Tidal-Harmonic Model Fitting

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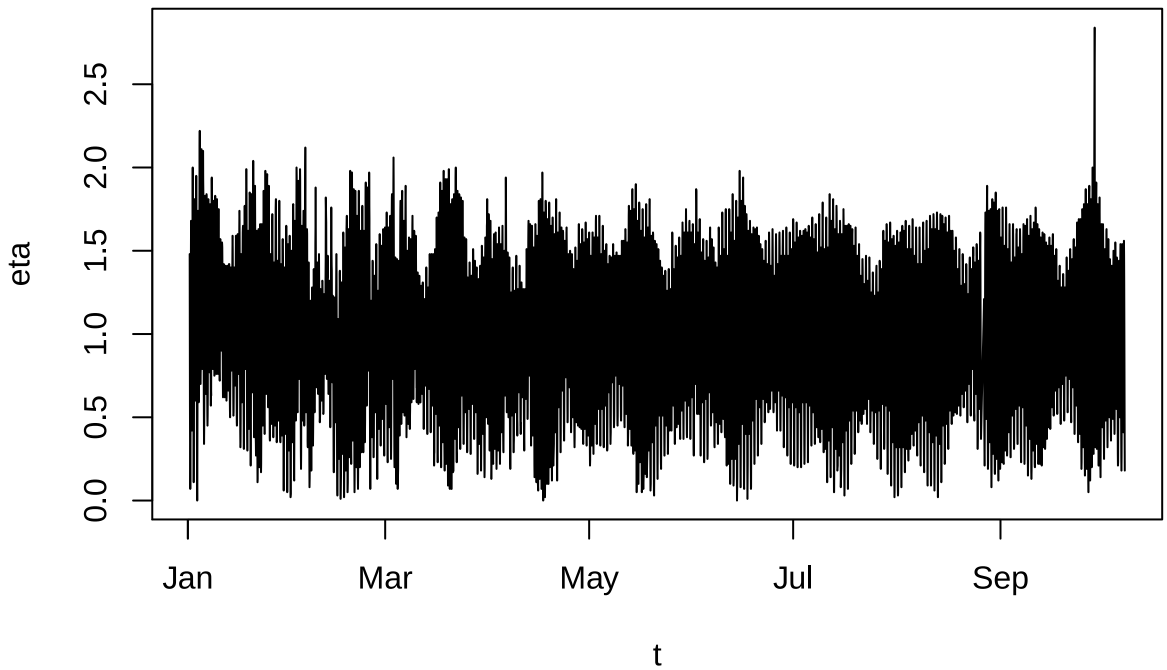
Goal. Demonstrated the use of `oce::tidem()`, which is somewhat similar to `t-tide` in Matlab.

A good test dataset is provided in the `oce` package. This is sea level in Halifax Harbour, in the year 2003.

```
library(oce)
```

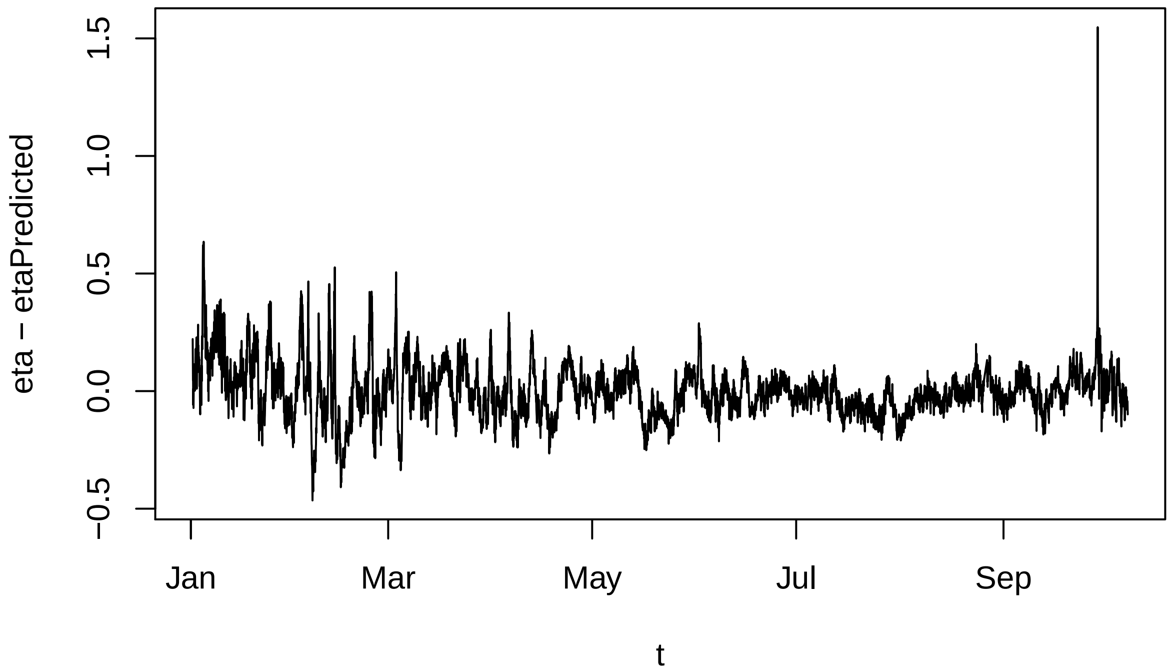
```
## Loading required package: gsw
```

```
data(sealevel)
t <- sealevel[["time"]]
eta <- sealevel[["elevation"]]
plot(t, eta, type='l')
```



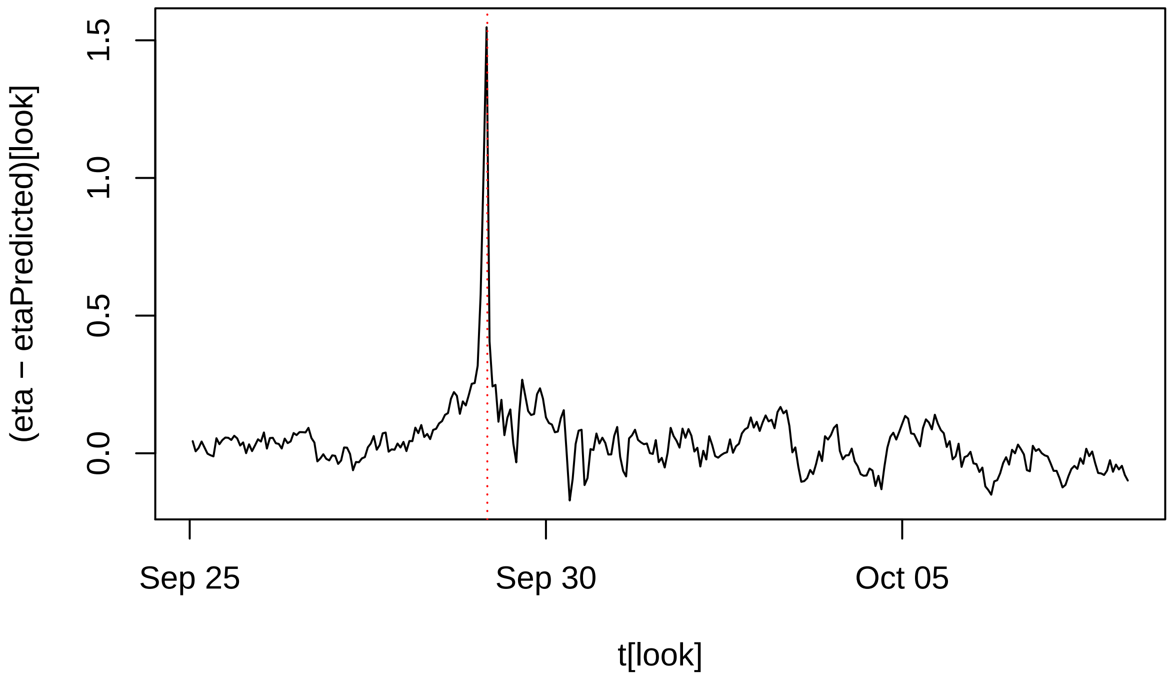
Those who lived in Halifax during 2003 know that Hurricane Juan happened then. Is that the big spike near the end?

```
m <- tidem(sealevel) # it 'understands' the first arg to be a sealevel-class object
etaPredicted <- predict(m)
plot(t, eta - etaPredicted, type='l')
```



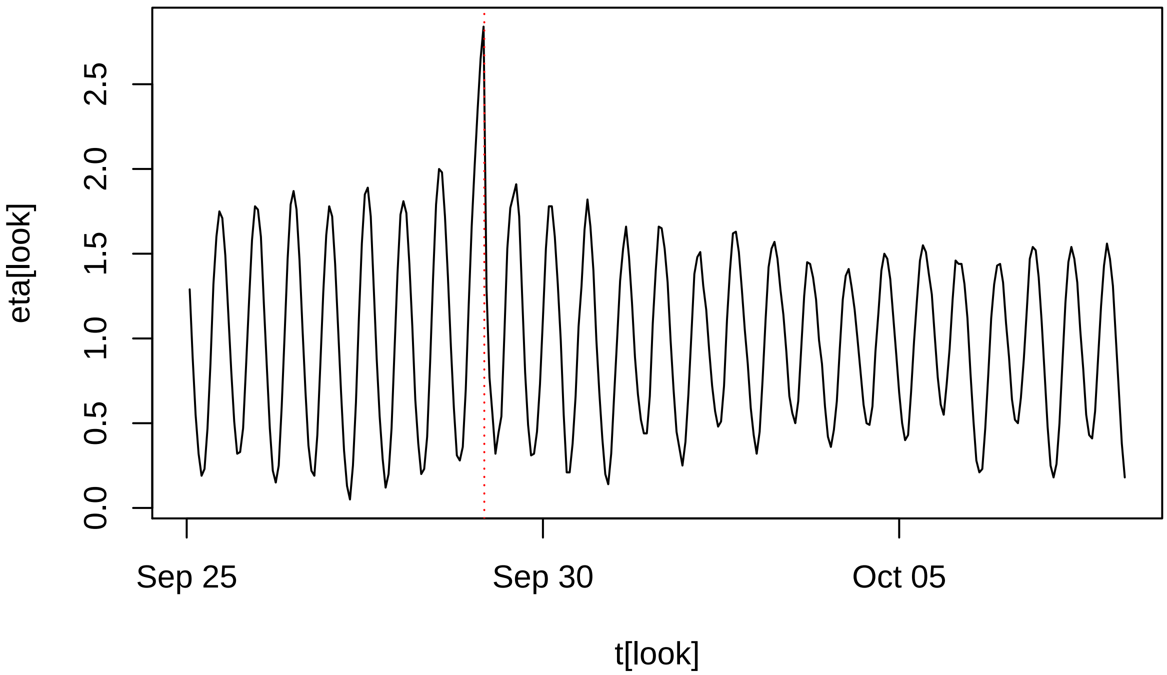
Well, that spike surely seems to stick out! Let's zoom in and add a dotted line for the approximate time Juan hit Halifax (personal knowledge)

```
look <- t > as.POSIXct("2003-09-25", tz="UTC")
plot(t[look], (eta - etaPredicted)[look], type='l')
tJuan <- as.POSIXct("2003-09-29 04:15:00", tz="UTC")
abline(v=tJuan, lty='dotted', col='red')
```



For comparson, let's look again at the raw data

```r
look <- t > as.POSIXct("2003-09-25", tz="UTC")
plot(t[look], eta[look], type='l')
tJuan <- as.POSIXct("2003-09-29 04:15:00", tz="UTC")
abline(v=tJuan, lty='dotted', col='red')
```



The peak is there, but *a lot* harder to see, and if it had occured at a lower tide, it could easily be missed.

Exercises.

1. See whether this surge could be detected against an anomaly field constructed by subtracting a low-passed signal.

2. Find wind and pressure data, and see how they line up with this signal. (Compute the inverted-barometer effect, for example.)