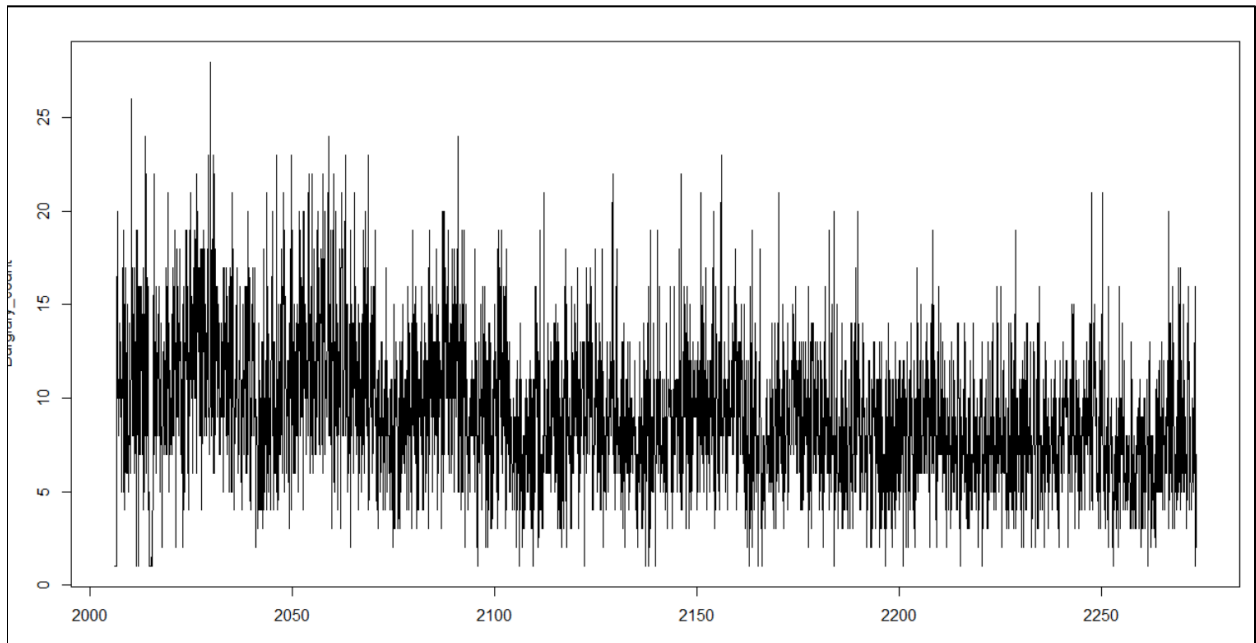
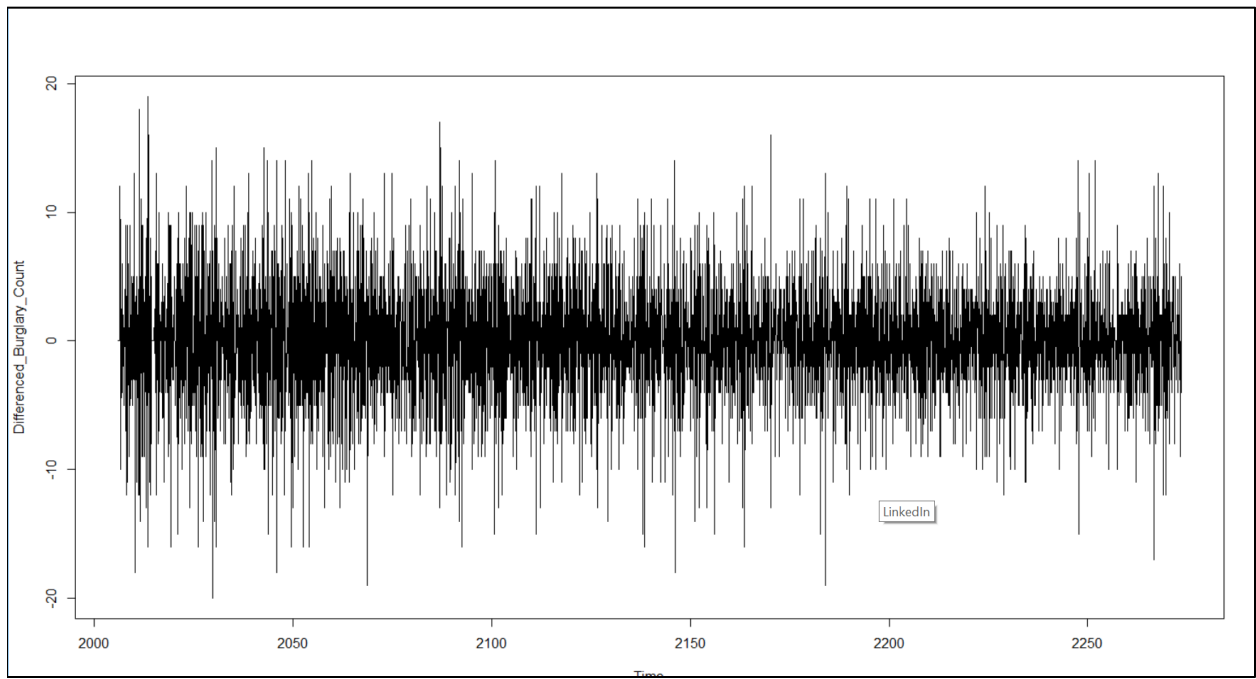


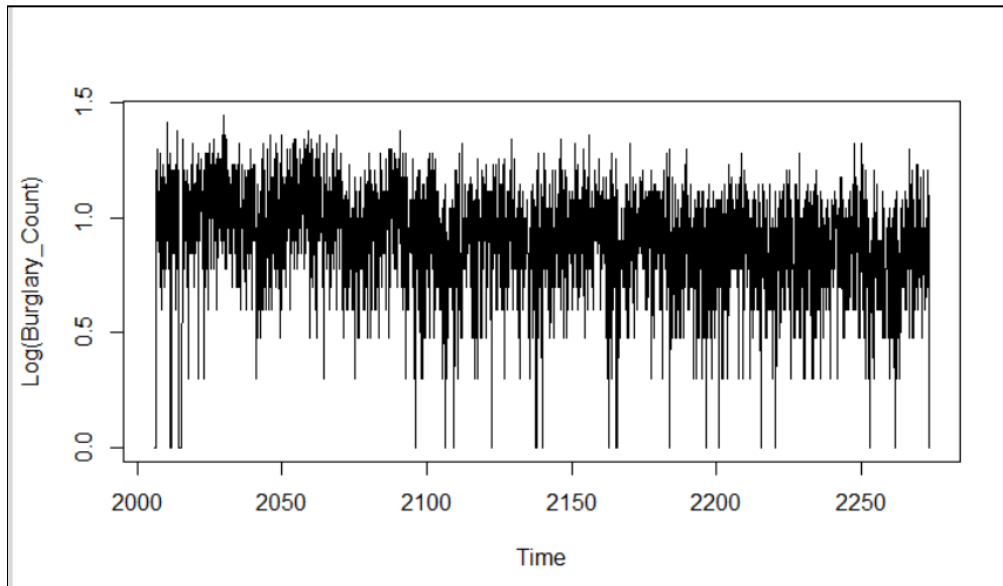
## Initial time series plot



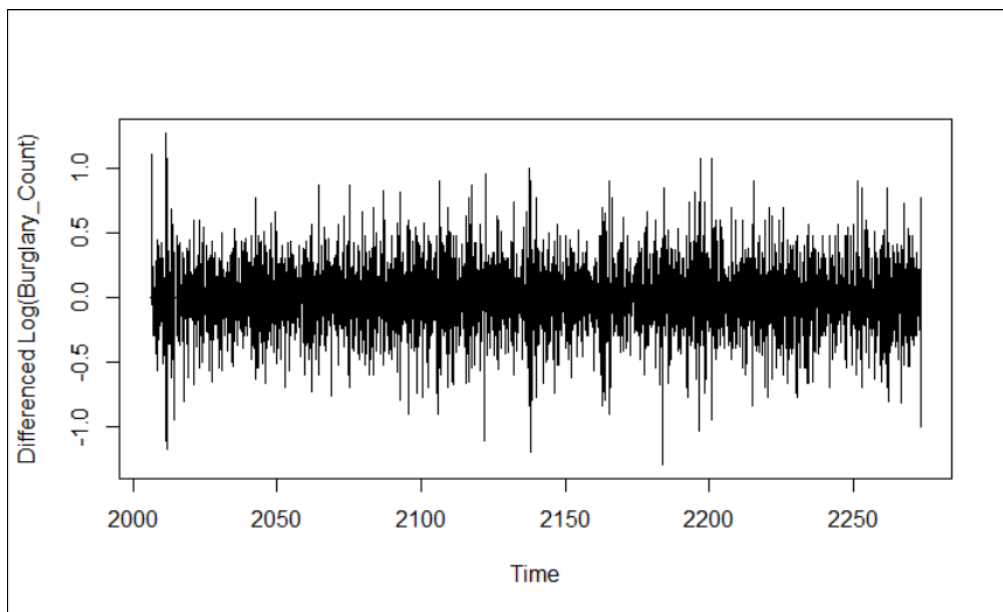
## Differencing



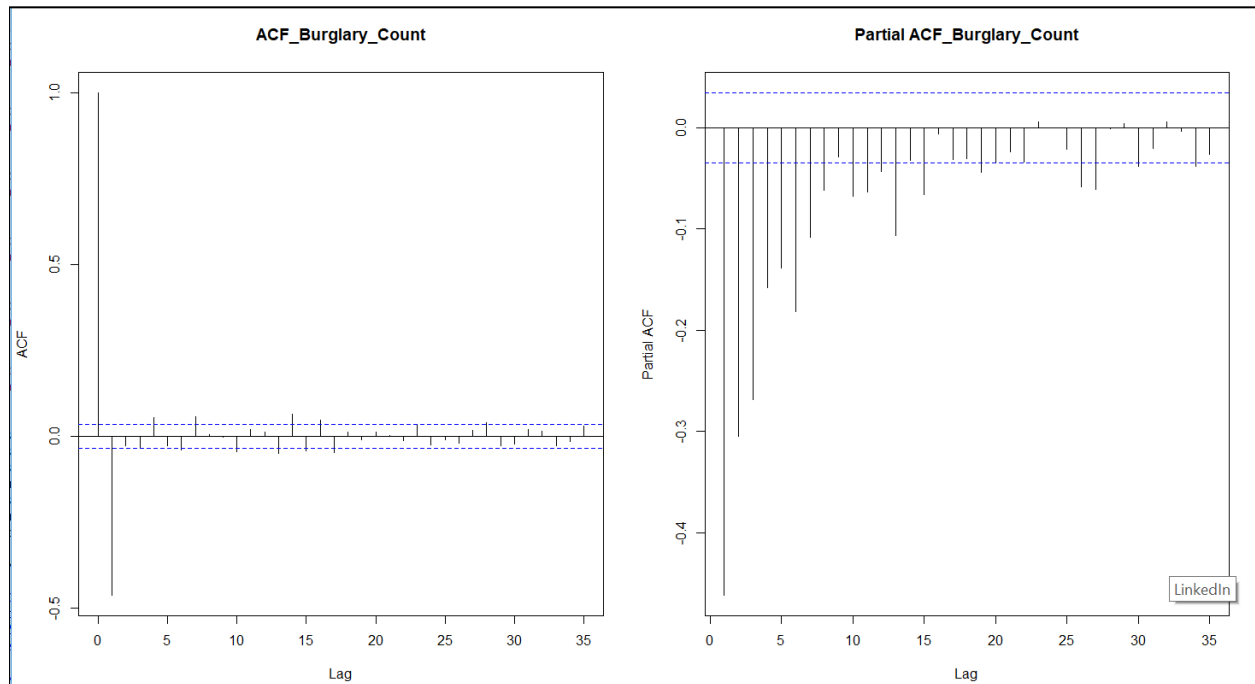
## Logarithmic/exponential smoothing



## Differencing with exponential smoothing



## Autocorrelation factors and partial autocorrelation factors



```

> ARIMAfit_bg = auto.arima(log10(bg_ts),approximation = FALSE, trace = FALSE)
> summary(ARIMAfit_bg)
Series: log10(bg_ts)
ARIMA(1,1,2)

Coefficients:
      ar1      ma1      ma2
    0.7840 -1.6593  0.6658
s.e.  0.0718  0.0807  0.0779

sigma^2 estimated as 0.0461:  log likelihood=383.92
AIC=-759.85   AICc=-759.84   BIC=-735.55

Training set error measures:
              ME      RMSE      MAE  MPE  MAPE      MASE      ACF1
Training set 0.002695473 0.2145836 0.1635251 -Inf  Inf  0.7150321 0.02011501

```

```

> par(mfrow = c(1,1))
> pred = predict(ARIMAfit_bg, n.ahead = 60)
> pred
$pred
      Jan      Feb      Mar      Apr      May      Jun      Jul      Aug      Sep
2273      0.8108607 0.8153410 0.8188536 0.8216077 0.8237669 0.8254599 0.8267872 0.8278278 0.8286438
2274 0.8304866 0.8307283 0.8309178 0.8310664 0.8311829 0.8312743 0.8313459 0.8314020 0.8314461
2275 0.8315455 0.8315585 0.8315687 0.8315768 0.8315830 0.8315880 0.8315918 0.8315949 0.8315972
2276 0.8316026 0.8316033 0.8316039 0.8316043 0.8316046 0.8316049 0.8316051 0.8316053 0.8316054
2277 0.8316057 0.8316057 0.8316058 0.8316058 0.8316058 0.8316058 0.8316058 0.8316058 0.8316058
2278      Oct      Nov      Dec
2273 0.7885622 0.7978581 0.8051464
2274 0.8292835 0.8297850 0.8301783
2275 0.8314806 0.8315076 0.8315288
2276 0.8315991 0.8316006 0.8316017
2277 0.8316055 0.8316056 0.8316056
2278

$se
      Jan      Feb      Mar      Apr      May      Jun      Jul      Aug      Sep
2273      0.2189559 0.2194090 0.2197609 0.2200424 0.2202743 0.2204706 0.2206412 0.2207929 0.2209305
2274 0.2213977 0.2215024 0.2216043 0.2217040 0.2218020 0.2218987 0.2219944 0.2220892 0.2221834
2275 0.2225560 0.2226484 0.2227407 0.2228328 0.2229248 0.2230167 0.2231086 0.2232003 0.2232919
2276 0.2236580 0.2237494 0.2238408 0.2239321 0.2240233 0.2241145 0.2242057 0.2242969 0.2243880
2277 0.2247520 0.2248429 0.2249338 0.2250246 0.2251154 0.2252062 0.2252969 0.2253876
2278      Oct      Nov      Dec
2273 0.2163800 0.2175333 0.2183546
2274 0.2210575 0.2211765 0.2212895
2275 0.2222771 0.2223704 0.2224633
2276 0.2233835 0.2234751 0.2235666
2277 0.2244790 0.2245701 0.2246611
2278

```