R Notebook

Load the test datasets

```
path = "TestDatasets/"

# Load all files
ll = lapply( list.files(path,".feather",full.names = T), function(x) read_feather(x) )

# Name them
names(ll) <- file_path_sans_ext( list.files(path,".feather") )
ll <- ll[which(!str_detect(string = names(ll),pattern = "TwoBreak"))]
```

```
res <- data.frame()
# Do the loopie
for( i in names(ll) ){
  # Define time series
  xx <- as.data.frame( ll[[i]] )

  # Define time
  tt <- seq.Date(as.Date( as.yearmon(1982.01) ),by = "1 month",length.out = 360)
  zz = zoo(xx$x,order.by = as.yearmon(tt),frequency = 12)

  # Run bfast01 model for single breaks
  rdist = 12/nrow(xx) # calculate h relative to total sample length
  bf1 = try(bfast01(as.ts(zz),formula = response ~ trend, test = c("OLS-MOSUM","BIC"),aggregate=any, ba
    bf2 = try(bfast01(as.ts(zz),formula = response ~ trend + harmon, test = c("OLS-MOSUM","BIC"),aggrega
    l = list(bf1,bf2)
    # Get best model
    bf <- try( l[[which.min(lapply(l,AIC))]], silent = T )

    # Extract largest breakpoint
    if(class(bf)=="try-error")
    {
      # Check if trend only converged and use this instead
      if(class(bf1)!="try-error"){
        bf = bf1 # Reset to trend only
      } else { next() }
    }

    if(bf$breaks > 0){
    # Time of largest change
    la_year <- bf$data$time[bf$breakpoints]

    res <- rbind(res, data.frame(SSBS = i, year = la_year,w = which.min(lapply(l,AIC))))
    } else {
        res <- rbind(res, data.frame(SSBS = i, year = 0, w = which.min(lapply(l,AIC))))
    }
}
```

The Result. It seems that the seasonal amplitude is quite affected by chance / random noise

```
res
```

```
##            SSBS     year w
## 1  monotonic_10    0.000 2
## 2  monotonic_11 1993.917 2
## 3  monotonic_12 1993.917 2
## 4  monotonic_13 2006.917 2
## 5  monotonic_14    0.000 2
## 6  monotonic_15 2000.750 2
## 7  monotonic_16 1994.917 2
## 8  monotonic_17    0.000 2
## 9  monotonic_18    0.000 2
## 10 monotonic_19    0.000 2
## 11  monotonic_1    0.000 2
## 12 monotonic_20 1989.917 2
## 13  monotonic_2    0.000 2
## 14  monotonic_3 1999.917 2
## 15  monotonic_4 2006.917 2
## 16  monotonic_5 2005.917 2
## 17  monotonic_6 1997.917 2
## 18  monotonic_7 2007.083 2
## 19  monotonic_8 2004.917 2
## 20  monotonic_9 1992.917 2
## 21  OneBreak_10 2004.500 2
## 22  OneBreak_11 1988.917 2
## 23  OneBreak_12 1985.250 2
## 24  OneBreak_13 1985.250 2
## 25  OneBreak_14 1990.750 2
## 26  OneBreak_15 2008.583 2
## 27  OneBreak_16 2002.417 2
## 28  OneBreak_17 1993.167 2
## 29  OneBreak_18 2000.167 2
## 30  OneBreak_19 2002.083 2
## 31   OneBreak_1 1985.500 2
## 32  OneBreak_20 1989.833 2
## 33   OneBreak_2 2000.417 2
## 34   OneBreak_3 2007.833 2
## 35   OneBreak_4 1985.250 2
## 36   OneBreak_5 1985.250 2
## 37   OneBreak_6 2008.583 2
## 38   OneBreak_7 2000.917 2
## 39   OneBreak_8 1985.250 2
## 40   OneBreak_9 1991.750 2
```

Fit a seperate model, but consider trend changes only

```
res2 <- data.frame()
# Do the loopie
for( i in names(ll) ){
  # Define time series
  xx <- as.data.frame( ll[[i]] )

  # Define time
  tt <- seq.Date(as.Date( as.yearmon(1982.01) ),by = "1 month",length.out = 360)
  zz = zoo(xx$x,order.by = as.yearmon(tt),frequency = 12)

  # Run bfast01 model for single breaks
```

```
  rdist = 12/nrow(xx) # calculate h relative to total sample length
  bf = try(bfast01(as.ts(zz),formula = response ~ trend, test = c("OLS-MOSUM","BIC"),aggregate=any, banc
    if(bf$breaks > 0){
    # Time of largest change
    la_year <- bf$data$time[bf$breakpoints]

    res2 <- rbind(res2, data.frame(SSBS = i, year = la_year,w = 1) )
    } else {
    res2 <- rbind(res2, data.frame(SSBS = i, year = 0, w = 1  ) )
    }
}
```

Apparently the seasonal change detection (harmonic series) overfits on random generated data

```
res2
```

```
##            SSBS     year w
## 1  monotonic_10    0.000 1
## 2  monotonic_11    0.000 1
## 3  monotonic_12    0.000 1
## 4  monotonic_13    0.000 1
## 5  monotonic_14    0.000 1
## 6  monotonic_15    0.000 1
## 7  monotonic_16    0.000 1
## 8  monotonic_17    0.000 1
## 9  monotonic_18    0.000 1
## 10 monotonic_19    0.000 1
## 11  monotonic_1    0.000 1
## 12 monotonic_20    0.000 1
## 13  monotonic_2    0.000 1
## 14  monotonic_3    0.000 1
## 15  monotonic_4    0.000 1
## 16  monotonic_5    0.000 1
## 17  monotonic_6    0.000 1
## 18  monotonic_7    0.000 1
## 19  monotonic_8    0.000 1
## 20  monotonic_9    0.000 1
## 21  OneBreak_10    0.000 1
## 22  OneBreak_11 1988.917 1
## 23  OneBreak_12 1983.833 1
## 24  OneBreak_13    0.000 1
## 25  OneBreak_14 1990.750 1
## 26  OneBreak_15    0.000 1
## 27  OneBreak_16 2002.417 1
## 28  OneBreak_17 1993.167 1
## 29  OneBreak_18 2000.167 1
## 30  OneBreak_19 2002.083 1
## 31   OneBreak_1 1985.500 1
## 32  OneBreak_20 1989.833 1
## 33   OneBreak_2 2000.417 1
## 34   OneBreak_3 2007.833 1
## 35   OneBreak_4 1985.083 1
## 36   OneBreak_5 1985.083 1
## 37   OneBreak_6 2011.083 1
## 38   OneBreak_7 2000.917 1
```

```
## 39   OneBreak_8 1983.333 1
## 40   OneBreak_9 1991.750 1
```