Exploring Autocorrelation in Movement Parameters

Josh Cullen

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Autocorrelation of SL, TA, and TAA
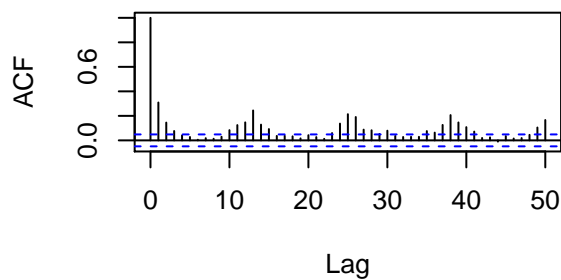
Autcorrelation is common in the time series of animal trajectories. This document shows trends in autocorrelation of individual movement parameters at different sections of tracks (filtered for only 1 h time steps) for each ID. This is shown at different scales as well (lag.max = 50 or nobs).
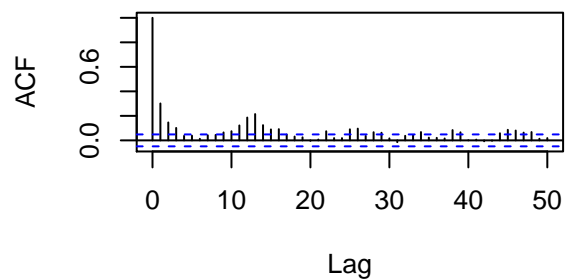
ID 1

There are 6500 total observations in this dataset that have 1 h time steps. This will be split into four equal sections.
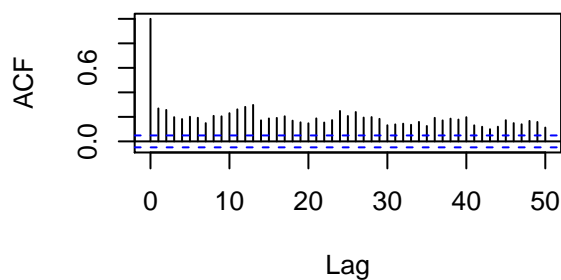
SL

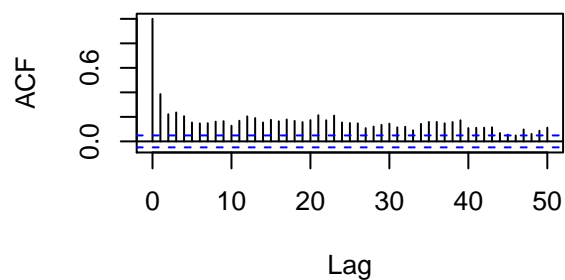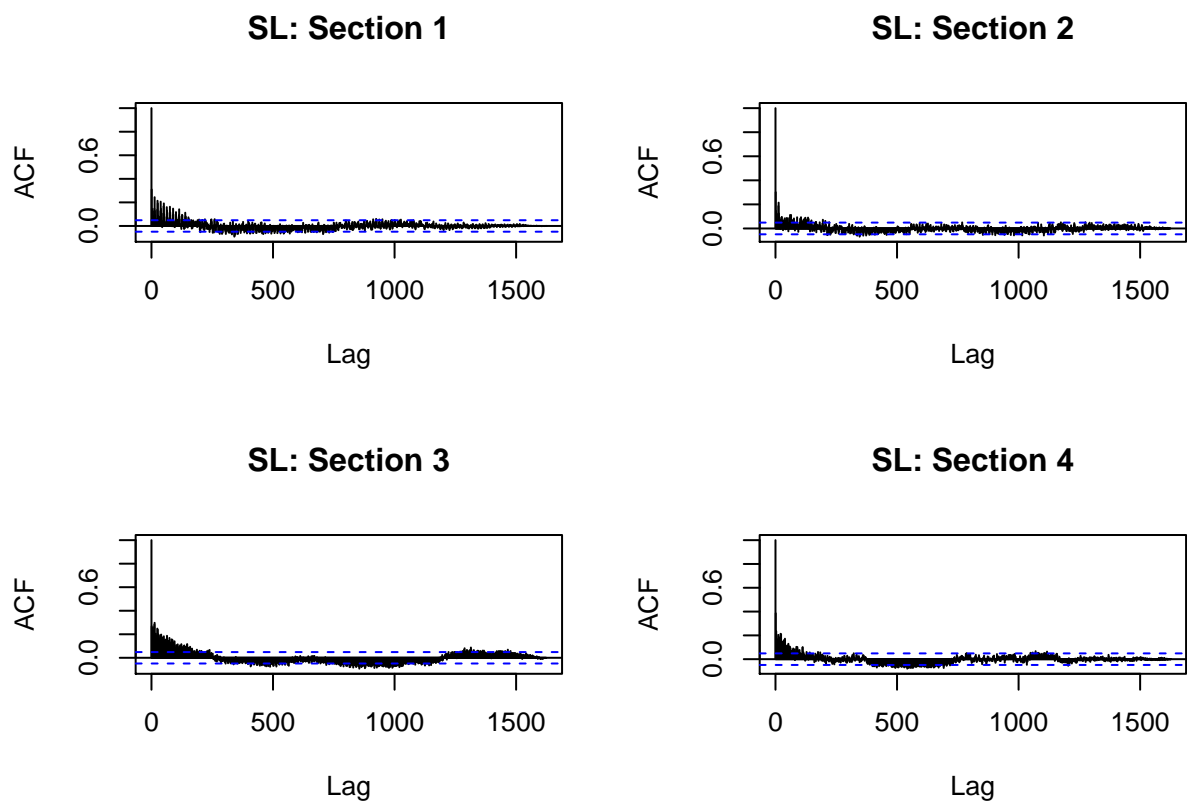Figure 1: Autocorrelation of SL with a max lag of 50 or 1625 observations.

TA

2

TA: Section 1

TA: Section 2

TA: Section 3

TA: Section 4
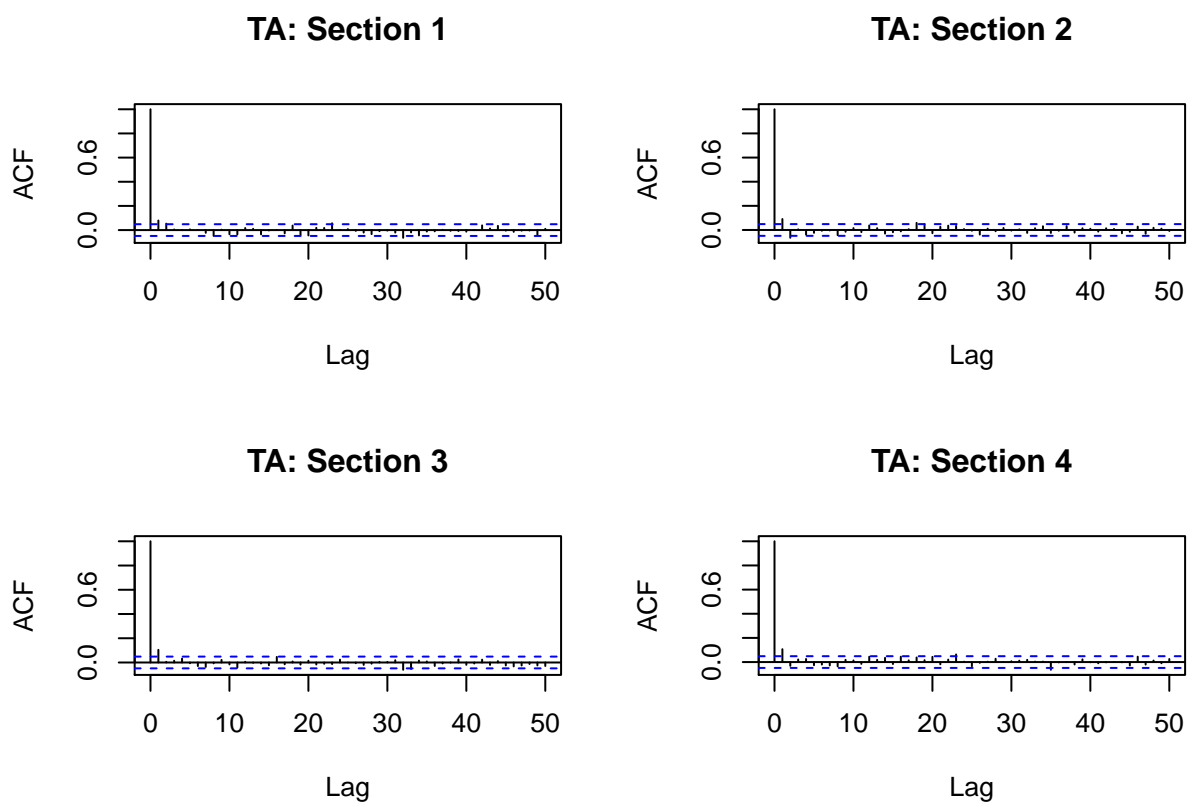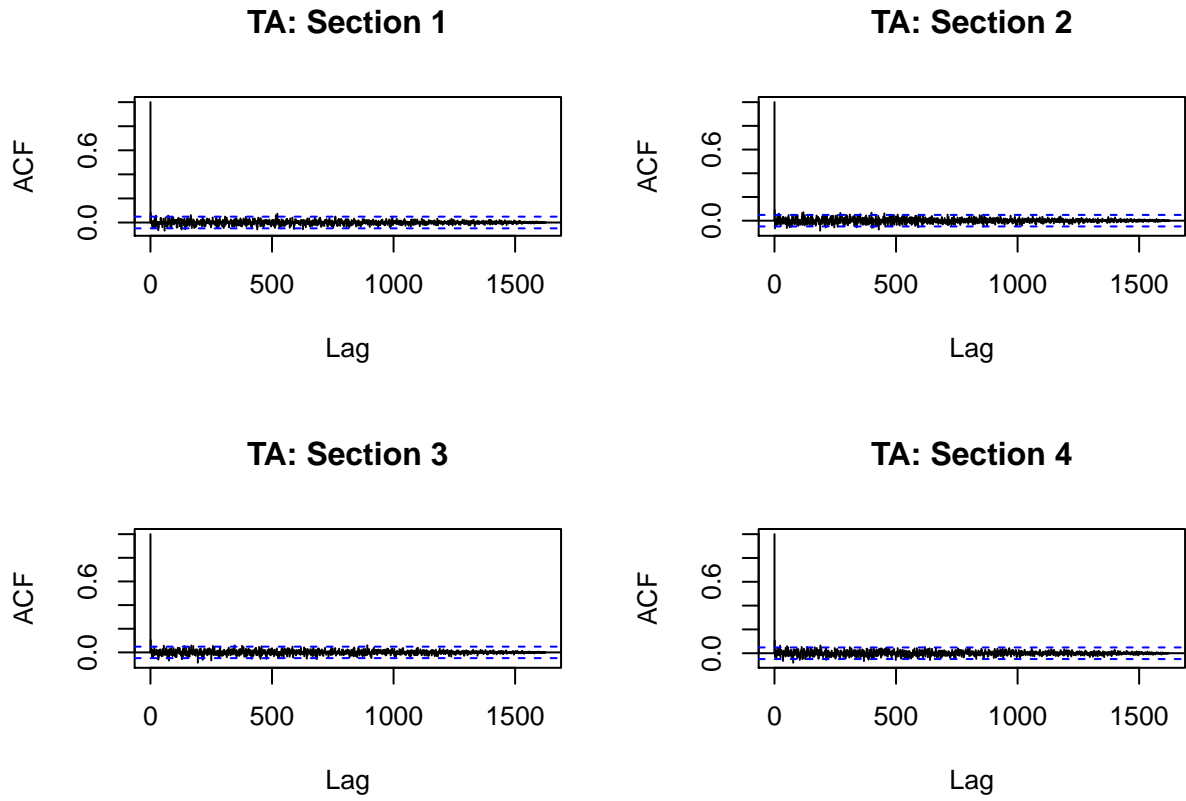
Figure 2: Autocorrelation of TA with a max lag of 50 or 1625 observations.

TAA

TAA: Section 1

TAA: Section 2

TAA: Section 3

TAA: Section 4

Figure 3: Autocorrelation of TAA with a max lag of 50 or 1625 observations.
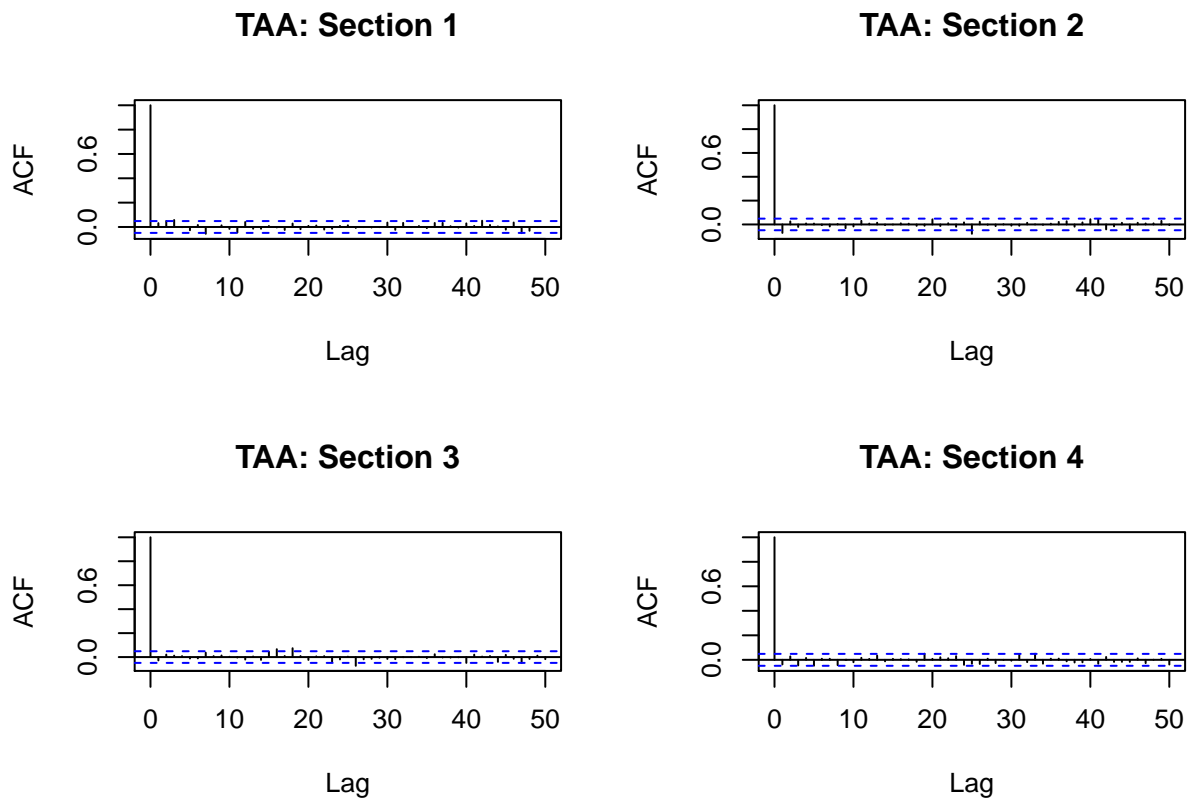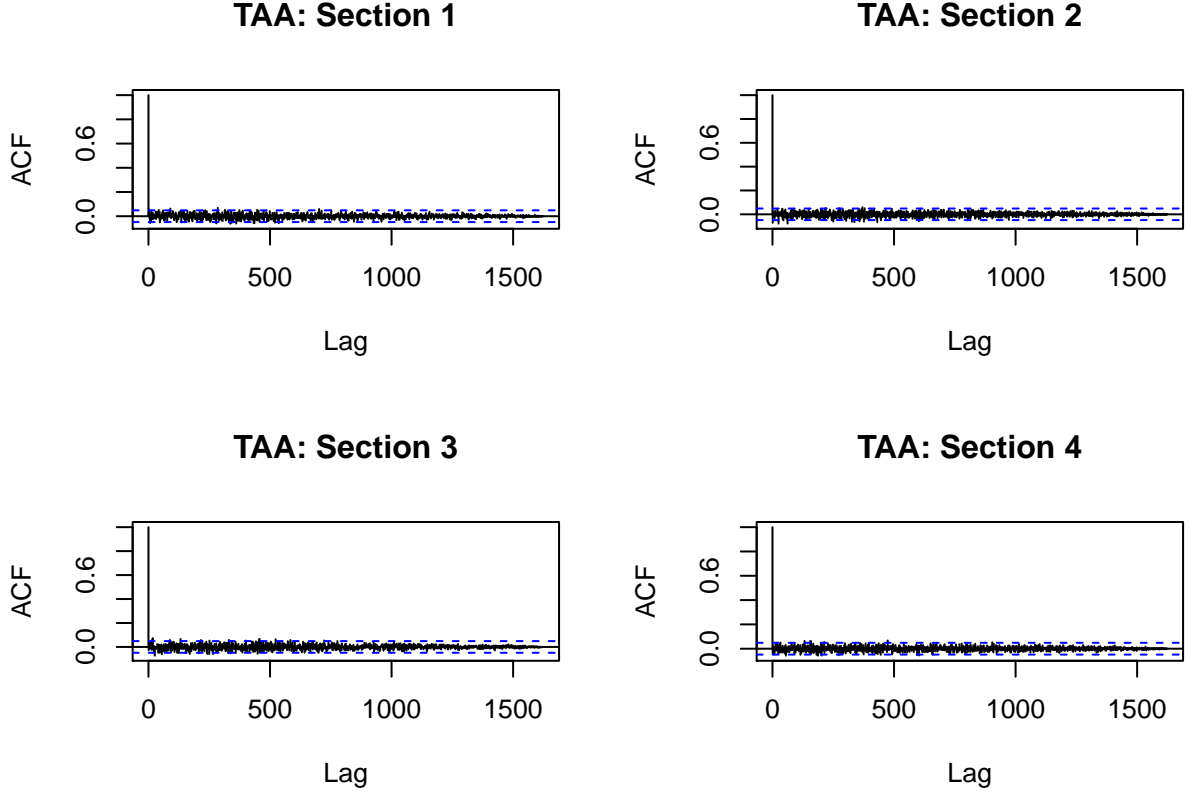
Trends in autocorrelation differed among the three movement parameters. For SL, it appears that there's a 12 h cycle within the 1st section for at least up to 50 observations, but this cyclical patterns appears to be lost within the last 3 sections that generally have high autocorrelation (**Fig 1**). When visualizing the ACF across all observations within each section, there appears to be a slight sinusoidal pattern that emerges after the decrease in autocorrelation after the first 250 observations. Autocorrelation may be significant at a lag of 1 for TA, but is low for all subsequent observations. Similarly, there does not appear to be autocorrelation present in TAA.
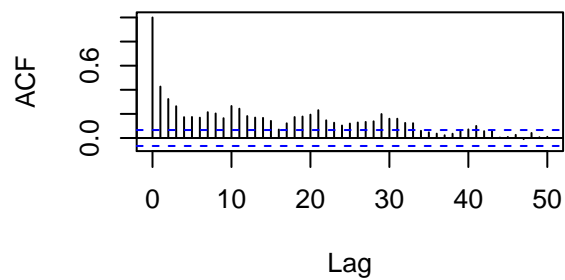
ID 12

There are 3513 total observations in this dataset that have 1 h time steps. This will be split into four (roughly) equal sections.

SL

SL: Section 1

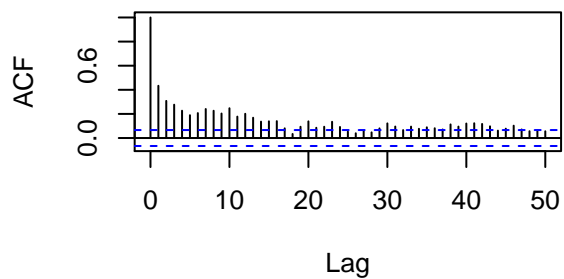
SL: Section 2

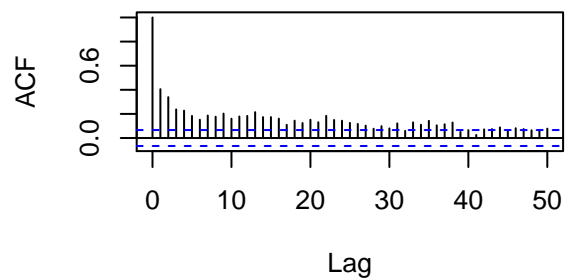## SL: Section 3

SL: Section 4
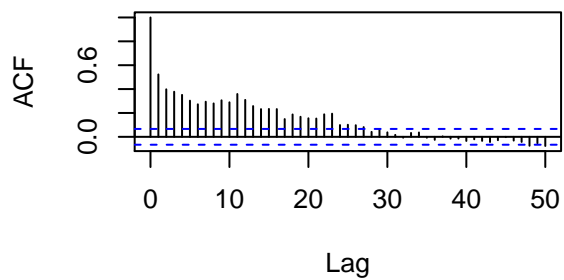
SL: Section 1

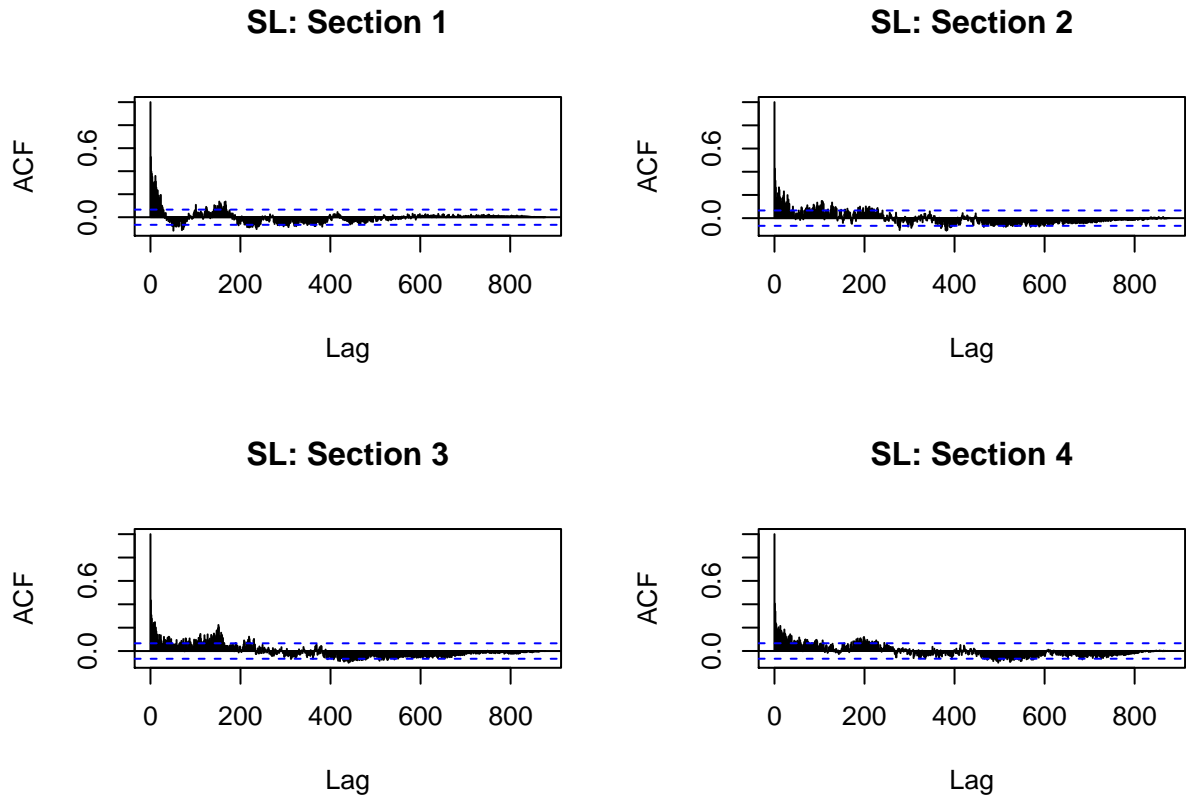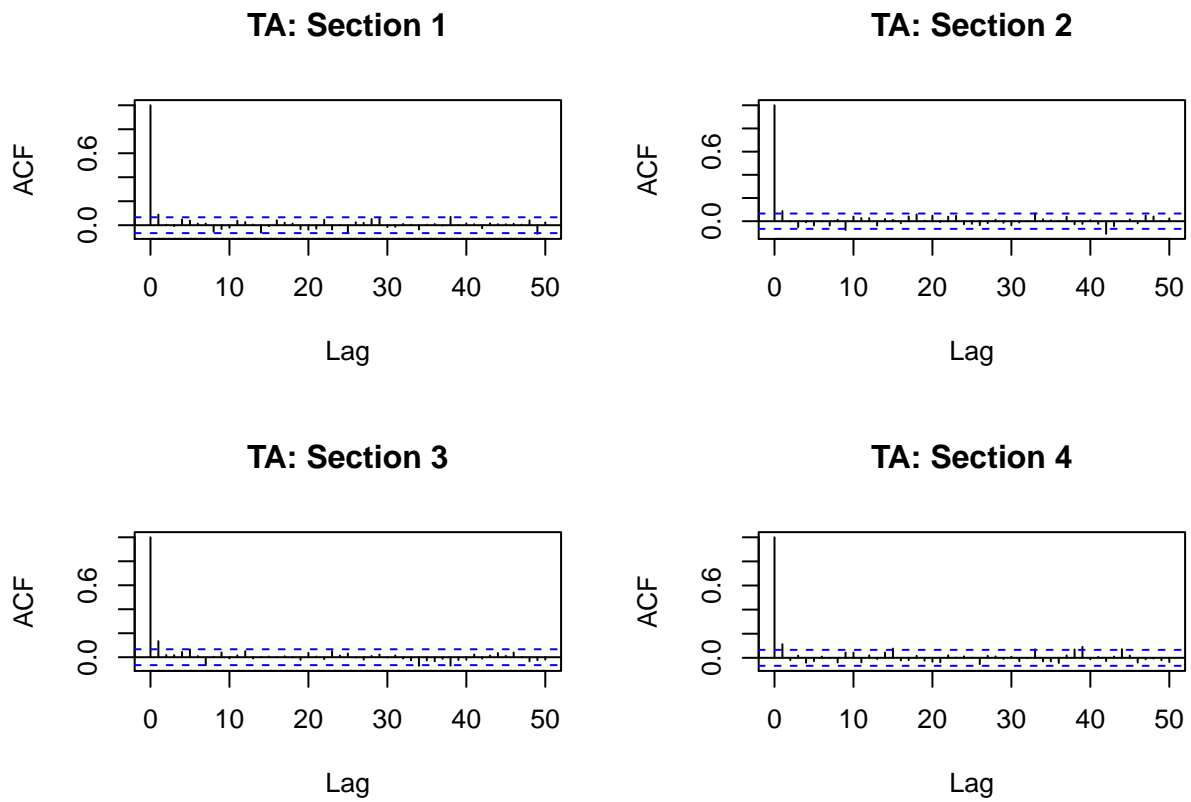**SL: Section 2**

SL: Section 3

SL: Section 4

Figure 4: Autocorrelation of SL with a max lag of 50 or 878 observations.

TA

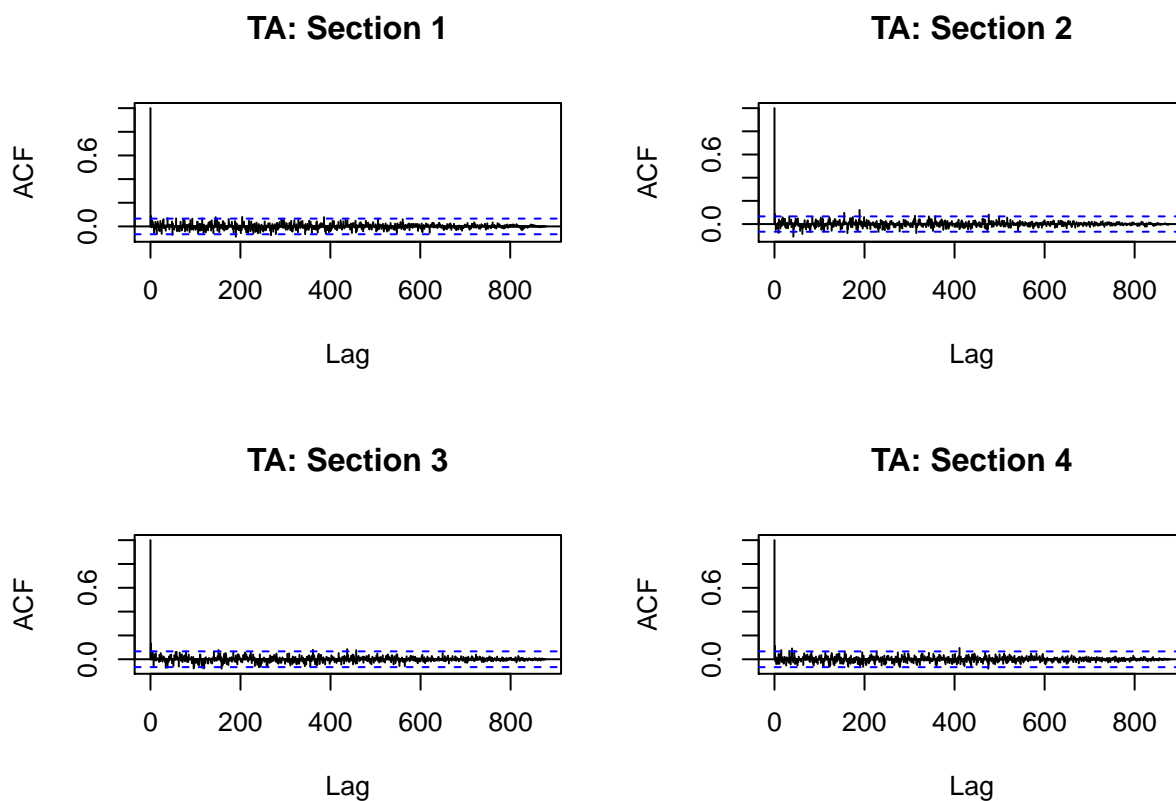**TA: Section 1**

TA: Section 2

TA: Section 3

TA: Section 4

TA: Section 1

TA: Section 2

TA: Section 3

TA: Section 4

Figure 5: Autocorrelation of TA with a max lag of 50 or 878 observations.

TAA

TAA: Section 1

TAA: Section 2

TAA: Section 3

TAA: Section 4

7

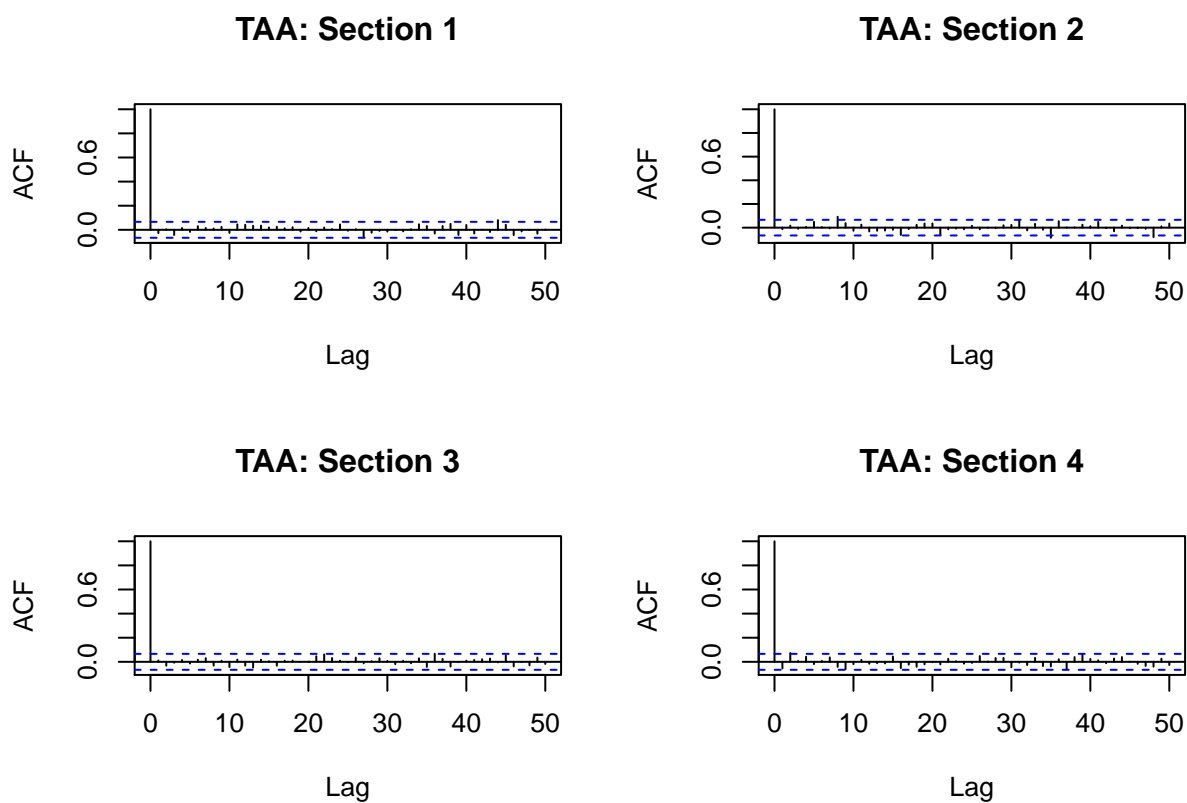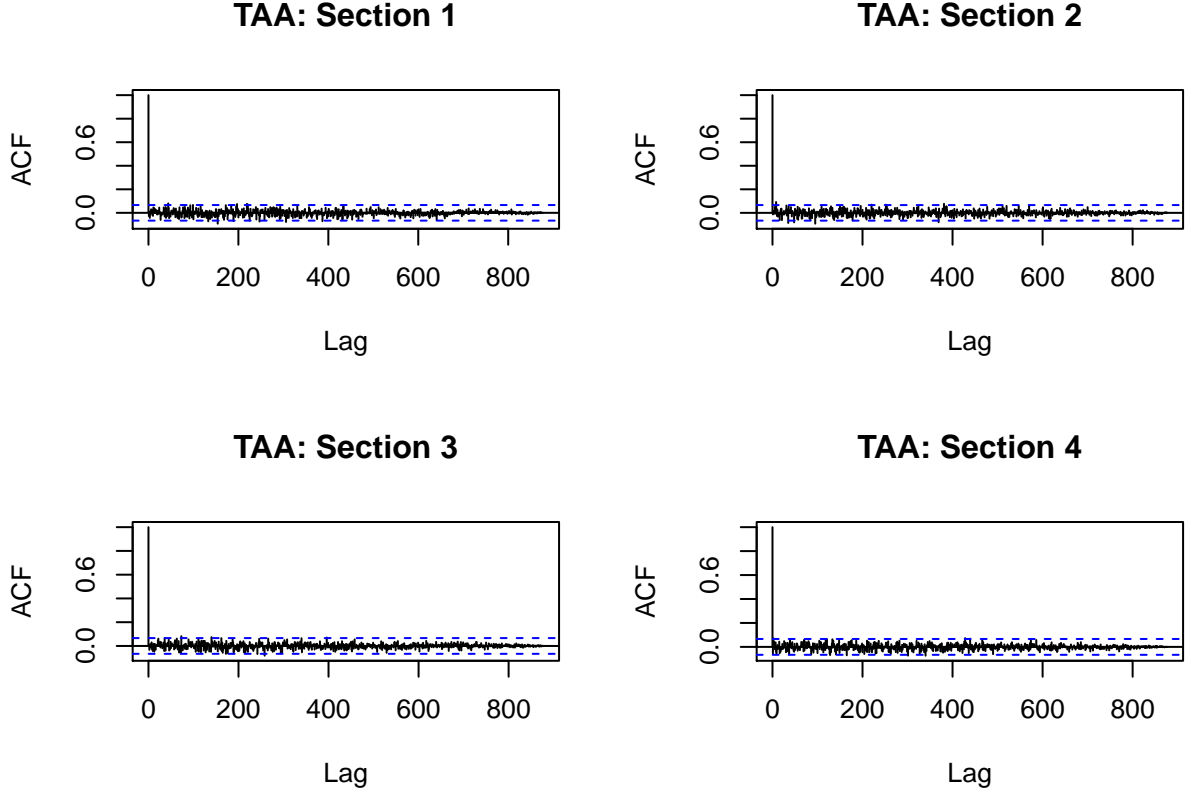Figure 6: Autocorrelation of TAA with a max lag of 50 or 878 observations.

There may be a slight cyclical pattern in the autocorrelation of SL over short lags (~10 obs), but generally decreases until ~20-40 observations. Over the entire time series of each segment, it appears that there are longer-term cyclical patterns emerging, but at different temporal scales by section (**Fig 4**). This pattern appears different in **ID 12** compared to **ID 1**. The autocorrelation in TA and TAA are essentially identical to that of **ID 1**, however.
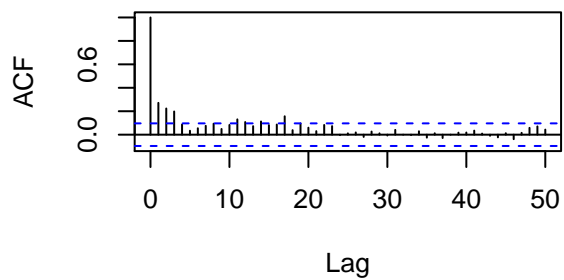
ID 19

There are 1652 total observations in this dataset that have 1 h time steps. This will be split into four equal sections.
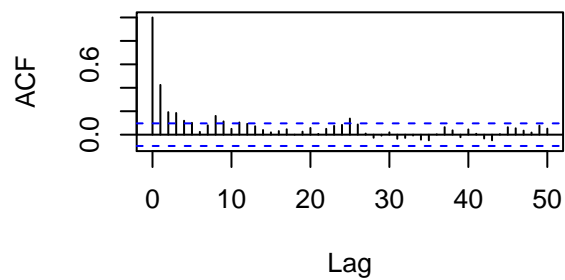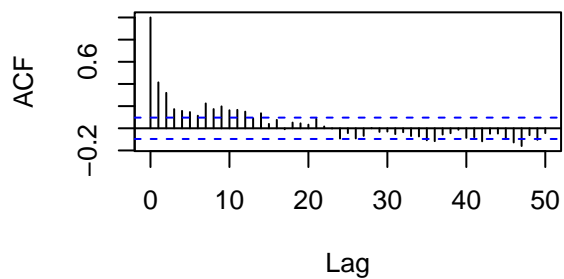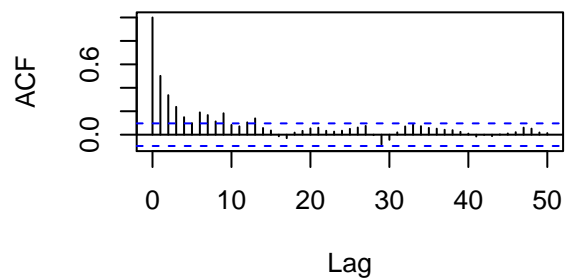
SL

SL: Section 1

ACF

Lag

SL: Section 2

ACF

Lag

SL: Section 3
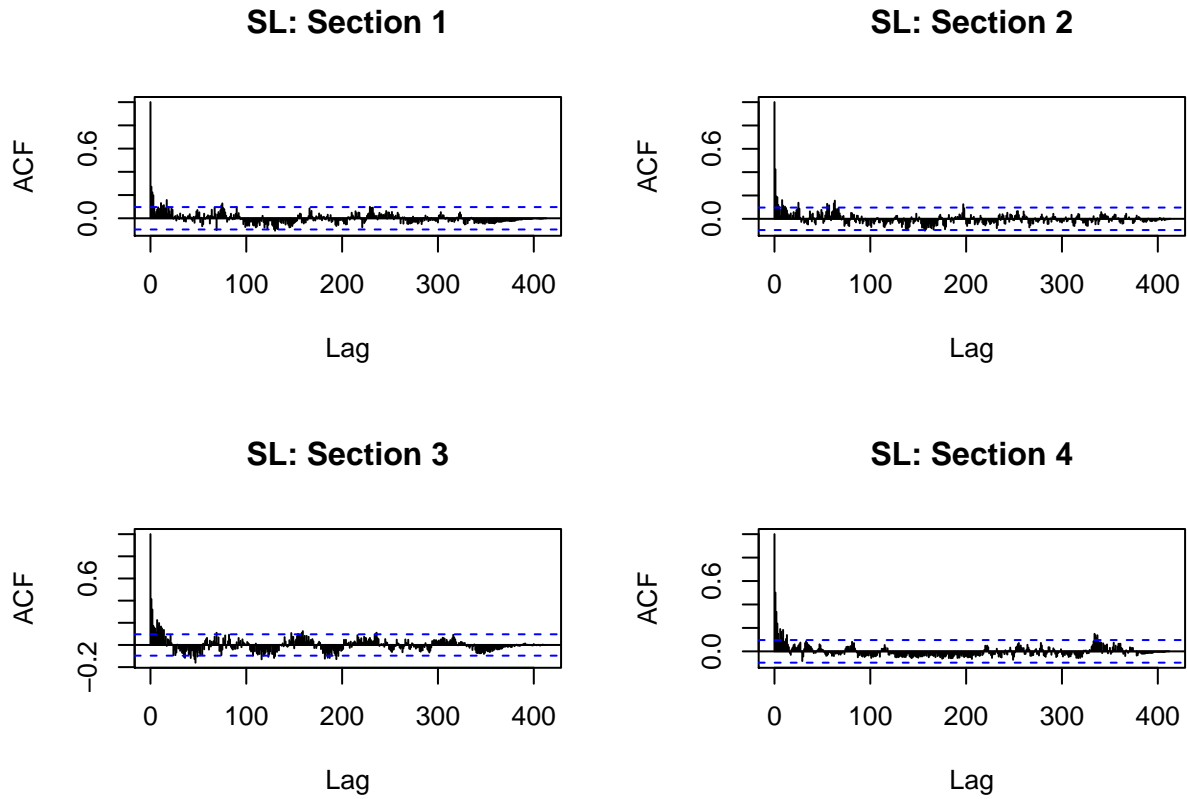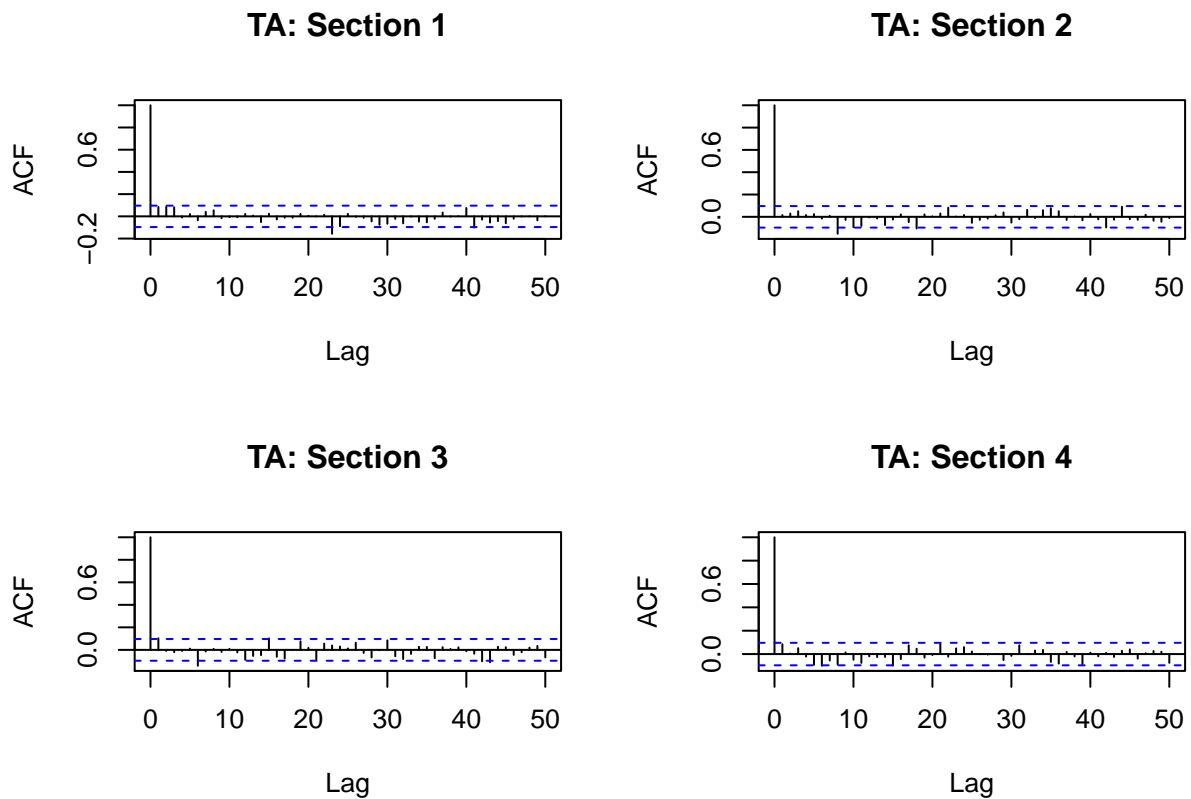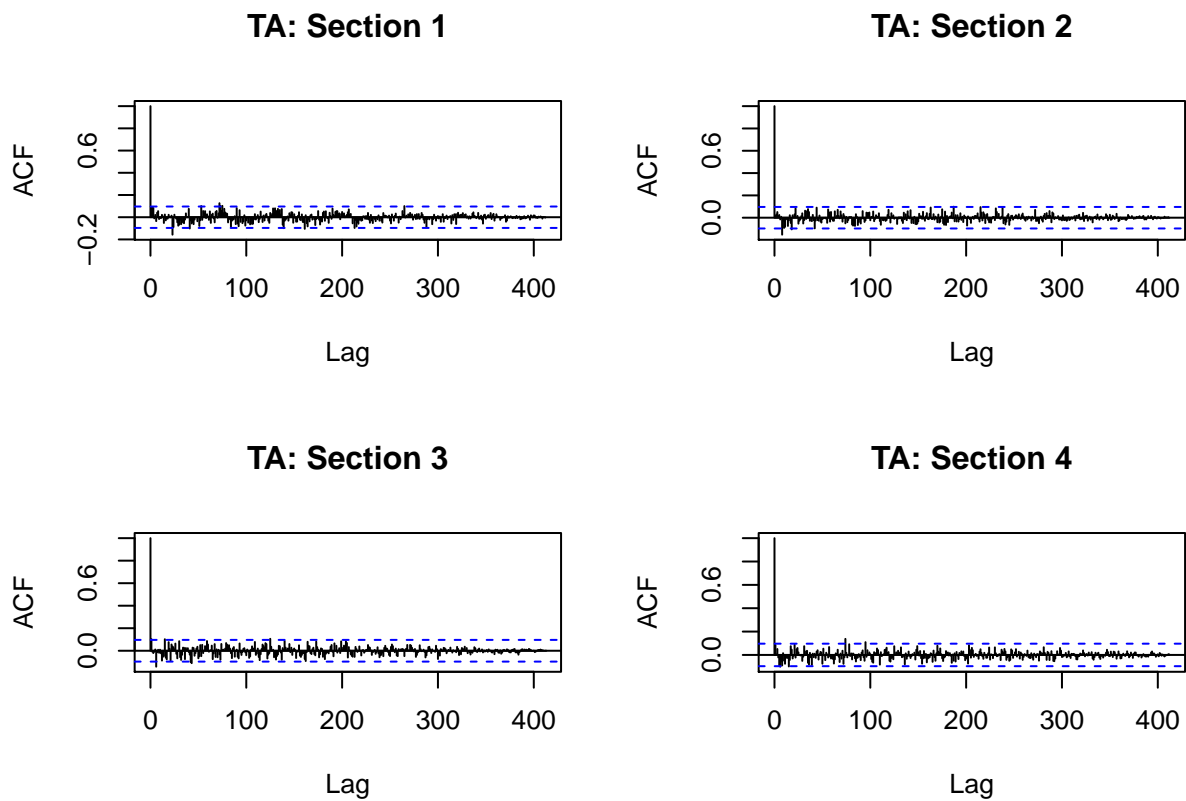
ACF

Lag

SL: Section 4

ACF

Lag

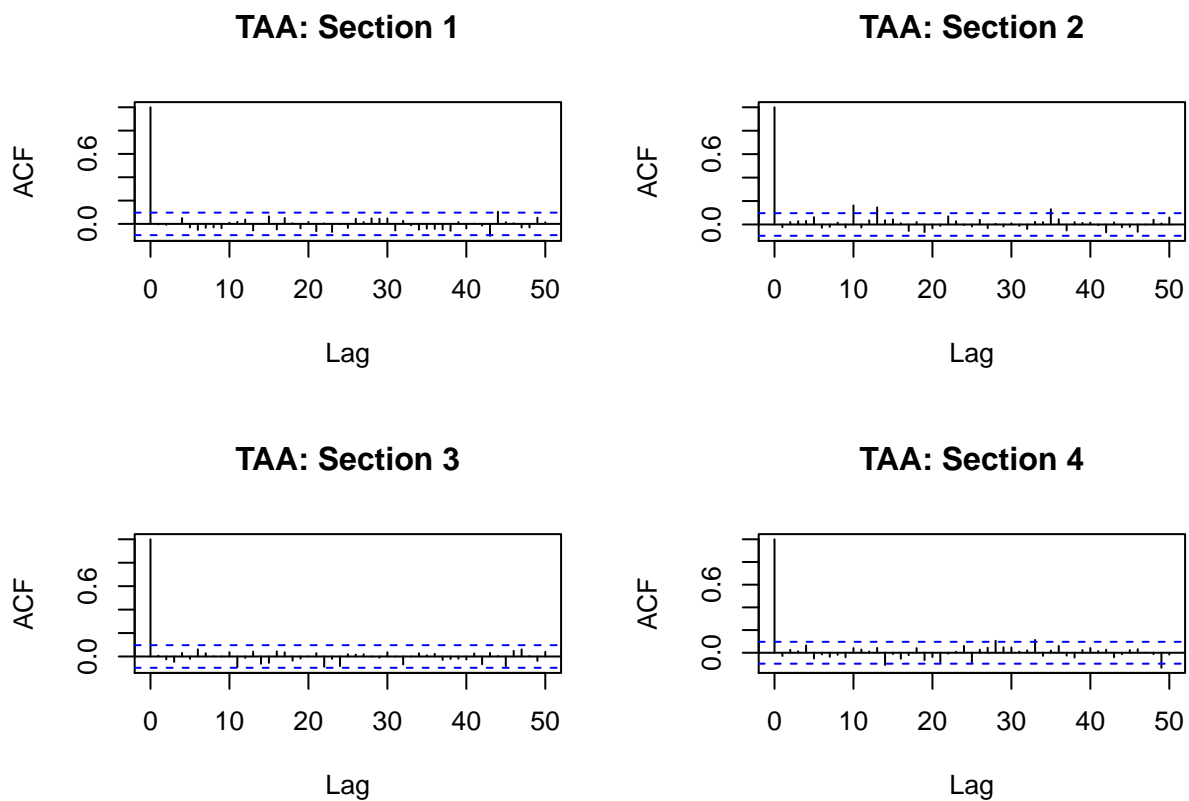Figure 7: Autocorrelation of SL with a max lag of 50 or 413 observations.

TA

Figure 8: Autocorrelation of TA with a max lag of 50 or 878 observations.

TAA

TAA: Section 1

TAA: Section 2

TAA: Section 3
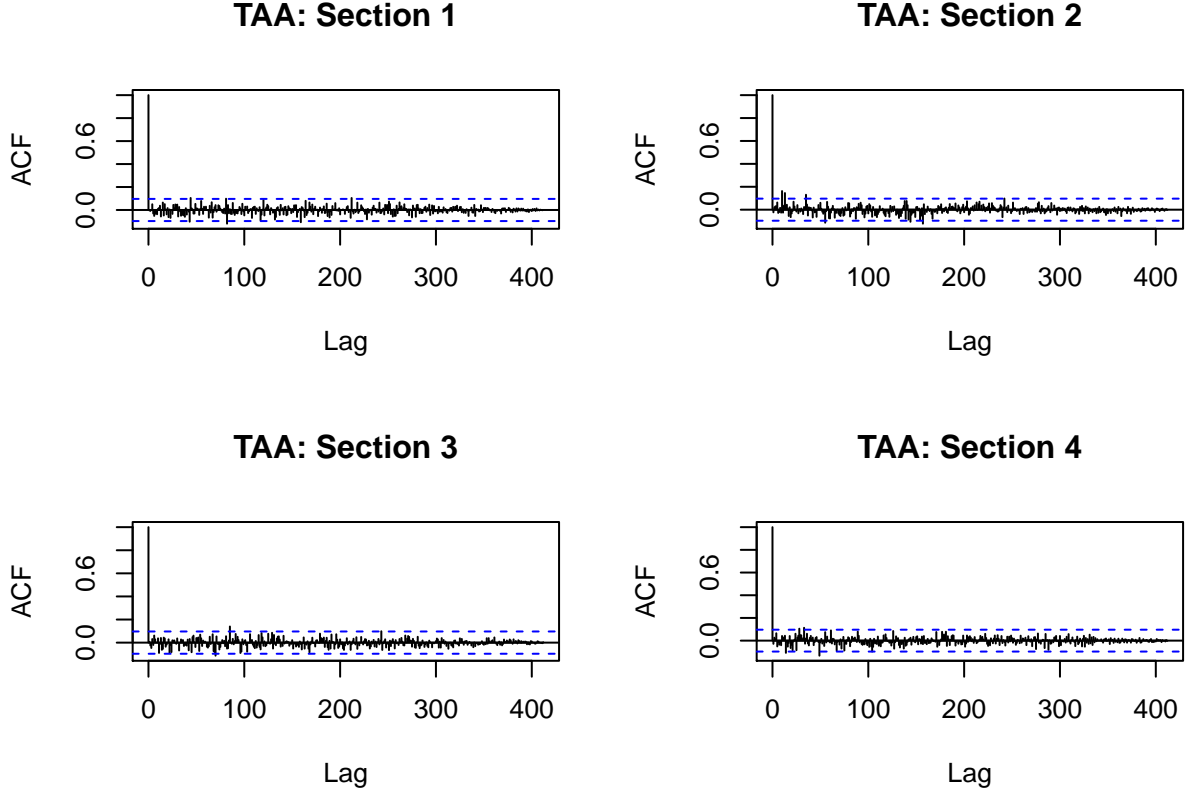
TAA: Section 4

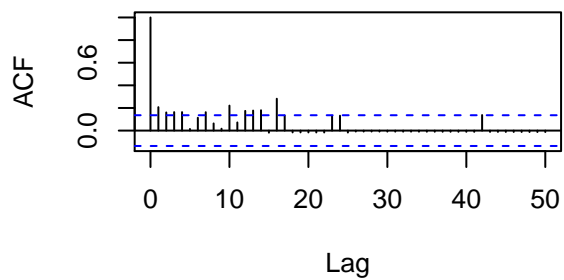Figure 9: Autocorrelation of TAA with a max lag of 50 or 878 observations.

Autocorrelation in SL appears to occur until a lag of 10-20 observations, but also shows long-term cyclical patterns in ACF; these cyclical patterns fall within the confidence interval, however (**Fig 7**). This pattern appears similar to **ID 12**. Again, the autocorrelation in TA and TAA are essentially identical to that of **ID 1** and **ID 12** in that it is not significant and shows no patterns over time.
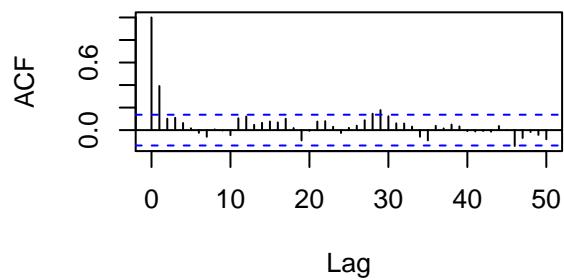
ID 27

There are 1652 total observations in this dataset that have 1 h time steps. This will be split into four (roughly) equal sections.
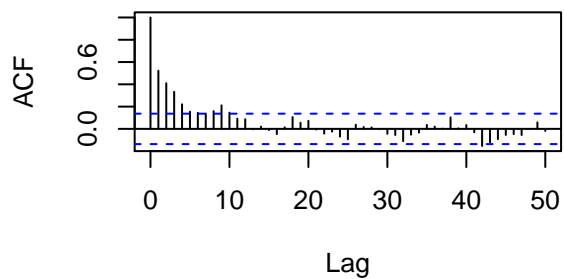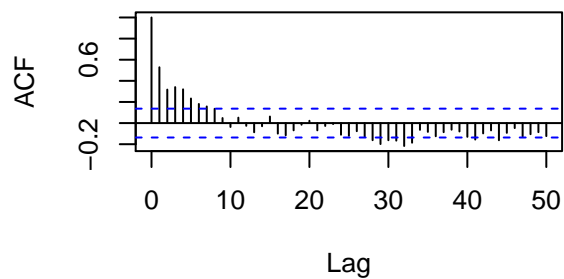
SL

SL: Section 1

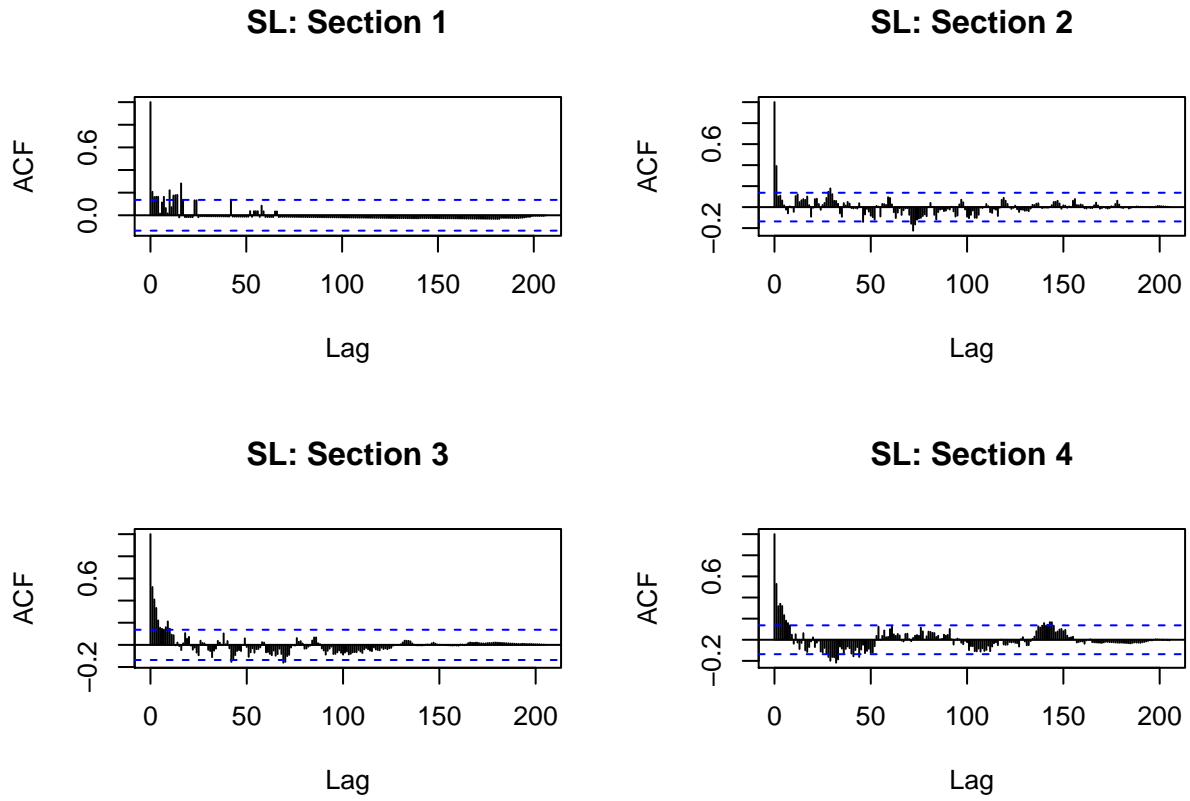## SL: Section 2

SL: Section 3

SL: Section 4

13

Figure 10: Autocorrelation of SL with a max lag of 50 or 413 observations.

TA

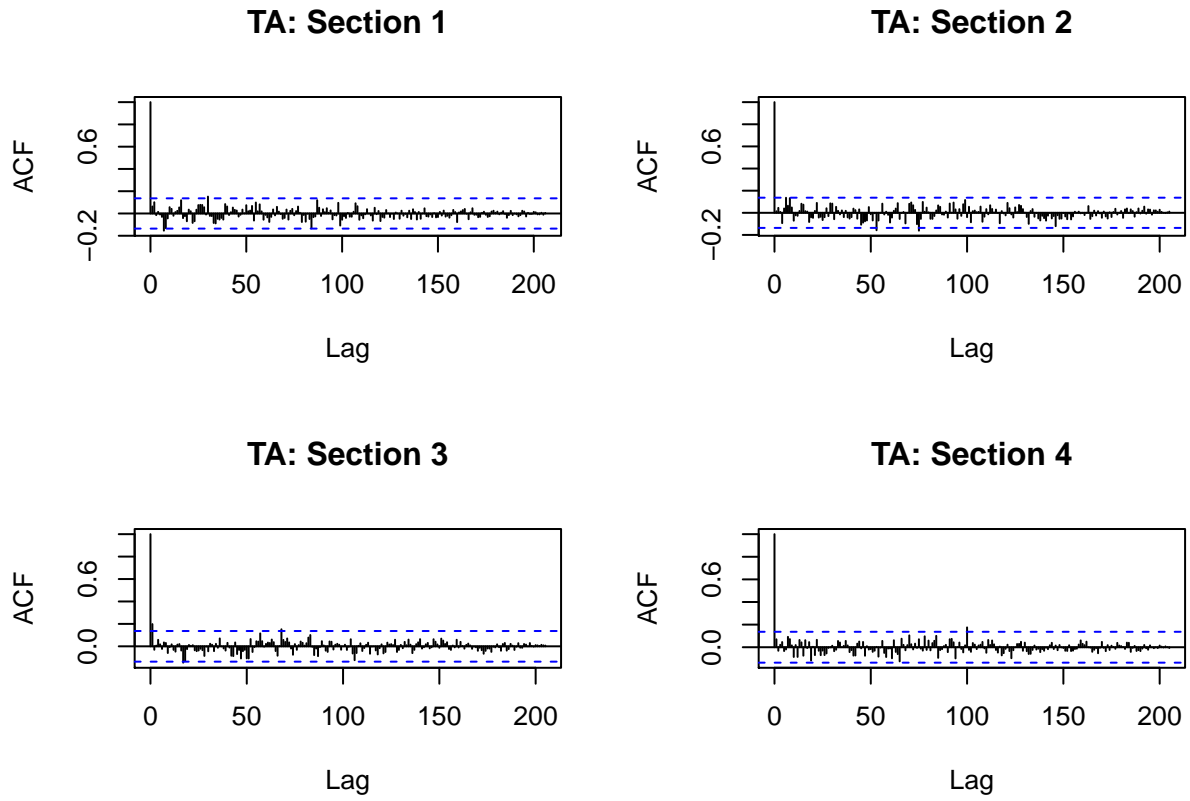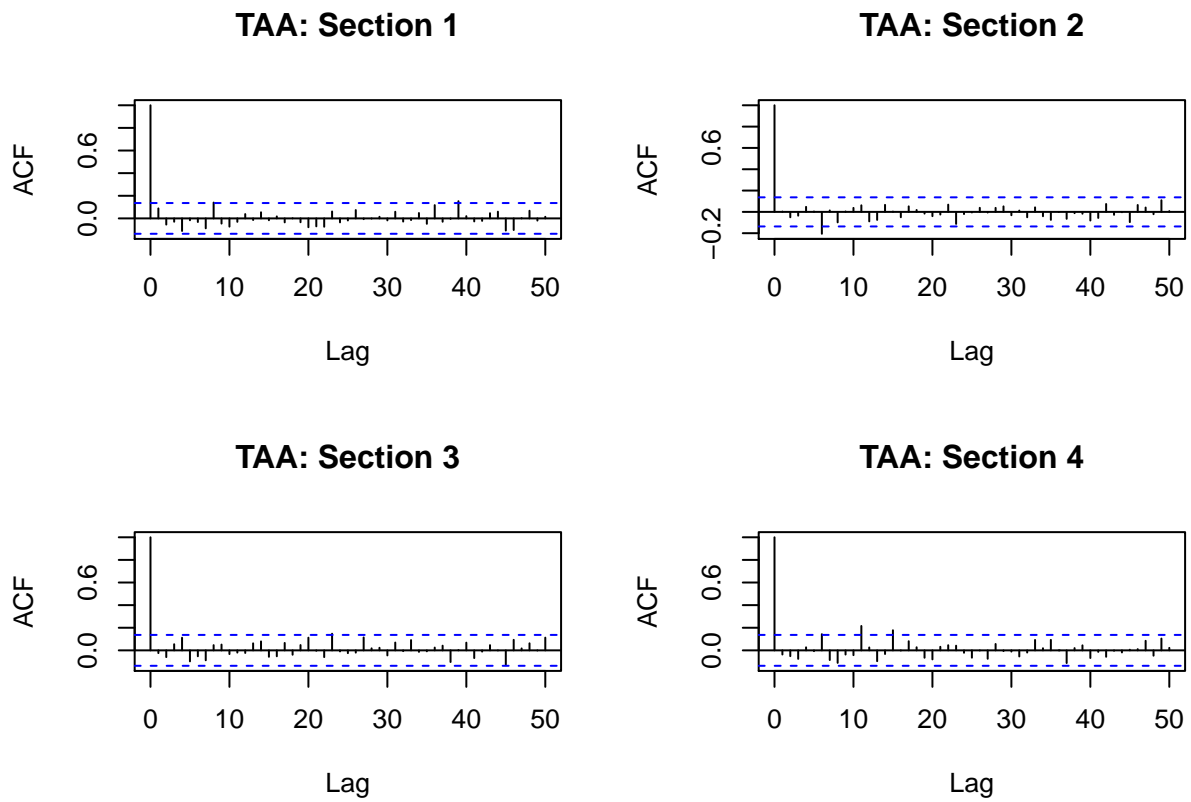## TA: Section 1

TA: Section 2

TA: Section 3

TA: Section 4
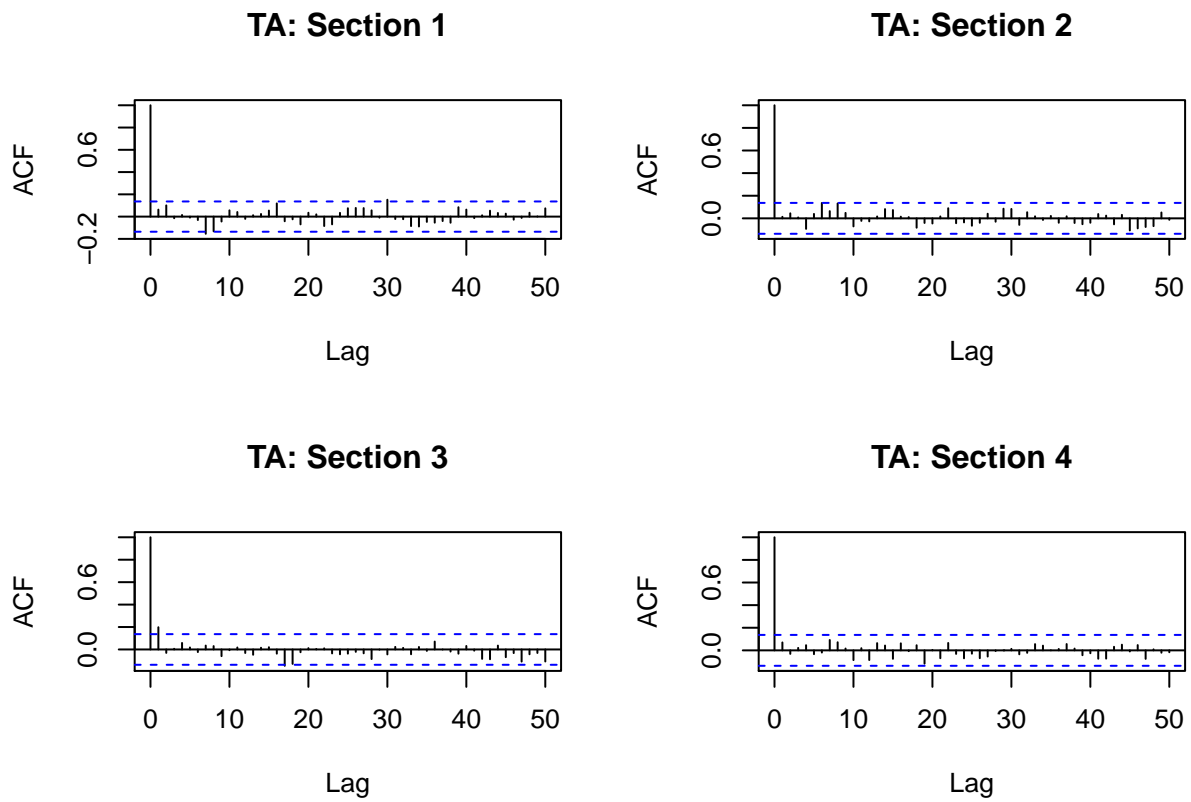
Figure 11: Autocorrelation of TA with a max lag of 50 or 878 observations.

TAA

TAA: Section 1

TAA: Section 2

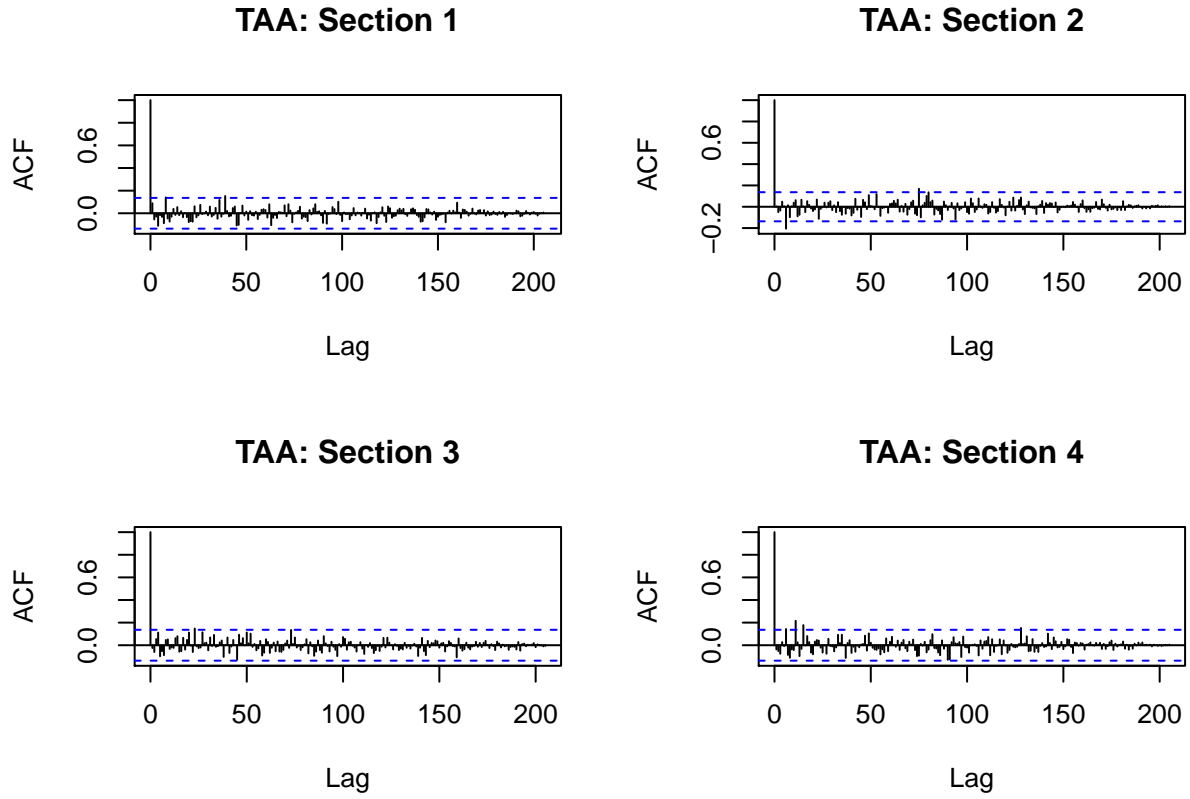## TAA: Section 3

TAA: Section 4

Figure 12: Autocorrelation of TAA with a max lag of 50 or 878 observations.

Autocorrelation in SL appears to occur until a lag of 10-20 observations, but shows long-term cyclical patterns in ACF in the second through fourth sections; these cyclical patterns fall mostly within the confidence interval, however (**Fig 10**). This pattern appears similar to **ID 12**. Again, the autocorrelation in TA and TAA are essentially identical to that of **ID 1**, **ID 12**, **ID 19** in that it is not significant and shows no patterns over time.

Cross-correlation among movement parameters was briefly explored as well, but due to the lack of signficance in the ACF of TA and TAA, there does not appear to be a significant trend when evaluating relationships of time series data.