968191
## 70	west	3.71743668	-1.24581575
## 71	west	1.35515585	1.31013188
## 72	west	1.87192900	0.53404143
## 73	west	2.04008231	1.20129044
## 74	west	4.44269609	0.15614912
## 75	west	0.55724394	1.29137668
## 76	west	2.53896676	1.43465681
## 77	west	3.83997478	0.24082443
## 78	west	3.06115993	0.65471488
## 79	west	-1.79432785	1.87474803
## 80	west	-1.41766266	1.89785944
## 81	west	2.95636249	1.27196335
## 82	west	-0.08435401	1.92867064

## 83	west	3.21494880	0.12682576
## 84	west	0.05905833	0.23816582
## 85	west	3.32072759	-0.25310341
## 86	west	3.03545926	0.54494035
## 87	west	2.98162649	2.17059357
## 88	west	1.81891827	1.35897831
## 89	west	-0.63385364	0.74105130
## 90	west	-0.43889481	0.36803846
## 91	west	-0.65472968	1.31435666
## 92	west	3.60411177	2.23152863
## 93	west	4.80876505	1.00243287
## 94	west	2.68277725	1.90675188
## 95	west	1.95102354	-0.59186094
## 96	west	1.52744705	0.16558263
## 97	west	1.52300094	1.19983550
## 98	west	0.69470078	0.05840645
## 99	west	0.69074934	1.03723403
## 100	west	0.69149079	1.73576991
## 101	west	0.46645617	1.17361466
## 102	west	1.76431324	2.33268178
## 103	west	2.23844771	1.87260682
## 104	west	0.57456066	0.43220765
## 105	west	-1.08737759	0.01785380
## 106	west	1.63276788	0.64966353
## 107	west	4.60486235	-0.27740852
## 108	west	0.62560091	-0.03707346
## 109	west	1.46208318	0.61901949
## 110	west	3.76365802	-0.21686669
## 111	west	-1.98009270	0.93355333
## 112	west	7.29991530	0.83254031
## 113	west	4.12761417	2.42114537
## 114	west	2.11712780	0.25383750
## 115	west	2.64107218	0.23876305
## 116	west	1.11069423	-0.14509219
## 117	west	2.82854064	1.77489881
## 118	west	-0.22578701	1.76682470
## 119	west	0.68905184	0.80767206
## 120	west	-0.72392237	0.86039477
## 121	west	3.47859027	3.30119277
## 122	west	4.51269898	0.60908715
## 123	west	0.62012877	1.91002676
## 124	west	0.59122537	0.66299190
## 125	west	-1.04476948	1.29577679
## 126	west	4.22919440	0.92675960
## 127	west	1.18325548	0.14239855
## 128	west	5.16029384	0.62389398
## 129	west	5.68323843	-0.50537865
## 130	west	1.86694898	0.45649142
## 131	west	1.16515706	-1.43531914
## 132	west	1.44673469	1.14075420
## 133	west	2.75229219	0.40773790
## 134	west	0.55366080	3.10029072
## 135	west	5.96602680	1.38379936
## 136	west	2.23657146	0.23067536

## 137	west	0.61618607	-0.48267452
## 138	west	-0.05593970	2.07785120
## 139	west	3.31903541	0.44841023
## 140	west	3.20037252	1.13940051
## 141	west	2.72919276	0.85581575
## 142	west	3.44018577	1.64198604
## 143	west	1.71058322	1.10802837
## 144	west	2.80608309	3.75262083
## 145	west	4.65035169	1.61066842
## 146	west	-1.76527597	1.89161126
## 147	west	1.34731438	1.86813371
## 148	west	2.37612388	-0.92826103
## 149	west	3.04844683	1.22955790
## 150	west	-1.74802240	1.50799636
## 151	west	4.24612992	1.81147988
## 152	west	1.03205732	0.33308649
## 153	west	3.93479790	0.87984045
## 154	west	-0.62575343	0.11944331
## 155	west	1.35927268	1.23545000
## 156	west	2.38292659	1.69633768
## 157	west	5.15166867	2.56923889
## 158	west	6.15581758	1.68976973
## 159	west	2.24907507	0.38045258
## 160	west	2.07736573	0.57552028
## 161	west	-0.81229529	1.70116518
## 162	west	1.46020345	1.00948936
## 163	west	3.93973999	-0.36121299
## 164	west	2.66809842	0.44092864
## 165	west	-0.55351841	0.82220023
## 166	west	2.97284399	1.01469381
## 167	west	2.91405360	1.44508899
## 168	west	4.64965341	2.27616049
## 169	west	3.70294430	0.29427850
## 170	west	0.94453790	1.56920001
## 171	west	2.55631394	1.35764028
## 172	west	2.15463757	0.05700142
## 173	west	-1.04993420	0.46874772
## 174	west	4.03931187	2.23856075
## 175	west	4.89033787	2.58723942
## 176	west	3.23318657	1.66331296
## 177	west	2.22537147	0.19337455
## 178	west	0.43190954	1.47117768
## 179	west	-0.78676714	1.44529024
## 180	west	4.85782804	0.91040658
## 181	west	0.80797260	1.36498897
## 182	west	0.88731564	2.29673846
## 183	west	2.28186430	1.71842421
## 184	west	2.68840150	-0.09140289
## 185	west	3.28598338	0.99997806
## 186	west	-1.73974842	-0.13698777
## 187	west	2.66416042	-0.34704269
## 188	west	-2.03747457	0.32158140
## 189	west	-0.15728347	2.47989689
## 190	west	0.59591979	0.94445287

```

## 191 west 4.03103060 0.92896592
## 192 west 1.98969365 0.64747472
## 193 west 2.14192414 1.61378759
## 194 west 1.70129170 -0.53389193
## 195 west 2.61508150 3.17078604
## 196 west 0.14336063 0.84063484
## 197 west 2.43841560 1.89524031
## 198 west 5.78120705 1.67077215
## 199 west 0.25537352 0.43867016
## 200 west 1.64296210 0.43218178
##
## [[3]]
##      sites      a      b
## 1      east 4.116053e+00 -0.84445858
## 2      east 3.499053e+00 0.38298717
## 3      east 3.633231e+00 0.12872339
## 4      east 3.144377e+00 3.62294180
## 5      east -4.328478e-01 3.18400436
## 6      east 1.983657e-01 2.23259351
## 7      east 7.253440e+00 1.36246896
## 8      east 4.003617e-05 4.53286623
## 9      east 2.389506e+00 -0.51849561
## 10     east 3.999272e-01 2.04663064
## 11     east -3.470925e+00 0.58470154
## 12     east 2.836573e+00 0.37382150
## 13     east 6.544311e+00 -0.22940804
## 14     east 2.323254e+00 1.41935032
## 15     east 6.046610e+00 2.03040109
## 16     east 3.139089e+00 1.37682953
## 17     east -2.186650e+00 0.86190987
## 18     east 6.282224e+00 1.02264816
## 19     east 2.043422e+00 0.33839962
## 20     east -2.465460e+00 0.99667985
## 21     east 6.069497e+00 1.39580895
## 22     east 3.891170e+00 2.60762429
## 23     east 2.658396e+00 5.12809930
## 24     east 4.943916e+00 1.27893007
## 25     east 6.328981e+00 0.39686002
## 26     east -6.643664e-02 4.37539648
## 27     east 4.086850e+00 2.76644618
## 28     east -2.533938e-01 1.47814957
## 29     east 1.248817e+00 1.24971740
## 30     east 6.671849e-01 0.75704366
## 31     east 4.702156e+00 2.98866073
## 32     east 8.327982e+00 -0.96895117
## 33     east 3.293231e+00 -0.35303230
## 34     east 5.684529e-01 2.01644306
## 35     east 3.983607e+00 1.28002946
## 36     east 8.350386e+00 2.09199236
## 37     east 4.956144e-01 1.23139380
## 38     east 2.957802e+00 2.17536547
## 39     east 4.743225e-01 2.85443736
## 40     east 1.060601e+01 1.57022442
## 41     east 2.429368e+00 0.68040154

```

## 42	east	8.042163e+00	2.24900537
## 43	east	3.694380e-01	-0.63772355
## 44	east	2.920947e+00	0.60154895
## 45	east	5.942642e+00	0.42676894
## 46	east	4.024328e+00	2.16484927
## 47	east	6.023290e+00	0.77961315
## 48	east	1.785166e+00	-1.46205626
## 49	east	2.151316e+00	3.21466785
## 50	east	-9.121727e-02	2.84877671
## 51	east	2.589798e+00	-0.76593295
## 52	east	3.744949e+00	-0.94151251
## 53	east	8.026240e+00	1.72067184
## 54	east	4.367541e+00	-0.14891460
## 55	east	9.567330e+00	2.52446085
## 56	east	7.053395e+00	0.97679097
## 57	east	2.981178e+00	1.27110819
## 58	east	-2.830286e+00	3.21904398
## 59	east	4.671702e+00	3.01854619
## 60	east	3.792138e+00	3.62592025
## 61	east	3.474774e+00	1.18975895
## 62	east	1.309489e-01	2.33749441
## 63	east	2.924784e+00	2.31694758
## 64	east	4.574326e+00	2.73537893
## 65	east	8.672205e+00	3.37953302
## 66	east	4.477076e+00	1.04170874
## 67	east	3.344609e+00	1.83370805
## 68	east	1.003214e+00	2.29030707
## 69	east	-1.370476e+00	3.08323274
## 70	east	2.613900e+00	0.10730392
## 71	east	6.061003e+00	-0.21895086
## 72	east	2.041785e+00	3.17887345
## 73	east	6.308599e+00	2.23293579
## 74	east	1.079845e+00	3.04281346
## 75	east	4.410836e+00	2.52843474
## 76	east	4.216814e+00	2.98123130
## 77	east	1.875875e+00	0.94664635
## 78	east	-5.774773e+00	-0.02968294
## 79	east	2.763061e+00	0.39861270
## 80	east	3.010128e+00	4.17161884
## 81	east	1.894090e+00	2.58430252
## 82	east	1.984988e+00	4.28067960
## 83	east	5.847418e+00	3.02796563
## 84	east	3.835524e+00	3.96324619
## 85	east	2.960100e+00	5.59791195
## 86	east	1.114445e+01	1.10307952
## 87	east	7.963451e+00	1.64026425
## 88	east	1.027062e+00	0.63179935
## 89	east	-1.772001e+00	2.59786820
## 90	east	4.576727e+00	2.90888631
## 91	east	5.281765e+00	2.02345267
## 92	east	4.955473e+00	0.53229961
## 93	east	-2.986653e+00	2.35304372
## 94	east	1.078243e+01	0.63683227
## 95	east	2.819028e+00	3.27664280

## 96	east	2.937511e+00	1.58574779
## 97	east	1.463429e+00	2.56459046
## 98	east	3.024279e+00	2.12697135
## 99	east	3.834875e-01	-0.20890590
## 100	east	2.464720e+00	4.29507152
## 101	east	3.034901e-01	1.27195111
## 102	east	4.650857e+00	1.50947925
## 103	east	3.683722e+00	3.67099211
## 104	east	1.743456e+00	0.39970322
## 105	east	3.272482e+00	0.55680003
## 106	east	4.330641e+00	0.96909540
## 107	east	5.575175e+00	3.09341203
## 108	east	-3.469914e+00	-0.12905211
## 109	east	2.259532e+00	0.92869129
## 110	east	3.502933e+00	2.62209917
## 111	east	5.989967e-01	1.90391112
## 112	east	-4.922210e-02	1.64204173
## 113	east	3.319291e+00	1.62320516
## 114	east	-3.149130e+00	2.83876094
## 115	east	4.536969e+00	4.72170352
## 116	east	7.694665e-01	2.45015668
## 117	east	1.398465e+00	1.03868824
## 118	east	6.023447e+00	1.55618625
## 119	east	7.521144e+00	0.29789167
## 120	east	5.910034e-01	2.06741197
## 121	east	3.755178e+00	2.03815184
## 122	east	8.001396e+00	3.87030852
## 123	east	-2.388956e+00	1.49413079
## 124	east	7.273228e-01	-0.05437548
## 125	east	9.924384e-01	2.61120087
## 126	east	7.386024e+00	2.83702221
## 127	east	-2.974537e-01	0.52912655
## 128	east	-8.340573e-01	2.03706677
## 129	east	4.249092e+00	1.40436010
## 130	east	3.298224e-01	0.91566067
## 131	east	-8.846826e-02	3.09266103
## 132	east	2.160467e+00	1.16610542
## 133	east	3.588989e-01	0.70398350
## 134	east	-7.886963e-02	0.66293859
## 135	east	5.556395e+00	1.89525081
## 136	east	5.815058e+00	0.62344319
## 137	east	1.131045e+00	2.04479680
## 138	east	3.872312e+00	1.34603659
## 139	east	2.783509e+00	2.84865937
## 140	east	-8.258657e-01	-0.13635703
## 141	east	2.670547e+00	1.54539883
## 142	east	7.616120e-01	2.16834678
## 143	east	7.028534e+00	-0.74525647
## 144	east	4.999298e+00	0.37127687
## 145	east	5.296721e+00	0.50003448
## 146	east	5.069268e+00	2.88964971
## 147	east	6.051078e+00	0.80769390
## 148	east	7.807935e+00	2.83042296
## 149	east	3.531590e+00	1.41518991

```

## 150 east 3.233331e+00 2.21692098
## 151 east 7.432991e-01 0.71028115
## 152 east 3.684234e+00 -0.48207765
## 153 east 6.453170e+00 1.60441563
## 154 east 4.882483e+00 -0.31898213
## 155 east 5.989083e+00 4.28643528
## 156 east -2.162645e+00 -1.72128427
## 157 east 2.599638e+00 1.14726021
## 158 east -1.872679e+00 0.71199988
## 159 east 3.614546e+00 3.11844496
## 160 east 1.043817e+00 2.77449055
## 161 east 4.967488e+00 -1.32647080
## 162 east 3.488782e+00 2.60427411
## 163 east -3.880079e+00 1.56844372
## 164 east 9.948234e+00 3.23574602
## 165 east 3.293407e+00 1.24783971
## 166 east 5.794384e+00 -1.76899453
## 167 east 6.047827e+00 1.02674081
## 168 east 2.358927e+00 2.32694603
## 169 east 1.143681e+00 -0.80061388
## 170 east 7.511738e+00 -1.63258849
## 171 east 6.335048e+00 2.63359680
## 172 east 1.002800e+00 1.13095863
## 173 east 7.668103e+00 -0.16786203
## 174 east -1.563462e-01 3.55986738
## 175 east 8.985120e+00 1.33341228
## 176 east 8.253578e-01 -1.49243112
## 177 east 5.211122e+00 0.71582781
## 178 east 1.124299e+01 0.97876851
## 179 east -2.947815e+00 2.18650197
## 180 east 1.701894e+00 1.23516769
## 181 east 4.813116e+00 3.59925448
## 182 east 2.304504e+00 0.60827494
## 183 east 4.145734e+00 -1.01315298
## 184 east 3.285591e+00 0.98694199
## 185 east -8.939440e-01 1.23277564
## 186 east 4.144326e+00 1.69119565
## 187 east 3.859472e+00 1.10327973
## 188 east 4.614140e+00 1.60350235
## 189 east 5.122352e+00 2.57336598
## 190 east 7.333266e+00 3.36795012
## 191 east 4.745339e+00 1.36563097
## 192 east 6.872388e+00 3.77153370
## 193 east -1.916392e+00 3.64382672
## 194 east 2.233794e+00 -0.17516920
## 195 east 1.453667e+00 4.12867215
## 196 east 3.699224e+00 4.13078493
## 197 east 1.448173e+00 2.51992630
## 198 east 8.969458e-01 1.14979314
## 199 east 1.593382e+00 2.64800081
## 200 east 2.928819e+00 0.52051398

```