Ruth's GPS

Version 2: handles missing columns better

```
rm(list=ls())
library(dplyr)
library(lubridate)
setwd("~/WORKSHOP/GPS/")

df <- read.csv("DATA/AdvancedExport_2022-04-13 16_40_31Z.csv",header=TRUE)
# clean out columns with only NA

not_all_na <- function(x) any(!is.na(x))
not_any_na <- function(x) all(!is.na(x))



#
unique_names <- unique(df$UnitName)
unique_names
```

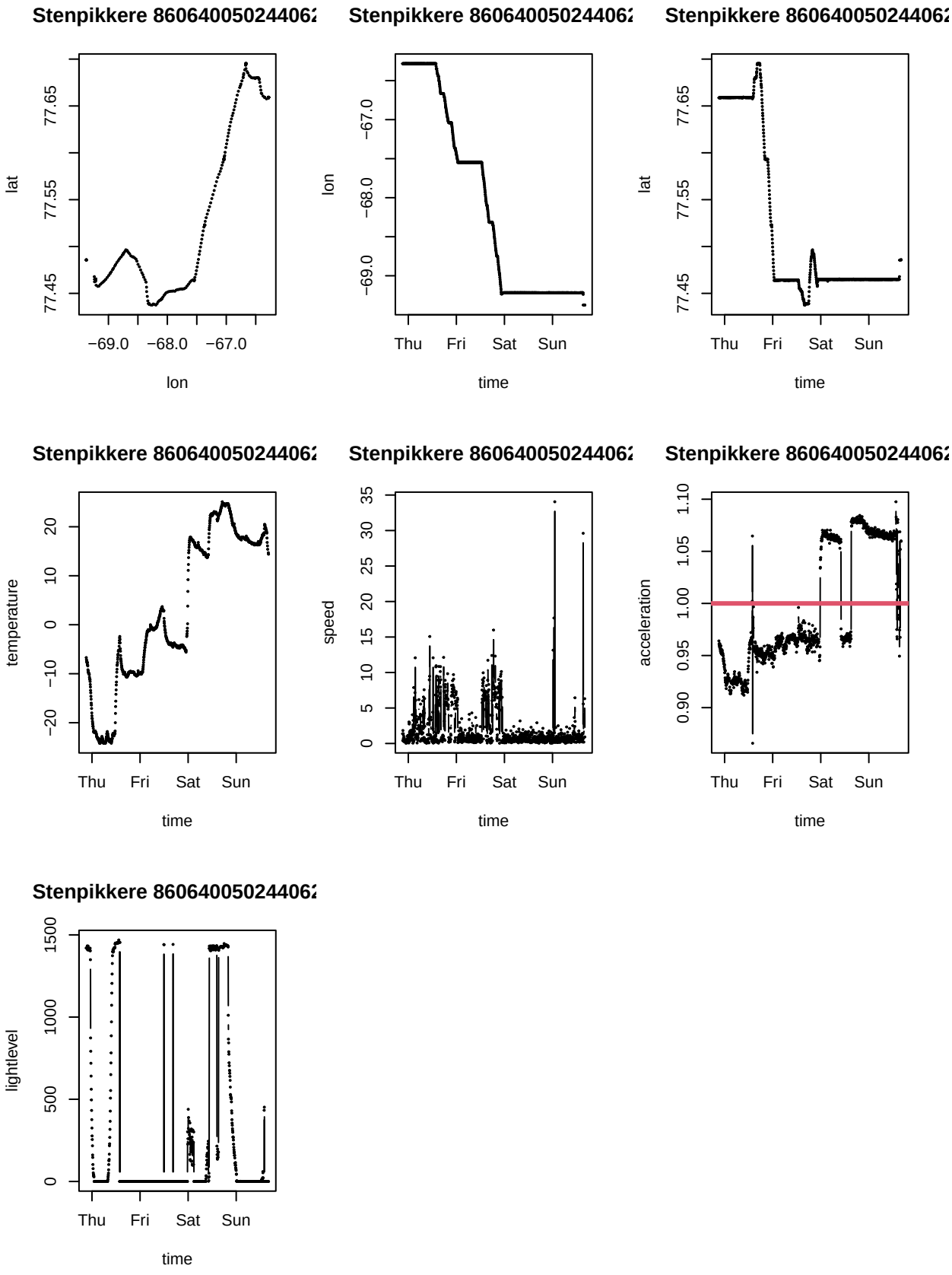
```
##  [1] "Stenpikkere 860640050244062" "Strandskade 860640050251356"
##  [3] "Landsvale 860640050251737"   "Fjeldrype 860640050232018"
##  [5] "Ravn 860640050244401"        "Soekonge 300434066433690"
##  [7] "Mallemuk 300434066431710"    "Havoern 300434066437680"
##  [9] "Ismaage 300434066437720"     "Havterne 300434066435700"
## [11] "Edder 300434066433700"
```

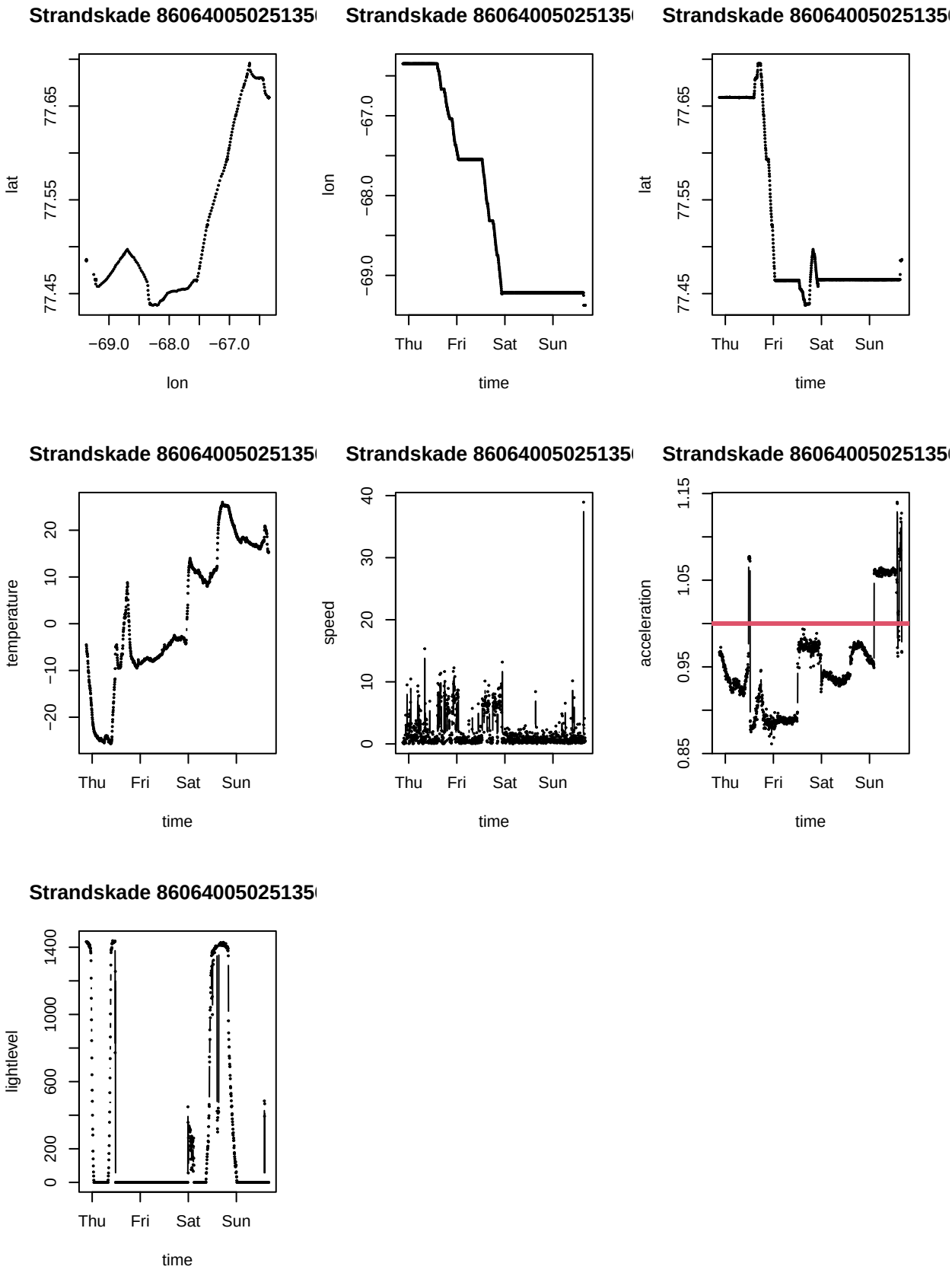
Define function to calculate speed

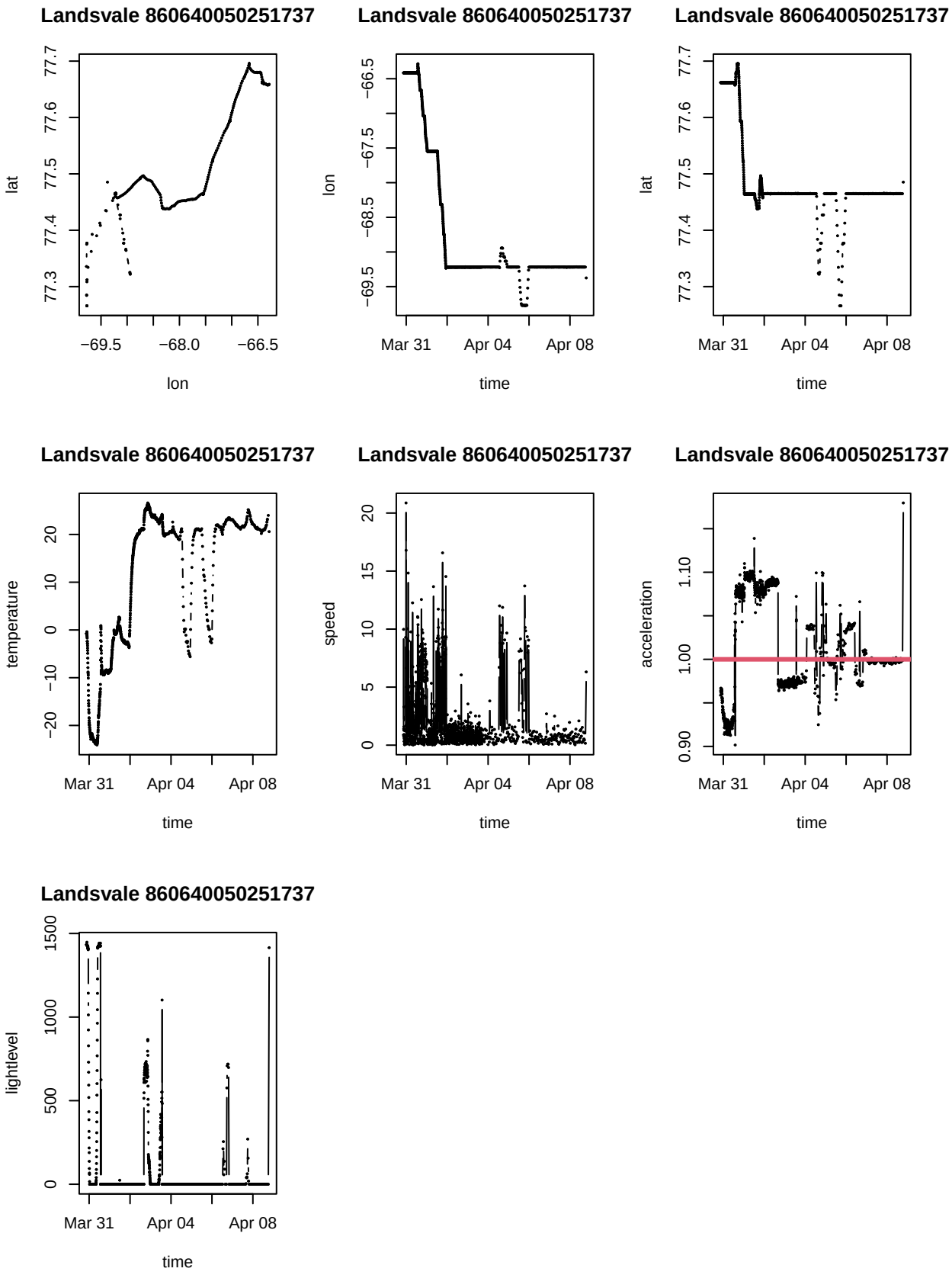
read

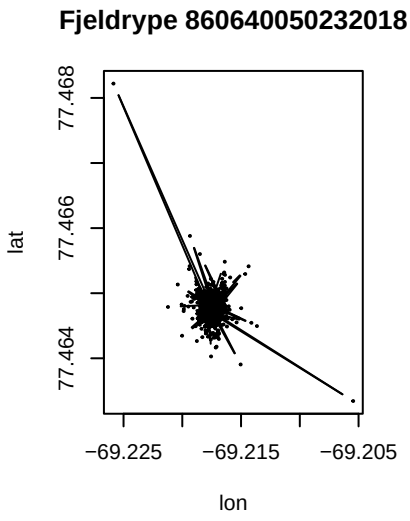
```
statdat <- NULL
alldf <- NULL
ic <- 1
for (istat in unique_names)
{
  par(mfrow=c(3,3))
  idx <- which(df$UnitName == istat & df$Longitude < -65)
  df2 <- df[idx,] %>% select(where(not_all_na))
  cnams <- colnames(df2)
  time <- as.POSIXct(df2$Timestamp.UTC,tz="UTC")
  idx <- which(time >= as.POSIXct("2022-03-19 00:00:00"))
  df2 <- df2[idx,]
  df2 <- na.omit(df2)
```

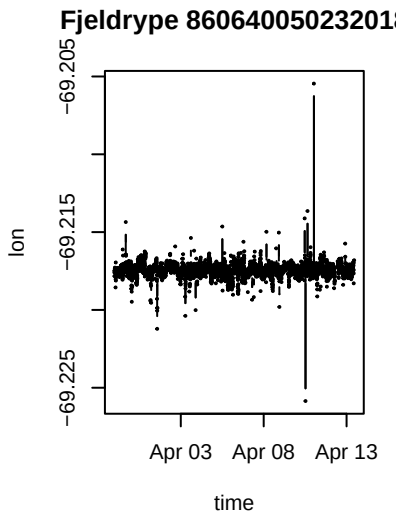
```
  time <- as.POSIXct(df2$Timestamp.UTC,tz="UTC")
  #
  lon <- df2$Longitude
  lat <- df2$Latitude
  temperature <- df2$Temperature..C.
  acceleration <- sqrt(df2$AccelerationX.g.^2+df2$AccelerationY.g.^2+df2$AccelerationZ.g.^2)
  lightlevel <- df2$LightLevel
  speed <- df2$"GPS.Speed.Km.h."
  #velocity <- getVelocity(time,lon,lat)
  plot(lon,lat,main=istat,pch=19,cex=0.2,type="b")
  plot(time,lon,main=istat,pch=19,cex=0.2,type="b")
  plot(time,lat,main=istat,pch=19,cex=0.2,type="b")
  if (length(temperature > 3)) {plot(time,temperature,main=istat,pch=19,cex=0.2,type="b")}
  if (length(speed > 3)) {plot(time,speed,main=istat,pch=19,cex=0.2,type="b")}
  if (length(acceleration > 3)) {
    plot(time,acceleration,main=istat,pch=19,cex=0.2,type="b")
    abline(h=1,col=2,lwd=3)
  }
  if (length(lightlevel > 3)) {plot(time,lightlevel,main=istat,pch=19,cex=0.2,type="b")}
  # the set_of_variables
  set <- c("time","lon","lat","temperature","acceleration","leightlevel","speed")
  df3 <- cbind.data.frame(time,lon,lat)
  colnames(df3)[1] <- "POSIX"
  if (length(temperature) == nrow(df3)){    df3 <- cbind.data.frame(df3,temperature)  }
  if (length(acceleration) == nrow(df3)){    df3 <- cbind.data.frame(df3,acceleration)  }
  if (length(lightlevel) == nrow(df3)){    df3 <- cbind.data.frame(df3,lightlevel)  }
  if (length(speed) == nrow(df3)){    df3 <- cbind.data.frame(df3,speed)  }
  saveRDS(df3,paste0('OUTPUT/',istat,'.rds'))
  #

}
```

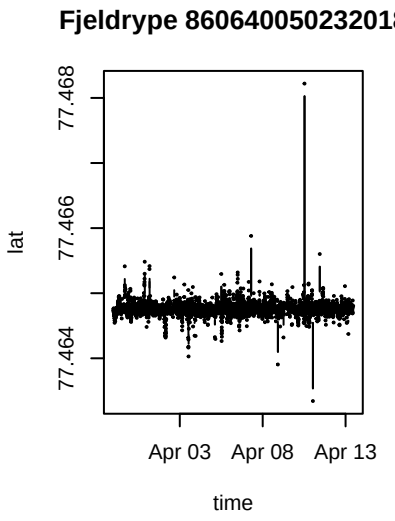

Stenpikkere 860640050244062
lat
77.45
77.55
77.65
−69.0
−68.0
−67.0
lon
Stenpikkere 860640050244062
lon
−67.0
−68.0
−69.0
Thu
Fri
Sat
Sun
time
Stenpikkere 860640050244062
lat
77.45
77.55
77.65
Thu
Fri
Sat
Sun
time
Stenpikkere 860640050244062
temperature
−20
−10
0
10
20
Thu
Fri
Sat
Sun
time
Stenpikkere 860640050244062
speed
0
5
10
15
20
25
30
35
Thu
Fri
Sat
Sun
time
Stenpikkere 860640050244062
acceleration
0.90
0.95
1.00
1.05
1.10
Thu
Fri
Sat
Sun
time
Stenpikkere 860640050244062
lightlevel
0
500
1000
1500
Thu
Fri
Sat
Sun
time

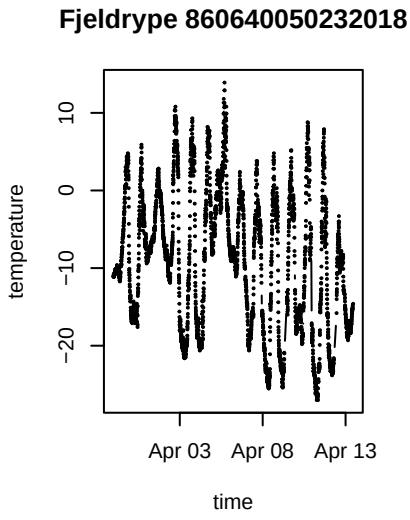

Strandskade 86064005025135
lat
77.45
77.55
77.65
−69.0
−68.0
−67.0
lon
Strandskade 86064005025135
lon
−67.0
−68.0
−69.0
Thu
Fri
Sat
Sun
time
Strandskade 86064005025135
lat
77.45
77.55
77.65
Thu
Fri
Sat
Sun
time
Strandskade 86064005025135
temperature
−20
−10
0
10
20
Thu
Fri
Sat
Sun
time
Strandskade 86064005025135
speed
0
10
20
30
40
Thu
Fri
Sat
Sun
time
Strandskade 86064005025135
acceleration
0.85
0.95
1.05
1.15
Thu
Fri
Sat
Sun
time
Strandskade 86064005025135
lightlevel
0
200
600
1000
1400
Thu
Fri
Sat
Sun
time

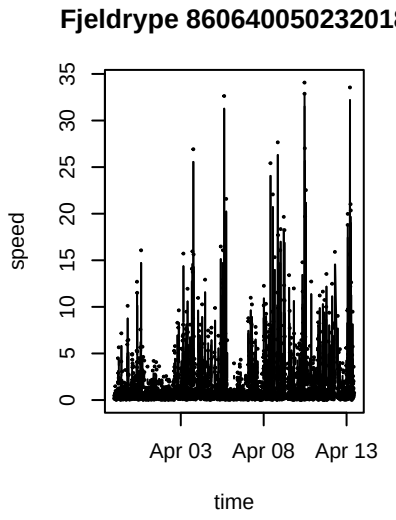

Landsvale 860640050251737
lat
77.3
77.4
77.5
77.6
77.7
−69.5
−68.0
−66.5
lon
Landsvale 860640050251737
lon
−66.5
−67.5
−68.5
−69.5
Mar 31
Apr 04
Apr 08
time
Landsvale 860640050251737
lat
77.3
77.4
77.5
77.6
77.7
Mar 31
Apr 04
Apr 08
time
Landsvale 860640050251737
temperature
−20
−10
0
10
20
Mar 31
Apr 04
Apr 08
time
Landsvale 860640050251737
speed
0
5
10
15
20
Mar 31
Apr 04
Apr 08
time
Landsvale 860640050251737
acceleration
0.90
1.00
1.10
Mar 31
Apr 04
Apr 08
time
Landsvale 860640050251737
lightlevel
0
500
1000
1500
Mar 31
Apr 04
Apr 08
time

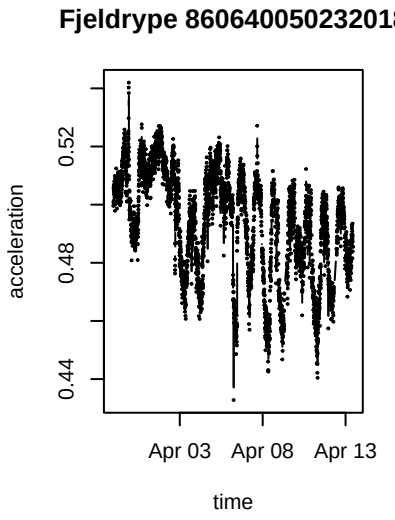

Fjeldrype 860640050232018
lat
77.468
77.466
77.464
−69.225
−69.215
−69.205
lon

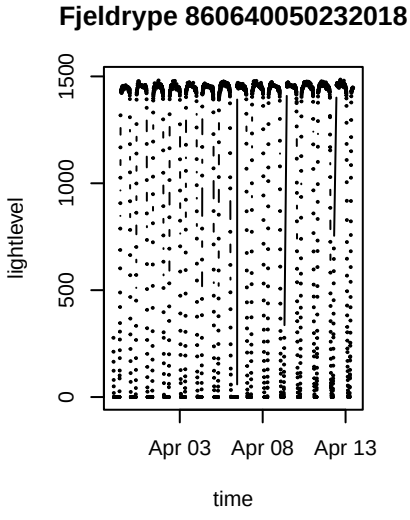

Fjeldrype 860640050232018
lon
−69.205
−69.215
−69.225
Apr 03
Apr 08
Apr 13
time

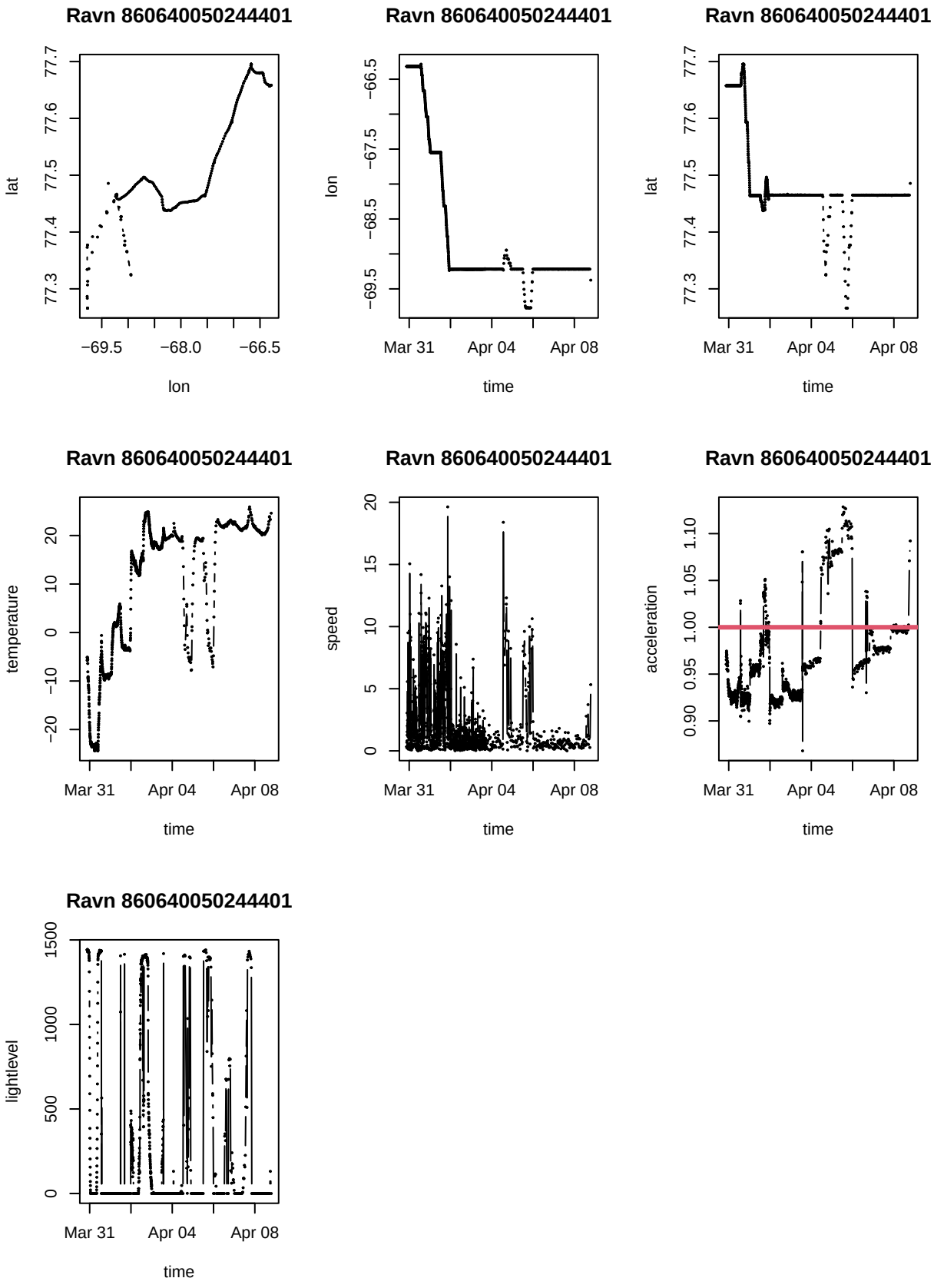

Fjeldrype 860640050232018
lat
77.468
77.466
77.464
Apr 03
Apr 08
Apr 13
time

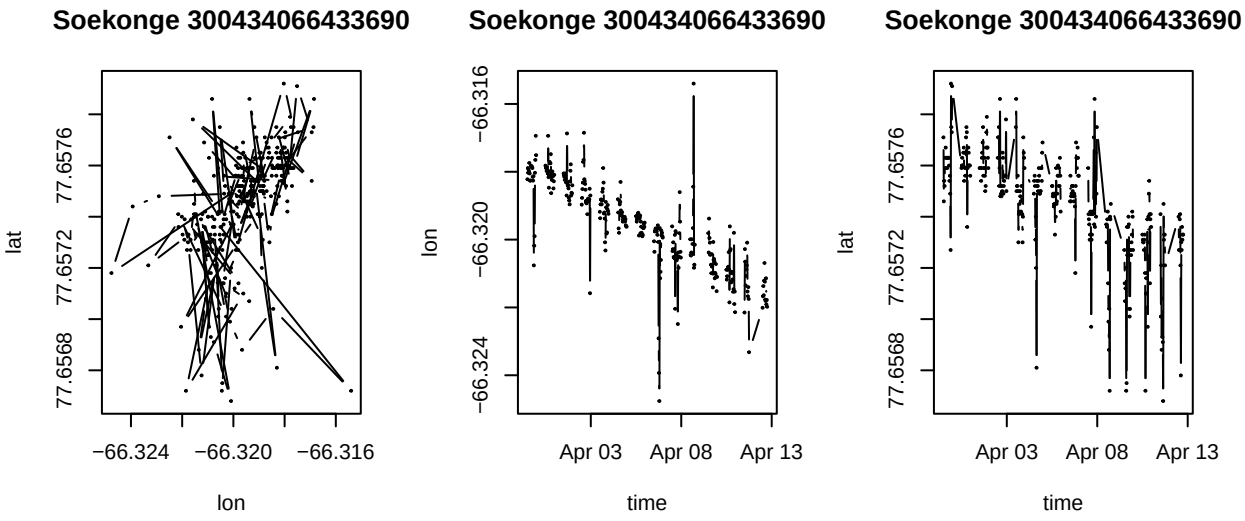

Fjeldrype 860640050232018
temperature
10
0
−10
−20
Apr 03
Apr 08
Apr 13
time

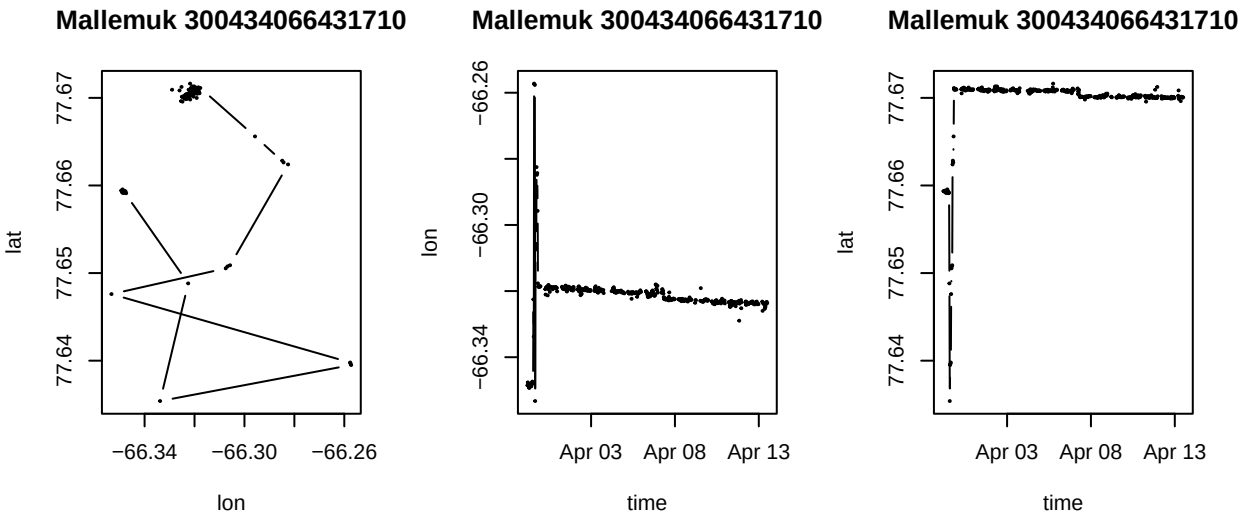

Fjeldrype 860640050232018
speed
35
30
25
20
15
10
5
0
Apr 03
Apr 08
Apr 13
time

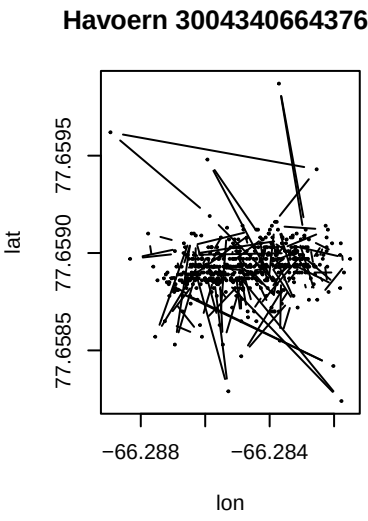

Fjeldrype 860640050232018
acceleration
0.52
0.48
0.44
Apr 03
Apr 08
Apr 13
time

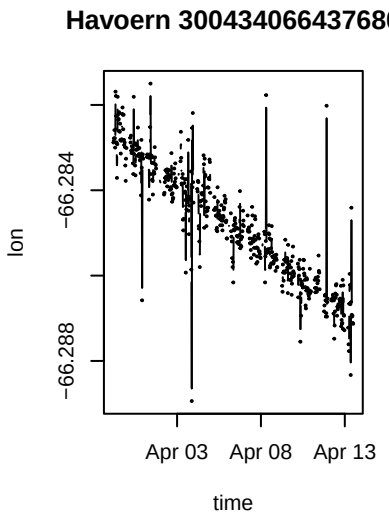

Fjeldrype 860640050232018
lightlevel
1500
1000
500
0
Apr 03
Apr 08
Apr 13
time

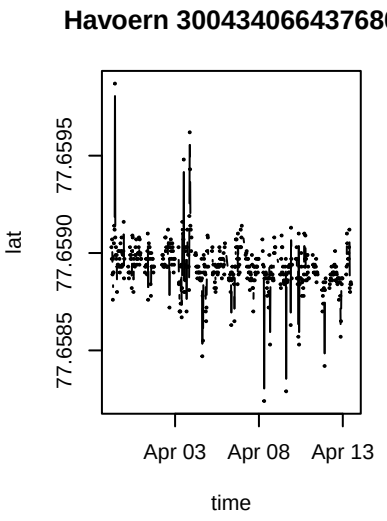

Ravn 860640050244401
lat
77.3
77.4
77.5
77.6
77.7
−69.5
−68.0
−66.5
lon
Ravn 860640050244401
lon
−66.5
−67.5
−68.5
−69.5
Mar 31
Apr 04
Apr 08
time
Ravn 860640050244401
lat
77.3
77.4
77.5
77.6
77.7
Mar 31
Apr 04
Apr 08
time
Ravn 860640050244401
temperature
−20
−10
0
10
20
Mar 31
Apr 04
Apr 08
time
Ravn 860640050244401
speed
0
5
10
15
20
Mar 31
Apr 04
Apr 08
time
Ravn 860640050244401
acceleration
0.90
0.95
1.00
1.05
1.10
Mar 31
Apr 04
Apr 08
time
Ravn 860640050244401
lightlevel
0
500
1000
1500
Mar 31
Apr 04
Apr 08
time

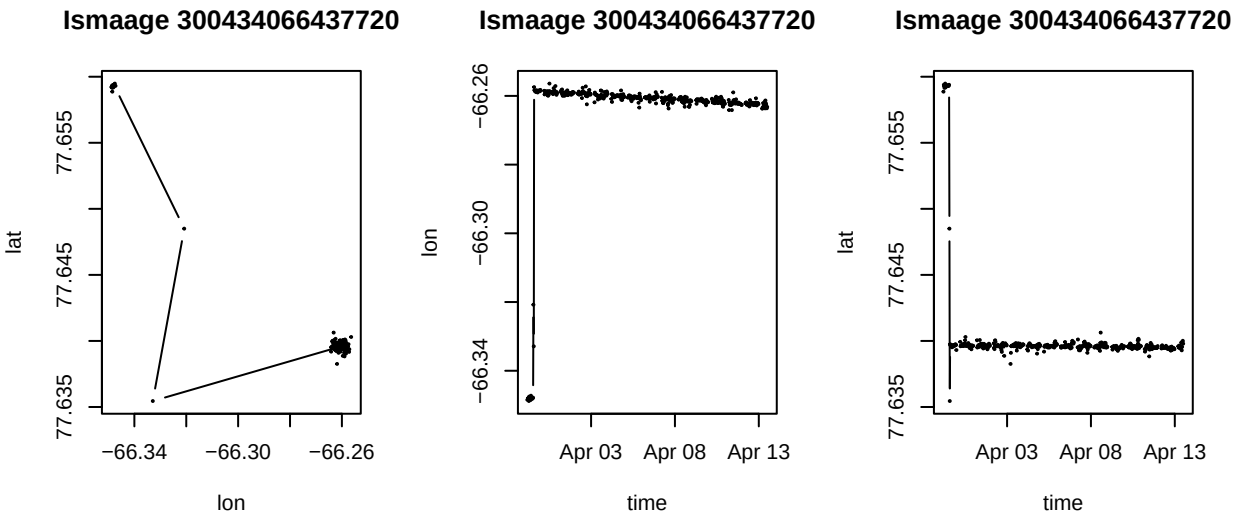

Soekonge 300434066433690
lat
77.6568
77.6572
77.6576
−66.324
−66.320
−66.316
lon
Soekonge 300434066433690
lon
−66.316
−66.320
−66.324
Apr 03
Apr 08
Apr 13
time
Soekonge 300434066433690
lat
77.6568
77.6572
77.6576
Apr 03
Apr 08
Apr 13
time

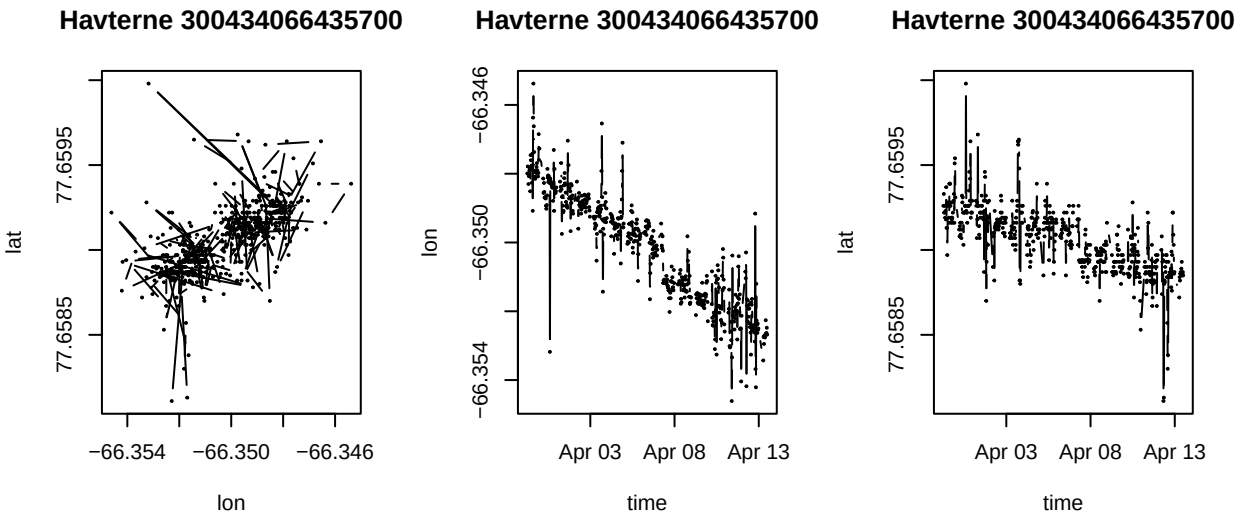

Mallemuk 300434066431710
lat
77.67
77.66
77.65
77.64
−66.34
−66.30
−66.26
lon
Mallemuk 300434066431710
lon
−66.26
−66.30
−66.34
Apr 03
Apr 08
Apr 13
time
Mallemuk 300434066431710
lat
77.67
77.66
77.65
77.64
Apr 03
Apr 08
Apr 13
time

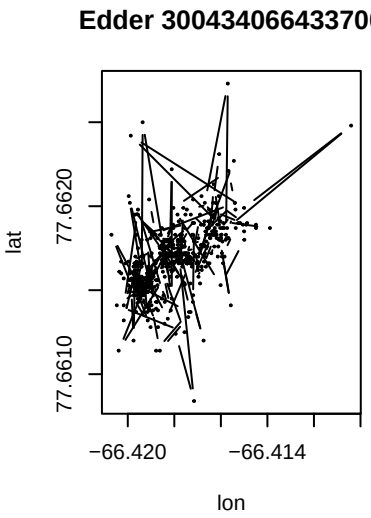

Havoern 300434066437680
lat
77.6585
77.6590
77.6595
−66.288
−66.284
lon

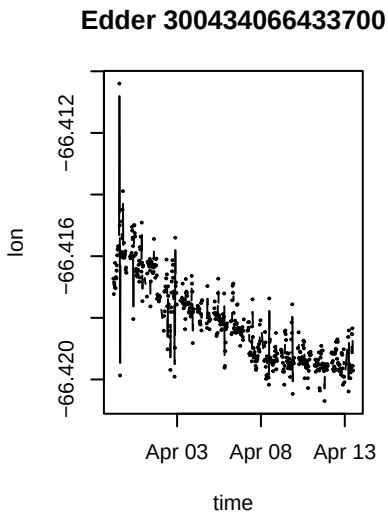

Havoern 300434066437680
lon
−66.288
−66.284
Apr 03
Apr 08
Apr 13
time

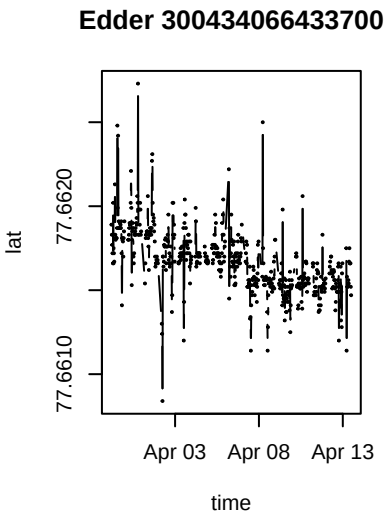

Havoern 300434066437680
lat
77.6585
77.6590
77.6595
Apr 03
Apr 08
Apr 13
time


Ismaage 300434066437720
lat
77.655
77.645
77.635
−66.34
−66.30
−66.26
lon
Ismaage 300434066437720
lon
−66.26
−66.30
−66.34
Apr 03
Apr 08
Apr 13
time
Ismaage 300434066437720
lat
77.655
77.645
77.635
Apr 03
Apr 08
Apr 13
time


Havterne 300434066435700
lat
77.6595
77.6585
−66.354
−66.350
−66.346
lon
Havterne 300434066435700
lon
−66.346
−66.350
−66.354
Apr 03
Apr 08
Apr 13
time
Havterne 300434066435700
lat
77.6595
77.6585
Apr 03
Apr 08
Apr 13
time


Edder 300434066433700
lat
77.6620
77.6610
−66.420
−66.414
lon


Edder 300434066433700
lon
−66.412
−66.416
−66.420
Apr 03
Apr 08
Apr 13
time

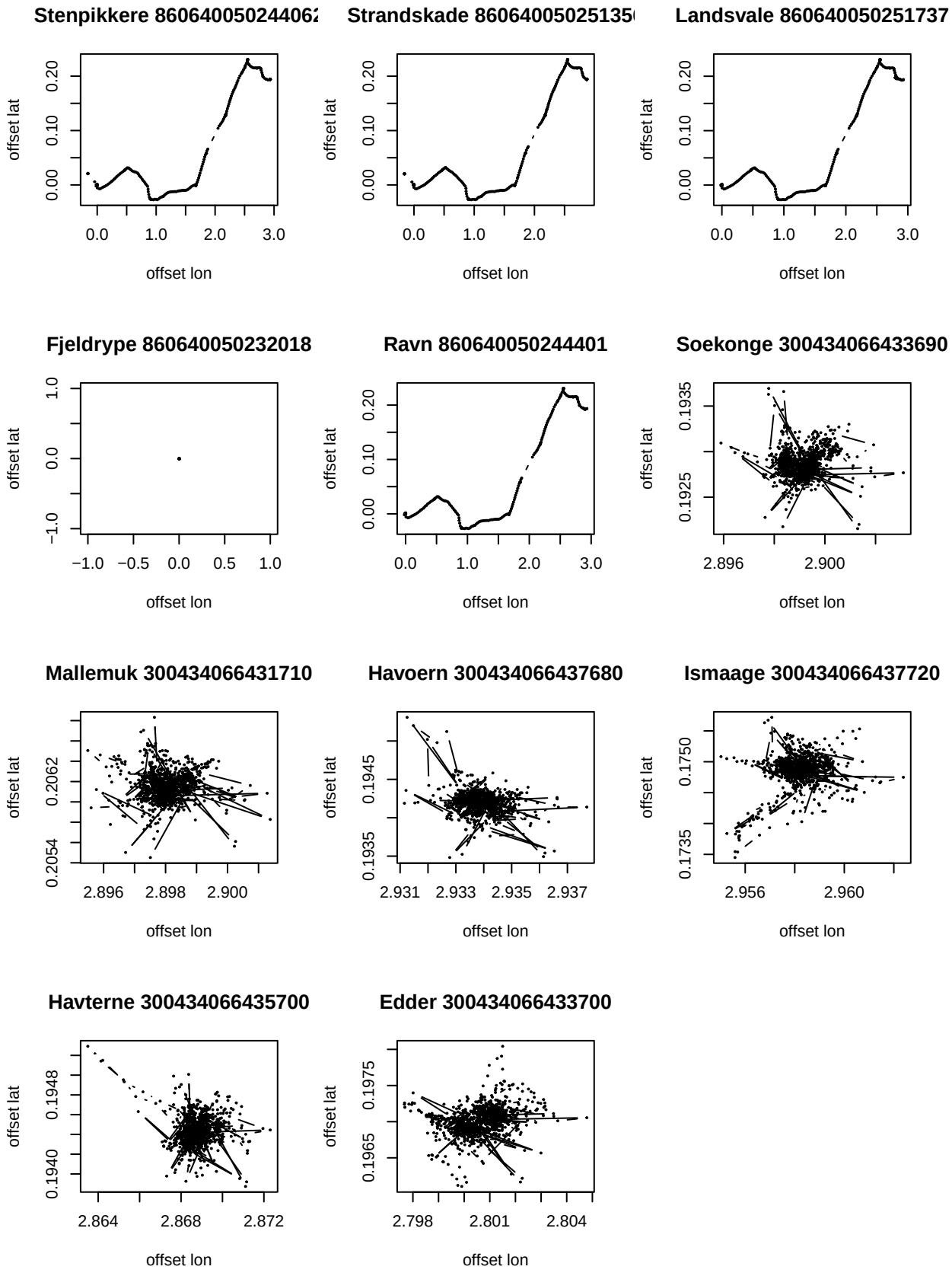

Edder 300434066433700
lat
77.6620
77.6610
Apr 03
Apr 08
Apr 13
time

relative to Fjeldrype

```
par(mfrow=c(4,3))

base_station <- readRDS("OUTPUT/Fjeldrype 860640050232018.rds")

alldf <- NULL
#
for (jstat in 1:length(unique_names))
{
  print(jstat)
  statname <- unique_names[jstat]
  print(statname)


  other <- readRDS(paste0("OUTPUT/",statname,".rds"))

  tmin <- max(c(min(base_station$POSIX),min(other$POSIX)))
  tmax <- min(max(base_station$POSIX),max(other$POSIX))
  idx <- which(base_station$POSIX >= tmin & base_station$POSIX <= tmax)
  base_station <- base_station[idx,]
  idx <- which(other$POSIX >= tmin & other$POSIX <= tmax)
  other <- other[idx,]
  #Interpolate to same times as in 'base_station'
  common_t <- base_station$POSIX
  lon_other_interp <- approx(other$POSIX,other$lon,base_station$POSIX,na.rm=TRUE)$y
  lat_other_interp <- approx(other$POSIX,other$lat,base_station$POSIX,na.rm=TRUE)$y
  #
  interp_lon <- na.omit(cbind.data.frame(common_t,lon_other_interp))
  colnames(interp_lon) <- c("POSIX","lon_i")
  interp_lat <- na.omit(cbind.data.frame(common_t,lat_other_interp))
  colnames(interp_lat) <- c("POSIX","lat_i")
  together <- merge(base_station,interp_lon,by="POSIX")
  together <- merge(together,interp_lat,by="POSIX")
  delta_lon <- together$lon_i-together$lon
  delta_lat <- together$lat_i-together$lat
  together <- cbind(together,delta_lon,delta_lat)
  saveRDS(together,paste0("OUTPUT/processed_",statname,".rds"))
  print(paste(statname,round(sd(together$delta_lon),4),round(sd(together$delta_lat),4)))
  plot(together$delta_lon,together$delta_lat,main=statname,xlab="offset lon",ylab="offset lat",pch=19,c
  #
}
```

```
## [1] 1
## [1] "Stenpikkere 860640050244062"
## [1] "Stenpikkere 860640050244062 1.1906 0.0862"

## [1] 2
## [1] "Strandskade 860640050251356"
## [1] "Strandskade 860640050251356 1.1729 0.0864"

## [1] 3
```

```
## [1] "Landsvale 860640050251737"
## [1] "Landsvale 860640050251737 1.1535 0.087"

## [1] 4
## [1] "Fjeldrype 860640050232018"
## [1] "Fjeldrype 860640050232018 0 0"

## [1] 5
## [1] "Ravn 860640050244401"
## [1] "Ravn 860640050244401 1.1784 0.0858"

## [1] 6
## [1] "Soekonge 300434066433690"
## [1] "Soekonge 300434066433690 7e-04 1e-04"

## [1] 7
## [1] "Mallemuk 300434066431710"
## [1] "Mallemuk 300434066431710 7e-04 1e-04"

## [1] 8
## [1] "Havoern 300434066437680"
## [1] "Havoern 300434066437680 7e-04 1e-04"

## [1] 9
## [1] "Ismaage 300434066437720"
## [1] "Ismaage 300434066437720 8e-04 3e-04"

## [1] 10
## [1] "Havterne 300434066435700"
## [1] "Havterne 300434066435700 7e-04 1e-04"

## [1] 11
## [1] "Edder 300434066433700"
## [1] "Edder 300434066433700 9e-04 2e-04"
```


Stenpikkere 860640050244062
Strandskade 86064005025135
Landsvale 860640050251737
Fjeldrype 860640050232018
Ravn 860640050244401
Soekonge 300434066433690
Mallemuk 300434066431710
Havoern 300434066437680
Ismaage 300434066437720
Havterne 300434066435700
Edder 300434066433700
offset lat
offset lon