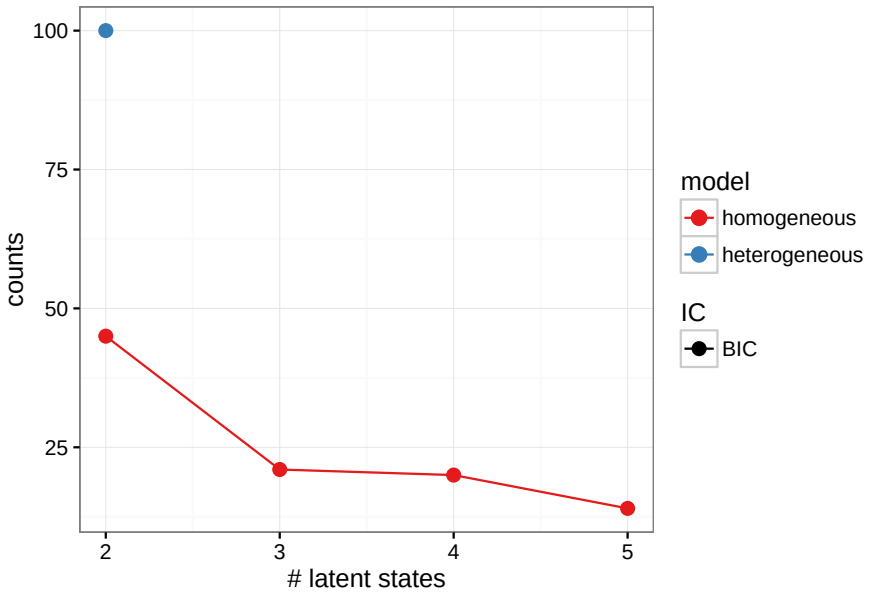
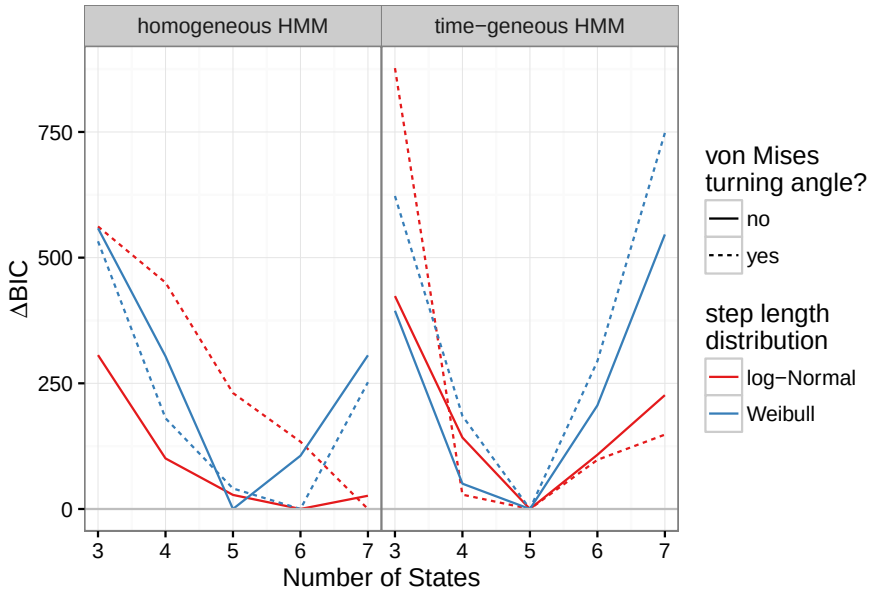
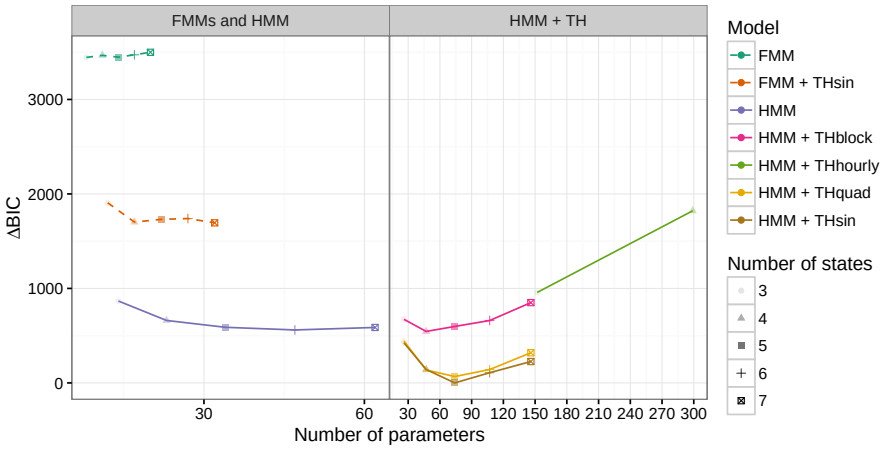
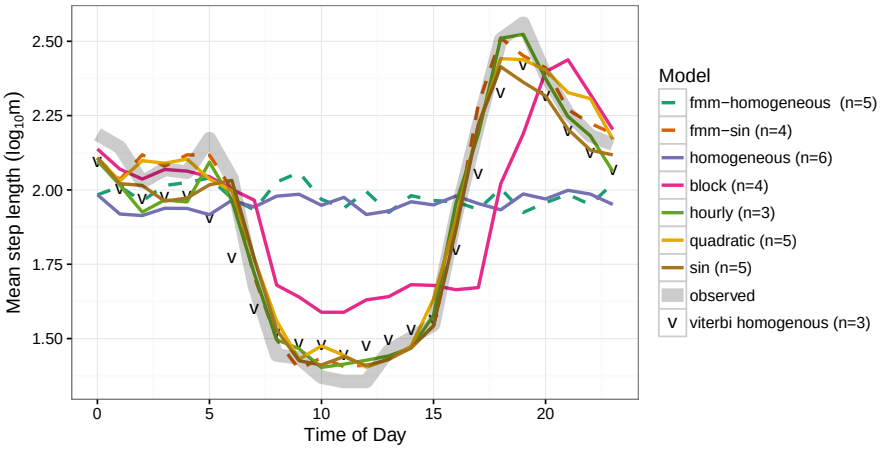
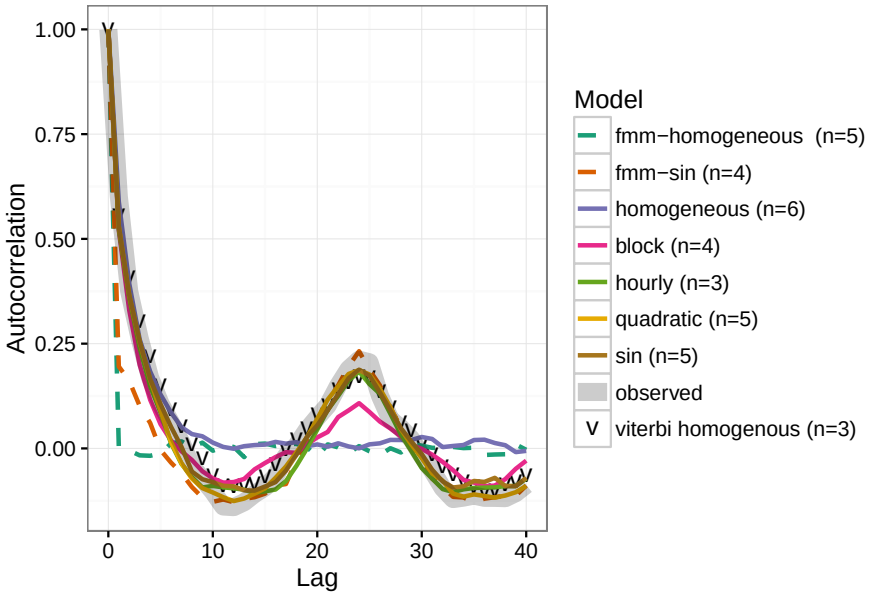


Figure 1: Simulation test for BIC-optimal approach

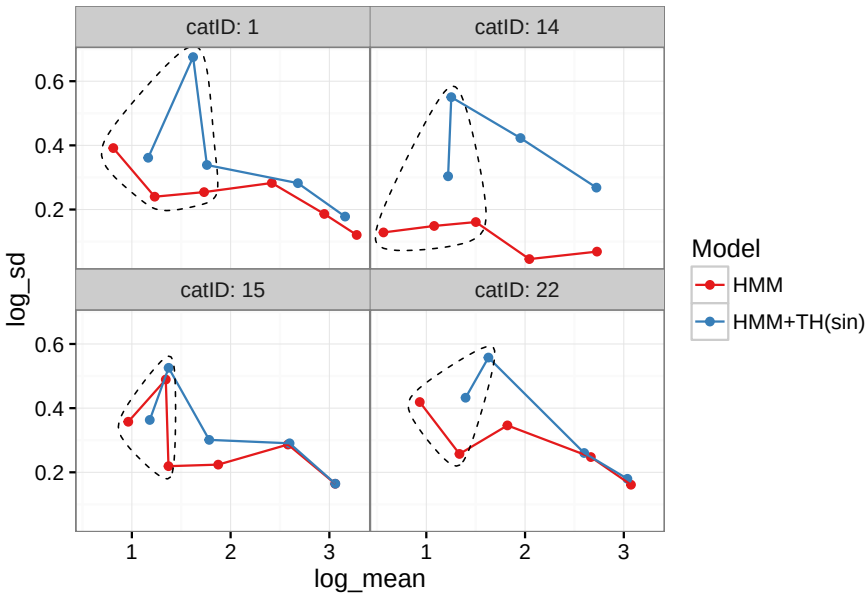

homogeneous HMM
time−geneous HMM
ΔBIC
750
500
250
0
3
4
5
6
7
Number of States
von Mises turning angle?
no
yes
step length distribution
log−Normal
Weibull


FMMs and HMM
HMM + TH
ΔBIC
3000
2000
1000
0
30
60
30 60 90 120 150 180 210 240 270 300
Number of parameters
Model
FMM
FMM + THsin
HMM
HMM + THblock
HMM + THhourly
HMM + THquad
HMM + THsin
Number of states
3
4
5
6
7

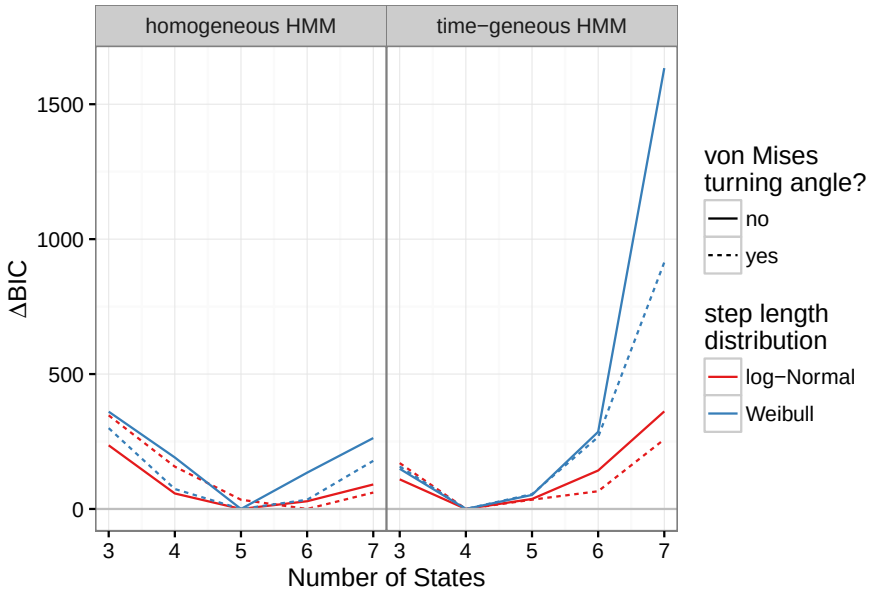

Mean step length (log10m)
2.50
2.25
2.00
1.75
1.50
0
5
10
15
20
Time of Day
Model
fmm−homogeneous (n=5)
fmm−sin (n=4)
homogeneous (n=6)
block (n=4)
hourly (n=3)
quadratic (n=5)
sin (n=5)
observed
viterbi homogenous (n=3)

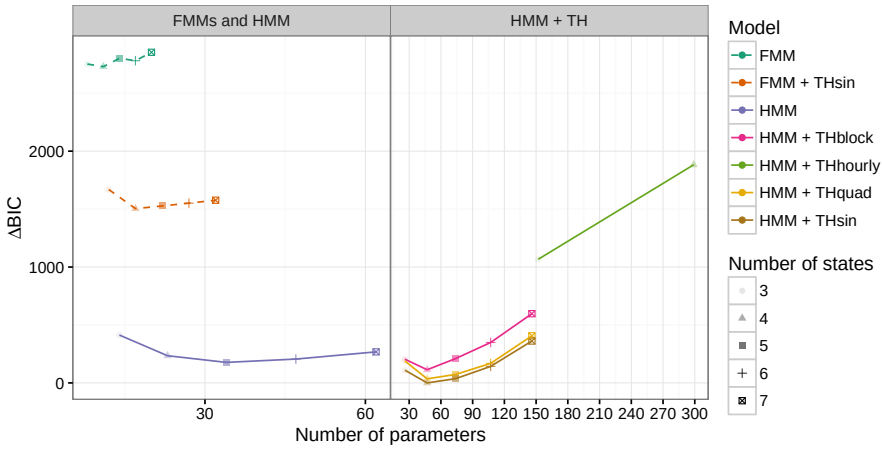

1.00
0.75
0.50
0.25
0.00
Autocorrelation
0
10
20
30
40
Lag
Model
fmm−homogeneous (n=5)
fmm−sin (n=4)
homogeneous (n=6)
block (n=4)
hourly (n=3)
quadratic (n=5)
sin (n=5)
observed
viterbi homogenous (n=3)

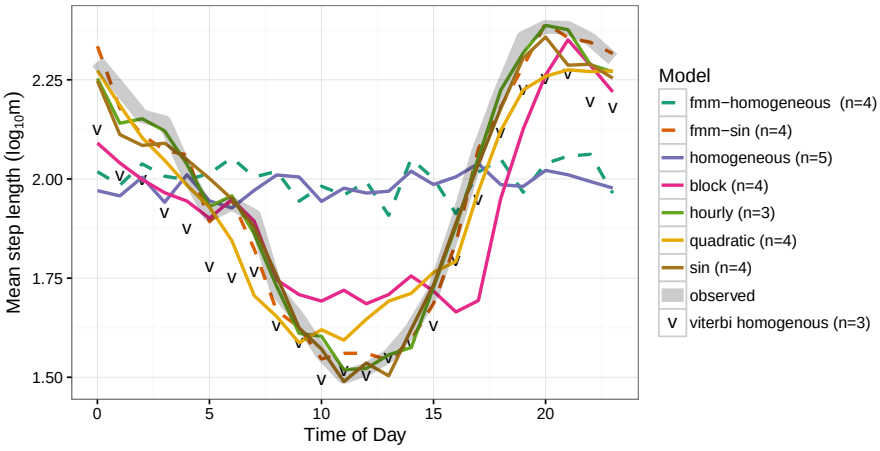
```
get_cat_pars2 <- function(catid){
  templist <- readRDS(paste("../summary_stats/cat.",catid,".df.RDS",sep=""))
  moddf <- templist$msdlist

  df <- data.frame(catID = catid
           , log_mean = c(unlist(moddf[1]),unlist(moddf[3]))
           , log_sd = c(unlist(moddf[2]),unlist(moddf[4]))
           , Model = c(rep("HMM",length(unlist(moddf[1]))),rep("HMM+TH(sin)",length(unlist(mo
  )
  return(df)
}

all_cat_pars2 <- ldply(lme4:::namedList(1,22,14,15),get_cat_pars2)

g0 <- ggplot(all_cat_pars2,aes(log_mean,log_sd,color=Model))+
     geom_point()+geom_line() + facet_wrap(~catID,labeller=label_both)+zmargin
 (g0c <- g0 +
     geom_encircle(data=subset(all_cat_pars2,
                               (catID=="15" & log_mean<1.5) |
                               (catID!="15" & log_mean<1.8)),
                   colour="black",linetype=2,expand=0.05))
```

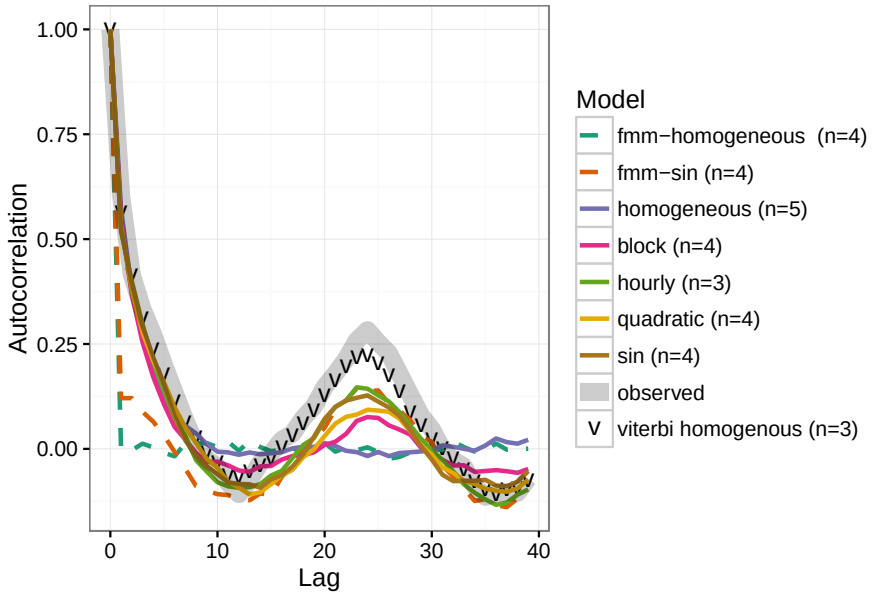


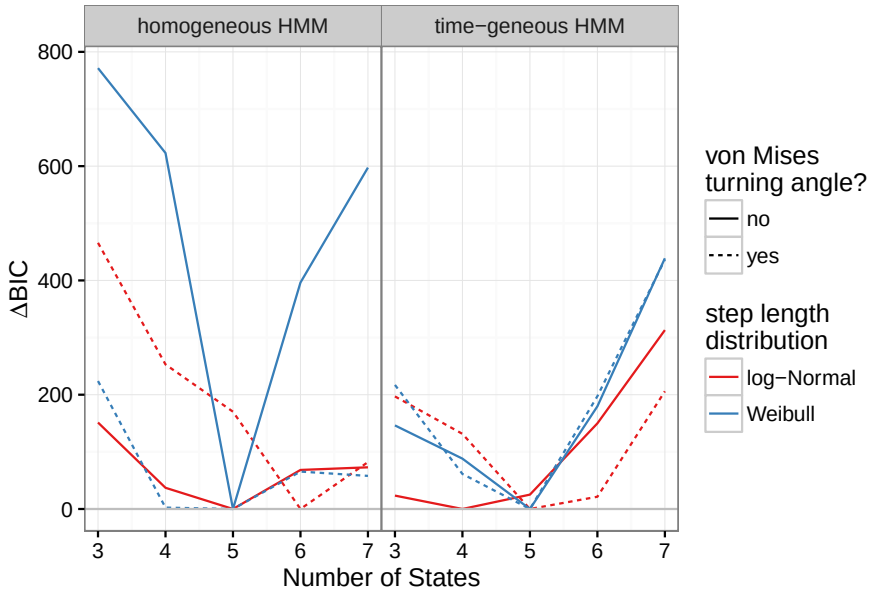
1 sup

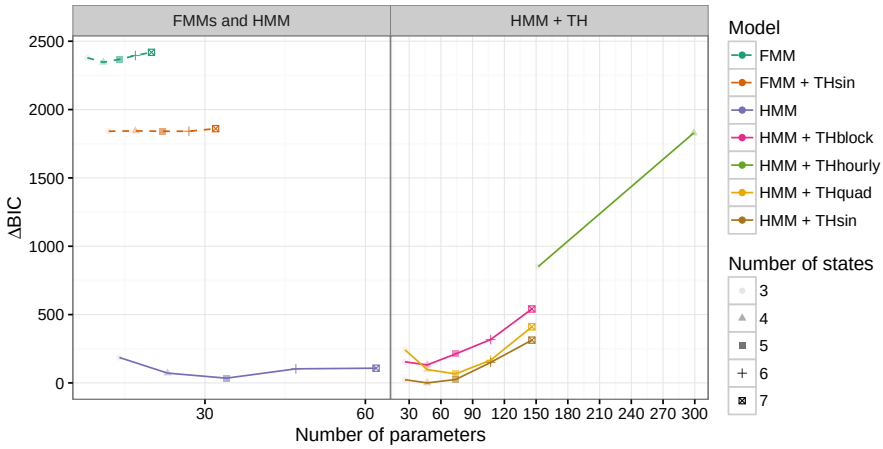

homogeneous HMM
time−geneous HMM
ΔBIC
1500
1000
500
0
3
4
5
6
7
Number of States
von Mises turning angle?
no
yes
step length distribution
log−Normal
Weibull


FMMs and HMM
HMM + TH
ΔBIC
2000
1000
0
30
60
30 60 90 120 150 180 210 240 270 300
Number of parameters
Model
FMM
FMM + THsin
HMM
HMM + THblock
HMM + THhourly
HMM + THquad
HMM + THsin
Number of states
3
4
5
6
7

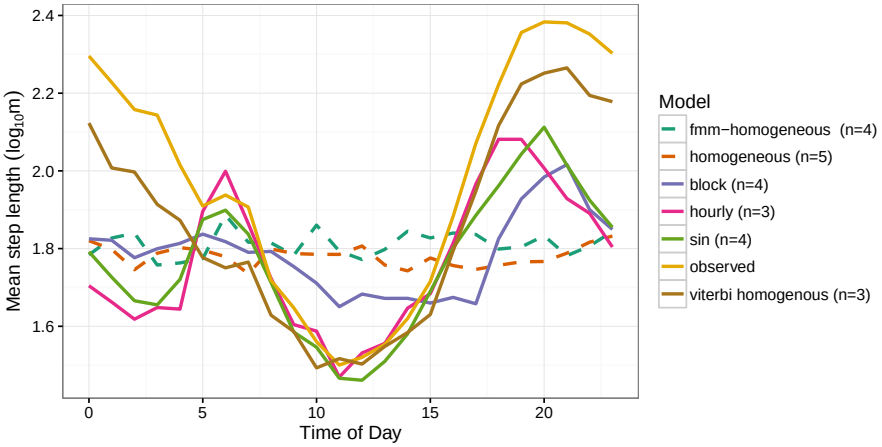

Mean step length (log10m)
2.25
2.00
1.75
1.50
0
5
10
15
20
Time of Day
Model
fmm−homogeneous (n=4)
fmm−sin (n=4)
homogeneous (n=5)
block (n=4)
hourly (n=3)
quadratic (n=4)
sin (n=4)
observed
viterbi homogenous (n=3)

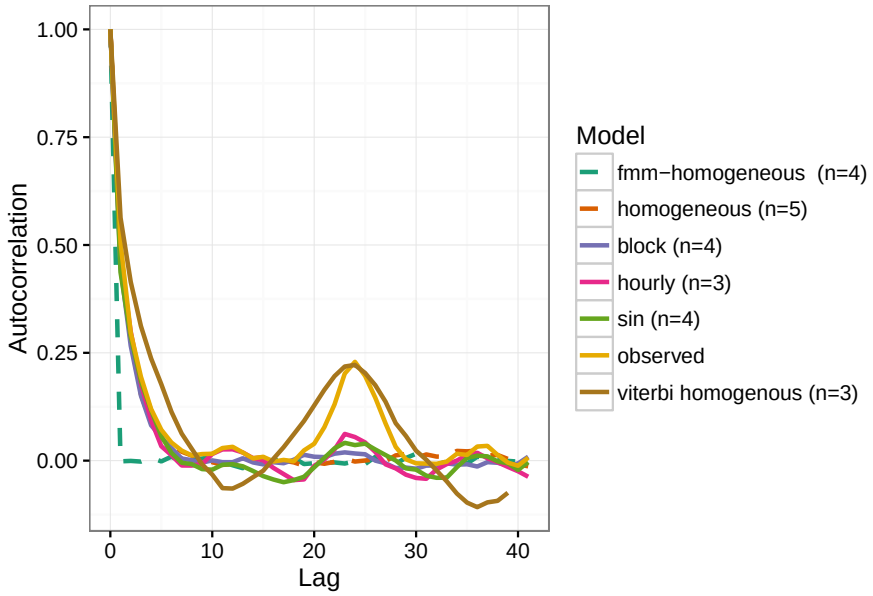

1.00
0.75
0.50
0.25
0.00
Autocorrelation
0
10
20
30
40
Lag
Model
fmm−homogeneous (n=4)
fmm−sin (n=4)
homogeneous (n=5)
block (n=4)
hourly (n=3)
quadratic (n=4)
sin (n=4)
observed
viterbi homogenous (n=3)


homogeneous HMM
time−geneous HMM
800
600
400
200
0
ΔBIC
3
4
5
6
7
Number of States
von Mises turning angle?
no
yes
step length distribution
log−Normal
Weibull


FMMs and HMM
HMM + TH
ΔBIC
2500
2000
1500
1000
500
0
30
60
30
60
90
120
150
180
210
240
270
300
Number of parameters
Model
FMM
FMM + THsin
HMM
HMM + THblock
HMM + THhourly
HMM + THquad
HMM + THsin
Number of states
3
4
5
6
7

```
## Error in gzfile(file, "rb"):  cannot open the connection
## Error in gzfile(file, "rb"):  cannot open the connection
```




1.00
0.75
0.50
0.25
0.00
Autocorrelation
0
10
20
30
40
Lag
Model
fmm−homogeneous (n=4)
homogeneous (n=5)
block (n=4)
hourly (n=3)
sin (n=4)
observed
viterbi homogenous (n=3)