chl-indicator-comparison-calculations

Matt Callahan

6/23/2022

The following document compares MODIS and OC\_CCI chlorophyll values in the SEBS, EGOA, and WGOA. Within each region/product, I compare filtered -50 to -200 Federal waters only with unfiltered (SEBS) or -10 to -200m (GOA) values.

## Load data

library(tidyverse)  
library(lubridate)  
library(sf)  
library(AKmarineareas)

**MODIS** MODIS data were downloaded from a google folder where Jordan stored them from previous efforts <https://drive.google.com/drive/u/1/folders/1mhwQ70mjLrkiQYiQ2oNHx08Q7IlL8Q3->

#EBS  
mod\_ebs<-readRDS("Data/MODIS/merged\_8day\_2003\_2021\_EBS.RDS")  
#GOA  
mod\_goa<-readRDS("Data/MODIS/merged\_8day\_2003\_2021\_GOA.RDS")

**Load oc-cci** This took a couple hundred lines of codes to make, found in chla-indicator-comparison-data.Rmd

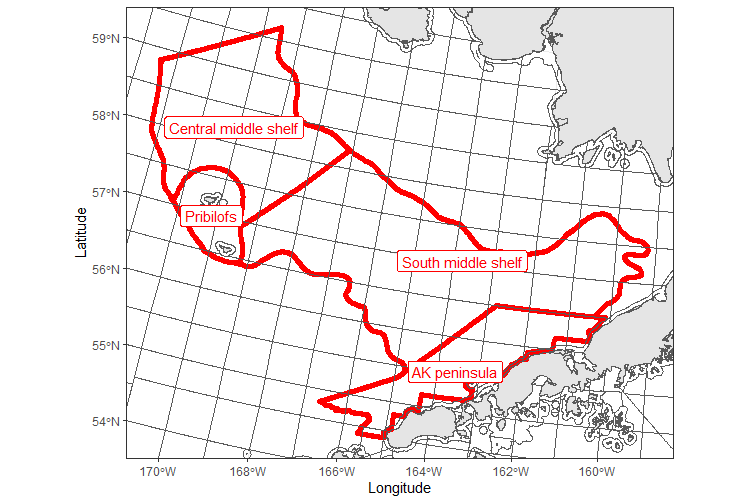
occ\_esp<-readRDS("Data/OCCCI/occ8\_esp\_strata.RDS")

**Create function for plotting MODIS and OC indicators over time**

chla\_timeplot<-function(x1,x2,x3,x4,indicator) {  
 ggplot()+  
 geom\_line(data=x1, aes(x=YEAR,y=OCCCI\_VALUE), color="red")+  
 geom\_line(data=x2, aes(x=YEAR,y=OCCCI\_VALUE), color="red", lty=2)+  
 geom\_line(data=x3, aes(x=YEAR,y=MODIS\_VALUE), color="blue")+  
 geom\_line(data=x4, aes(x=YEAR,y=MODIS\_VALUE), color="blue", lty=2)+  
 ylab("chla")+  
 ylim(c(0,5))+  
 ggtitle(paste(indicator, "\n OC-CCI=red, MODIS=blue, dashed=depth filtered"))  
}

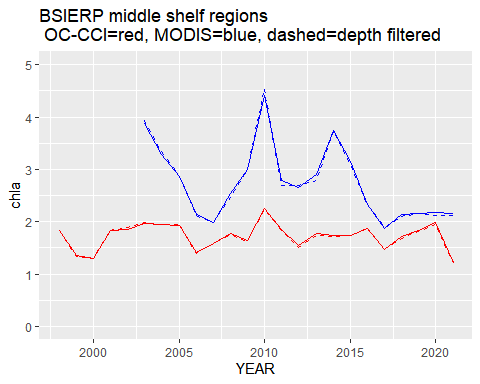
## 3

**SEBS** I first look at the BSIERP “super region” consisting of the South Middle shelf, Alaska Peninsula, Pribilofs, and Central Middle Shelf regions.



selected BSEIRP regions

#define indicator  
indicator<-"BSIERP middle shelf regions"  
  
#MODIS with a 50-200 depth filter and limited to federal waters.   
mod\_esr\_df<-mod\_ebs%>%  
 mutate(month=month(date),  
 YEAR=year(date),  
 ) %>%  
 filter(bsierp\_id %in% c(1,3,5,6) & month %in% c(4,5,6) & depth <(-50) & depth>(-200) & statefed == "FED"  
 )%>%  
 group\_by(YEAR)%>%  
 summarise(MODIS\_VALUE=round(mean(chlorophyll, na.rm=T),2))  
  
#no depth filter  
mod\_esr\_ndf<-mod\_ebs%>%  
 mutate(month=month(date),  
 YEAR=year(date),  
 ) %>%  
 filter(bsierp\_id %in% c(1,3,5,6) & month %in% c(4,5,6) #& depth <(-50) & depth>(-200)  
 )%>%  
 group\_by(YEAR)%>%  
 summarise(MODIS\_VALUE=round(mean(chlorophyll, na.rm=T),2))  
  
  
#oc-cci depth filter  
occci\_esr\_df<-occ\_esp%>%  
 filter(BSIERP\_ID %in% c(1,3,5,6) & month %in% c(4,5,6) & depth <(-50) & depth>(-200) & WATERS\_COD== "FED"  
 )%>%  
 mutate(YEAR=year) %>%  
 group\_by(YEAR)%>%  
 summarise(OCCCI\_VALUE=round(mean(chlorophyll, na.rm=T),2))  
  
#oc-cci no depth filter  
occci\_esr\_ndf<-occ\_esp%>%  
 filter(BSIERP\_ID %in% c(1,3,5,6) & month %in% c(4,5,6) #& depth <(-50) & depth>(-200)  
 )%>%  
 mutate(YEAR=year) %>%  
 group\_by(YEAR)%>%  
 summarise(OCCCI\_VALUE=round(mean(chlorophyll, na.rm=T),2))  
  
#plot  
chla\_timeplot(occci\_esr\_ndf, occci\_esr\_df, mod\_esr\_ndf, mod\_esr\_df, indicator)



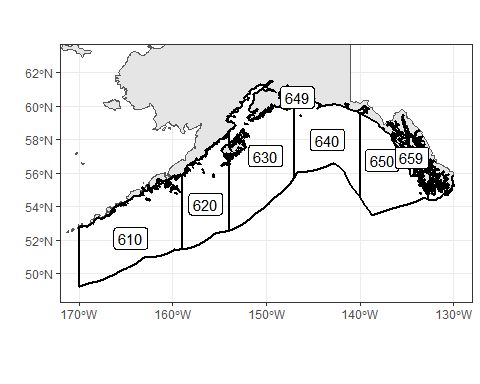
#how much was filtered out?  
mod\_ebs%>%  
 mutate(month=month(date) ) %>%  
 filter(bsierp\_id %in% c(1,3,5,6) & month %in% c(4,5,6))%>%  
 summarise(no\_filter=n())%>%  
 bind\_cols(mod\_ebs %>%  
 mutate(month=month(date) ) %>%  
 filter(bsierp\_id %in% c(1,3,5,6) & month %in% c(4,5,6) & depth <(-50) & depth>(-200) & statefed == "FED")%>%  
 summarise(depth\_filter=n())) %>%   
 mutate(percent\_remaining=depth\_filter/no\_filter\*100)

## # A tibble: 1 x 3  
## no\_filter depth\_filter percent\_remaining  
## <int> <int> <dbl>  
## 1 1557978 1373314 88.1

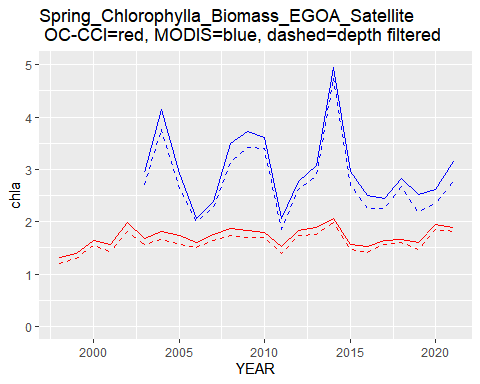
#<12% removed by filter... didn't make much of a difference here.

**Spring\_Chlorophylla\_Biomass\_EGOA\_Satellite** The next two indicators are the eastern and western Gulf of Alaska

ak<-AK\_basemap()  
nmfs<-AK\_marine\_area()%>%filter(NMFS\_REP\_AREA>600)  
  
ggplot()+  
 geom\_sf(data=ak)+  
 geom\_sf(data=nmfs, fill=NA, size=1, color="black")+  
 geom\_sf\_label(data=nmfs, aes(label=NMFS\_REP\_AREA))+  
 xlab("")+ylab("")+  
 coord\_sf(xlim=c(-170, -130), ylim=c(49, 63))+  
 theme\_bw()



#define indicator  
indicator<-"Spring\_Chlorophylla\_Biomass\_EGOA\_Satellite"  
#MODIS  
#recalculate indicator  
mod\_EGOA\_10 <- mod\_goa %>%  
 mutate(month=month(date),  
 YEAR=year(date)) %>%  
 filter(nmfsarea %in% c(640,650) & month%in% c(4:6) & depth<(-10) & depth>(-200)) %>%  
 group\_by(YEAR) %>%  
 summarise(MODIS\_VALUE=mean(chlorophyll,na.rm=TRUE))  
  
#50m filter  
mod\_EGOA\_50 <- mod\_goa %>%  
 mutate(month=month(date),  
 YEAR=year(date)) %>%  
 filter(nmfsarea %in% c(640,650) & month%in% c(4:6) & depth<(-50) & depth>(-200) & statefed=="FED") %>%  
 group\_by(YEAR) %>%  
 summarise(MODIS\_VALUE=mean(chlorophyll,na.rm=TRUE))  
  
  
#OCC  
occci\_EGOA\_10<-occ\_esp%>%  
 filter(NMFS\_REP\_AREA%in% c(640, 650) & month %in% c(4:6) & depth<(-10) & depth>(-200))%>%  
 mutate(YEAR=year) %>%  
 group\_by(YEAR)%>%  
 summarise(OCCCI\_VALUE=mean(chlorophyll,na.rm=TRUE))  
  
occci\_EGOA\_50<-occ\_esp%>%  
 filter(NMFS\_REP\_AREA%in% c(640, 650) & month %in% c(4:6) & depth<(-50) & depth>(-200) & WATERS\_COD== "FED")%>%  
 mutate(YEAR=year) %>%  
 group\_by(YEAR)%>%  
 summarise(OCCCI\_VALUE=mean(chlorophyll,na.rm=TRUE))  
  
#plot  
chla\_timeplot(occci\_EGOA\_10, occci\_EGOA\_50, mod\_EGOA\_10, mod\_EGOA\_50, indicator)



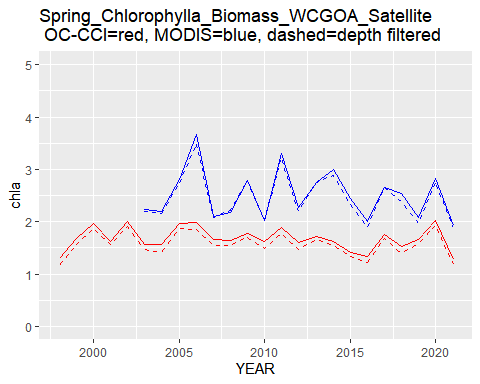
#how much was filtered out?  
mod\_goa%>%  
 mutate(month=month(date) ) %>%  
 filter(nmfsarea %in% c(640, 650) & month %in% c(4,5,6) & depth <(-10) & depth>(-200))%>%  
 summarise(ten\_m\_filter=n())%>%  
 bind\_cols(mod\_goa %>%  
 mutate(month=month(date) ) %>%  
 filter(nmfsarea %in% c(640, 650) & month %in% c(4,5,6) & depth <(-50) & depth>(-200) & statefed == "FED")%>%  
 summarise(fifty\_m\_filter=n())) %>%   
 mutate(percent\_remaining=fifty\_m\_filter/ten\_m\_filter\*100)

## # A tibble: 1 x 3  
## ten\_m\_filter fifty\_m\_filter percent\_remaining  
## <int> <int> <dbl>  
## 1 710296 612793 86.3

#<14% removed by filter... didn't make much of a difference here.

**Spring\_Chlorophylla\_Biomass\_WCGOA\_Satellite**

#define indicator  
#define indicator  
indicator<-"Spring\_Chlorophylla\_Biomass\_WCGOA\_Satellite"  
#MODIS  
#recalculate indicator  
mod\_WGOA\_10 <- mod\_goa %>%  
 mutate(month=month(date),  
 YEAR=year(date)) %>%  
 filter(nmfsarea %in% c(610, 620, 630) & month%in% c(4:6) & depth<(-10) & depth>(-200)) %>%  
 group\_by(YEAR) %>%  
 summarise(MODIS\_VALUE=mean(chlorophyll,na.rm=TRUE))  
  
#50m filter  
mod\_WGOA\_50 <- mod\_goa %>%  
 mutate(month=month(date),  
 YEAR=year(date)) %>%  
 filter(nmfsarea %in% c(610, 620, 630) & month%in% c(4:6) & depth<(-50) & depth>(-200) & statefed=="FED") %>%  
 group\_by(YEAR) %>%  
 summarise(MODIS\_VALUE=mean(chlorophyll,na.rm=TRUE))  
  
#OCC  
occci\_WGOA\_10<-occ\_esp%>%  
 filter(NMFS\_REP\_AREA%in% c(610, 620, 630) & month %in% c(4:6) & depth<(-10) & depth>(-200))%>%  
 mutate(YEAR=year) %>%  
 group\_by(YEAR)%>%  
 summarise(OCCCI\_VALUE=mean(chlorophyll,na.rm=TRUE))  
  
occci\_WGOA\_50<-occ\_esp%>%  
 filter(NMFS\_REP\_AREA%in% c(610, 620, 630) & month %in% c(4:6) & depth<(-50) & depth>(-200) & WATERS\_COD== "FED")%>%  
 mutate(YEAR=year) %>%  
 group\_by(YEAR)%>%  
 summarise(OCCCI\_VALUE=mean(chlorophyll,na.rm=TRUE))  
  
#plot  
chla\_timeplot(occci\_WGOA\_10, occci\_WGOA\_50, mod\_WGOA\_10, mod\_WGOA\_50, indicator)



#how much was filtered out?  
mod\_goa%>%  
 mutate(month=month(date) ) %>%  
 filter(nmfsarea %in% c(610, 620, 630) & month %in% c(4,5,6) & depth <(-10) & depth>(-200))%>%  
 summarise(ten\_m\_filter=n())%>%  
 bind\_cols(mod\_goa %>%  
 mutate(month=month(date) ) %>%  
 filter(nmfsarea %in% c(610, 620, 630) & month %in% c(4,5,6) & depth <(-50) & depth>(-200) & statefed == "FED")%>%  
 summarise(fifty\_m\_filter=n())) %>%   
 mutate(percent\_remaining=fifty\_m\_filter/ten\_m\_filter\*100)

## # A tibble: 1 x 3  
## ten\_m\_filter fifty\_m\_filter percent\_remaining  
## <int> <int> <dbl>  
## 1 1954772 1584651 81.1

#<19% removed by filter.