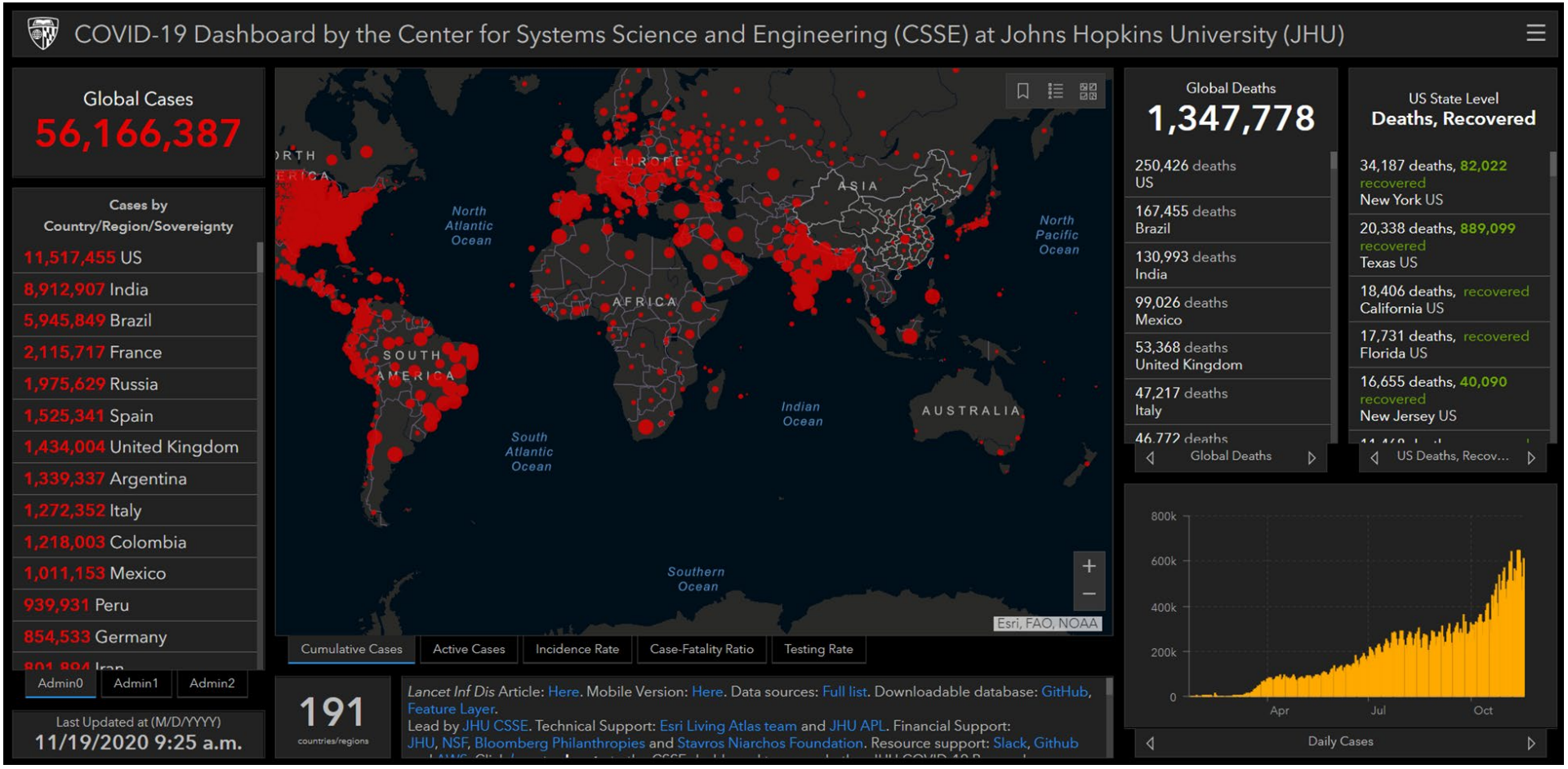
Time series forecasting of COVID19 in Australia using Dynamic Regression model

Eddie Akao, Associate Professor Cecilia Xia and Professor Victor Carlo
Curtin University

FOSS4G SotM Oceania

20 November 2020

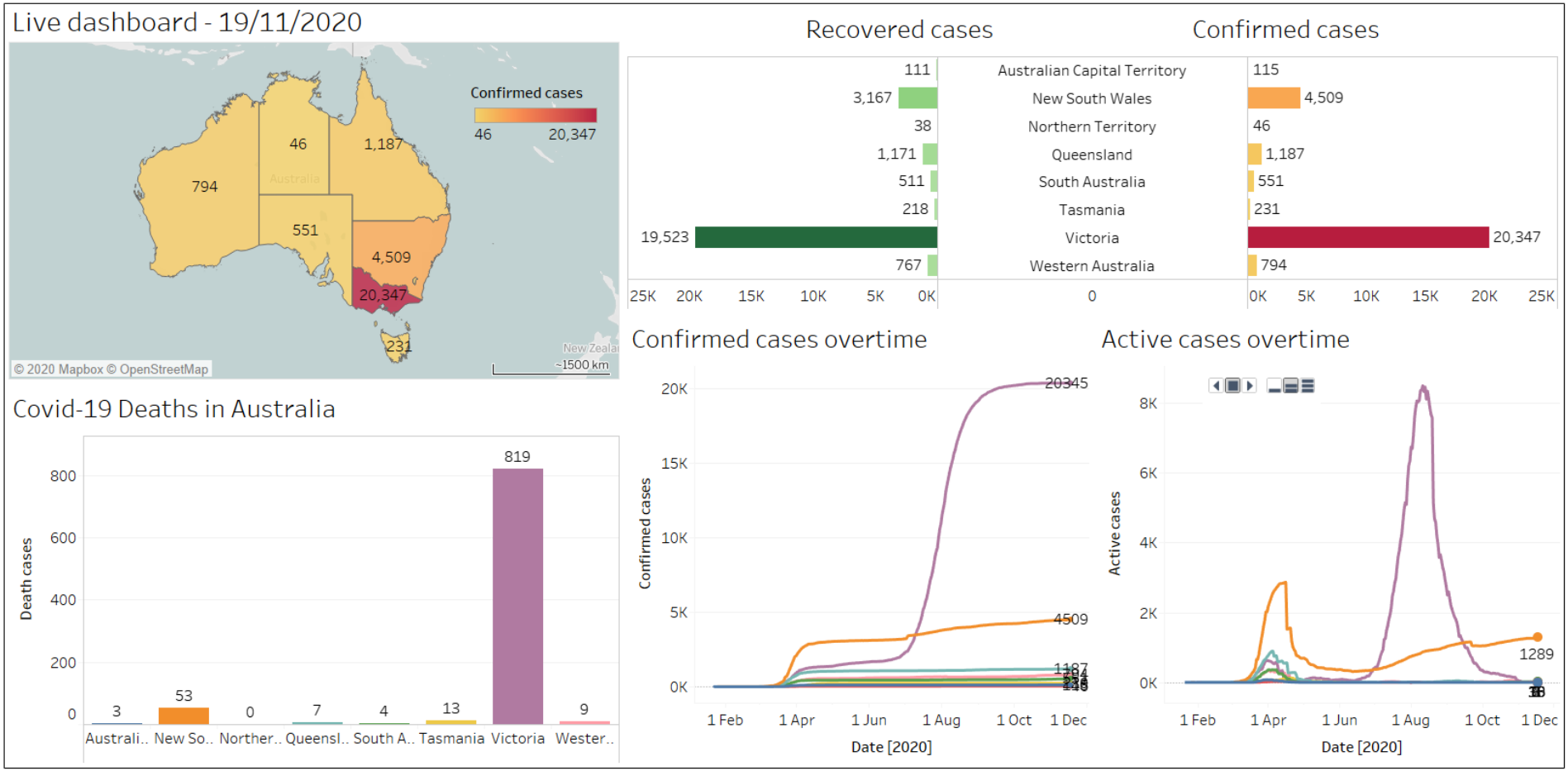
Motivation



(Data source: CSSE, JHU)

Curtin University

Motivation



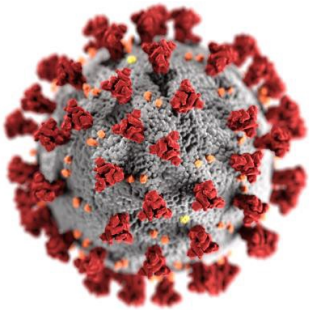
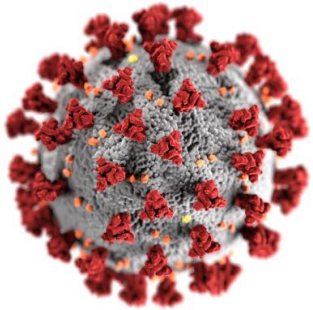
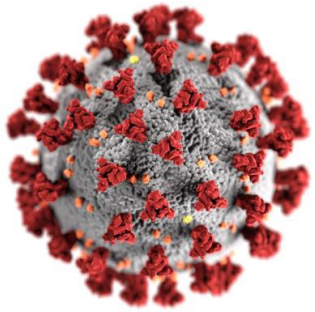
Link: https://public.tableau.com/profile/eddie.philemon#!/vizhome/AustraliaCovid-19sample/Coronaviruspandemicoutbreak?publish=yes

(Data source: CSSE, JHU)

Curtin University

Aim and Objectives

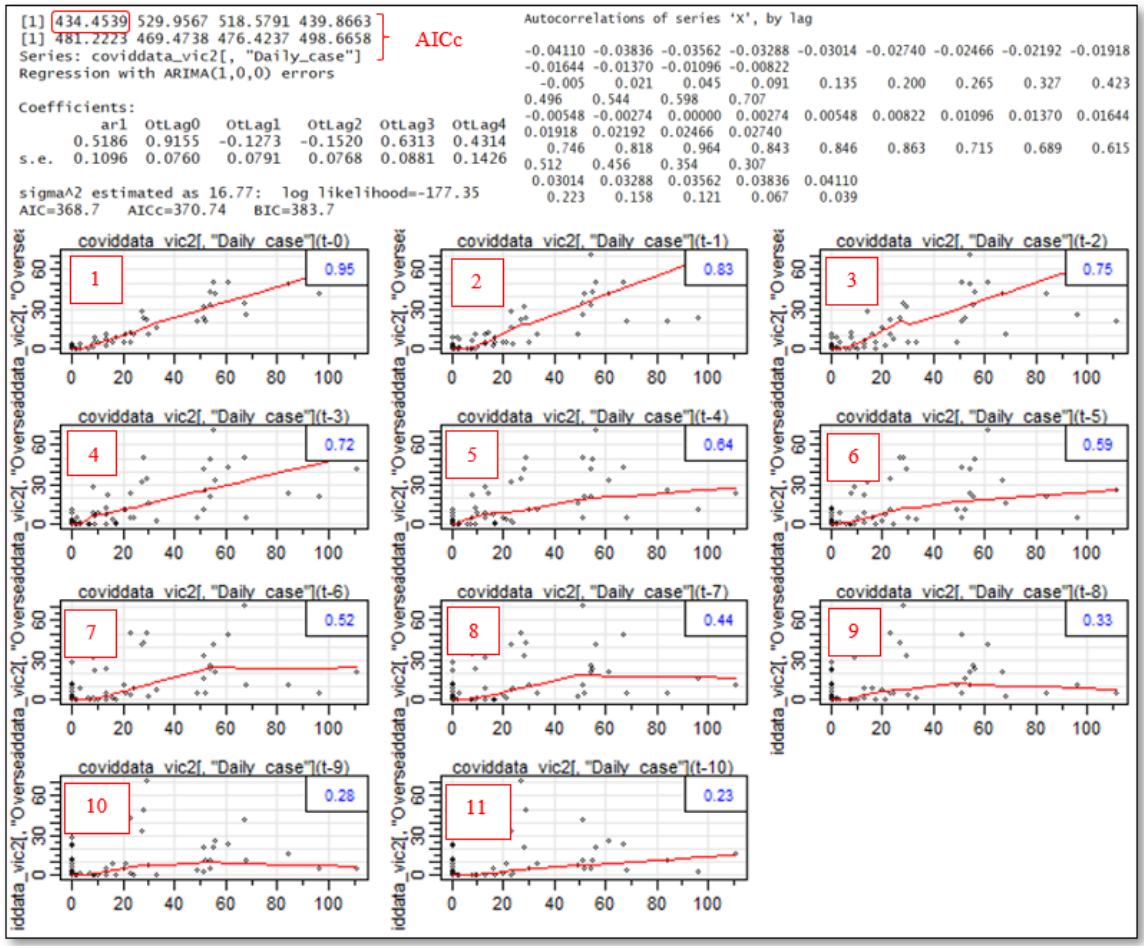
- Provide 2 weeks forecast of COVID19 in Australia.
- Delineate lag effects of factors impacting on daily cases.

Methods

- DATA – Johns Hopkins University, Department of Health, Australian Bureau of Statistics
- Data processing – Python, Tableau public
- Exploratory Data Analysis – Python, Tableau public
- Confirmatory Data Analysis – R, Rstudio

Results -- Victoria First Wave



Distributed Lag effect

DV: Daily cases
IDV: Overseas Transmission

1 lagged predictor: overseas transmission only in the current day

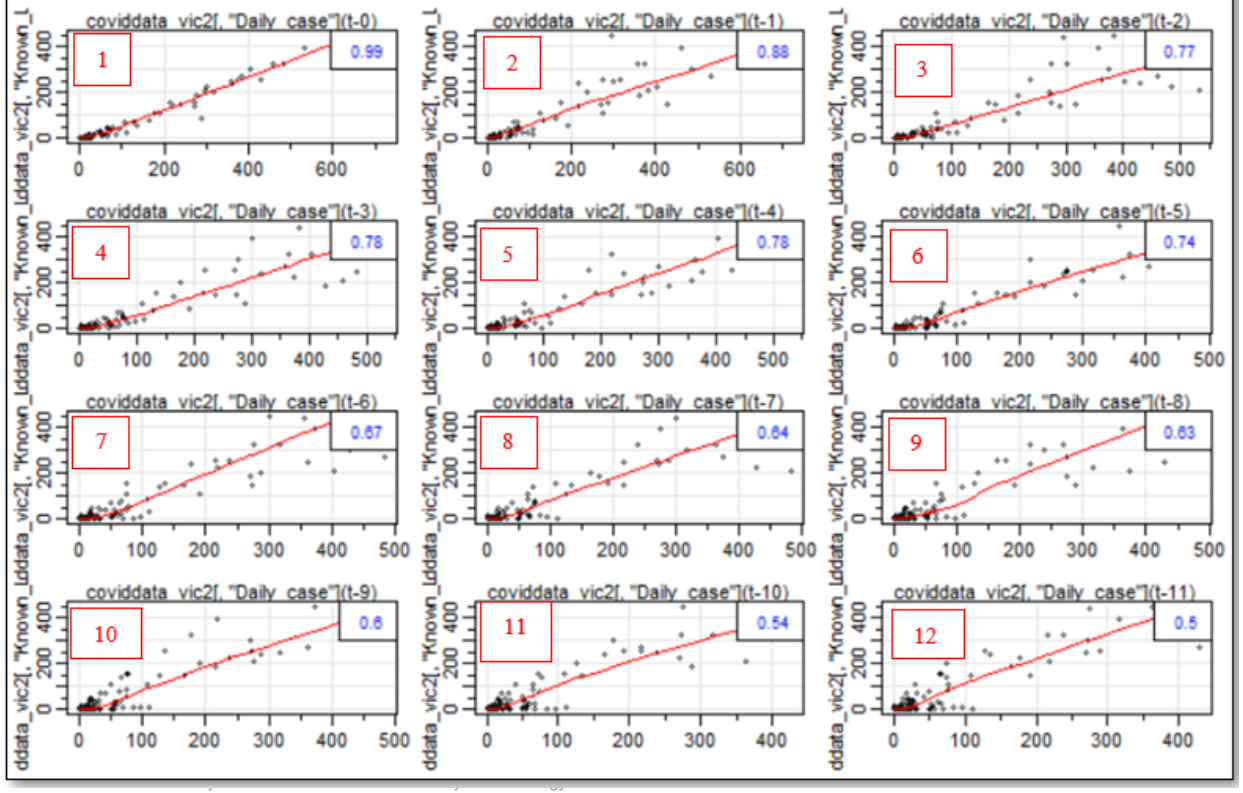
Curtin University

Results -- Victoria Second Wave

```
[1] 1584.047 1999.921 1997.402 1919.561
[1] 1918.156 1884.304 1965.490 1978.601
[1] 1895.820 1942.229 1854.299 1862.954
Series: Daily_case
Regression with ARIMA(1,0,0) errors

Coefficients:
         ar1   OtLag0  OtLag1  OtLag2  OtLag3  OtLag4
      0.9652  -0.0224  0.0239  0.0527  0.0812  0.1584
s.e.  0.0171   0.0496  0.0640  0.0912  0.0951  0.0970

sigma^2 estimated as 120.8:  log likelihood=-679.6
AIC=1387.21   AICc=1389.78   BIC=1431.75
```

AICc

```
Autocorrelations of series 'X', by lag

-0.05205 -0.04932 -0.04658 -0.04384 -0.04110 -0.03836 -0.03562 -0.03288 -0.03014
-0.02740 -0.02466 -0.02192 -0.01918
   0.245    0.263    0.297    0.332    0.368    0.421    0.438    0.466    0.504
0.544    0.598    0.631    0.639
-0.01644 -0.01370 -0.01096 -0.00822 -0.00548 -0.00274  0.00000  0.00274  0.00548
0.00822  0.01096  0.01370  0.01644
   0.667    0.736    0.779    0.783    0.774    0.877    0.988    0.859    0.766
0.788    0.767    0.706    0.637
 0.01918  0.02192  0.02466  0.02740  0.03014  0.03288  0.03562  0.03836  0.04110
0.04384  0.04658  0.04932  0.05205
   0.600    0.593    0.541    0.489    0.445    0.398    0.370    0.354    0.309
0.267    0.228    0.203    0.198
```

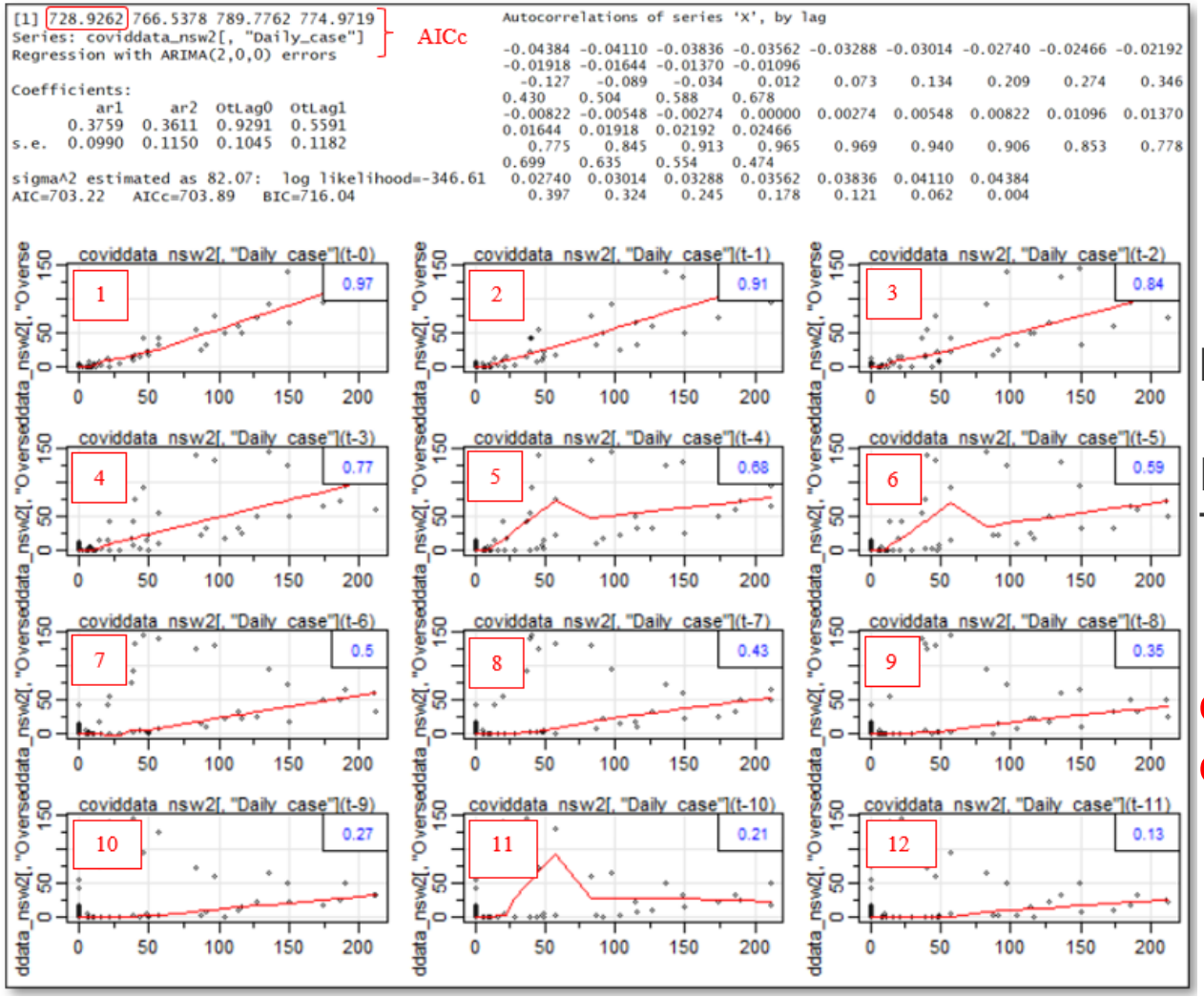


Distributed Lag effect

DV: Daily cases
IDV: Known Local Transmission

1 lagged predictor: Known Local Transmission only in the current day

Results -- New South Wales



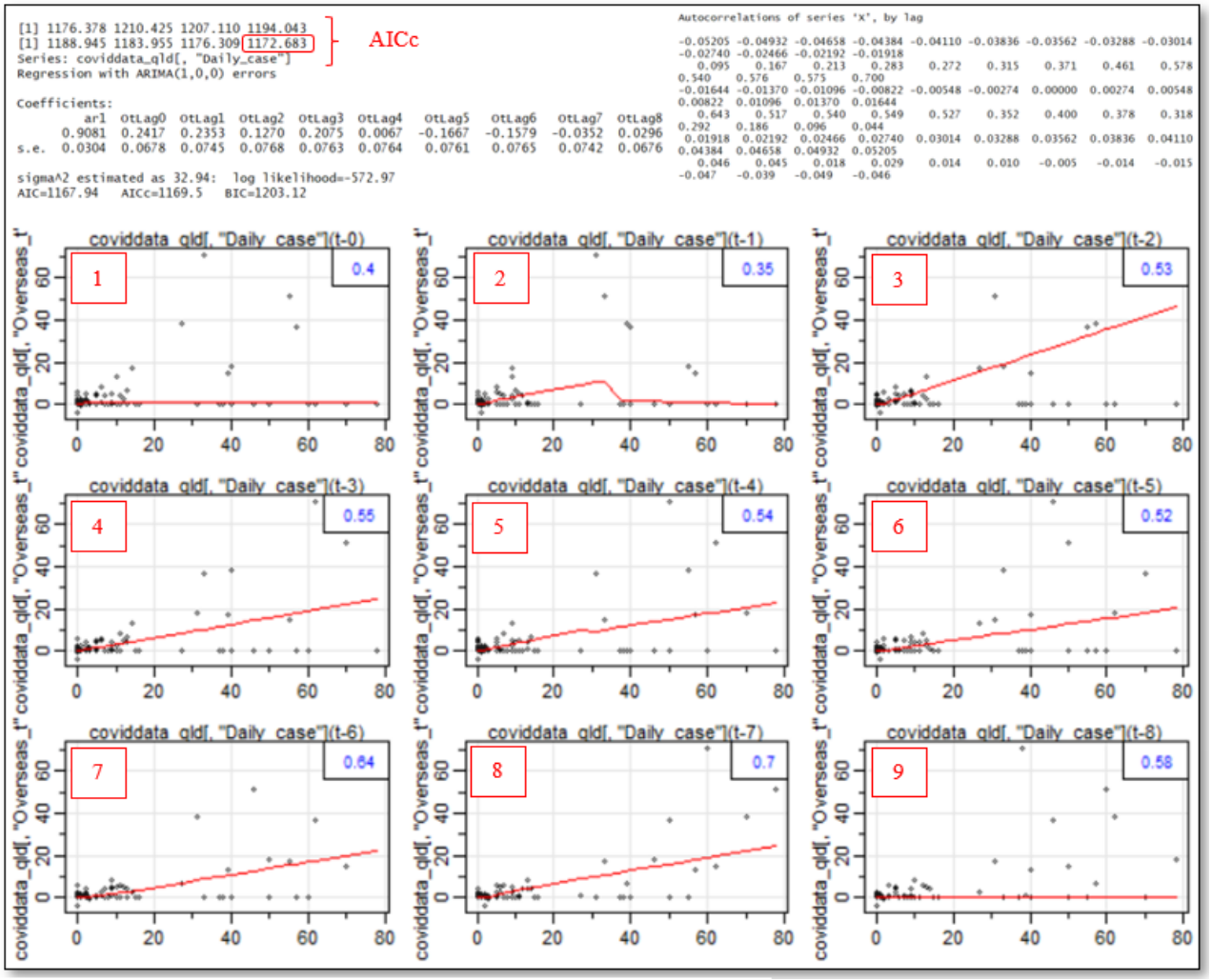
Distributed Lag effect

DV: Daily cases

IDV: Overseas Transmission

1 lagged predictor: overseas transmission only in the current day

Results -- Queensland



Distributed Lag effect

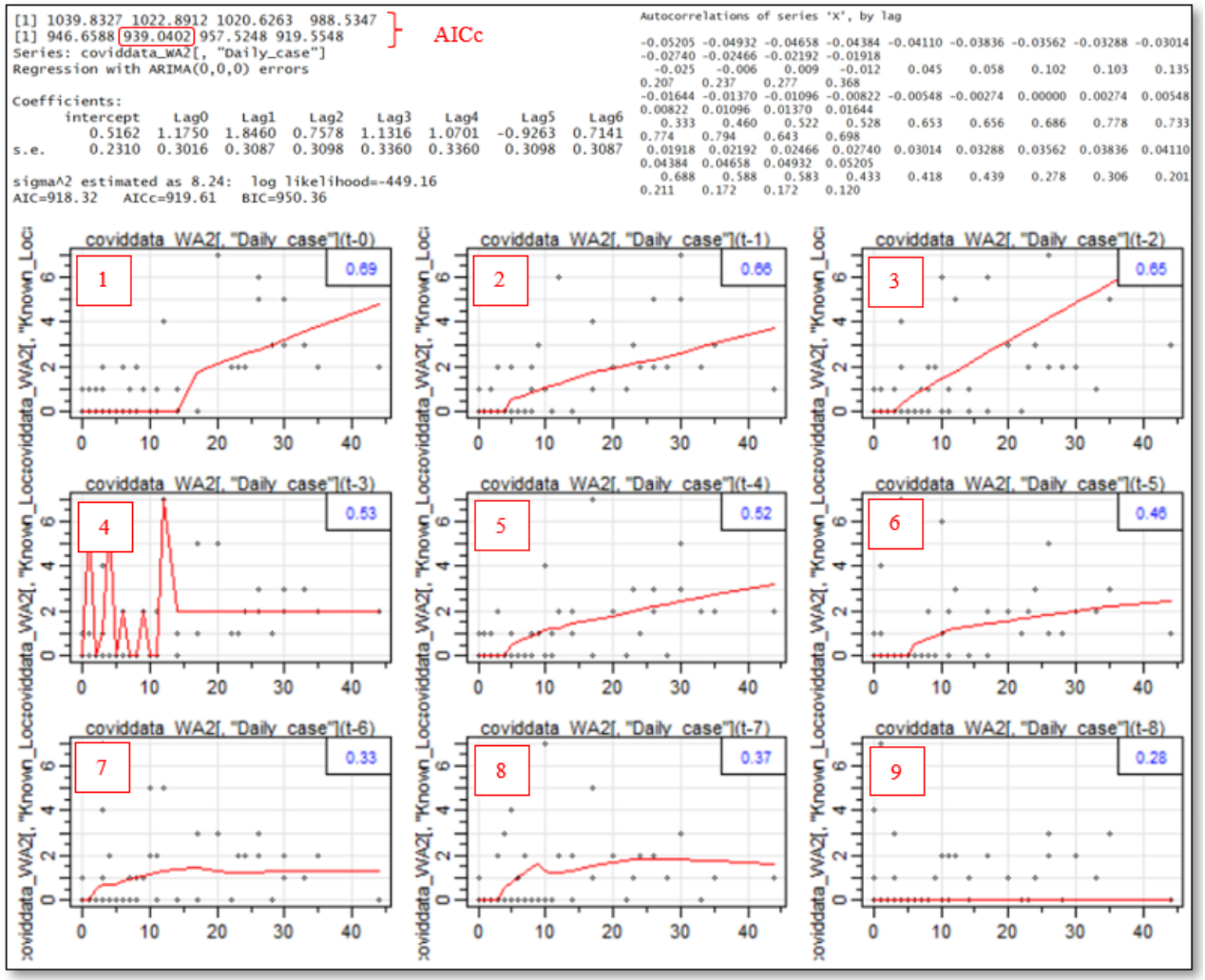
DV: Daily cases

IDV: Overseas Transmission

8 lagged predictor: overseas transmission only in the current day, previous day, …, previous 7th day.

Curtin University

Results – Western Australia



Distributed Lag effect

DV: Daily cases

IDV: Known Local Transmission

6 lagged predictor: Known Local Transmission only in the current day, previous day, …, previous 5th day.

Discussion and Conclusions

- Known Local Transmission, Overseas arrival and Overseas transmission contributed causing second spike in Victoria and NSW.
- Lag model proved to be good predictors to understand the lag effect of factors causing COVID-9 spread.
- The early emergency lockdown and strict COVID19 restrictions in place prior to the outbreak in Western Australia were proved to be effective in preventing COVID-19 spread.

QUESTIONS?