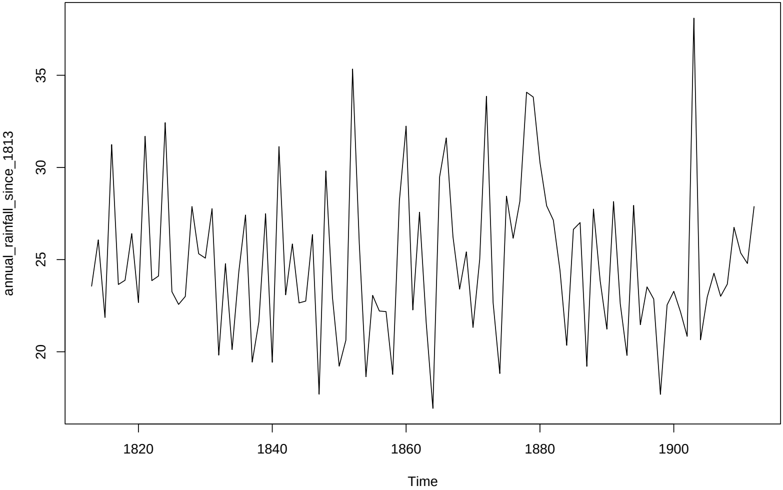
Exponential Smoothing Forecasting

Forecasting with Exponential Smoothing

- Single ES: constant level (no trend) and no seasonality
- Holt's Exponential Smoothing (Using double ES): increasing or decreasing trend and no seasonality.
- Holt-Winters Exponential Smoothing (Using triple ES): increasing or decreasing trend and seasonality. Holt and Winter

Forecasting with Single Exponential Smoothing



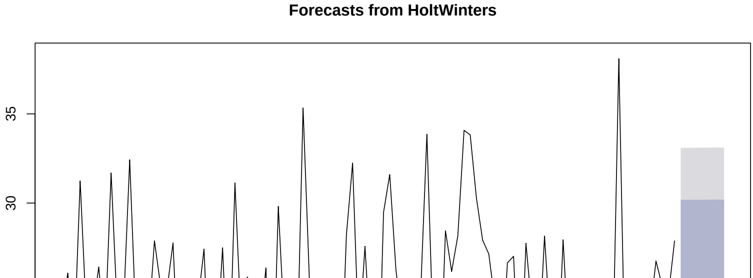
Making Forecast

```
Holt-Winters exponential smoothing without trend and withou

Call:
HoltWinters(x = ts1, beta = FALSE, gamma = FALSE)

Smoothing parameters:
 alpha: 0.02412151
 beta : FALSE
 gamma: FALSE

Coefficients:
      [,1]
a 24.67819
```

```
Time Series:
Start = 1814
End = 1912
Frequency = 1
         xhat    level
1814 23.56000 23.56000
1815 23.62054 23.62054
1816 23.57808 23.57808
1817 23.76290 23.76290
1818 23.76017 23.76017
1819 23.76306 23.76306
1820 23.82691 23.82691
1821 23.79900 23.79900
1822 23.98935 23.98935
1823 23.98623 23.98623
1824 23.98921 23.98921
1825 24.19282 24.19282
1826 24.17032 24.17032
1827 24.13171 24.13171
1828 24.10442 24.10442
```

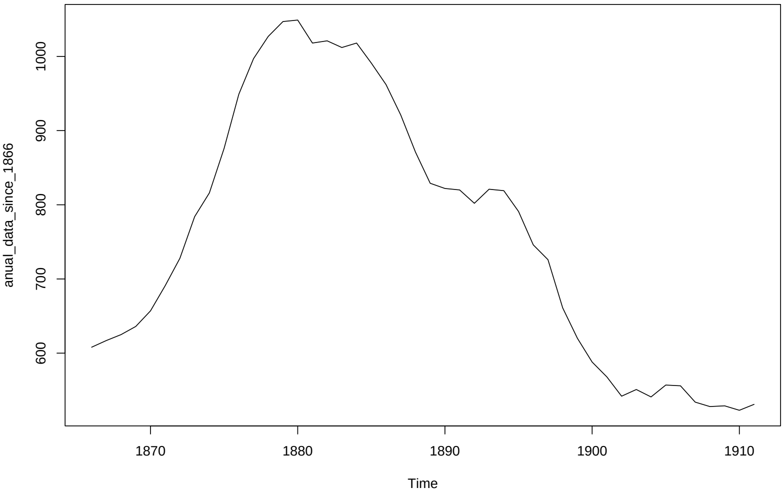
Forecasting

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
1913	24.67819	19.17493	30.18145	16.26169	33.09470
1914	24.67819	19.17333	30.18305	16.25924	33.09715
1915	24.67819	19.17173	30.18465	16.25679	33.09960
1916	24.67819	19.17013	30.18625	16.25434	33.10204
1917	24.67819	19.16853	30.18785	16.25190	33.10449
1918	24.67819	19.16694	30.18945	16.24945	33.10694
1919	24.67819	19.16534	30.19105	16.24701	33.10938
1920	24.67819	19.16374	30.19265	16.24456	33.11182

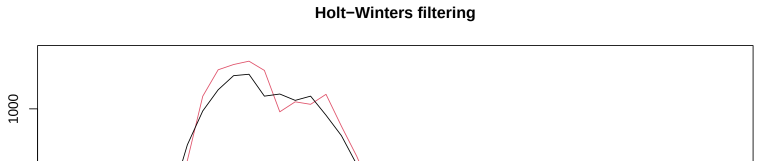


Holt's Exponential Smoothing

- Increasing or decreasing trend and no seasonality

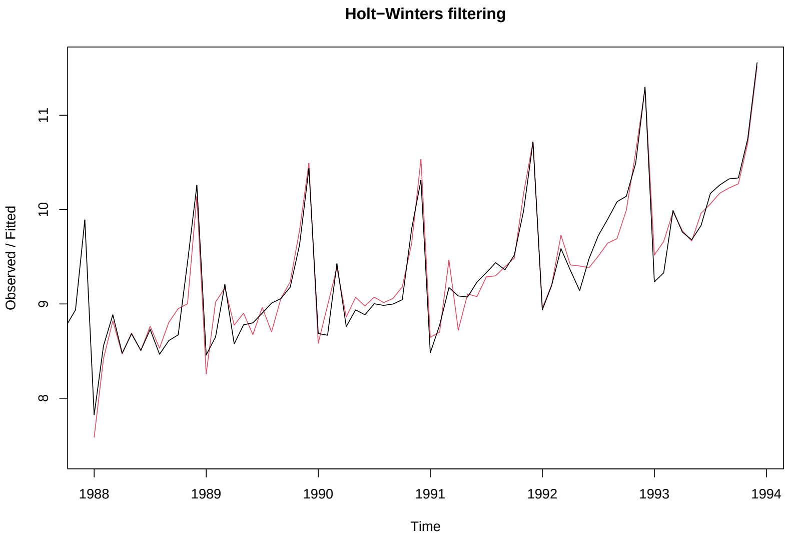


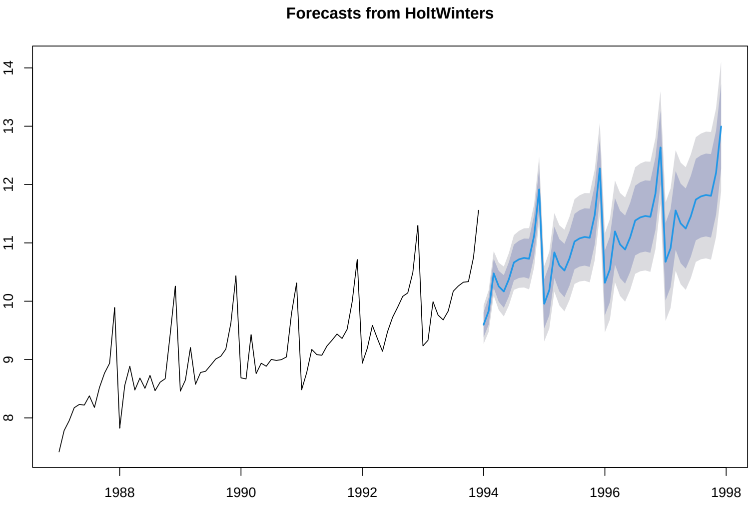
```
Holt-Winters exponential smoothing with trend and without s

Call:
HoltWinters(x = ts2, gamma = FALSE)

Smoothing parameters:
 alpha: 0.8383481
 beta : 1
 gamma: FALSE

Coefficients:
        [,1]
a 529.308585
b   5.690464
```

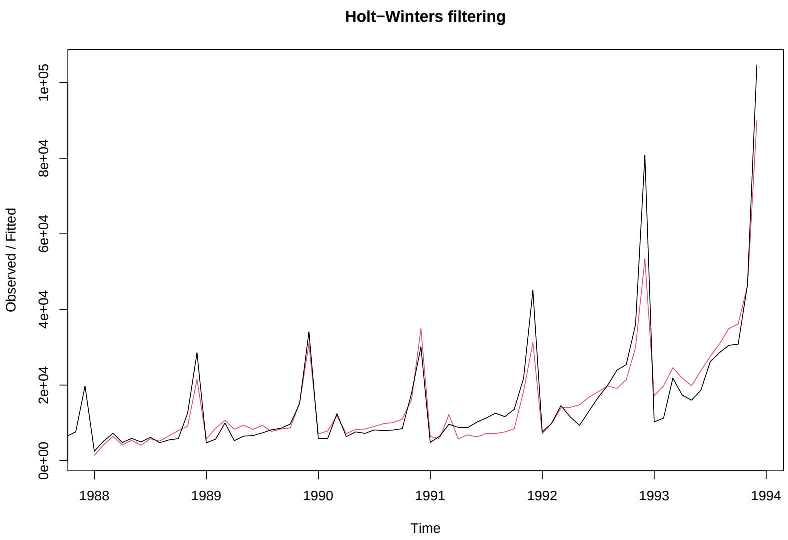


Holt-Winters Exponential Smoothing

- increasing or decreasing trend and seasonality




Forecasts from HoltWinters
14
13
12
11
10
9
8
1988
1990
1992
1994
1996
1998


Holt−Winters filtering
Observed / Fitted
0e+00
2e+04
4e+04
6e+04
8e+04
1e+05
1988
1989
1990
1991
1992
1993
1994
Time


Forecasts from HoltWinters

- The parameters alpha, beta and gamma all have values between 0 and 1.
- Values that are close to 0 mean that relatively little weight is placed on the most recent observations (the weights are spread out for the past observations) when making forecasts of future values.
- Alpha estimates the level
- Beta estimate the slopes of the trend component
- Gamma estimate the slope of the seasonal component