Using WRTDS to evaluate chlorophyll trends in the Patuxent River estuary

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To note: Focus on TF1.6 and LE1.3. There are interesting changes before/after 2003 in chlorophyll, coincides with Hurricane Isabel.

The following is a description and presentation of preliminary results of the application of WRTDS to tidal waters of the Patuxent River Estuary.

```
# load the wrtds tidal package
# devtools::install_github('fawda123/wtreg_for_estuaries')
# library(WRTDStidal)
devtools::load_all('M:/docs/wtreg_for_estuaries')

# load current library
devtools::load_all('M:/docs/tidal_comp/TidalComp')

# load the patuxent data
data(pax_data)

# create separate 'tidal' objects for each station as a list
# filter by station, remove station column, add detection limit column
# remove missing data, sort by date, create tidal
tidals <- vector('list', length = length(unique(pax_data$STATION)))
names(tidals) <- levels(pax_data$STATION)
for(tid in names(tidals)){

  # format the individual station
  tmp <- filter(pax_data, STATION == tid) %>%
    select(-STATION) %>%
    mutate(chllim = rep(0, nrow(.))) %>%
    na.omit %>%
```

```
    arrange(date) %>%
    tidal

  # save to output
  tidals[[tid]] <- tmp

}
```

Create separate WRTDS models for each station.

```
# process datasets in parallel
library(doParallel)
library(foreach)
num_cores <- detectCores()
cl <- makeCluster(num_cores)
registerDoParallel(cl)
strt <- Sys.time()

# function for processing, same as modfit but creates log
# created to modify defaults in modfit
res <- foreach(i = names(tidals), .packages = 'WRTDStidal') %dopar% {

  sink('log.txt')
  cat(i, '\n')
  print(Sys.time() - strt)
  sink()

  out <- modfit(tidals[[i]], tau = c(0.1, 0.5, 0.9))
  out

  }
names(res) <- names(tidals)
print(Sys.time() - strt)

pax_fits <- res
save(pax_fits, file = 'data/pax_fits.RData')
```

Make some plots.

```
data(pax_fits)

stations <- names(pax_fits)
```

```r
stat_plos <- vector('list', length = length(stations))
names(stat_plos) <- stations
for(stat in stations){

  tmp <- prdnrmplot(pax_fits[[stat]], logspace = F, annuals = T)
  tmp <- tmp +
    theme(
      legend.position = 'none',
      plot.margin = unit(rep(0.1, 4), 'lines')
      ) +
    scale_y_continuous('chla', limits = c(0, 60)) +
    ggtitle(stat)

  stat_plos[[stat]] <- tmp

  }

library(gridExtra)
library(ggplot2)
pdf('figs/patux_prdnrms.pdf', family = 'serif', height = 8, width = 6)
grid.arrange(
  stat_plos[[1]],
  stat_plos[[2]],
  stat_plos[[3]],
  stat_plos[[4]],
  stat_plos[[5]],
  stat_plos[[6]],
  stat_plos[[7]],
  stat_plos[[8]],
  stat_plos[[9]],
  stat_plos[[10]],
  ncol = 2,
  nrow = 5
  )
dev.off()
```

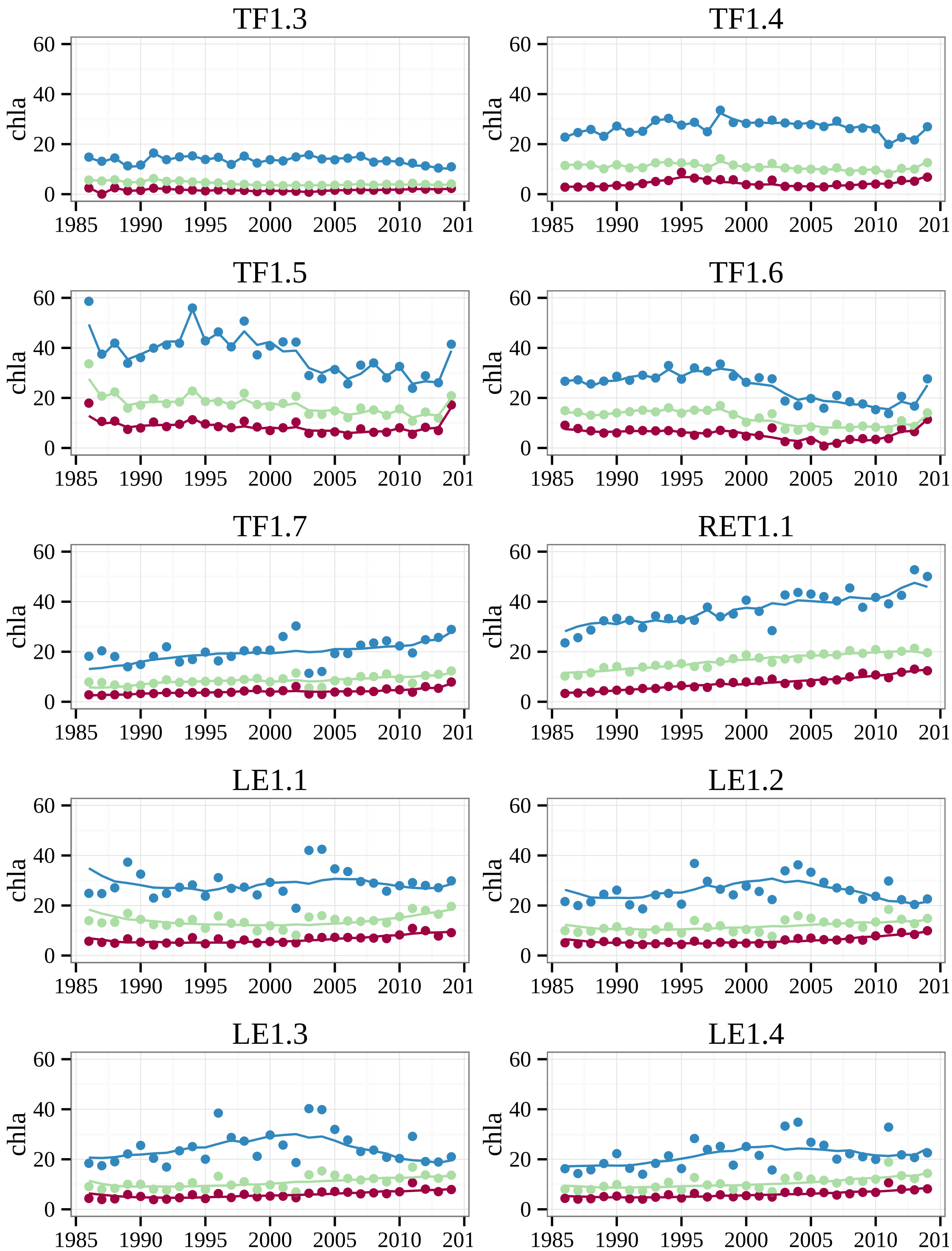

Figure 1: Fitted and normalized chlorophyll-a estimates for stations in the Patuxent River estuary using the tidal adaptation of WRTDS. Colors indicate estimates for the tenth, fiftieth, and ninetieth percentile.