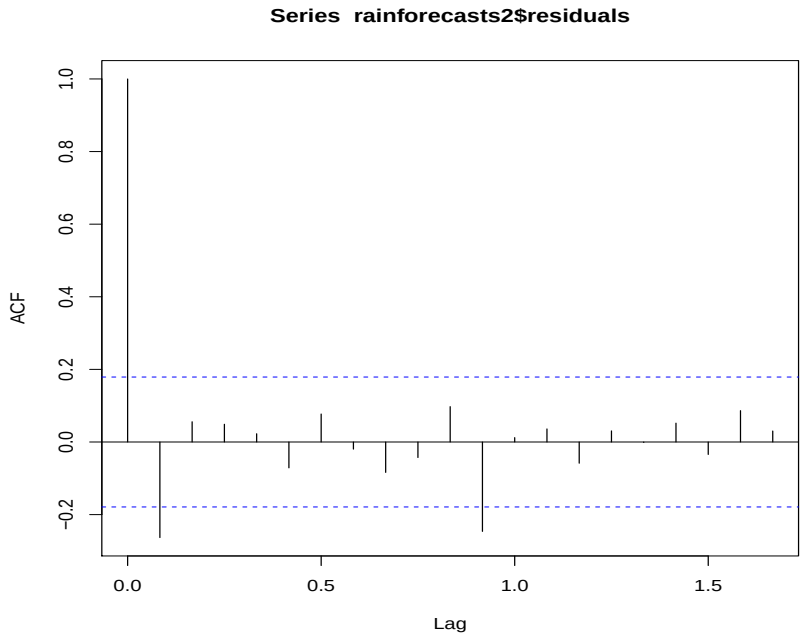

Figure 4.9: `acf()` output.

Here the correlogram shows that the sample autocorrelation for the in-sample forecast errors at lags 1 and 11 exceed the significance bounds. This is more than the 1 than the one in 20 of the autocorrelations for the first twenty lags to exceed the 95% significance bounds by chance alone indicating possible auto-correlation in internal errors.

```
Box.test(rainforecasts2$residuals, lag = 20, type = "Ljung-Box")
```

```
        Box-Ljung test

data:  rainforecasts2$residuals
X-squared = 23.91, df = 20, p-value = 0.2465
```

```
plot.ts(rainforecasts2$residuals)
```

The Ljung-Box test, with p-value of 0.2465 on the other hand shows no evidence of non-zero autocorrelations in the in-sample forecast errors at lags 1-20.

To be sure that the predictive model cannot be improved upon, the researchers checked whether the forecast errors are normally distributed with mean zero and constant variance. To check whether the forecast errors have constant variance, the researchers made a time plot of the in-sample forecast errors: