

C. TIRF Dataset: Late Night Subset TIME SERIES

Summary

TIRF data set contains 400 observations of car-driver fatality accidents from January 1992 to December 1998. There were actually 434 cases in the original SPSS file but after deleting all cases where the hour variable was missing we were left with 400 cases. Of these 400 cases, 347 were in Ontario and 53 were in Manitoba.

[Figure 1](#) and [Table 1](#) show time series of total car fatality accidents per month for January 1992 to December 1998. In Manitoba there are fewer fatalities and there no noticeable change over time. In Ontario there is an increasing trend for about the first two years and this is followed by a decreasing trend starting around 1994. The table below indicates the death rate has been halved.

Estimated mean death rate/month from loess smooth.

| | Beginning of 1992 | End of 1998 | Percentage Change |
|----------|-------------------|-------------|-------------------|
| Ontario | 4 . 5 | 2 . 3 | 49 |
| Manitoba | 0 . 32 | 0 . 37 | -13 |

[Figure 2](#) shows that in Ontario there was a marked downward trend starting around 1995 in fatalities with drink=yes. There also appears a slight decline in Manitoba for fatalities with drink=yes but the numbers are smaller and there is a lot of variability. The number of fatalities in Ontario with drink=no has also started to decline since about 1995 or 1996.

[Figure 3a&b](#). The comparisons between driving with drink and without drink within drink factor, and between ThuSat and SunWed within wkgrp factor are shown in Fig 3 (a) and (b). There more fatalities with drink=yes and there are are more accidents in SunWed. In Ontario, both SunWed and ThuSat have a downward trend.

[Figure 6a,b-I,b-ii](#), fatalities by hour, drink and province. In each hour slot the accidents are larger in drinking alcohol group than no drinking alcohol group. In [Figure 4b-ii](#), there is an increasing trend in Ontario in the 2AM slot and decreasing trends at 11PM, 12AM and 1AM.

[Figure 4a and 4b](#) are the fatalities by wkgrp and hour. In each hour slot the accidents are larger in SunWed group than in ThuSat group. There are declining trends at 1AM in both weekgroups. At 2AM-ThuSat there is a downward trend. The other panels do not exhibit noticeable trends.

[Tables 5a-5d](#). Monthly time series, deaths by province, hour and wkgrp. Mann-Kendall tests. Ontario 1AMSunWed and 2AMThuSat downward trend (<5%) and Manitoba 2AMSunWed upward trend (<5%).

[Tables 7a-d](#). Annual total fatalities are decomposed by hour, wkgrp and drink for Ontario and Manitoba. Table 6b shows that there has been a shift in fatalities from early evening to late evening starting around 1996. The Mann-Kendall trend test is statistically significant on a two-sided test for Ontario fatalities with drink=yes for Total, 11PM, 1AM, SunWed and ThuSat and in all cases the sign of tau indicates a downward trend. The trend test is not significant for drink=no in Ontario. There are no trends in Manitoba for either drink=yes or drink=no.

No Figure 7 in this report.

[Figures 8a,b,c,d](#). STL analysis for monthly time series with drink=yes and drink=no in Ontario. For drink=yes, a change occurred in 1996 and this is reflected in the trend and seasonal component. The peaks are higher in the seasonal after 1996 and the troughs are lower pre-1996. The shape of the seasonal component has changed. The seasonal component shows fatalities with drink peak in Aug and reach a minimum in Jan. There is a secondary peak in Oct. The trend is upward for Sep, Oct and Jan but is elsewhere downward and or level.

[Figures 9a,b,c,d](#). STL analysis, Ontario, drink=no, downward trend since 1996. Although Mann-Kendall test is not significant the loess trend indicates a downward trend in recent years ([Figure 9d](#)) Seasonal component is very irregular and changing. Peak in July and trough in Apr. There is a lot of change over time.

Figures [10a,b](#) [11a,b](#) STL analysis for monthly time series with drink=yes and drink=no in Manitoba.

Data Visualization

1. All fatalities, Ontario and Manitoba

In the data visualization plots we have used a 60% robust linear smoother.

Table 1a. Monthly fatalities, Ontario

```
> tirf.ont.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:   1  4  4  4  6 10  3  3  5  6  5  6
1993:   4  4  4  4  6  9  8  9  2  5  3  3
1994:   2  5  5  5  4  4  7  5  4  7  5  3
1995:   1  2  1  3  5  6  5  6  7  7  2  5
1996:   1  2  5  2  7  3  6  8  3  7  2  0
1997:   2  4  3  3  1  4  7  8  6  6  6  3
1998:   2  0  0  2  2  3  1  2  4  3  2  3
> sum(tirf.ont.ts)= 347
> SeasonalMannKendall(tirf.ont.ts)
tau = -0.287,    sl =0.2497%
```

Table 1b. Monthly fatalities, Manitoba

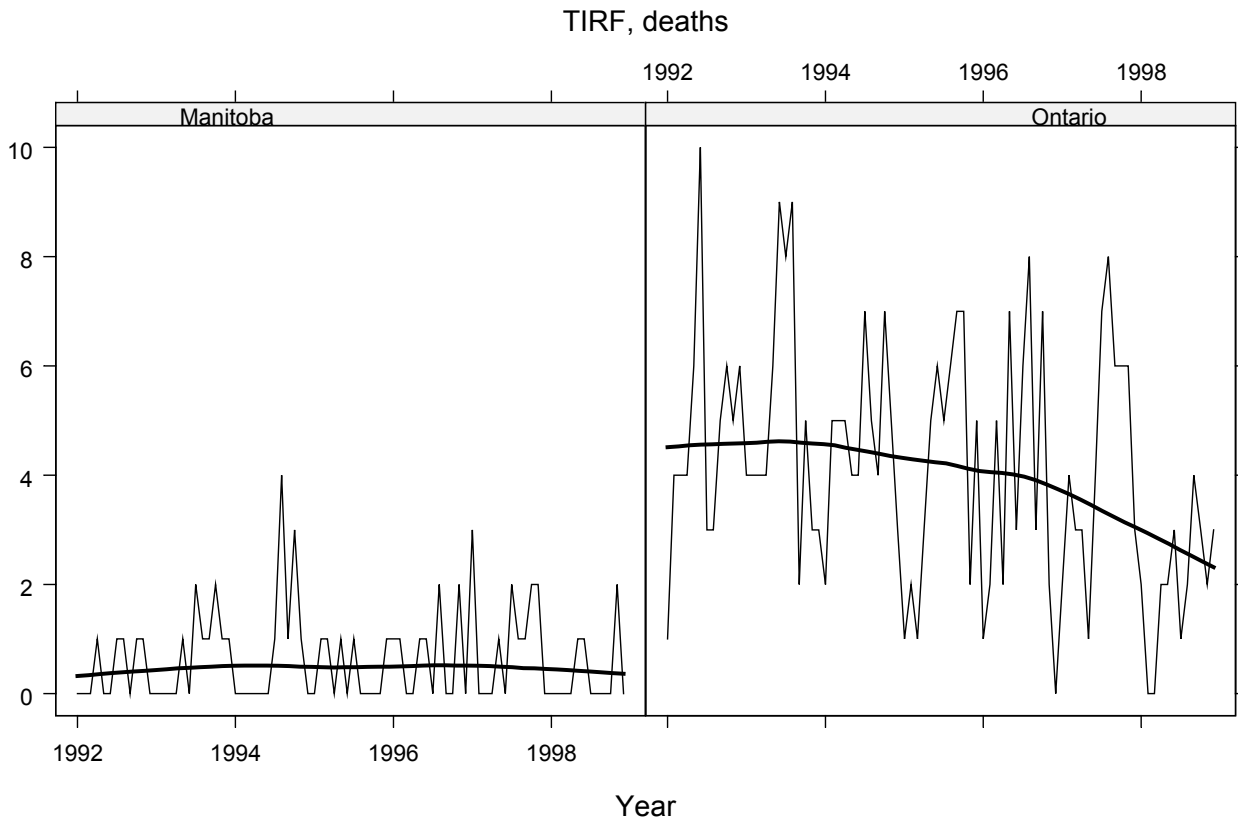
```
> tirf.man.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:   0  0  0  1  0  0  1  1  0  1  1  0
1993:   0  0  0  0  1  0  2  1  1  2  1  1
1994:   0  0  0  0  0  0  1  4  1  3  1  0
1995:   0  1  1  0  1  0  1  0  0  0  0  1
1996:   1  1  0  0  1  1  0  2  0  0  2  0
1997:   3  0  0  0  1  0  2  1  1  2  2  0
1998:   0  0  0  0  1  1  0  0  0  0  2  0
> sum(tirf.man.ts)
[1] 53
> SeasonalMannKendall(tirf.man.ts)
tau = 0.0324,    sl =74.96%

> pc.change(tirf.ont.ts)
[1] 4.512848  2.311812 48.772666
[1] 3.783476  1.935217 48.850810
> pc.change(tirf.man.ts)
[1] 0.3246352  0.3678582 -13.3143284
> aggregate(tirf.ont.ts,1,mean)
> aggregate(tirf.ont.ts,1,mean)
1992: 4.750000 5.083333 4.666667 4.166667 3.833333 4.416667 2.000000
> aggregate(tirf.man.ts,1,mean)
1992: 0.4166667 0.7500000 0.8333333 0.4166667 0.6666667 1.0000000 0.3333333
> MannKendall(tirf.ont.ts)
[1] -0.20029531  0.01088074
> MannKendall(tirf.man.ts)
[1] 0.01823654  0.83558142
```

Table 1c-i. Estimated mean death rate/month from loess smooth.

| | Beginning of 1992 | End of 1998 | Percentage Change |
|----------|-------------------|-------------|-------------------|
| Ontario | 4.5 | 2.3 | 49 |
| Manitoba | 0.32 | 0.37 | -13 |

Figure 1. Time series trellis plot of total car fatality accidents per month for January 1992 to December 1998. In Manitoba there are fewer fatalities and there no noticeable change over time. In Ontario there is an increasing trend for about the first two years and this is followed by a decreasing trend starting around 1994. Because of the extremely low death rates for car fatalities in Manitoba, it does not seem to provide any useful information. It just gets in the way of understanding the Ontario data so it will be omitted from further graphical displays.



2. Fatalities by hour

Table 2. Time series tabulation by province and hour

```

> ont.11PM.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  0  2  0  1  2  1  0  1  1  3
1993:  1  0  0  1  1  2  1  2  1  1  0  0
1994:  0  1  3  0  1  1  2  1  2  2  1  0
1995:  0  0  1  1  0  4  1  2  3  1  0  1
1996:  0  1  2  0  4  2  1  0  1  2  2  0
1997:  0  1  0  1  0  1  2  2  0  2  2  0
1998:  1  0  0  0  0  1  0  1  0  1  0  0
> SeasonalMannKendall(ont.11PM.ts)
tau = -0.127,    sl =20.06%
> ont.12AM.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  2  0  4  5  0  1  0  1  2  2
1993:  2  0  0  0  0  3  2  0  0  0  0  0
1994:  0  2  0  0  1  0  0  1  0  2  2  0
1995:  0  0  0  0  1  1  2  0  3  3  0  1
1996:  1  0  1  1  0  0  1  4  0  1  0  0
1997:  1  1  0  0  0  0  5  1  1  1  1  2
1998:  0  0  0  0  0  0  0  1  1  0  0  0
> SeasonalMannKendall(ont.12AM.ts)
tau = -0.129,    sl =19.43%
> ont.1AM.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  2  0  1  1  1  1  4  0  0  0
1993:  1  3  2  0  3  2  4  5  1  3  0  0
1994:  1  2  2  0  2  1  1  1  1  1  2  1
1995:  1  1  0  0  0  0  2  2  0  2  1  3
1996:  0  1  2  0  2  0  3  1  2  1  0  0
1997:  1  0  0  1  0  0  0  1  1  0  0  0
1998:  0  0  0  0  1  0  0  0  0  1  2  1
> SeasonalMannKendall(ont.1AM.ts)
tau = -0.283,    sl =0.4093%
> ont.2AM.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  0  2  1  1  0  0  1  2  1  1
1993:  0  1  1  3  1  1  1  1  0  0  0  1
1994:  1  0  0  4  0  2  2  1  1  2  0  2
1995:  0  1  0  2  3  0  0  1  1  1  1  0
1996:  0  0  0  0  1  0  0  1  0  1  0  0
1997:  0  1  0  0  0  1  0  4  2  0  0  1
1998:  0  0  0  2  1  1  1  0  2  1  0  1
> SeasonalMannKendall(ont.2AM.ts)
tau = -0.129,    sl =20.03%
> ont.3AM.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  1  0  0  0  0  2  0  0  0  2  1  0
1993:  0  0  1  0  1  1  0  1  0  1  3  2
1994:  0  0  0  1  0  0  2  1  0  0  0  0
1995:  0  0  0  0  1  1  0  1  0  0  0  0
1996:  0  0  0  1  0  1  1  2  0  2  0  0
1997:  0  1  3  1  1  2  0  0  2  3  3  0
1998:  1  0  0  0  0  1  0  0  1  0  0  1
> SeasonalMannKendall(ont.3AM.ts)
tau = 0.0634,    sl =52.9%
> sum(ont.11PM.ts+ont.12AM.ts+ont.1AM.ts+ont.2AM.ts+ont.3AM.ts)
[1] 347

```

```

man.11PM.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  1  0  0  0  0  2  0  0  0  2  1  0
1993:  0  0  1  0  1  1  0  1  0  1  3  2
1994:  0  0  0  1  0  0  2  1  0  0  0  0
1995:  0  0  0  0  1  0  0  1  0  0  0  0
1996:  0  0  0  1  0  1  1  2  0  2  0  0
1997:  0  1  3  0  1  2  0  0  2  2  3  0
1998:  1  0  0  0  0  1  0  0  1  0  0  1
> MannKendall(man.11PM.ts)
tau = 0.042,    sl =62.88%
> man.12AM.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  1  0  0  0  0  0
1993:  0  0  0  0  0  0  0  0  0  0  0  0
1994:  0  0  0  0  0  0  1  1  0  1  0  0
1995:  0  0  0  0  0  0  1  0  0  0  0  1
1996:  0  1  0  0  0  0  0  0  0  0  0  0
1997:  0  0  0  0  0  0  0  0  0  0  0  0
1998:  0  0  0  0  0  1  0  0  0  0  1  0
> MannKendall(man.12AM.ts)
tau = 0.0306,    sl =73.94%
> man.1AM.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  0  0  0  0  1  0
1993:  0  0  0  0  0  0  2  1  0  1  0  1
1994:  0  0  0  0  0  0  0  0  0  0  0  0
1995:  0  0  1  0  0  0  0  0  0  0  0  0
1996:  0  0  0  0  0  0  0  2  0  0  0  0
1997:  0  0  0  0  1  0  0  0  0  0  1  0
1998:  0  0  0  0  0  0  0  0  0  0  0  0
> MannKendall(man.1AM.ts)
tau = -0.0729,    sl =41.86%
> man.2AM.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  0  0  0  0  0  0
1993:  0  0  0  0  0  0  0  0  0  0  1  0
1994:  0  0  0  0  0  0  0  0  0  0  1  0
1995:  0  0  0  0  0  0  0  0  0  0  0  0
1996:  0  0  0  0  0  0  0  0  0  0  1  0
1997:  2  0  0  0  0  0  0  0  0  1  0  0
1998:  0  0  0  0  0  0  0  0  0  0  1  0
> MannKendall(man.2AM.ts)
tau = 0.119,    sl =18.7%
> man.3AM.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  1  0  0  0  1  0  1  0  0
1993:  0  0  0  0  0  0  0  0  0  1  0  0
1994:  0  0  0  0  0  0  0  0  0  0  0  0
1995:  0  1  0  0  0  0  0  0  0  0  0  0
1996:  0  0  0  0  1  0  0  0  0  0  1  0
1997:  0  0  0  0  0  0  0  0  1  0  0  0
1998:  0  0  0  0  1  0  0  0  0  0  0  0
> MannKendall(man.3AM.ts)
tau = -0.0554,    sl =54.36%

```

Figure 2a. Time series line plot by hour

TIRF, deaths by hour, Ontario.

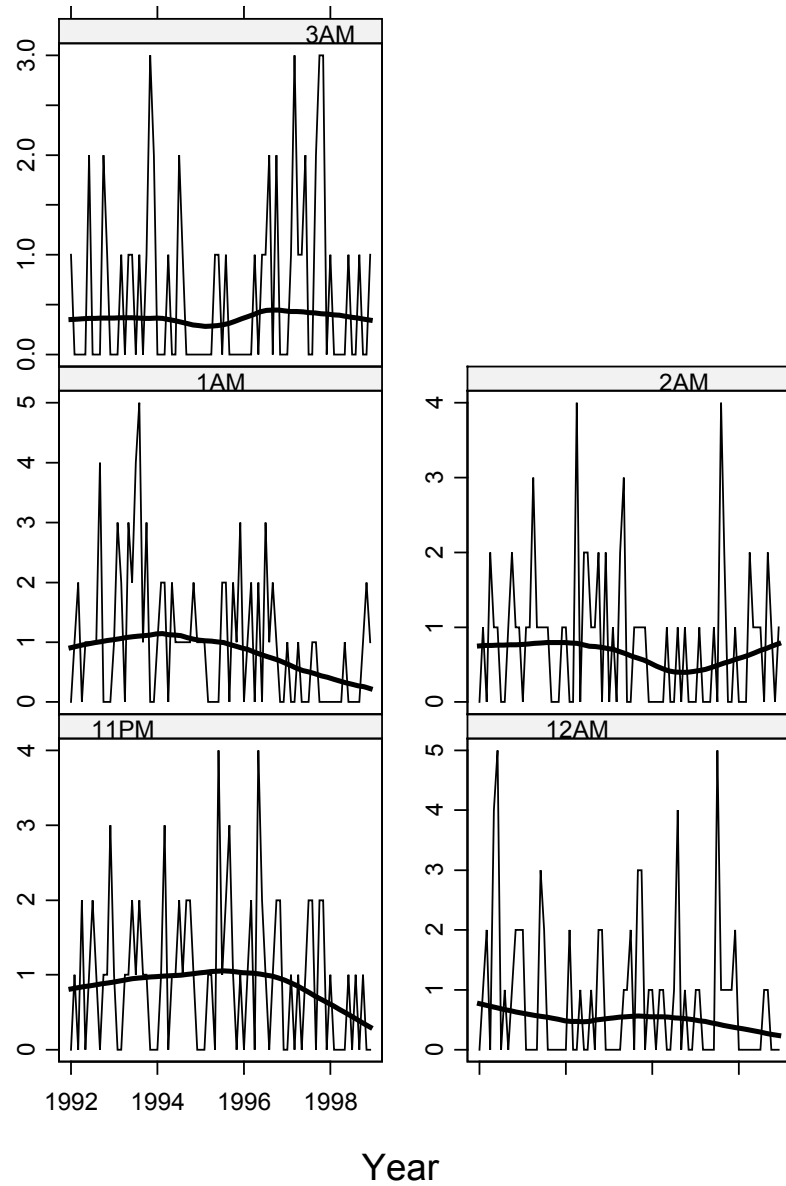
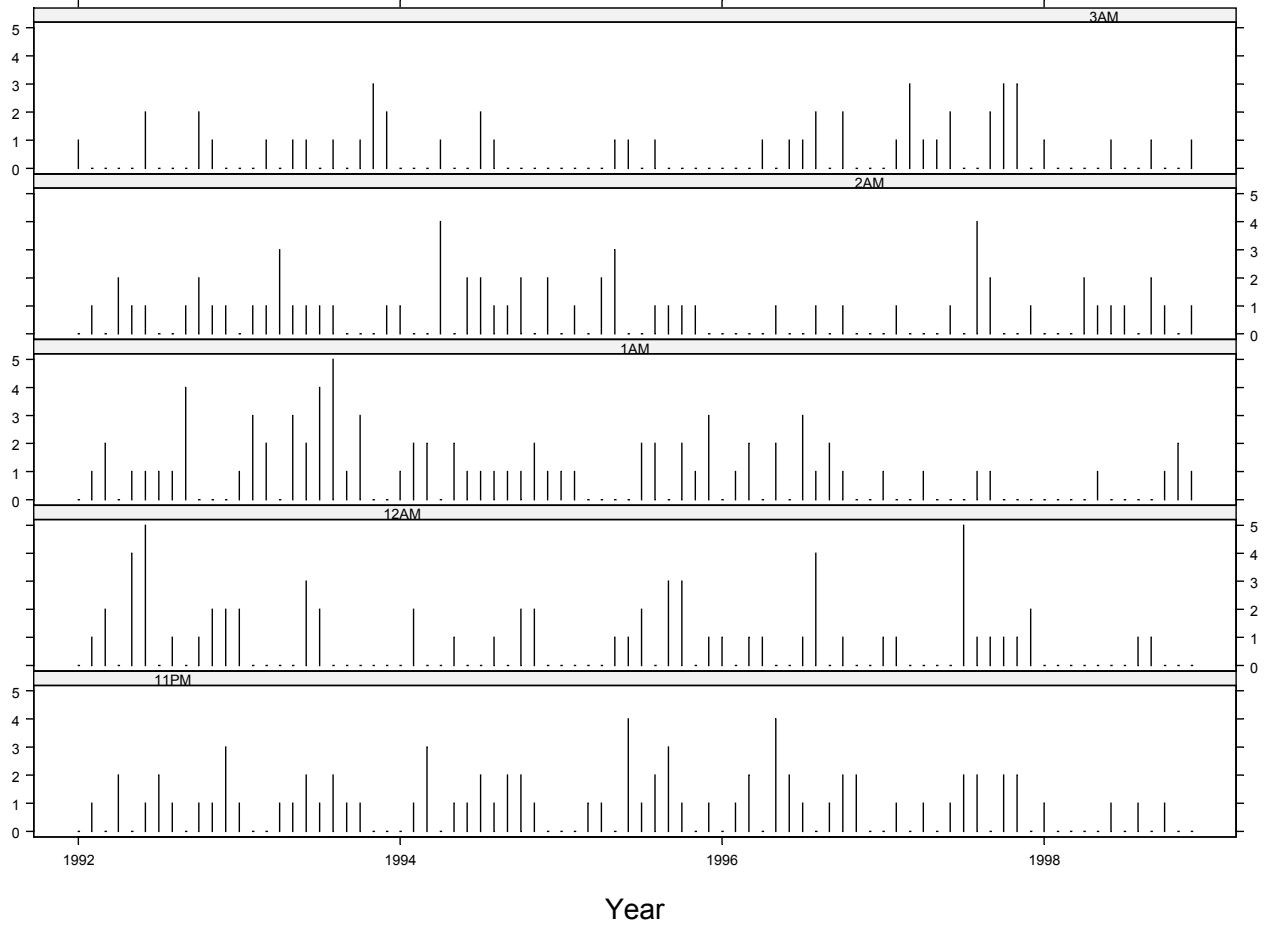


Figure 2b. Time series loess analysis by hour

TIRF, deaths by hour, Ontario.



3. Fatalities by wkgrp

```
> ont.ThuSat.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:   1  2  2  2  2  1  2  0  3  2  0  4
1993:   1  2  2  2  0  4  3  3  0  2  1  2
1994:   1  3  3  2  1  1  2  1  1  0  0  1
1995:   0  2  1  0  2  4  1  2  5  2  0  2
1996:   0  2  2  0  1  1  3  3  2  4  0  0
1997:   2  1  1  0  0  1  3  5  2  4  0  2
1998:   0  0  0  1  1  0  0  1  1  0  0  2
> SeasonalMannKendall(ont.ThuSat.ts)
tau = -0.243,    sl =1.29%

> ont.SunWed.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:   0  2  2  2  4  9  1  3  2  4  5  2
1993:   3  2  2  2  6  5  5  6  2  3  2  1
1994:   1  2  2  3  3  3  5  4  3  7  5  2
1995:   1  0  0  3  3  2  4  4  2  5  2  3
1996:   1  0  3  2  6  2  3  5  1  3  2  0
1997:   0  3  2  3  1  3  4  3  4  2  6  1
1998:   2  0  0  1  1  3  1  1  3  3  2  1
> SeasonalMannKendall(ont.SunWed.ts)
tau = -0.228,    sl =1.836%

> sum(ont.SunWed.ts+ont.ThuSat.ts)
[1] 347
```

Figure 3a. Time series line plot by wkgrp

TIRF, deaths by wkgrp, Ontario.

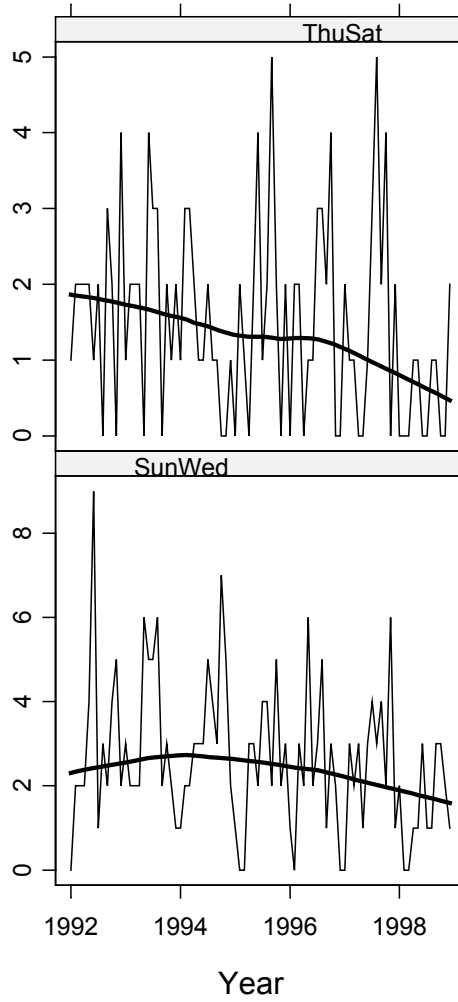
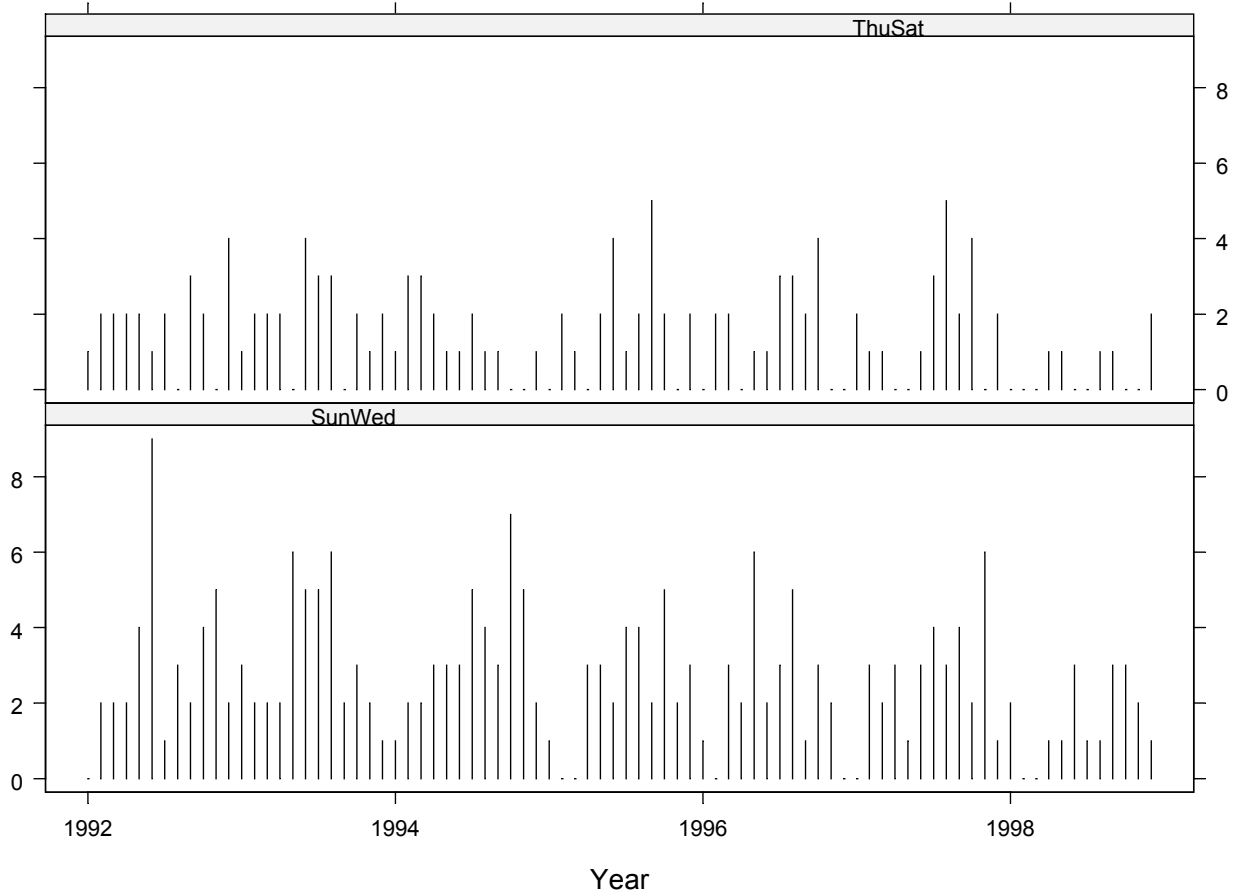


Figure 3b. Time series line plot.

TIRF, deaths by wkgrp, Ontario.



4. Fatalities by hour and wkgrp

Figure 4a and 4b are the fatalities by wkgrp and hour. There are declining trends at 1AM in both weekgroups. At 2AM-ThuSat there is a downward trend. The other panels do not exhibit noticeable trends.

Figure 4a. Loess analysis

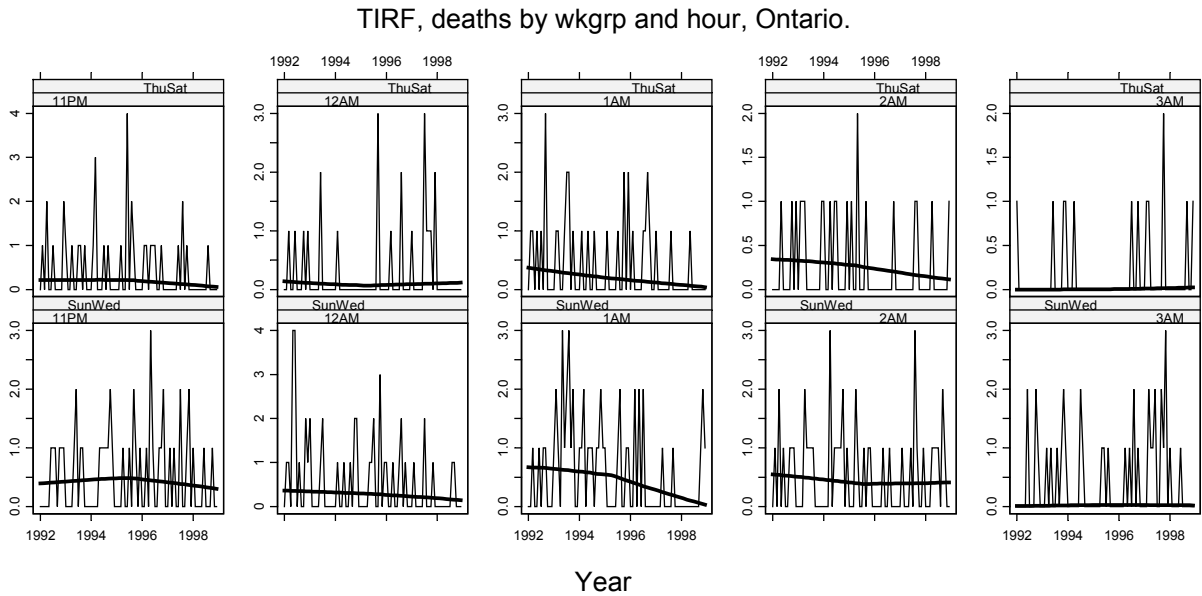


Figure 4b. Line plot of time series

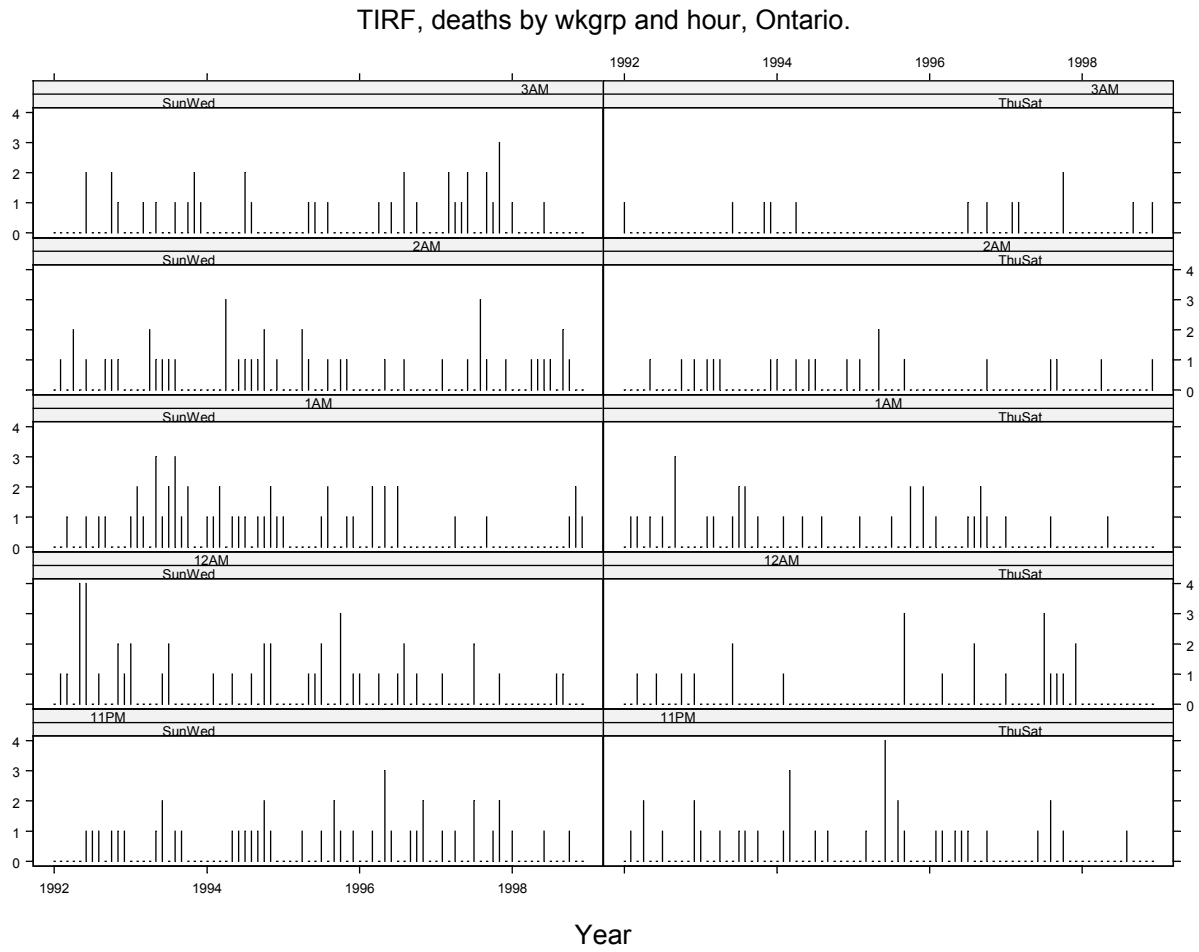


Table 5a to 5d**Monthly time series, deaths by province, hour and wkgrp. Mann-Kendall tests.**

Ontario 12AMSunWed, 1AMSunWed and 1AMThuSat downward trend (<5%) and Manitoba 2AMSunWed upward trend (<5%).

Table 4a. Ontario-SunWed

```
> ont.11PMSunWed.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  1  1  1  0  1  1  1
1993:  0  0  0  0  1  2  0  1  1  0  0  0
1994:  0  0  0  0  1  1  1  1  1  2  1  0
1995:  0  0  0  1  0  0  1  0  2  1  0  1
1996:  0  0  1  0  3  1  0  0  1  1  2  0
1997:  0  1  0  1  0  0  2  0  0  1  2  0
1998:  1  0  0  0  0  1  0  0  0  1  0  0
> SeasonalMannKendall(ont.11PMSunWed.ts)
tau = -0.0605,  sl =55.25%
> ont.12AMSunWed.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  1  0  4  4  0  1  0  0  2  1
1993:  2  0  0  0  0  1  2  0  0  0  0  0
1994:  0  1  0  0  1  0  0  1  0  2  2  0
1995:  0  0  0  0  1  1  2  0  0  3  0  1
1996:  1  0  0  1  0  0  1  2  0  1  0  0
1997:  0  1  0  0  0  0  2  0  0  0  1  0
1998:  0  0  0  0  0  0  0  1  1  0  0  0
> SeasonalMannKendall(ont.12AMSunWed.ts)
tau = -0.207,  sl = 4.165%
> ont.1AMSunWed.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  1  0  0  1  0  1  1  0  0  0
1993:  1  2  1  0  3  1  2  3  1  2  0  0
1994:  1  1  2  0  1  1  1  0  1  1  2  1
1995:  1  0  0  0  0  0  1  2  0  0  1  1
1996:  0  0  2  0  2  0  2  0  0  0  0  0
1997:  0  0  0  1  0  0  0  0  1  0  0  0
1998:  0  0  0  0  0  0  0  0  0  1  2  1
> SeasonalMannKendall(ont.1AMSunWed.ts)
tau = -0.239,  sl = 1.727%
> ont.2AMSunWed.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  0  2  0  1  0  0  1  1  1  0
1993:  0  0  0  2  1  1  1  1  0  0  0  0
1994:  0  0  0  3  0  1  1  1  1  2  0  1
1995:  0  0  0  2  1  0  0  1  0  1  1  0
1996:  0  0  0  0  1  0  0  1  0  0  0  0
1997:  0  1  0  0  0  1  0  3  1  0  0  1
1998:  0  0  0  1  1  1  1  0  2  1  0  0
> SeasonalMannKendall(ont.2AMSunWed.ts)
tau = -0.0434,  sl =69.51%
> ont.3AMSunWed.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  2  0  0  0  2  1  0
1993:  0  0  1  0  1  0  0  1  0  1  2  1
1994:  0  0  0  0  0  0  2  1  0  0  0  0
1995:  0  0  0  0  1  1  0  1  0  0  0  0
1996:  0  0  0  1  0  1  0  2  0  1  0  0
1997:  0  0  2  1  1  2  0  0  2  1  3  0
1998:  1  0  0  0  0  1  0  0  0  0  0  0
> SeasonalMannKendall(ont.3AMSunWed.ts)
tau = 0.0247,  sl =81.7%
```

Table 5b. Ontario-ThuSat

```

ont.11PMThuSat.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  0  2  0  0  1  0  0  0  0  2
1993:  1  0  0  1  0  0  1  1  0  1  0  0
1994:  0  1  3  0  0  0  1  0  1  0  0  0
1995:  0  0  1  0  0  4  0  2  1  0  0  0
1996:  0  1  1  0  1  1  1  0  0  1  0  0
1997:  0  0  0  0  0  1  0  2  0  1  0  0
1998:  0  0  0  0  0  0  0  1  0  0  0  0
> MannKendall(ont.11PMThuSat.ts)
tau = -0.125,    sl =15.5%
> ont.12AMThuSat.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  1  0  0  1  0  0  0  1  0  1
1993:  0  0  0  0  0  2  0  0  0  0  0  0
1994:  0  1  0  0  0  0  0  0  0  0  0  0
1995:  0  0  0  0  0  0  0  0  3  0  0  0
1996:  0  0  1  0  0  0  0  2  0  0  0  0
1997:  1  0  0  0  0  0  3  1  1  1  0  2
1998:  0  0  0  0  0  0  0  0  0  0  0  0
> MannKendall(ont.12AMThuSat.ts)
tau = 0.00359,    sl =97.22%
> ont.1AMThuSat.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  1  0  1  0  1  0  3  0  0  0
1993:  0  1  1  0  0  1  2  2  0  1  0  0
1994:  0  1  0  0  1  0  0  1  0  0  0  0
1995:  0  1  0  0  0  0  1  0  0  2  0  2
1996:  0  1  0  0  0  0  1  1  2  1  0  0
1997:  1  0  0  0  0  0  0  1  0  0  0  0
1998:  0  0  0  0  1  0  0  0  0  0  0  0
> MannKendall(ont.1AMThuSat.ts)
tau = -0.192,    sl =2.867%
> ont.2AMThuSat.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  1  0  0  0  0  1  0  1
1993:  0  1  1  1  0  0  0  0  0  0  0  1
1994:  1  0  0  1  0  1  1  0  0  0  0  1
1995:  0  1  0  0  2  0  0  0  1  0  0  0
1996:  0  0  0  0  0  0  0  0  0  1  0  0
1997:  0  0  0  0  0  0  0  1  1  0  0  0
1998:  0  0  0  1  0  0  0  0  0  0  0  1
> MannKendall(ont.2AMThuSat.ts)
tau = -0.114,    sl =20.46%
> ont.3AMThuSat.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  1  0  0  0  0  0  0  0  0  0  0  0
1993:  0  0  0  0  0  1  0  0  0  0  1  1
1994:  0  0  0  1  0  0  0  0  0  0  0  0
1995:  0  0  0  0  0  0  0  0  0  0  0  0
1996:  0  0  0  0  0  0  1  0  0  1  0  0
1997:  0  1  1  0  0  0  0  0  0  2  0  0
1998:  0  0  0  0  0  0  0  0  1  0  0  1
> MannKendall(ont.3AMThuSat.ts)
tau = 0.0693,    sl =44.35%

```

Table 5c. Manitoba-SunWed

```

man.11PMSunWed.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  0  0  0  0  0  0
1993:  0  0  0  0  1  0  0  0  1  0  0  0
1994:  0  0  0  0  0  0  0  3  1  1  0  0
1995:  0  0  0  0  1  0  0  0  0  0  0  0
1996:  1  0  0  0  0  1  0  0  0  0  0  0
1997:  1  0  0  0  0  0  2  0  0  0  0  0
1998:  0  0  0  0  0  0  0  0  0  0  0  0
> MannKendall(man.11PMSunWed.ts)
tau = -0.0179,    sl =84.69%
> man.12AMSunWed.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  1  0  0  0  0  0
1993:  0  0  0  0  0  0  0  0  0  0  0  0
1994:  0  0  0  0  0  0  1  0  0  1  0  0
1995:  0  0  0  0  0  0  0  0  0  0  0  1
1996:  0  1  0  0  0  0  0  0  0  0  0  0
1997:  0  0  0  0  0  0  0  0  0  0  0  0
1998:  0  0  0  0  0  1  0  0  0  0  1  0
> MannKendall(man.12AMSunWed.ts)
tau = 0.0489,    sl =59.33%
> man.1AMSunWed.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  0  0  0  0  0  0
1993:  0  0  0  0  0  0  2  1  0  0  0  0
1994:  0  0  0  0  0  0  0  0  0  0  0  0
1995:  0  0  1  0  0  0  0  0  0  0  0  0
1996:  0  0  0  0  0  0  0  1  0  0  0  0
1997:  0  0  0  0  1  0  0  0  0  0  1  0
1998:  0  0  0  0  0  0  0  0  0  0  0  0
> MannKendall(man.1AMSunWed.ts)
tau = 0.0195,    sl =83.5%
> man.2AMSunWed.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  0  0  0  0  0  0
1993:  0  0  0  0  0  0  0  0  0  0  0  0
1994:  0  0  0  0  0  0  0  0  0  0  0  0
1995:  0  0  0  0  0  0  0  0  0  0  0  0
1996:  0  0  0  0  0  0  0  0  0  0  1  0
1997:  2  0  0  0  0  0  0  0  0  1  0  0
1998:  0  0  0  0  0  0  0  0  0  0  1  0
> MannKendall(man.2AMSunWed.ts)
tau = 0.193,    sl =3.221%
> man.3AMSunWed.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  1  0  0  0  1  0  1  0  0
1993:  0  0  0  0  0  0  0  0  0  0  0  0
1994:  0  0  0  0  0  0  0  0  0  0  0  0
1995:  0  1  0  0  0  0  0  0  0  0  0  0
1996:  0  0  0  0  1  0  0  0  0  0  1  0
1997:  0  0  0  0  0  0  0  0  1  0  0  0
1998:  0  0  0  0  1  0  0  0  0  0  0  0
> MannKendall(man.3AMSunWed.ts)
tau = -0.0302,    sl =74.32%

```


Table 5d. Manitoba-ThuSat

```

man.11PMThuSat.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  0  0  0  0  0  0
1993:  0  0  0  0  0  0  0  0  0  0  0  0
1994:  0  0  0  0  0  0  0  0  0  0  1  0
1995:  0  0  0  0  0  0  0  0  0  0  0  0
1996:  0  0  0  0  0  0  0  0  0  0  0  0
1997:  0  0  0  0  0  0  0  1  0  1  1  0
1998:  0  0  0  0  0  0  0  0  0  0  0  0
> MannKendall(man.11PMThuSat.ts)
tau = 0.138,    sl =12.78%
> man.12AMThuSat.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  0  0  0  0  0  0
1993:  0  0  0  0  0  0  0  0  0  0  0  0
1994:  0  0  0  0  0  0  0  1  0  0  0  0
1995:  0  0  0  0  0  0  1  0  0  0  0  0
1996:  0  0  0  0  0  0  0  0  0  0  0  0
1997:  0  0  0  0  0  0  0  0  0  0  0  0
1998:  0  0  0  0  0  0  0  0  0  0  0  0
> MannKendall(man.12AMThuSat.ts)
tau = -0.0265,    sl =78.05%
> man.1AMThuSat.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  0  0  0  0  1  0
1993:  0  0  0  0  0  0  0  0  0  1  0  1
1994:  0  0  0  0  0  0  0  0  0  0  0  0
1995:  0  0  0  0  0  0  0  0  0  0  0  0
1996:  0  0  0  0  0  0  0  1  0  0  0  0
1997:  0  0  0  0  0  0  0  0  0  0  0  0
1998:  0  0  0  0  0  0  0  0  0  0  0  0
> MannKendall(man.1AMThuSat.ts)
tau = -0.108,    sl =23.53%
> man.2AMThuSat.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  0  0  0  0  0  0
1993:  0  0  0  0  0  0  0  0  0  0  1  0
1994:  0  0  0  0  0  0  0  0  0  0  1  0
1995:  0  0  0  0  0  0  0  0  0  0  0  0
1996:  0  0  0  0  0  0  0  0  0  0  0  0
1997:  0  0  0  0  0  0  0  0  0  0  0  0
1998:  0  0  0  0  0  0  0  0  0  0  0  0
> MannKendall(man.2AMThuSat.ts)
tau = -0.0714,    sl =43.69%
> man.3AMThuSat.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  0  0  0  0  0  0
1993:  0  0  0  0  0  0  0  0  0  1  0  0
1994:  0  0  0  0  0  0  0  0  0  0  0  0
1995:  0  0  0  0  0  0  0  0  0  0  0  0
1996:  0  0  0  0  0  0  0  0  0  0  0  0
1997:  0  0  0  0  0  0  0  0  0  0  0  0
1998:  0  0  0  0  0  0  0  0  0  0  0  0
> MannKendall(man.3AMThuSat.ts)
tau = -0.0762,    sl =40.95%

```

6. Fatalities by drink

Table 6. Time series tabulation and Mann-Kendall trend test for fatalities by province (ont or man) and drinking class (yes or no)

```

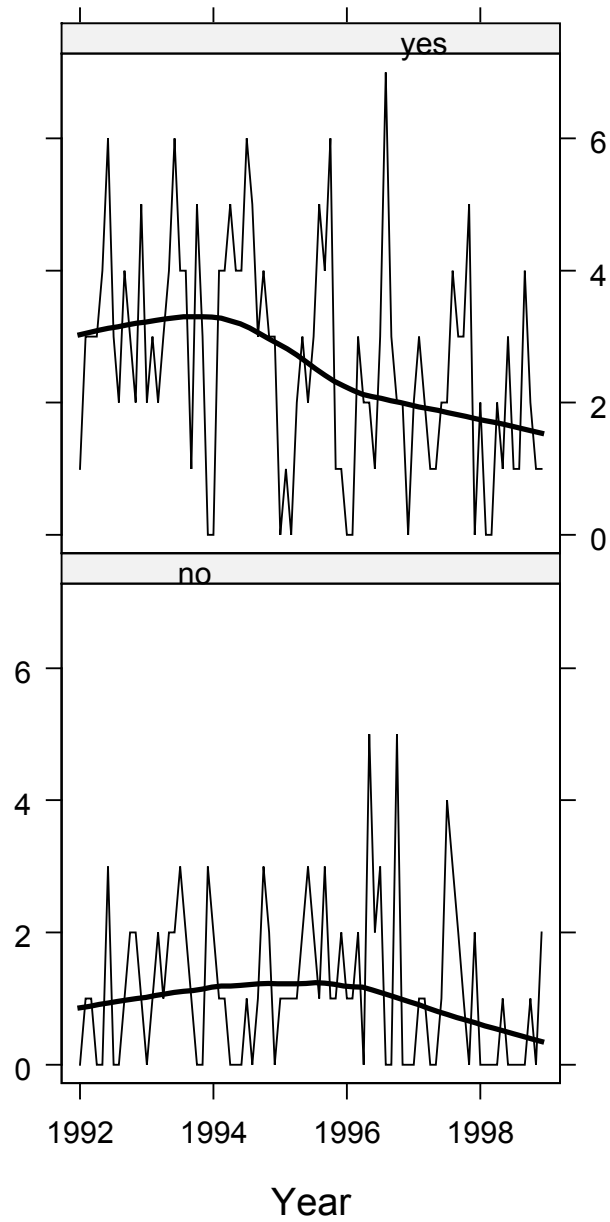
> ont.yes.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:   1  3  3  3  4  6  3  2  4  3  2  5
1993:   2  3  2  3  4  6  4  4  4  1  5  3  0
1994:   0  4  4  5  4  4  6  5  3  4  3  3
1995:   0  1  0  2  3  2  3  5  4  6  1  1
1996:   0  0  3  2  2  1  3  7  3  2  2  0
1997:   2  3  2  1  1  2  2  4  3  3  5  0
1998:   2  0  0  2  1  3  1  1  4  2  1  1
> SeasonalMannKendall(ont.yes.ts)
tau = -0.336,    sl =0.0459%
> ont.no.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:   0  1  1  0  0  3  0  0  1  2  2  1
1993:   0  1  2  1  2  2  3  2  1  0  0  3
1994:   2  1  1  0  0  0  1  0  1  3  2  0
1995:   1  1  1  1  2  3  2  1  3  1  1  2
1996:   1  1  2  0  5  2  3  0  0  5  0  0
1997:   0  1  1  0  0  1  4  3  2  1  0  2
1998:   0  0  0  0  1  0  0  0  0  1  0  2
> SeasonalMannKendall(ont.no.ts)
tau = -0.147,    sl =13.3%
> man.yes.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:   0  0  0  1  0  0  1  1  0  1  0  0
1993:   0  0  0  0  1  0  2  1  1  2  0  1
1994:   0  0  0  0  0  0  1  3  0  3  1  0
1995:   0  1  1  0  1  0  0  0  0  0  0  1
1996:   0  0  0  0  1  1  0  1  0  0  2  0
1997:   2  0  0  0  0  0  1  1  0  2  2  0
1998:   0  0  0  0  1  1  0  0  0  0  2  0
> SeasonalMannKendall(man.yes.ts)
tau = -0.029,    sl =77.77%
> man.no.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:   0  0  0  0  0  0  0  0  0  0  1  0
1993:   0  0  0  0  0  0  0  0  0  0  1  0
1994:   0  0  0  0  0  0  0  1  1  0  0  0
1995:   0  0  0  0  0  0  1  0  0  0  0  0
1996:   1  1  0  0  0  0  0  1  0  0  0  0
1997:   1  0  0  0  1  0  1  0  1  0  0  0
1998:   0  0  0  0  0  0  0  0  0  0  0  0
> SeasonalMannKendall(man.no.ts)
tau = 0.0843,    sl =53.38%

```

Figure 5.

Figure 5 shows that in Ontario there was a marked downward trend starting around 1994 in fatalities with drink=yes. . The number of fatalities in Ontario with drink=no has also started to decline since about 1995 or 1996.

TIRF deaths by drink, Ontario



6. Fatalities by drink and hour

Figure 6, fatalities by hour, drink and province. In each hour slot the accidents are larger in drinking alcohol group than no drinking alcohol group. There is an increasing trend in Ontario in the 2AM slot and decreasing trends at 11PM, 12AM and 1AM.

```
> ont.11PMno.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  1  0  0  0  0  0  1
1993:  0  0  0  0  1  1  0  1  1  0  0  0
1994:  0  0  1  0  0  0  0  0  1  1  0  0
1995:  0  0  1  1  0  3  0  1  1  0  0  0
1996:  0  1  0  0  4  1  0  0  0  1  0  0
1997:  0  0  0  0  0  1  0  1  0  1  0  0
1998:  0  0  0  0  0  0  0  0  0  1  0  0
> MannKendall(ont.11PMno.ts)
tau = -0.0276,    sl =76.11%
> ont.12AMno.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  1  0  0  1  0  0  0  1  0  0
1993:  0  0  0  0  0  0  0  0  0  0  0  0
1994:  0  0  0  0  0  0  0  0  0  1  1  0
1995:  0  0  0  0  0  0  1  0  1  0  0  0
1996:  1  0  1  0  0  0  0  0  0  1  0  0
1997:  0  1  0  0  0  0  4  0  1  0  0  1
1998:  0  0  0  0  0  0  0  0  0  0  0  0
> MannKendall(ont.12AMno.ts)
tau = -0.0277,    sl =76.17%
> ont.1AMno.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  1  0  0  1  0  0  0
1993:  0  1  1  0  1  1  2  1  0  0  0  0
1994:  1  1  0  0  0  0  0  0  0  1  1  0
1995:  1  1  0  0  0  0  1  0  0  1  1  2
1996:  0  0  1  0  1  0  2  0  0  1  0  0
1997:  0  0  0  0  0  0  0  1  0  0  0  0
1998:  0  0  0  0  0  0  0  0  0  0  0  1
> MannKendall(ont.1AMno.ts)
tau = -0.127,    sl =15.37%
> ont.2AMno.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  0  0  0  1  1  0
1993:  0  0  1  1  0  0  1  0  0  0  0  1
1994:  1  0  0  0  0  0  0  0  0  0  0  0
1995:  0  0  0  0  2  0  0  0  1  0  0  0
1996:  0  0  0  0  0  0  0  0  0  0  0  0
1997:  0  0  0  0  0  0  0  1  1  0  0  1
1998:  0  0  0  0  1  0  0  0  0  0  0  0
> MannKendall(ont.2AMno.ts)
tau = -0.0659,    sl =46.61%
> ont.3AMno.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  0  0  0  0  0  1  0
1993:  0  0  0  0  0  0  0  0  0  0  0  2
1994:  0  0  0  0  0  0  1  0  0  0  0  0
1995:  0  0  0  0  0  0  0  0  0  0  0  0
1996:  0  0  0  0  0  1  1  0  0  2  0  0
1997:  0  0  1  0  0  0  0  0  0  0  0  0
1998:  0  0  0  0  0  0  0  0  0  0  0  1
> MannKendall(ont.3AMno.ts)
tau = 0.0531,    sl =55.78%
```

```
ont.11PMyes.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  0  1  0  0  2  1  0  1  1  2
1993:  1  0  0  1  0  1  1  0  0  1  0  0
1994:  0  1  2  0  1  1  2  1  1  1  1  0
1995:  0  0  0  0  0  1  1  1  2  1  0  0
1996:  0  0  2  0  0  1  1  0  1  1  2  0
1997:  0  1  0  0  0  0  1  1  0  0  1  0
1998:  1  0  0  0  0  1  0  1  0  0  0  0
```

```
> MannKendall(ont.11PMyes.ts)
tau = -0.153,    sl =8.147%
```

```
> ont.12AMyes.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  1  0  3  3  0  1  0  0  1  2
1993:  0  0  0  0  0  3  1  0  0  0  0  0
1994:  0  2  0  0  1  0  0  1  0  1  1  0
1995:  0  0  0  0  1  1  1  0  2  3  0  1
1996:  0  0  0  1  0  0  1  4  0  0  0  0
1997:  1  0  0  0  0  0  1  0  0  1  1  0
1998:  0  0  0  0  0  0  0  0  1  0  0  0
```

```
> MannKendall(ont.12AMyes.ts)
tau = -0.129,    sl =13.79%
```

```
> ont.1AMyes.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  2  0  1  0  1  0  3  0  0  0
1993:  1  2  1  0  2  0  2  3  1  3  0  0
1994:  0  1  2  0  2  1  1  1  1  0  1  1
1995:  0  0  0  0  0  0  1  2  0  1  0  0
1996:  0  0  1  0  1  0  1  0  2  0  0  0
1997:  1  0  0  1  0  0  0  0  0  0  0  0
1998:  0  0  0  0  1  0  0  0  0  1  1  0
```

```
> MannKendall(ont.1AMyes.ts)
tau = -0.257,    sl =0.2899%
```

```
> ont.2AMyes.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  0  2  0  1  0  0  1  0  0  1
1993:  0  1  0  2  1  1  0  0  0  0  0  0
1994:  0  0  0  4  0  2  2  1  1  2  0  2
1995:  0  1  0  2  1  0  0  1  0  1  1  0
1996:  0  0  0  0  1  0  0  1  0  1  0  0
1997:  0  1  0  0  0  0  0  3  1  0  0  0
1998:  0  0  0  2  0  1  1  0  2  1  0  1
```

```
> MannKendall(ont.2AMyes.ts)
tau = -0.0267,    sl =76.04%
```

```
> ont.3AMyes.ts
  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  1  0  0  0  0  2  0  0  0  2  0  0
1993:  0  0  1  0  1  1  0  1  0  1  3  0
1994:  0  0  0  1  0  0  1  1  0  0  0  0
1995:  0  0  0  0  1  0  0  1  0  0  0  0
1996:  0  0  0  1  0  0  0  2  0  0  0  0
1997:  0  1  2  0  1  2  0  0  2  2  3  0
1998:  1  0  0  0  0  1  0  0  1  0  0  0
```

```
> MannKendall(ont.3AMyes.ts)
tau = 0.0195,    sl =82.67%
```

Figure 6a. Loess Analysis

TIRF, deaths by hour and drink, Ontario.

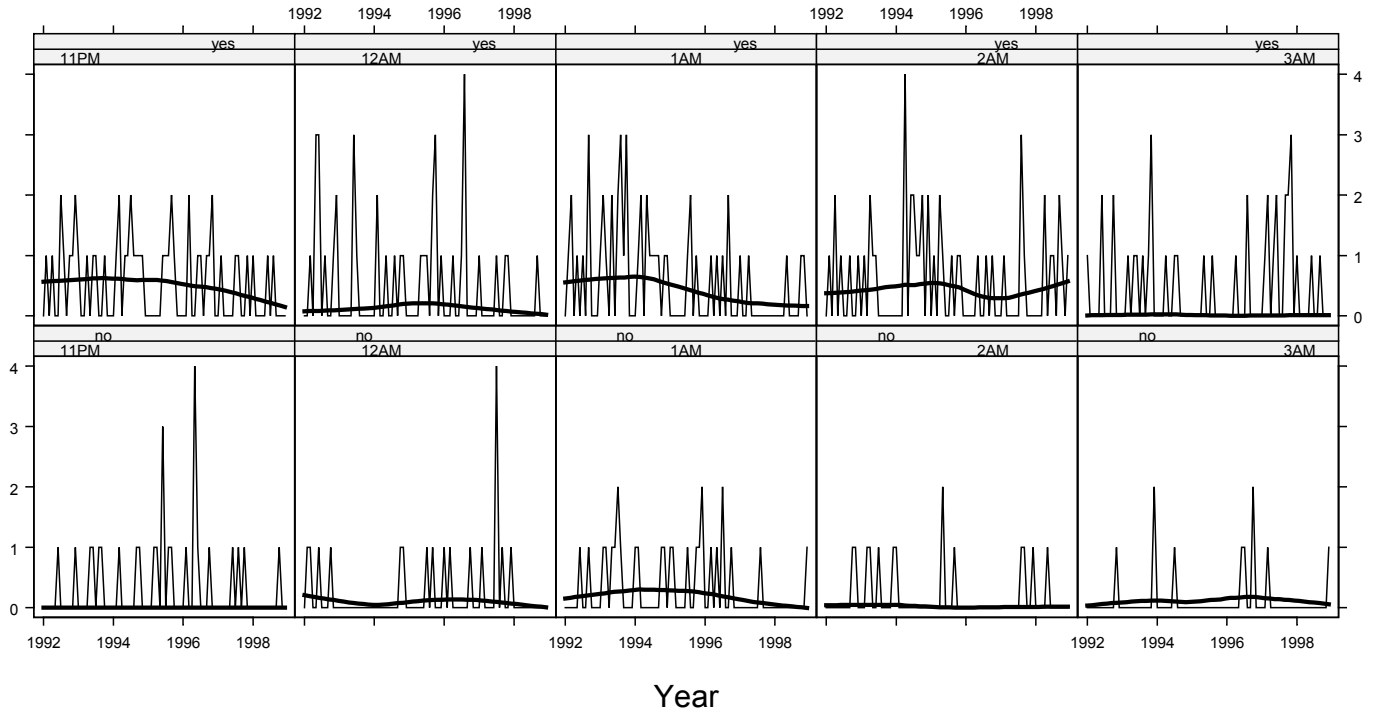
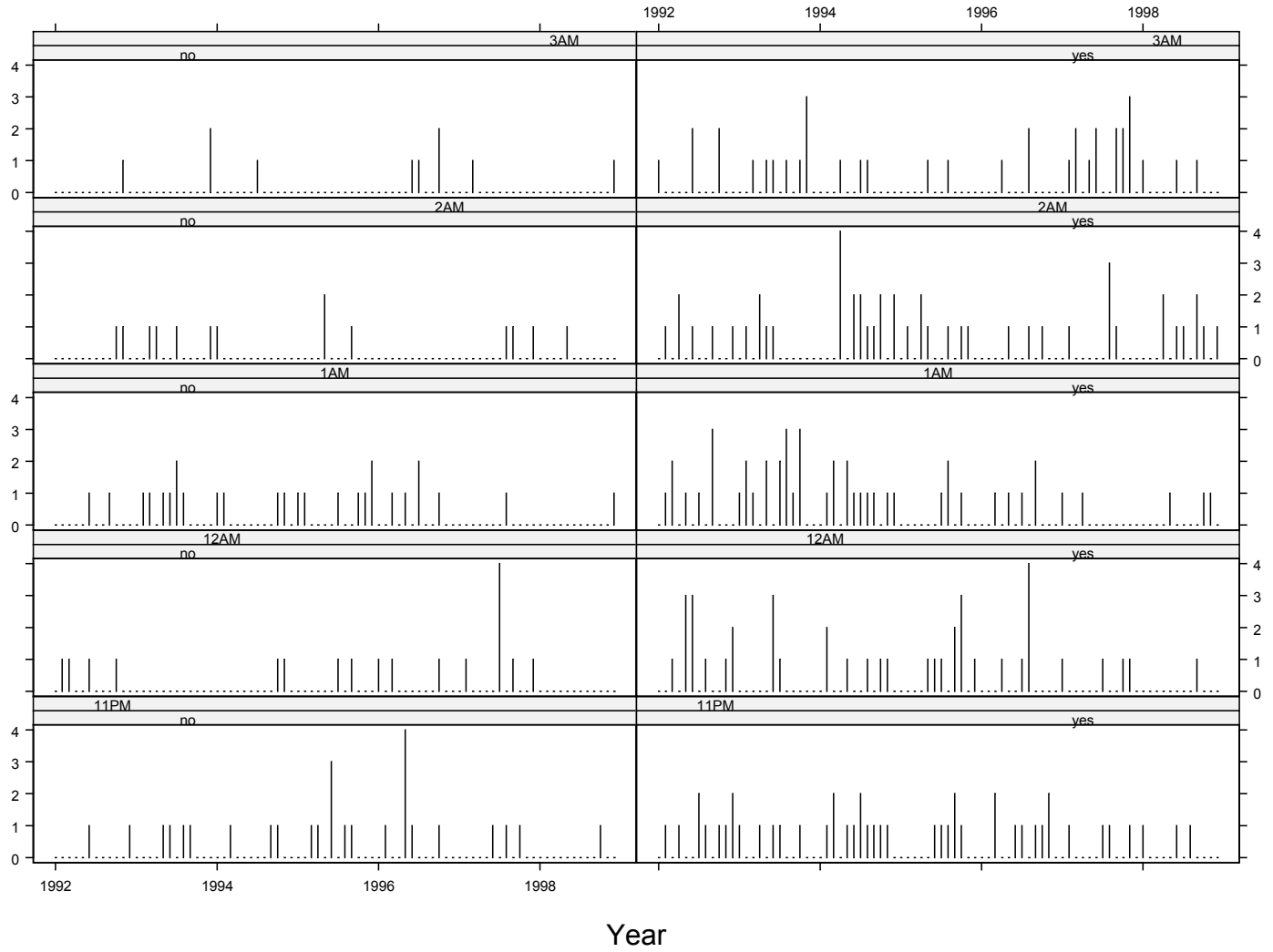


Figure 6b. Line plot of time series

TIRF, deaths by hour and drink, Ontario.



7. Fatalities by drink and wkgrp

```

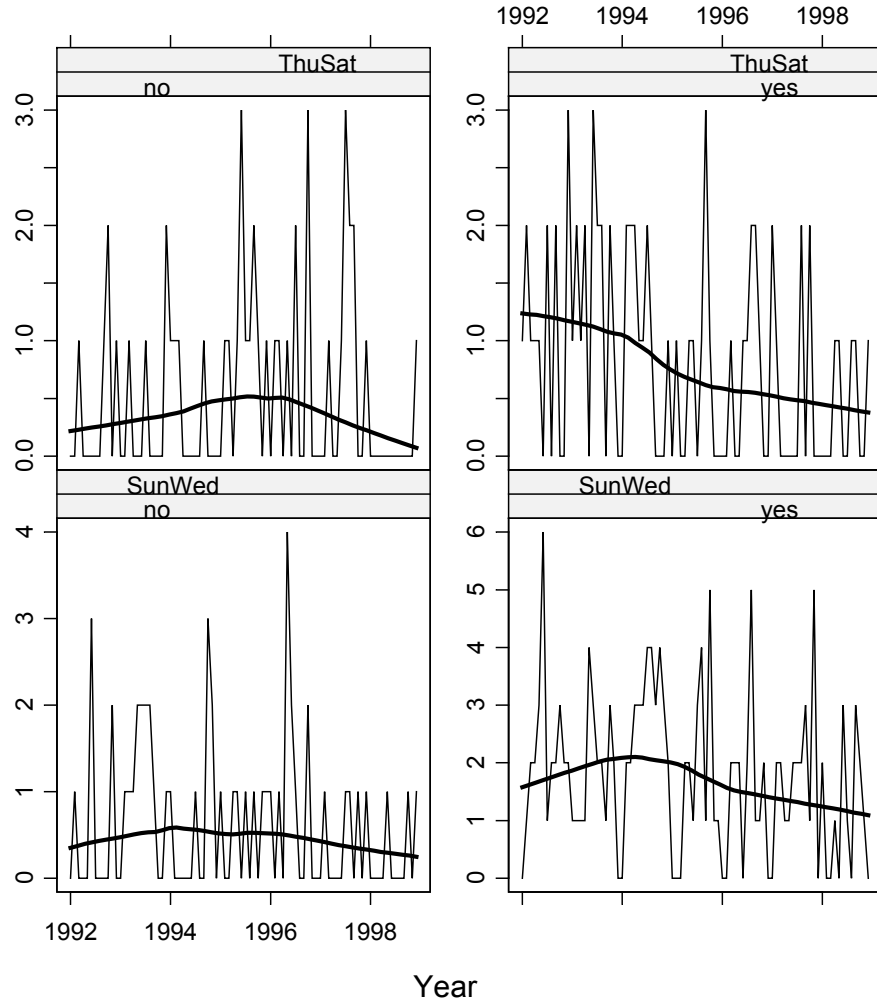
> ont.SunWedno.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  0  0  0  3  0  0  0  0  2  0
1993:  0  1  1  1  2  2  2  2  1  0  0  1
1994:  1  0  0  0  0  0  1  0  0  3  2  0
1995:  1  0  0  1  1  0  1  0  1  0  1  1
1996:  1  0  1  0  4  2  1  0  0  2  0  0
1997:  0  1  0  0  0  0  1  1  0  1  0  1
1998:  0  0  0  0  1  0  0  0  0  1  0  1
> MannKendall(ont.SunWedno.ts)
tau = -0.0886,  sl =30.53%
> ont.ThuSatno.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  1  0  0  0  0  0  1  2  0  1
1993:  0  0  1  0  0  0  1  0  0  0  0  2
1994:  1  1  1  0  0  0  0  0  1  0  0  0
1995:  0  1  1  0  1  3  1  1  2  1  0  1
1996:  0  1  1  0  1  0  2  0  0  3  0  0
1997:  0  0  1  0  0  1  3  2  2  0  0  1
1998:  0  0  0  0  0  0  0  0  0  0  0  1
> MannKendall(ont.ThuSatno.ts)
tau = 0.0129,  sl =88.56%
> ont.lAMno.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  0  0  0  0  1  0  0  1  0  0  0
1993:  0  1  1  0  1  1  2  1  0  0  0  0
1994:  1  1  0  0  0  0  0  0  0  1  1  0
1995:  1  1  0  0  0  0  1  0  0  1  1  2
1996:  0  0  1  0  1  0  2  0  0  1  0  0
1997:  0  0  0  0  0  0  0  1  0  0  0  0
1998:  0  0  0  0  0  0  0  0  0  0  0  1

ont.SunWedyes.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  0  1  2  2  3  6  1  2  2  3  2  2
1993:  1  1  1  1  4  3  2  2  1  3  2  0
1994:  0  2  2  3  3  3  4  4  3  4  3  2
1995:  0  0  0  2  2  1  3  4  1  5  1  1
1996:  0  0  2  2  2  0  2  5  1  1  2  0
1997:  0  2  2  1  1  2  2  2  3  1  5  0
1998:  2  0  0  1  0  3  1  0  3  2  1  0
> MannKendall(ont.SunWedyes.ts)
tau = -0.147,  sl =7.105%
> ont.ThuSatyes.ts
      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1992:  1  2  1  1  1  0  2  0  2  0  0  3
1993:  1  2  1  2  0  3  2  2  0  2  1  0
1994:  0  2  2  2  1  1  2  1  0  0  0  1
1995:  0  1  0  0  1  1  0  1  3  1  0  0
1996:  0  0  1  0  0  1  1  2  2  1  0  0
1997:  2  1  0  0  0  0  0  2  0  2  0  0
1998:  0  0  0  1  1  0  0  1  1  0  0  1
> MannKendall(ont.ThuSatyes.ts)
tau = -0.239,  sl =0.4885%

```


Figure 7. The comparisons between driving with drink and without drink within drink factor, and between ThuSat and SunWed within wkgrp factor are shown in Fig 3. There are more fatalities with drink=yes and there are more accidents in SunWed. In Ontario, both SunWed and ThuSat have a downward trend.

TIRF deaths by WKGRP and Drink, Ontario, panels scaled independently.



8. Annual Time Series

Table 8a. Annual fatalities, Ontario and Manitoba. There are 347 deaths in Ontario and 53 in Manitoba. The death rate for Total in Ontario has declined from 57 to 24 which represents an average annual rate of decrease of about 13%.

```
> tirf.annual.ont
      Total PM11 AM12 AM1 AM2 AM3 SunWed ThuSat
1992    57   12   18  11  10   6    36   21
1993    61   10    7  24  10  10    39   22
1994    56   14    8  15  15   4    40   16
1995    50   14   11  12  10   3    29   21
1996    46   15    9  12   3   7    28   18
1997    53   11   13   4   9  16    32   21
1998    24    4    2   5   9   4    18    6
> MannKendallMatrix(tirf.annual.ont)
      Total  PM11  AM12  AM1  AM2  AM3  SunWed  ThuSat
tau -0.71  -0.10  -0.14  -0.49  -0.48   0  -0.52  -0.41
sl%  3.55  87.93  76.39  17.16  20.40 100  13.31  27.23
```

```
tirf.annual.man
      Total PM11 AM12 AM1 AM2 AM3 SunWed ThuSat
1992     5    0    1   1   0   3     4    1
1993     9    2    0   5   1   1     5    4
1994    10    6    3   0   1   0     7    3
1995     5    1    2   1   0   1     4    1
1996     8    2    1   2   1   2     7    1
1997    12    6    0   2   3   1     9    3
1998     4    0    2   0   1   1     4    0
> MannKendallMatrix(tirf.annual.man)
      Total  PM11  AM12  AM1  AM2  AM3  SunWed  ThuSat
tau     0  0.10    0  -0.10  0.47  -0.17   0.26  -0.37
sl%    100 87.64  100  87.64 23.45  73.77  52.54  34.08
```

Annual rate of decline in Total fatalities in Ontario

```
> 1-(24/57)^(1/6)
[1] 0.1342562
```

Tables 8b(i)-(iv). Annual total fatalities are decomposed by hour, wkgrp and drink for Ontario and Manitoba. Table 8b might suggest that there has been a shift in fatalities from early evening to late evening starting around 1996. The Mann-Kendall trend test is statistically significant on a two-sided test for Ontario fatalities with drink=yes for Total, 11PM, 1AM, SunWed and ThuSat and in all cases the sign of tau indicates a downward trend. The trend test is not significant for drink=no in Ontario. There are no trends in Manitoba for either drink=yes or drink=no.

Table 8b(i). Annual Fatalities, Ontario, drink=no

```
> tirf.drink.no.annual.ont[,-1]
      Total PM11 AM12 AM1 AM2 AM3 SunWed ThuSat
1992     11    2    4    2    2    1     6     5
1993     17    4    0    7    4    2    13     4
1994     11    3    2    4    1    1     7     4
1995     19    7    2    7    3    0     7    12
1996     19    7    3    5    0    4    11     8
1997     15    3    7    1    3    1     5    10
1998     4    1    0    1    1    1     3     1
> MannKendallAnnual(tirf.drink.no.annual.ont[,-1])
      Total      PM11      AM12      AM1      AM2      AM3      SunWed ThuSat
tau -0.05006262 -0.05006262 0.05006262 -0.3504383 -0.2503131 -0.05634362 -0.3903600    0
sl  1.00000000  1.00000000 1.00000000  0.3564410  0.5387009  1.00000000  0.2876112    1
```

Table 8b(ii). Annual Fatalities, Ontario, drink=yes

```
> tirf.drink.yes.annual.ont[,-1]
      Total PM11 AM12 AM1 AM2 AM3 SunWed ThuSat
1992     39    9   11    8    6    5    26    13
1993     37    5    4   15    5    8    21    16
1994     45   11    6   11   14    3    33    12
1995     28    6    9    4    7    2    20    8
1996     25    8    6    5    3    3    17    8
1997     28    4    4    2    5   13    21    7
1998     18    3    1    3    8    3    13    5
> MannKendallAnnual(tirf.drink.yes.annual.ont[,-1])
      Total      PM11      AM12      AM1 AM2      AM3      SunWed      ThuSat
tau -0.6831300 -0.52380949 -0.5506887 -0.61904758 0 -0.1028689 -0.58554000 -0.878310025
sl  0.0482861  0.06904757 0.1243064  0.03015876 1 0.8753926  0.09471773  0.009809151
```

Table 8b(iii). Annual Fatalities, Manitoba, drink=no

```
> tirf.drink.no.annual.man[,-1]
      Total PM11 AM12 AM1 AM2 AM3 SunWed ThuSat
1992     1     0     0     1     0     0     0     1
1993     1     0     0     0     1     0     0     1
1994     2     2     0     0     0     0     2     0
1995     1     0     1     0     0     0     0     1
1996     3     1     1     1     0     0     3     0
1997     4     1     0     1     1     1     4     0
1998     0     0     0     0     0     0     0     0
> MannKendallAnnual(tirf.drink.no.annual.man[,-1])
      Total      PM11      AM12 AM1 AM2      AM3      SunWed      ThuSat
tau 0.2057378 0.1166424 0.1380131  0  0 0.3563483 0.3944053 -0.6299408
sl  0.6380424 0.8651347 0.8464506  1  1 0.4532547 0.3150597  0.1116118
```

Table 8b(iv). Annual Fatalities, Manitoba, drink=yes

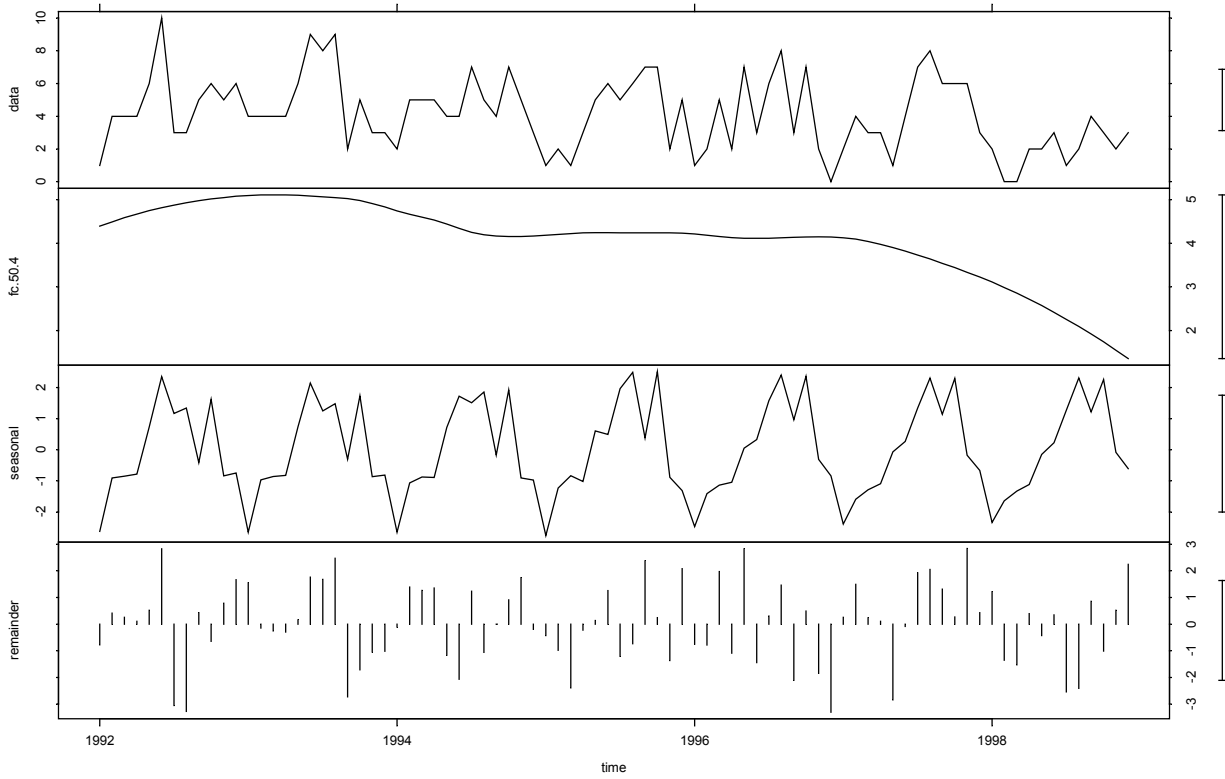
```
> tirf.drink.yes.annual.man[,-1]
      Total PM11 AM12 AM1 AM2 AM3 SunWed ThuSat
1992     4     0     1     0     0     3     4     0
1993     8     2     0     5     0     1     5     3
1994     8     4     3     0     1     0     5     3
1995     4     1     1     1     0     1     4     0
1996     5     1     0     1     1     2     4     1
1997     8     5     0     1     2     0     5     3
1998     4     0     2     0     1     1     4     0
> MannKendallAnnual(tirf.drink.yes.annual.man[,-1])
      Total      PM11      AM12      AM1      AM2      AM3      SunWed      ThuSat
tau -0.05634362 0.05006262 -0.05292561 -0.05634362 0.6197798 -0.2646281 -0.1259882 -0.05634362
sl  1.00000000 1.00000000  1.00000000  1.00000000 0.1001784  0.5253584  0.8596838  1.00000000
```

9. STL Analysis

R-sq = 53.9 %

Figure 9a.

STL TIRF deaths, Ontario



ss.window = 7 , ss.robust = TRUE , fc.window = 50.4 , fc.degree = 2

Figure 9b. Monthplot of Seasonal Component. May through October are high and November through April are relatively lower. Upward trends exist in August and September and to a lesser extent in January and November.

Monthplot, seasonal, TIRF deaths Ontario

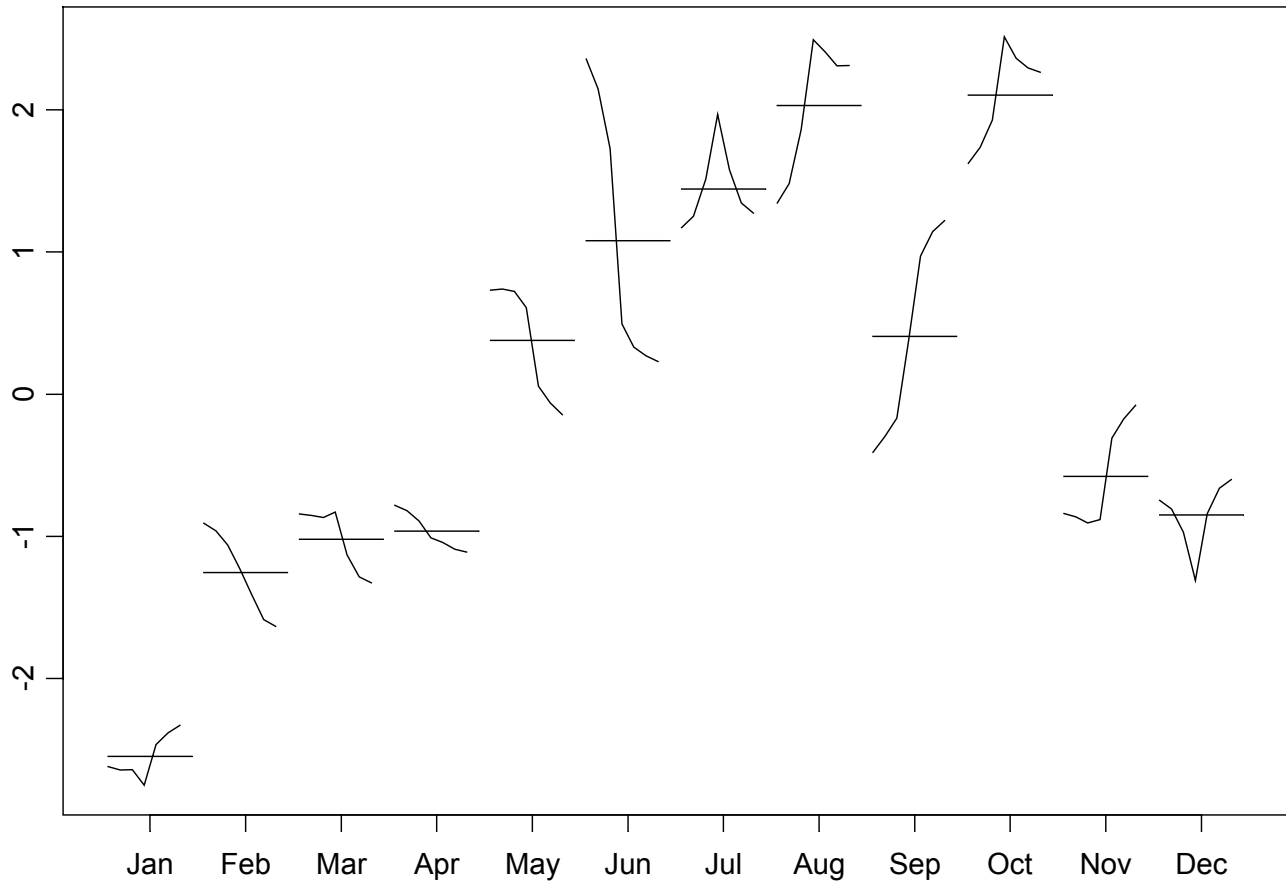


Figure 9c. Loess trend analysis of deseasonalized TIRF.

$\tau = -0.28$, $s1 = 0.01655\%$

The loess trend line has decreased from a monthly death-rate of 4.32 in January 1992 to 1.78 in December 1998. This corresponds to an annual rate of decrease of 12%.

```
> pc.change(tirf.deseasonalized.ts)
[1] 5.117620 2.086254 59.233909
> 1-(2.086254/5.117620)^(1/7)
[1] 0.1203124
```

