Forecasting

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Séries Temporais

```
#install.packages("TTR")
#install.packages("forecast")
library("TTR")
library("forecast")
```

```
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```

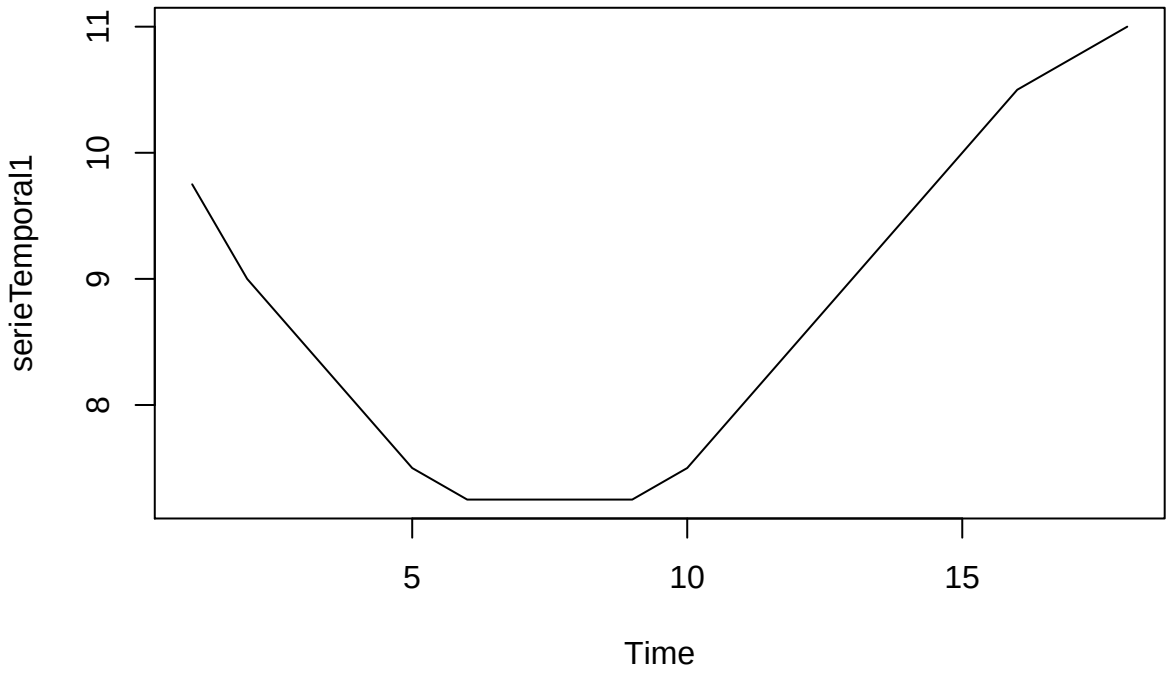
```
serie1 <- scan("./dados/hw1.csv", dec = ",")
serie1
```

```
##  [1]  9.75  9.00  8.50  8.00  7.50  7.25  7.25  7.25  7.25  7.50  8.00  8.50
## [13]  9.00  9.50 10.00 10.50 10.75 11.00
```

```
serieTemporal1 <- ts(serie1)
serieTemporal1
```

```
## Time Series:
## Start = 1
## End = 18
## Frequency = 1
##  [1]  9.75  9.00  8.50  8.00  7.50  7.25  7.25  7.25  7.25  7.50  8.00  8.50
## [13]  9.00  9.50 10.00 10.50 10.75 11.00
```

```
plot.ts(serieTemporal1)
```



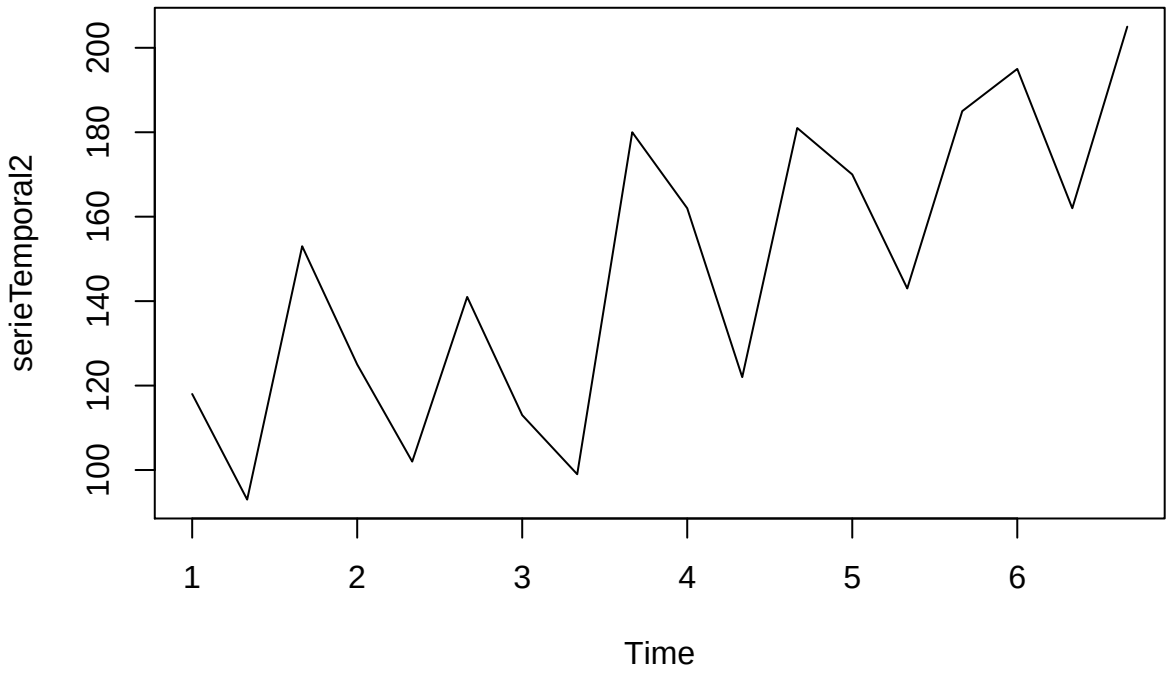

```
serie2 <- scan("./dados/hw2.txt", dec = ",")
serie2
```

```
##  [1] 118  93 153 125 102 141 113  99 180 162 122 181 170 143 185 195 162 205
```

```
serieTemporal2 <- ts(serie2, frequency = 3)
serieTemporal2
```

```
## Time Series:
## Start = c(1, 1)
## End = c(6, 3)
## Frequency = 3
##  [1] 118  93 153 125 102 141 113  99 180 162 122 181 170 143 185 195 162 205
```

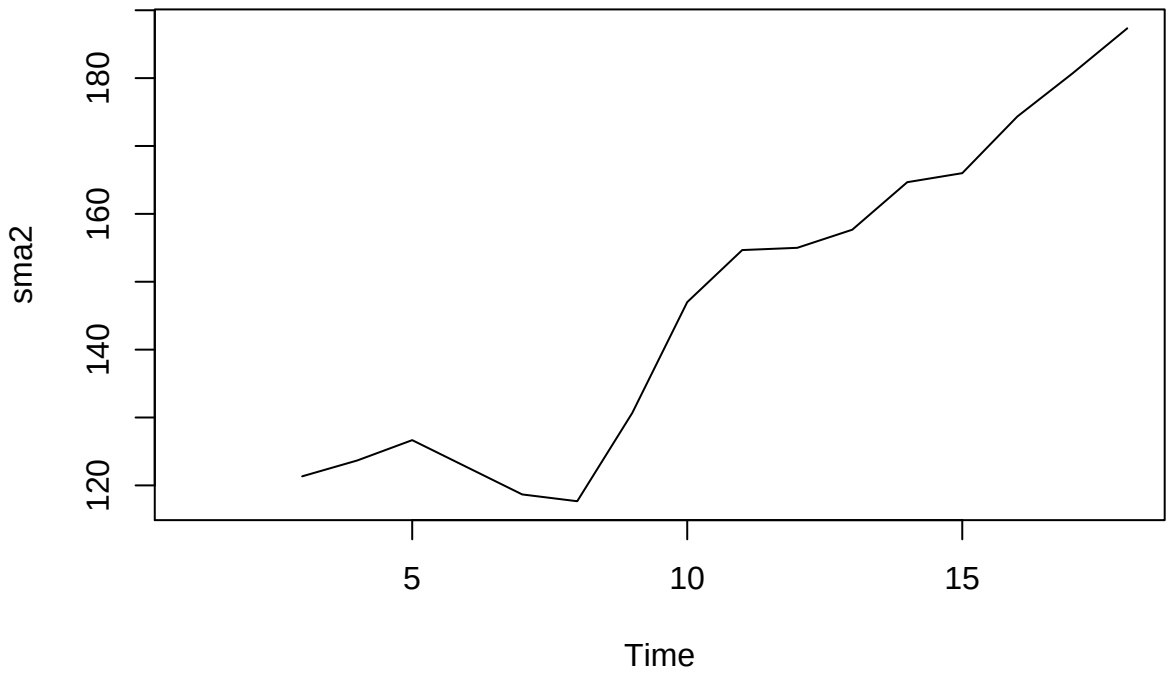
```
plot.ts(serieTemporal2)
```



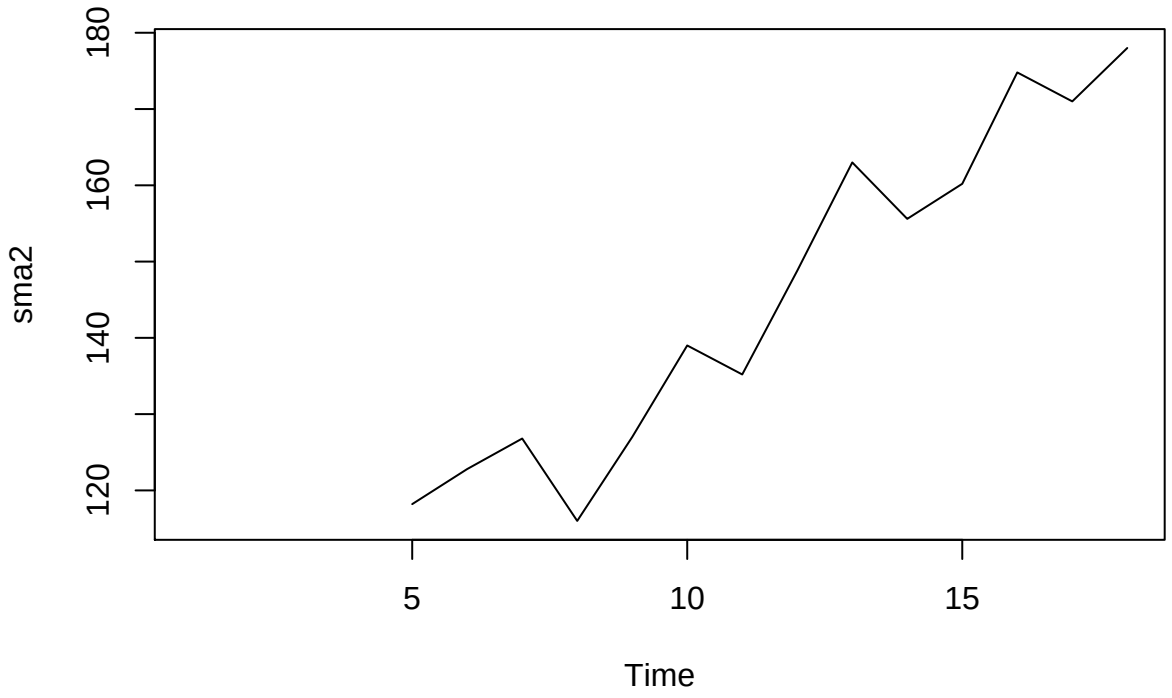
##

Média Móvel

```
sma2 <- SMA(serieTemporal2,n=3)

plot.ts(sma2)
```




```
sma2 <- SMA(serieTemporal2,n=5)

plot.ts(sma2)
```

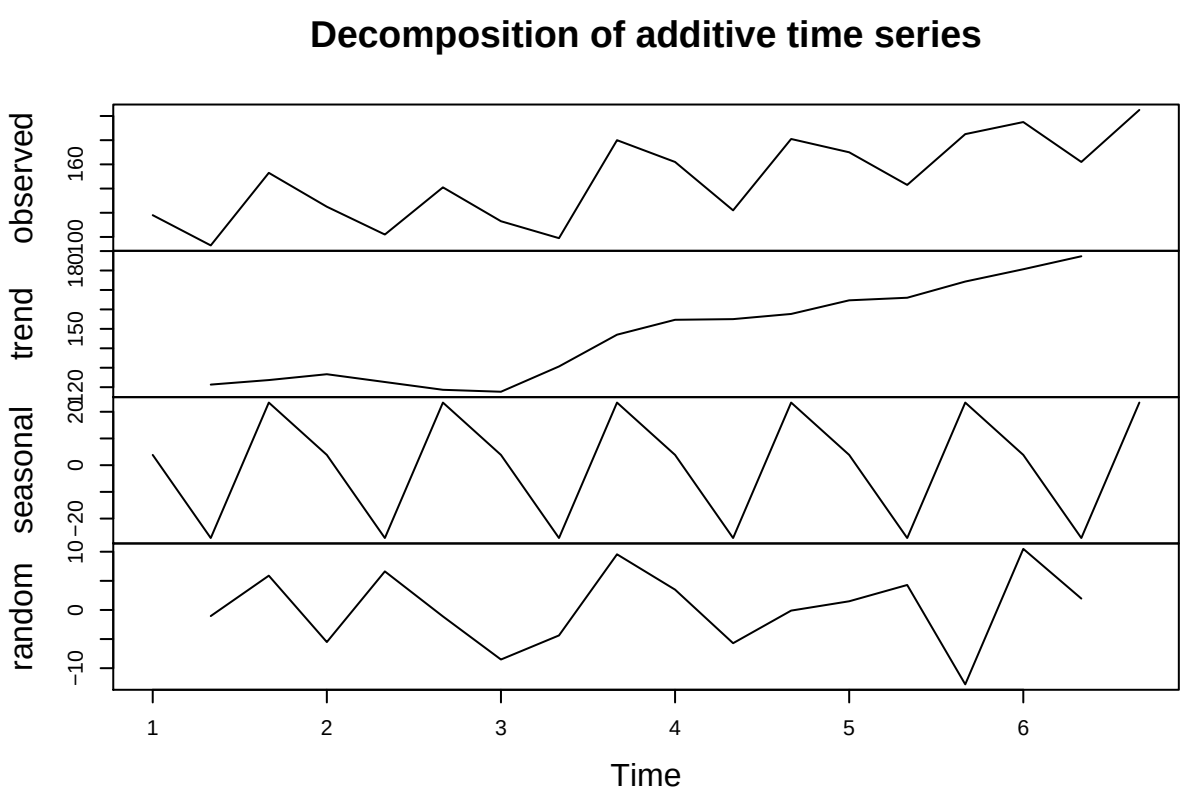



```
dct2 <- decompose(serieTemporal2)
dct2
```

```
## $x
## Time Series:
## Start = c(1, 1)
## End = c(6, 3)
## Frequency = 3
##  [1] 118  93 153 125 102 141 113  99 180 162 122 181 170 143 185 195 162 205
##
## $seasonal
## Time Series:
## Start = c(1, 1)
## End = c(6, 3)
## Frequency = 3
##  [1]   3.844444 -27.288889  23.444444   3.844444 -27.288889  23.444444
##  [7]   3.844444 -27.288889  23.444444   3.844444 -27.288889  23.444444
## [13]   3.844444 -27.288889  23.444444   3.844444 -27.288889  23.444444
##
## $trend
## Time Series:
## Start = c(1, 1)
## End = c(6, 3)
## Frequency = 3
##  [1]       NA 121.3333 123.6667 126.6667 122.6667 118.6667 117.6667 130.6667
##  [9] 147.0000 154.6667 155.0000 157.6667 164.6667 166.0000 174.3333 180.6667
## [17] 187.3333       NA
##
## $random
## Time Series:
## Start = c(1, 1)
## End = c(6, 3)
```

```
## Frequency = 3
##  [1]          NA  -1.0444444   5.8888889  -5.5111111   6.6222222  -1.1111111
##  [7]  -8.5111111  -4.3777778   9.5555556   3.4888889  -5.7111111  -0.1111111
## [13]   1.4888889   4.2888889 -12.7777778  10.4888889   1.9555556          NA
##
## $figure
## [1]   3.844444 -27.288889  23.444444
##
## $type
## [1] "additive"
##
## attr(,"class")
## [1] "decomposed.ts"
```

```
plot(dct2)
```



HoltWinters

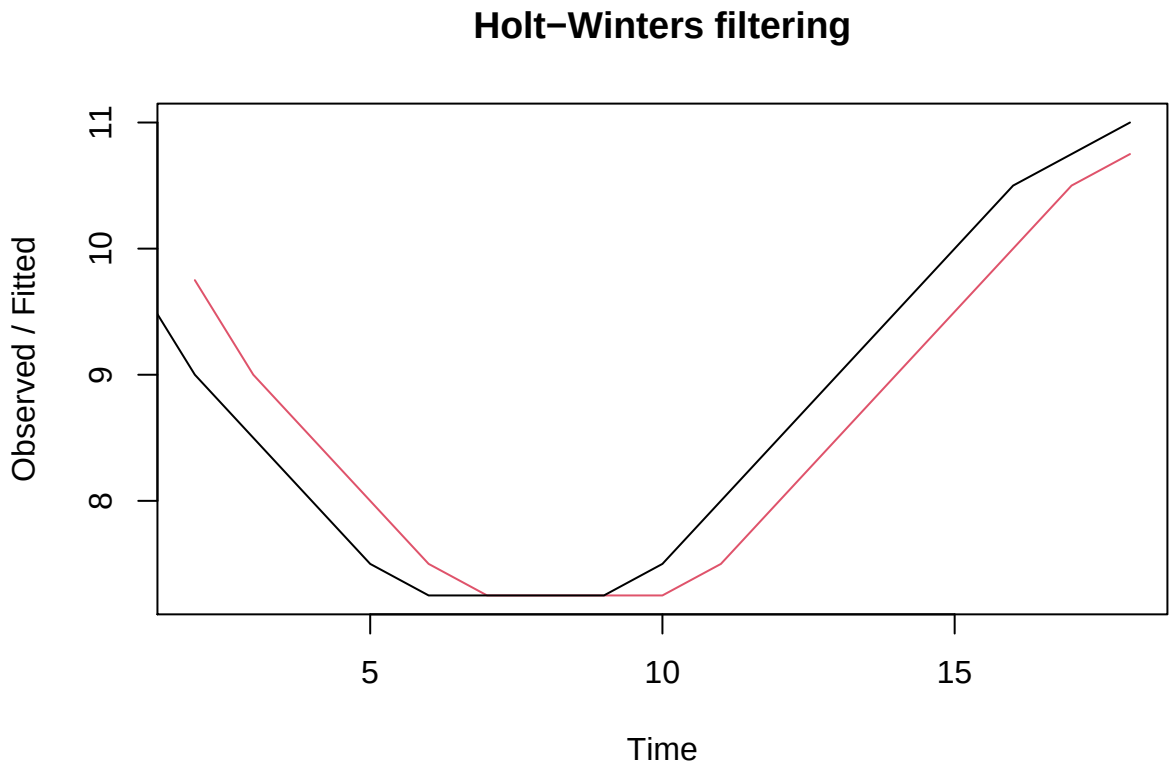
HoltWinters Nivel

```
ht1 <- HoltWinters(serieTemporal1, beta=FALSE, gamma=FALSE)

ht1 <- HoltWinters(serieTemporal1, beta=FALSE, gamma=FALSE , l.start=serieTemporal1[1])
ht1
```

```
## Holt-Winters exponential smoothing without trend and without seasonal component.
##
## Call:
```

```
## HoltWinters(x = serieTemporal1, beta = FALSE, gamma = FALSE,     l.start = serieTemporal1[1])
##
## Smoothing parameters:
##  alpha: 0.9999377
##  beta : FALSE
##  gamma: FALSE
##
## Coefficients:
##       [,1]
## a 10.99998
```

```
plot(ht1)
```




```
ht1$SSE
```

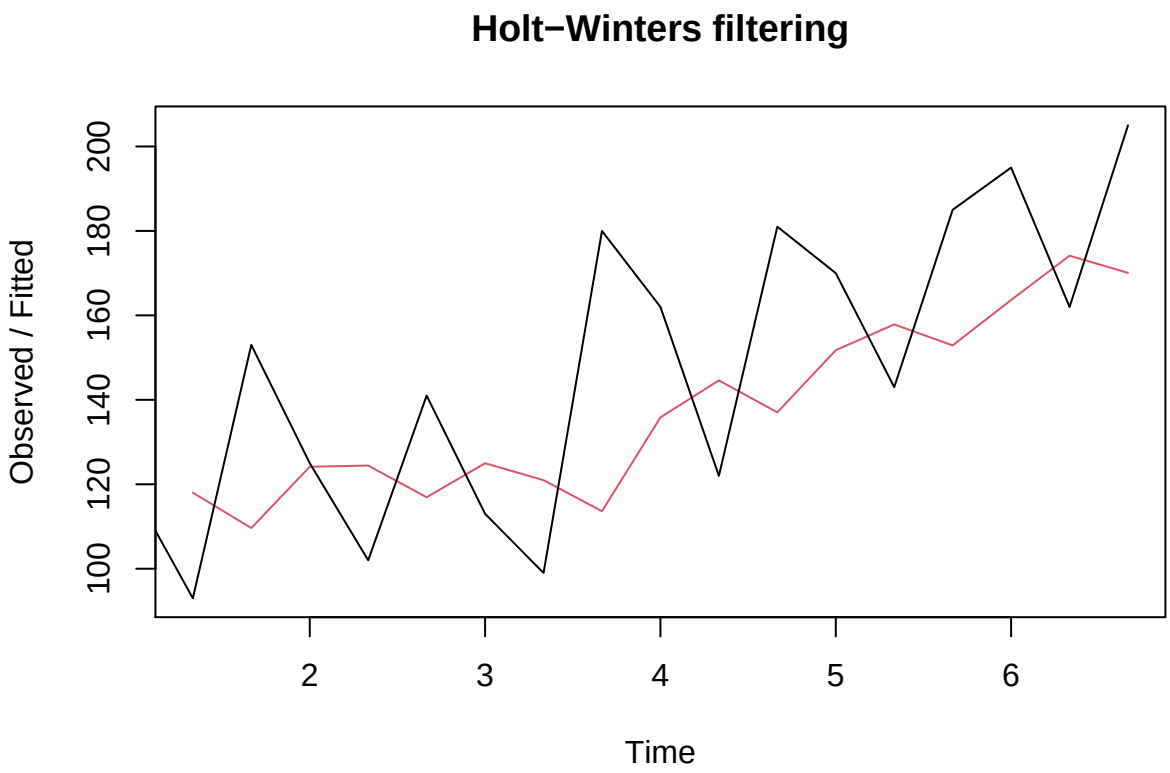
```
## [1] 3.062819
```

```
ht2 <- HoltWinters(serieTemporal2, beta=FALSE, gamma=FALSE)

ht2 <- HoltWinters(serieTemporal2, beta=FALSE, gamma=FALSE , l.start=serieTemporal2[1])
ht2
```

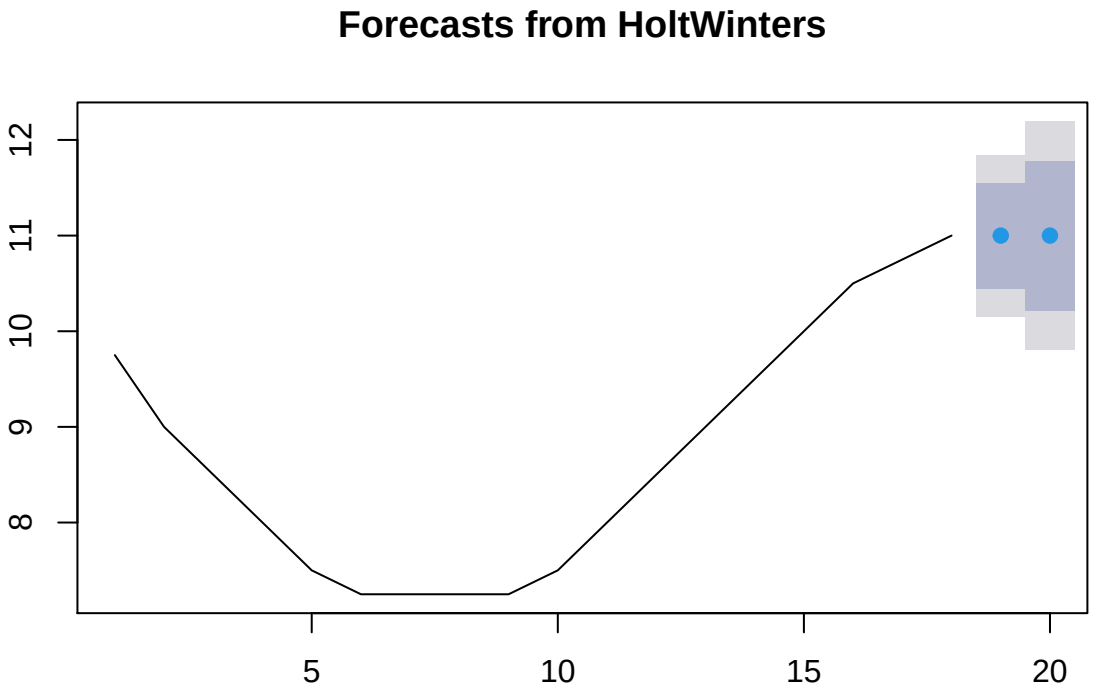
```
## Holt-Winters exponential smoothing without trend and without seasonal component.
##
## Call:
## HoltWinters(x = serieTemporal2, beta = FALSE, gamma = FALSE,     l.start = serieTemporal2[1])
##
## Smoothing parameters:
##  alpha: 0.3346552
##  beta : FALSE
##  gamma: FALSE
##
```

```
## Coefficients:
##       [,1]
## a 181.7595
```

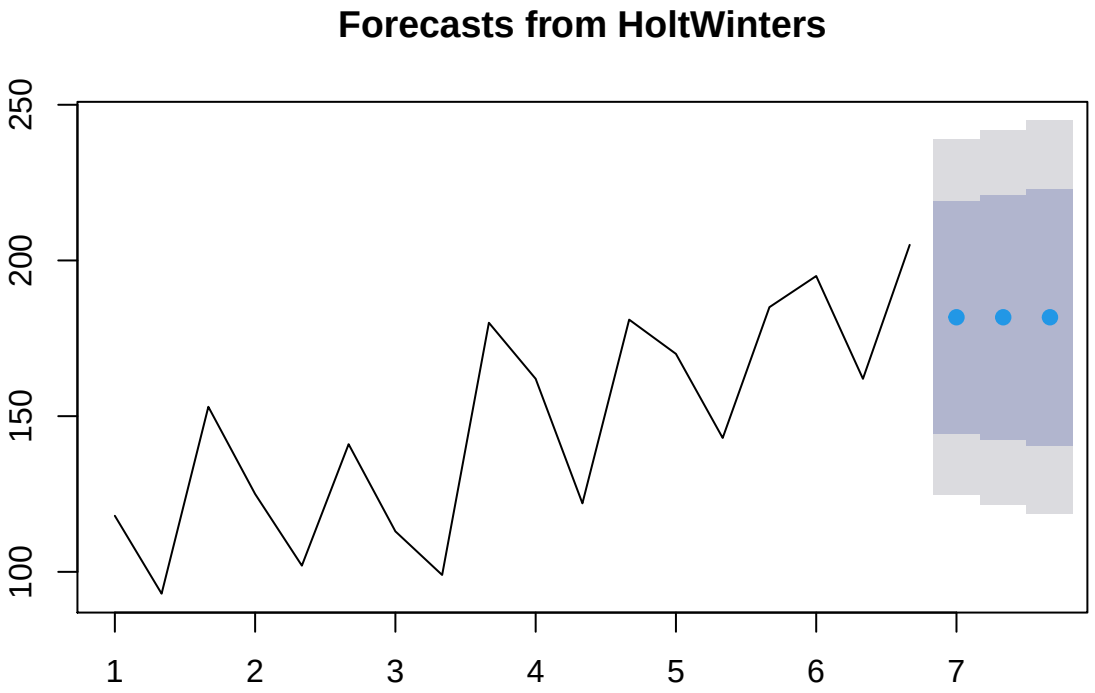
```
plot(ht2)
```



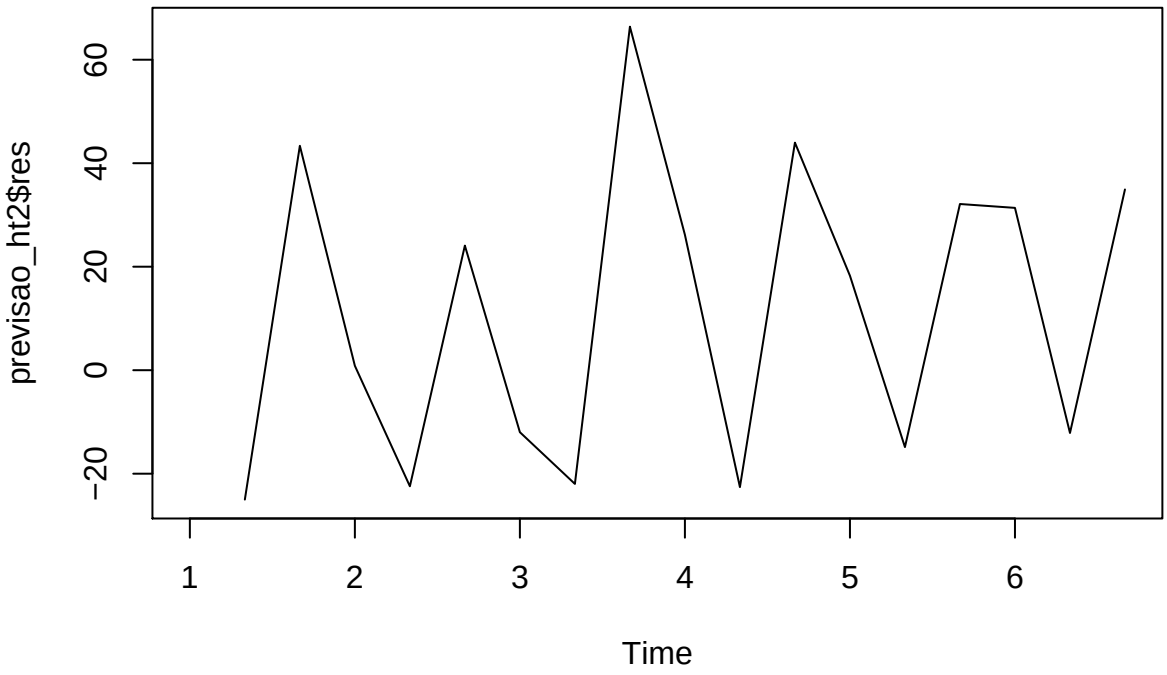

```
library("forecast")

previsao_ht1 <-forecast(ht1, h=2)

plot(previsao_ht1)
```




```
previsao_ht2 <-forecast(ht2, h=3)
plot(previsao_ht2)
```



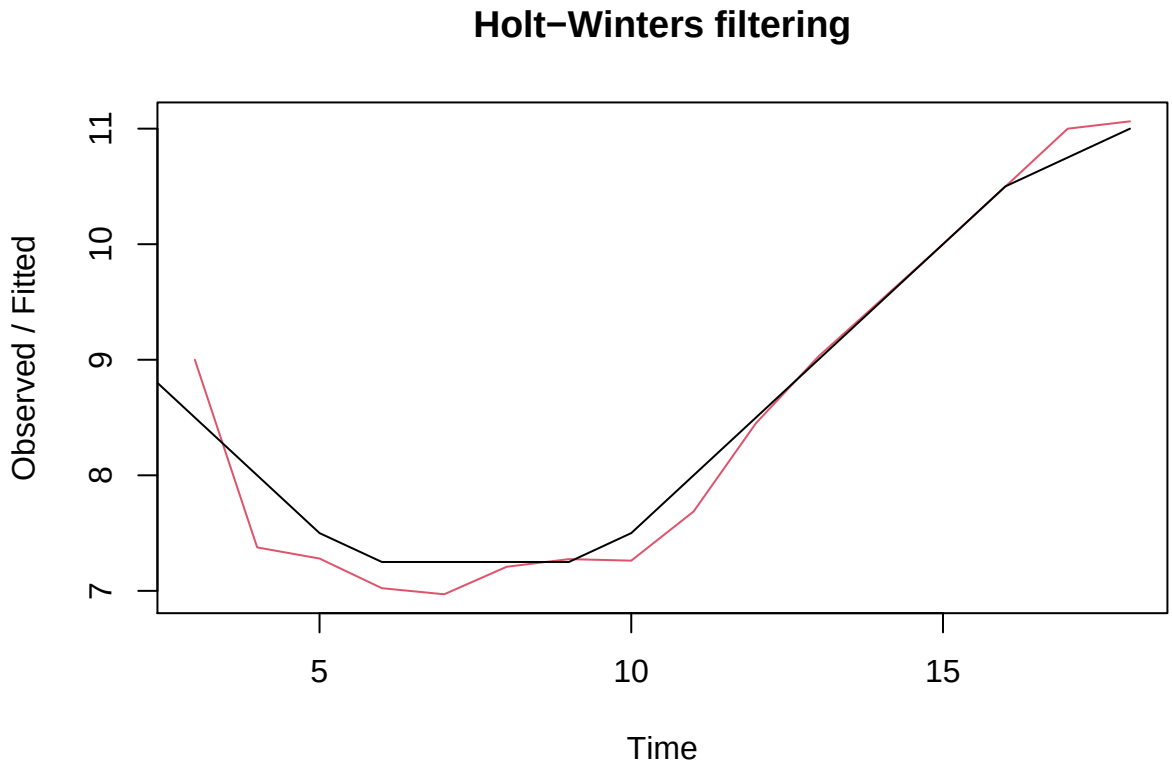

```
plot.ts(previsao_ht2$res)
```




```
htt1 <- HoltWinters(serieTemporal1, gamma=FALSE , l.start=serieTemporal1[1])
htt1
```

```
## Holt-Winters exponential smoothing with trend and without seasonal component.
##
## Call:
## HoltWinters(x = serieTemporal1, gamma = FALSE, l.start = serieTemporal1[1])
##
## Smoothing parameters:
##  alpha: 0.8740089
##  beta : 1
##  gamma: FALSE
##
## Coefficients:
##         [,1]
## a 11.0079506
## b  0.2265037
```

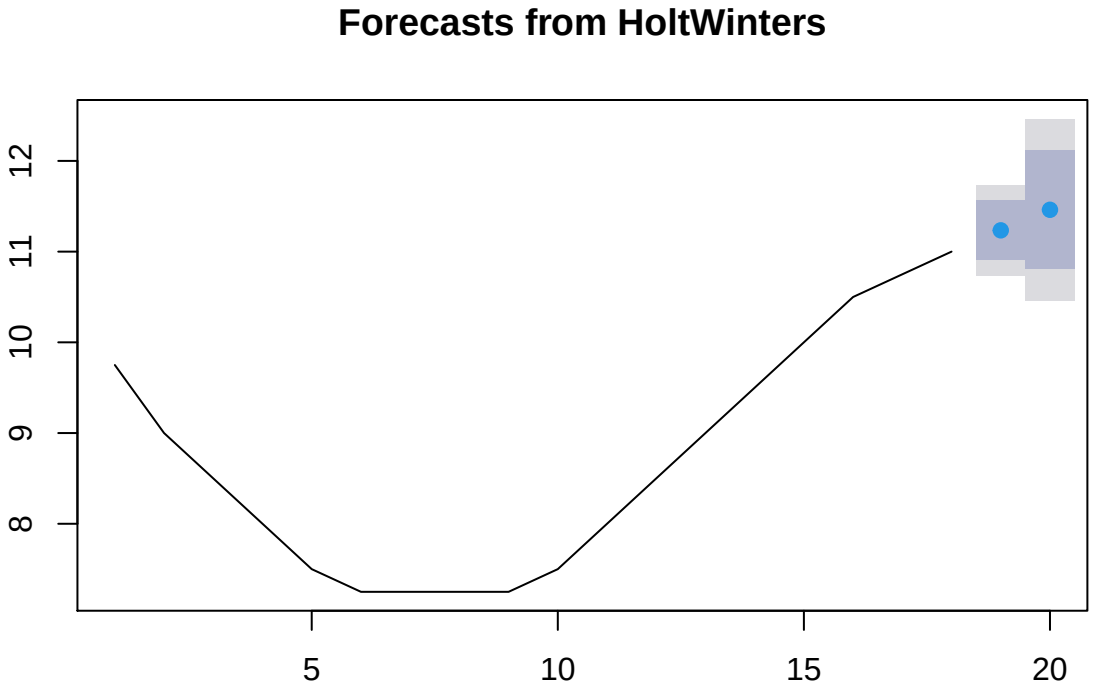
```
plot(htt1)
```




```
previsao_htt1 <- forecast(htt1,h=2)
previsao_htt1
```

```
##    Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
## 19       11.23445 10.90917 11.55973 10.73698 11.73193
## 20       11.46096 10.80590 12.11602 10.45913 12.46279
```

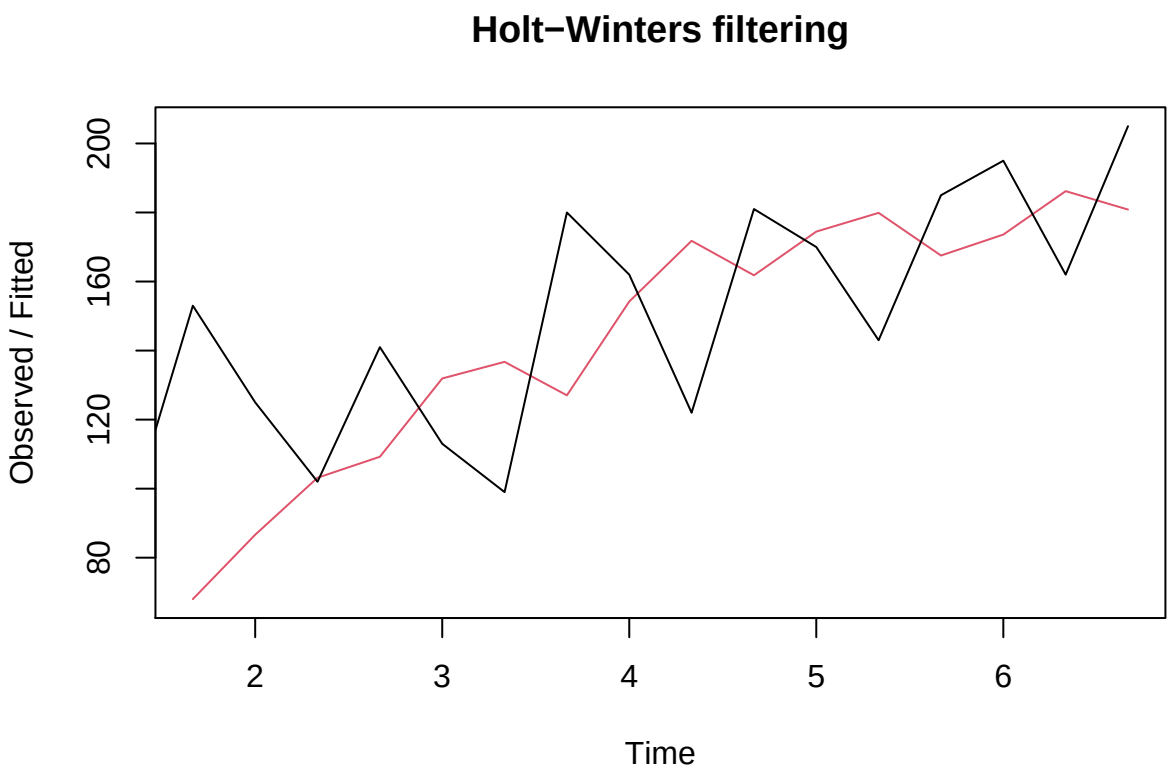
```
plot(previsao_htt1)
```



```r
htt2 <- HoltWinters(serieTemporal2, gamma=FALSE )
htt2
```

```
## Holt-Winters exponential smoothing with trend and without seasonal component.
##
## Call:
## HoltWinters(x = serieTemporal2, gamma = FALSE)
##
## Smoothing parameters:
##  alpha: 0.2567522
##  beta : 1
##  gamma: FALSE
##
## Coefficients:
##        [,1]
## a 187.05160
## b   7.07521
```

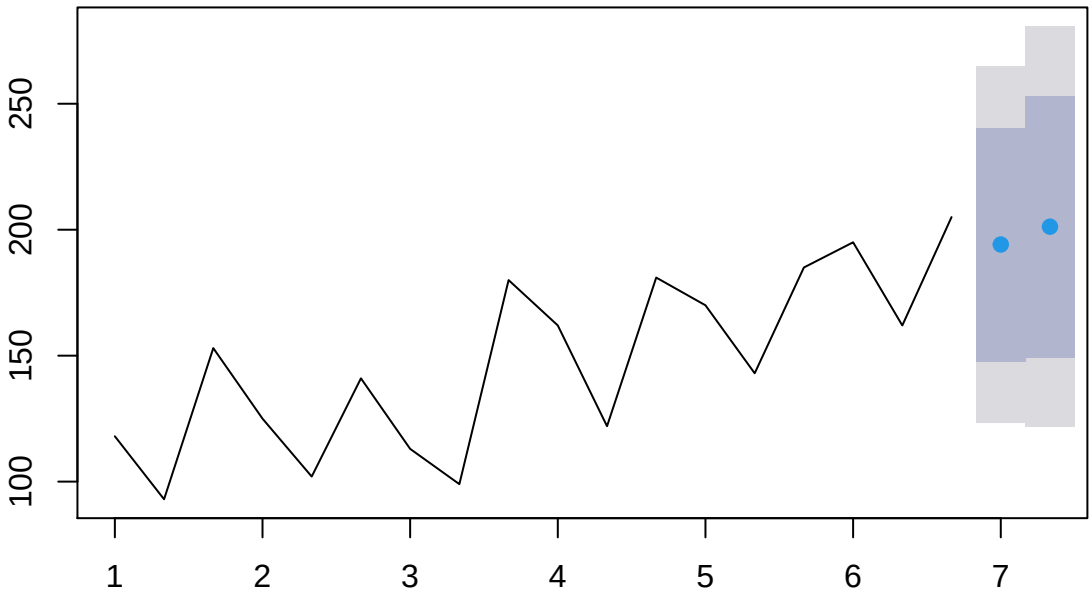
```r
plot(htt2)
```




```r
previsao_htt2 <- forecast(htt2,h=2)
previsao_htt2
```

```
##          Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
## 7.000000       194.1268 147.8735 240.3801 123.3885 264.8652
## 7.333333       201.2020 149.2069 253.1972 121.6823 280.7217
```

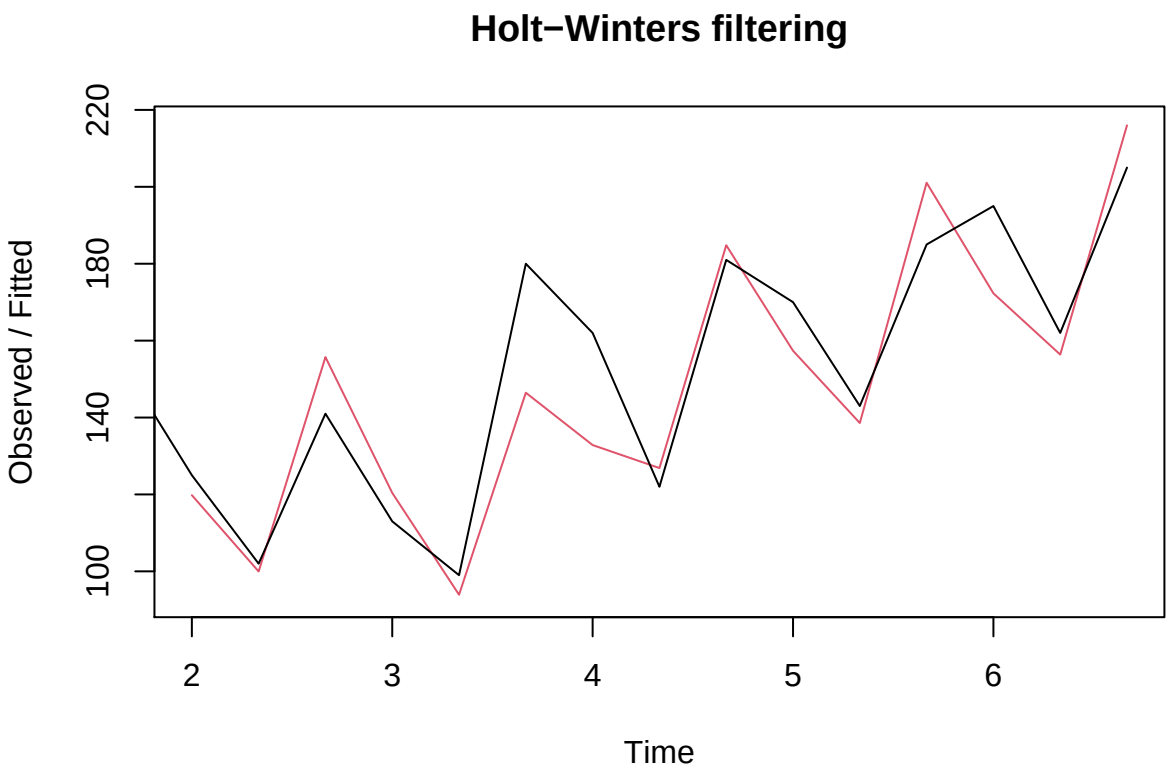
```r
plot(previsao_htt2)
```




```
htts2 <- HoltWinters(serieTemporal2 )
htts2
```

```
## Holt-Winters exponential smoothing with trend and additive seasonal component.
##
## Call:
## HoltWinters(x = serieTemporal2)
##
## Smoothing parameters:
##  alpha: 0.3801877
##  beta : 0.1598965
##  gamma: 0.3211962
##
## Coefficients:
##          [,1]
## a  183.734397
## b    4.505001
## s1   9.679893
## s2 -23.105581
## s3  25.886556
```

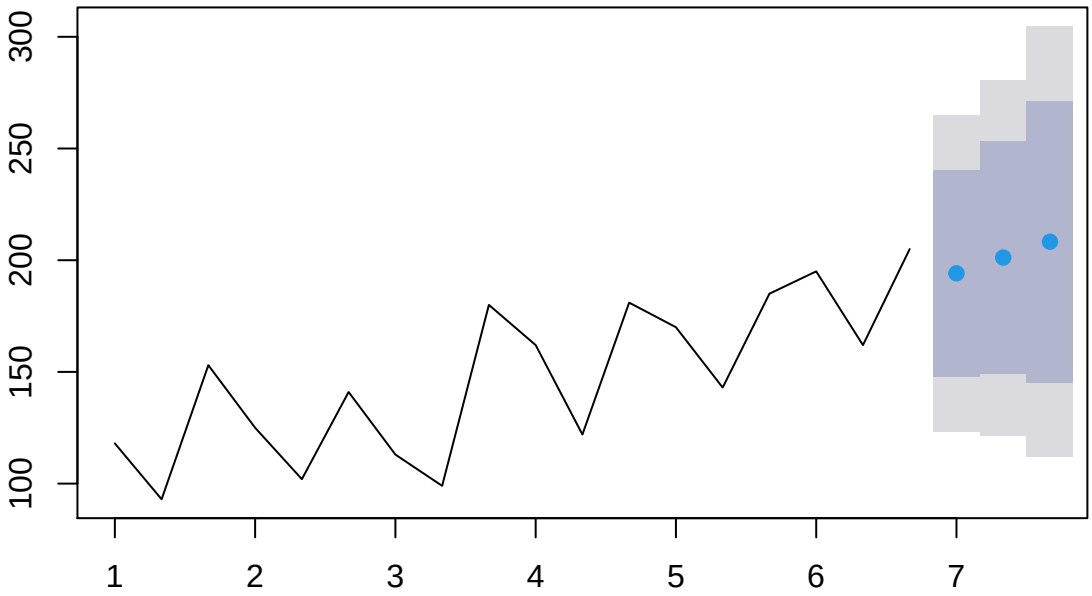
```
plot(htts2)
```




```
previsao_htts2 <- forecast(htt2,h=3)
previsao_htts2
```

```
##          Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
## 7.000000       194.1268 147.8735 240.3801 123.3885 264.8652
## 7.333333       201.2020 149.2069 253.1972 121.6823 280.7217
## 7.666667       208.2772 145.2473 271.3072 111.8813 304.6732
```

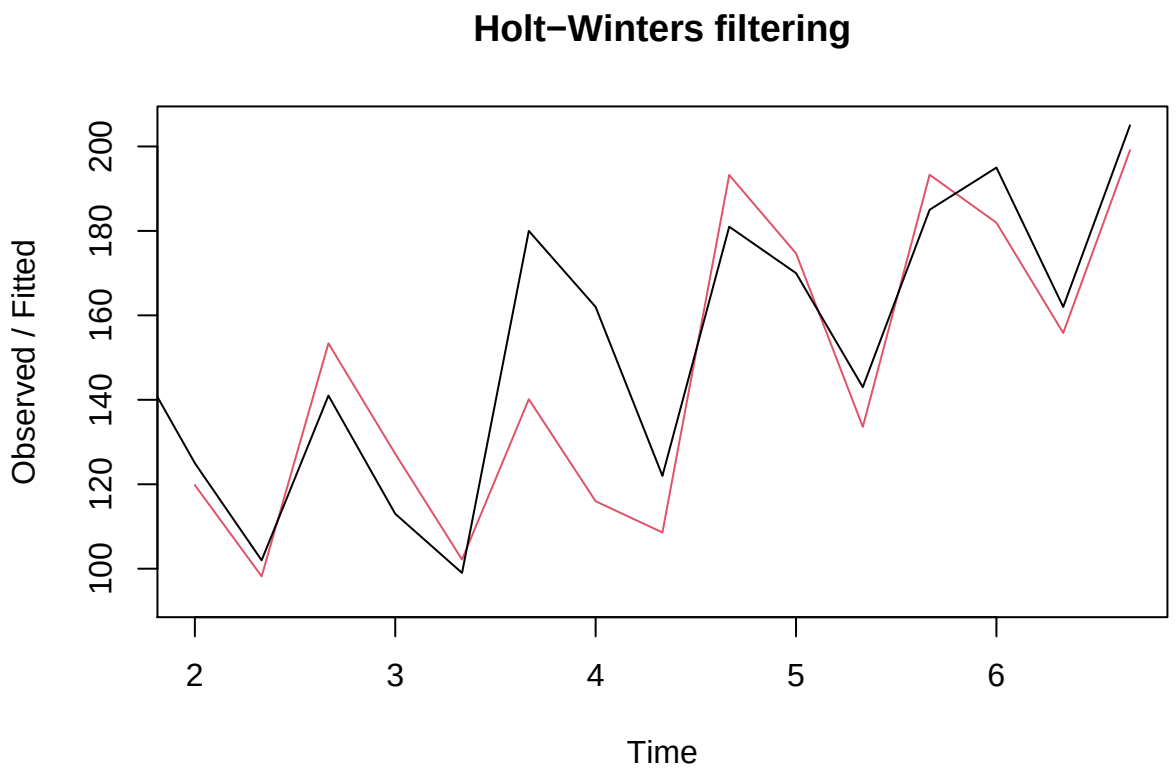
```
plot(previsao_htts2 )
```



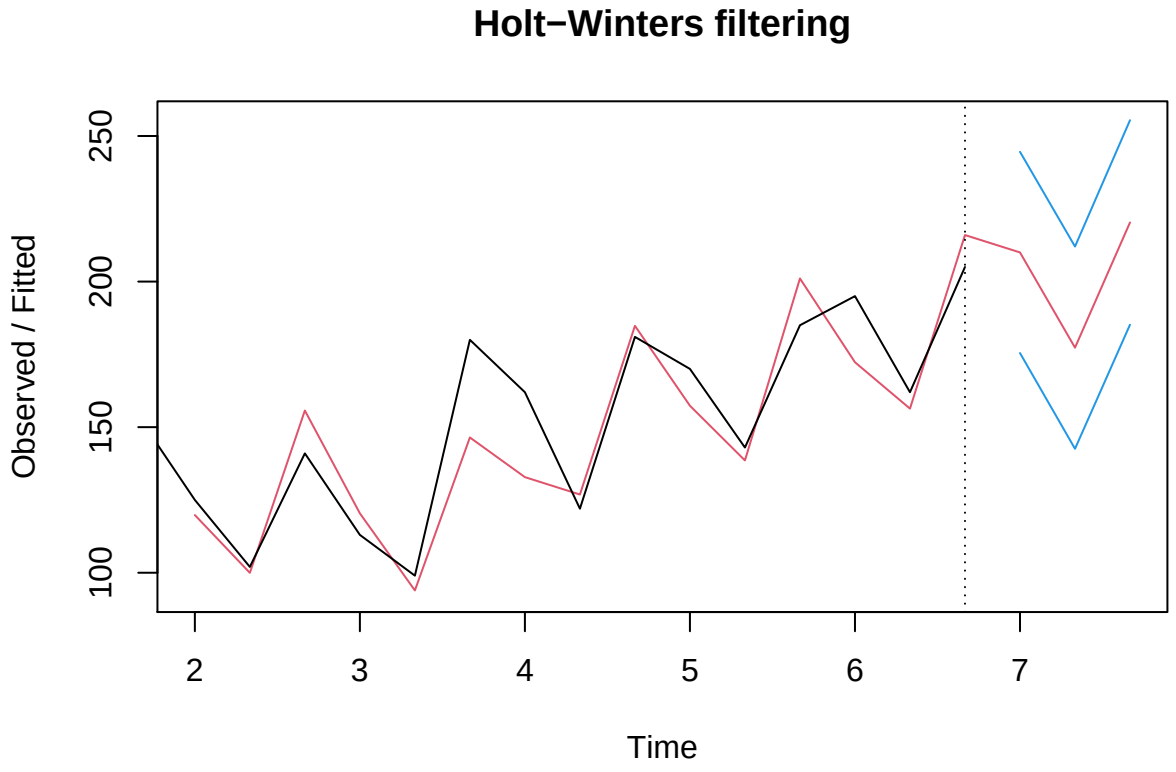

```
htnts2 <- HoltWinters(serieTemporal2, gamma = TRUE, beta = TRUE)
previsao_htts2 <- predict(htnts2, n.ahead = 3, prediction.interval = TRUE,level = 0.95)
require(graphics)
previsao_htts2
```

```
## Time Series:
## Start = c(7, 1)
## End = c(7, 3)
## Frequency = 3
##                fit      upr      lwr
## 7.000000 210.0074 244.5620 175.4528
## 7.333333 177.3026 212.0302 142.5750
## 7.666667 220.3026 255.4164 185.1887
```

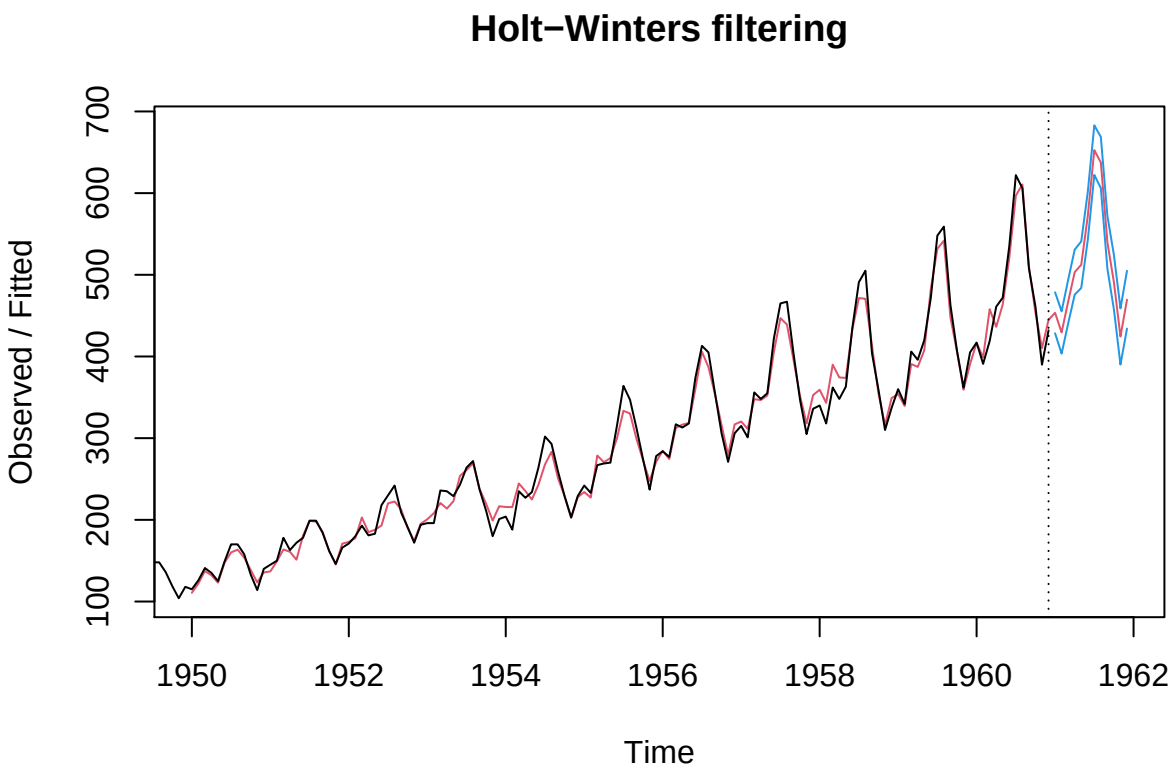
```
plot(htnts2)
```




```
plot(htts2,previsao_htts2)
```




```
m <- HoltWinters(AirPassengers)
p <- predict(m, 12, prediction.interval = TRUE)
plot(m, p)
```


Holt−Winters filtering
Observed / Fitted
100
200
300
400
500
600
700
1950
1952
1954
1956
1958
1960
1962
Time