Nov.2nd.report

November 19, 2022

1 Progress

The mainly progress for the last two weeks are 1)visualization code(See helper.R). 2) literature review

1.1 visualization

a) visualize the trend using Linear Regression

b) visualize the correlation between sst and chlA

c) draw the contour line(we dont have the SSL data so we use the Chl data)
d) repair the outlier values(5 std away from a mean)
e) discription statistic
f) R functions are organized in seperated file for reuse purpose

1.2 Literature review

There is strong connection between Ch and SST, but the relationship could differ in region, which aligns with our observation[1]. Second paper[2] contains the method to get the movement from consecutive 2D matrix.

2 Demonstration

[1]:
```
# load data
library(ncdf4)
library(ggplot2)
library(lubridate)
library(gamm4)
library(mgcv)
library(rjson)
library(rray)
source("../helper.R")
```

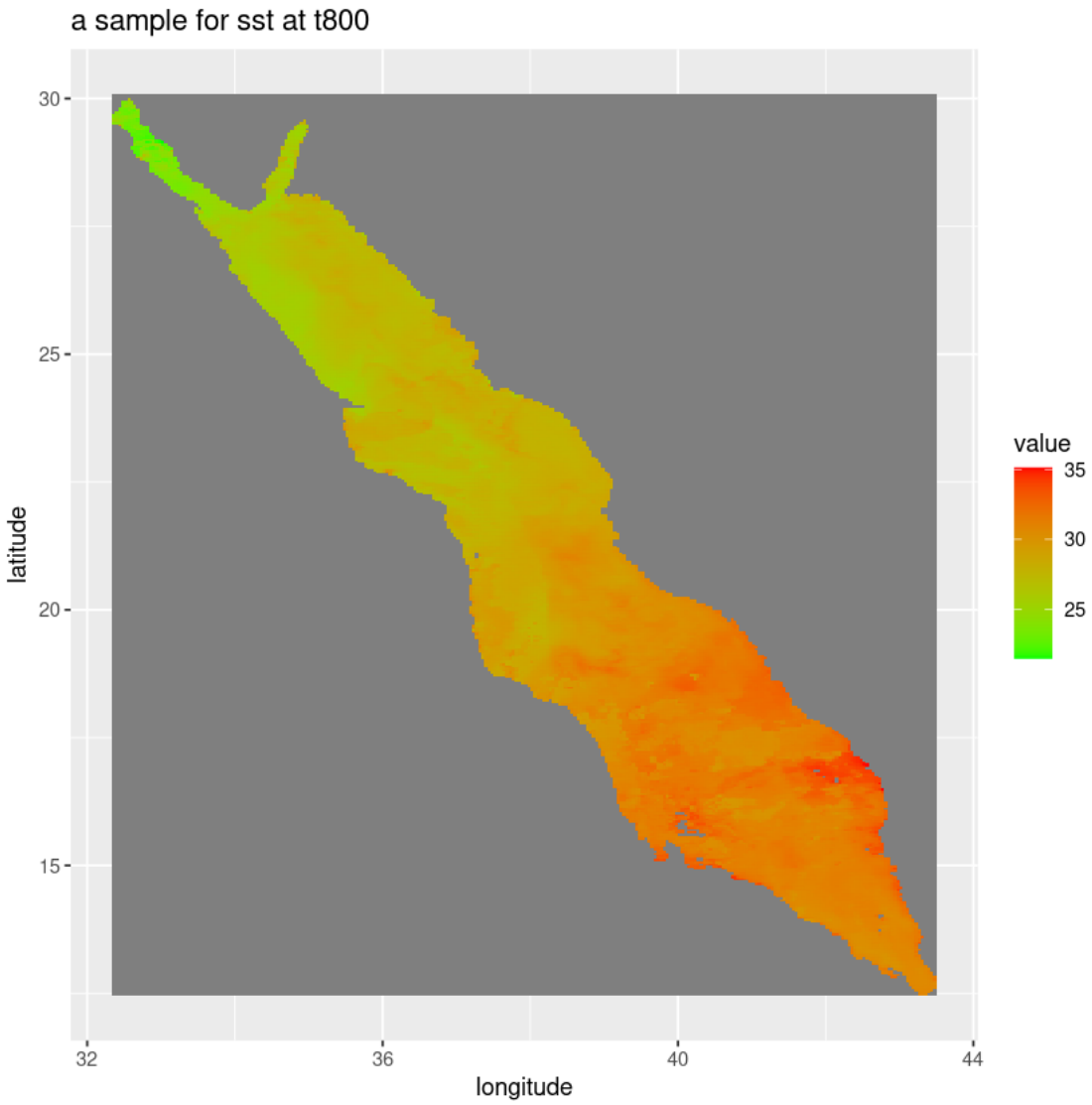
[2]:
```
database <- '/home/jianj0c/dataset/redsea/'
```

```
chl_data_folder  <- 'Chlorophyll/8-Days_composite/'
chl_dir_path <-␣
 ↪paste(database,chl_data_folder,"Aqua_MODIS_chloA_8_Days_Composite.2003_2022.
 ↪nc",sep="")
chl_nc_obj <- nc_open(chl_dir_path)
chl_T_array <- ncvar_get(chl_nc_obj,"chlorophyllA")

sst_data_folder  <- 'SST/Aqua_MODIS_8_days_L3m_4km_SST/'
sst_dir_path <- paste(database,sst_data_folder,"Aqua_MODIS_sstd_8day_Composite.
 ↪2003_2022.nc",sep="")
sst_nc_obj <- nc_open(sst_dir_path)
sst_T_array <- ncvar_get(sst_nc_obj,"sstMasked")

longitude<-chl_nc_obj$dim[[1]]$vals
latitude <- chl_nc_obj$dim[[2]]$vals
timestamp_ch <- chl_nc_obj$dim[[3]]$vals
timestamp_sst <- sst_nc_obj$dim[[3]]$vals
## configuration
config<-fromJSON(file="../config.json")
task_paral_maximum<-parallel::detectCores()-5
```

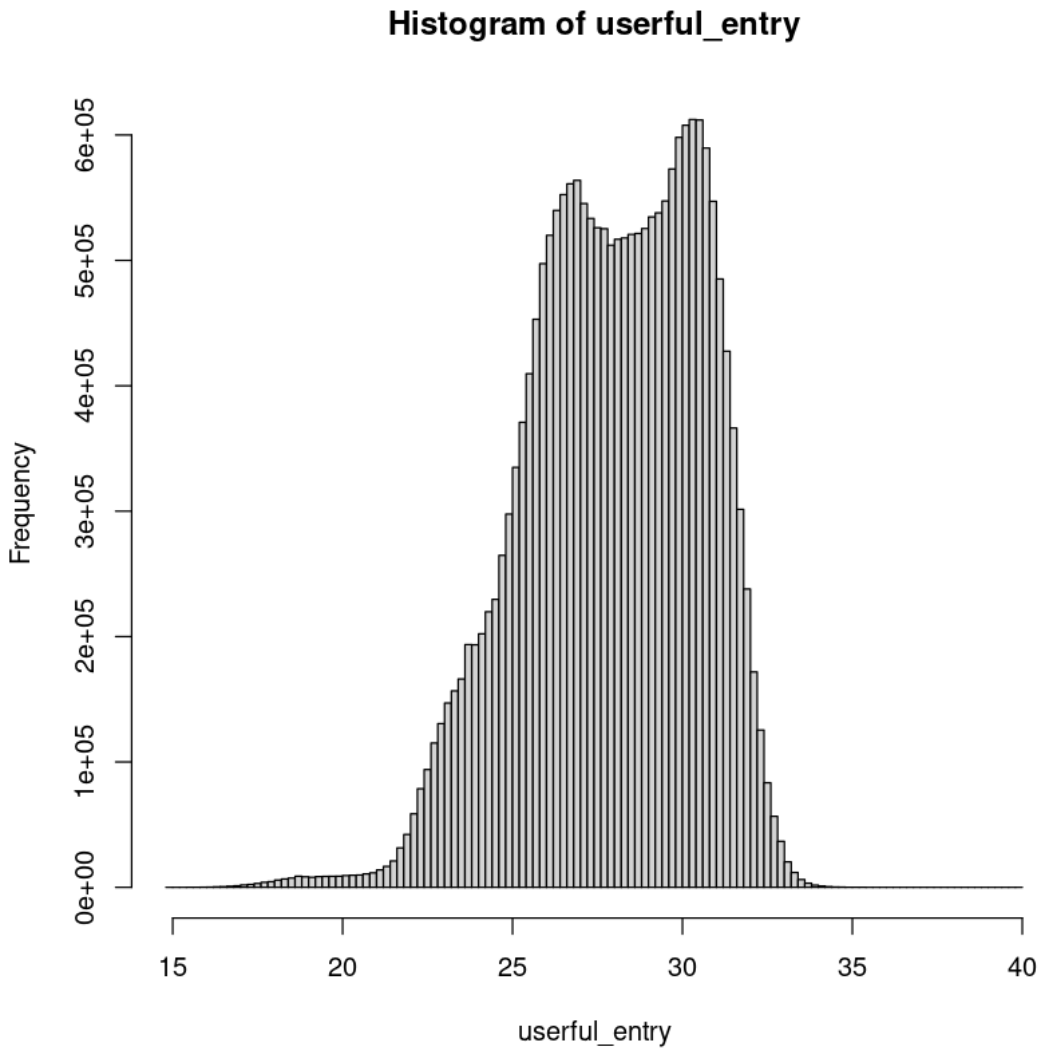
2.1 statistic discription of SST and CHL

2.1.1 SST(Before filter outlier)

[143]:
```
visualize_frame_ggplot(sst_T_array[,,800],latitude,longitude,title="a sample␣
 ↪for sst at t800")
helper_describe(sst_T_array)
```

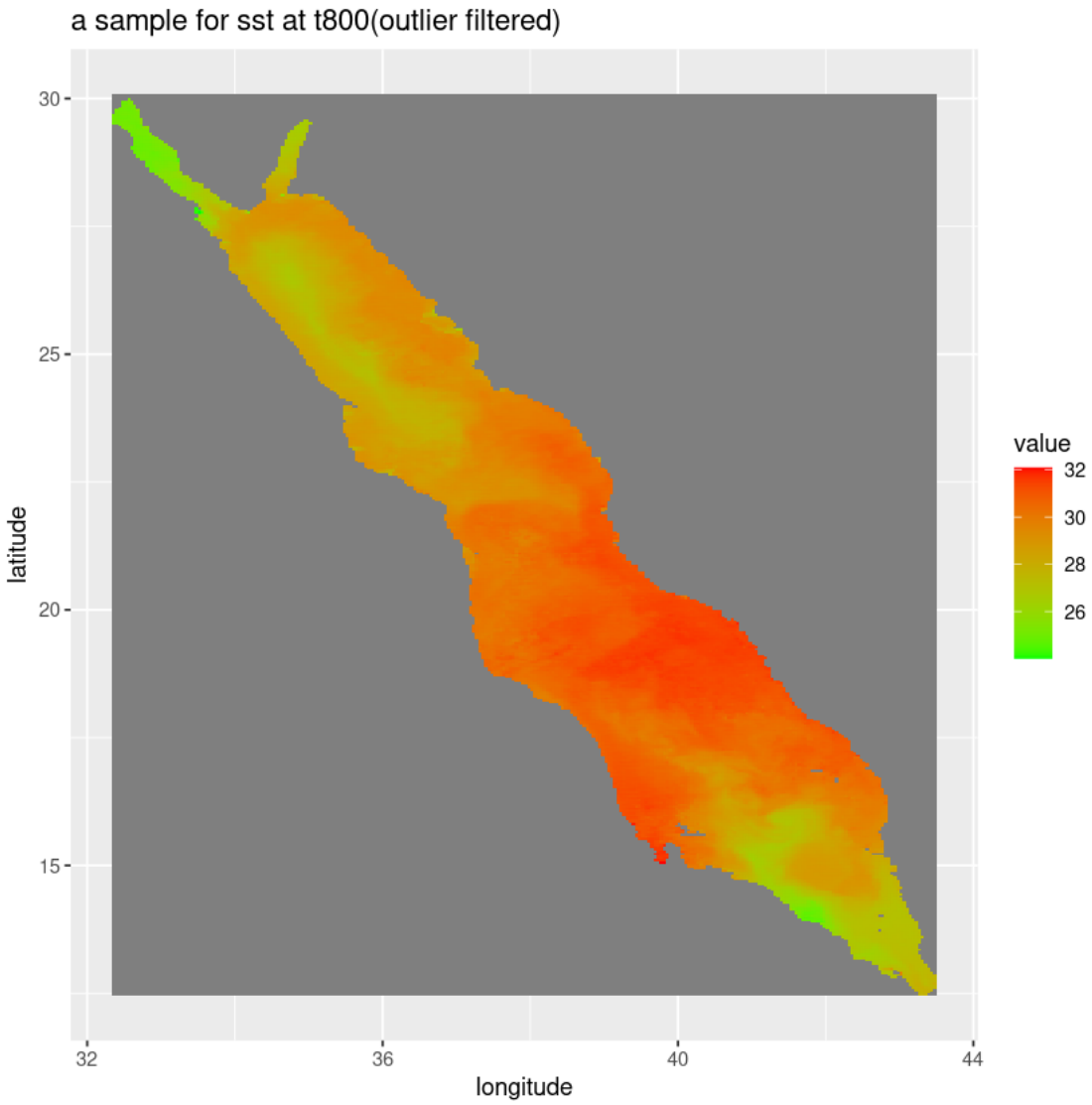


Min.	1st Qu.	Median	Mean	3rd Qu.
15	26	28	28	30
Max.	Valid.Ent	Valid.percent	Std	
40	20969524	21	3	

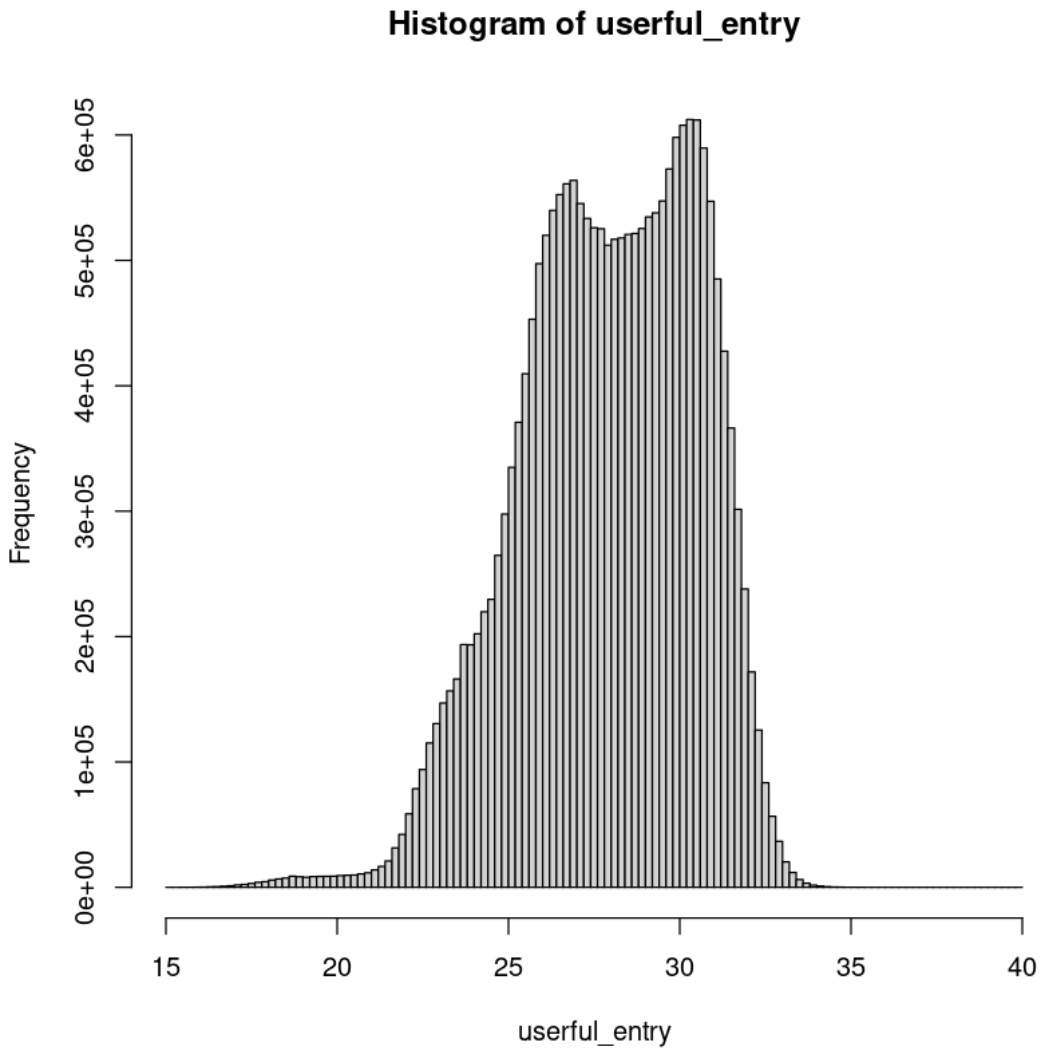


2.1.2 SST(After filter outlier)

[144]:
```
sst_T_array_filter_outlier<-sst_T_array

sst_T_array_filter_outlier[pipeline_filter_for_outlier(sst_T_array,5)]=NA
visualize_frame_ggplot(sst_T_array_filter_outlier[,,819],latitude,longitude,title="a␣
 ↪sample for sst at t800(outlier filtered)")
helper_describe(sst_T_array_filter_outlier)
```

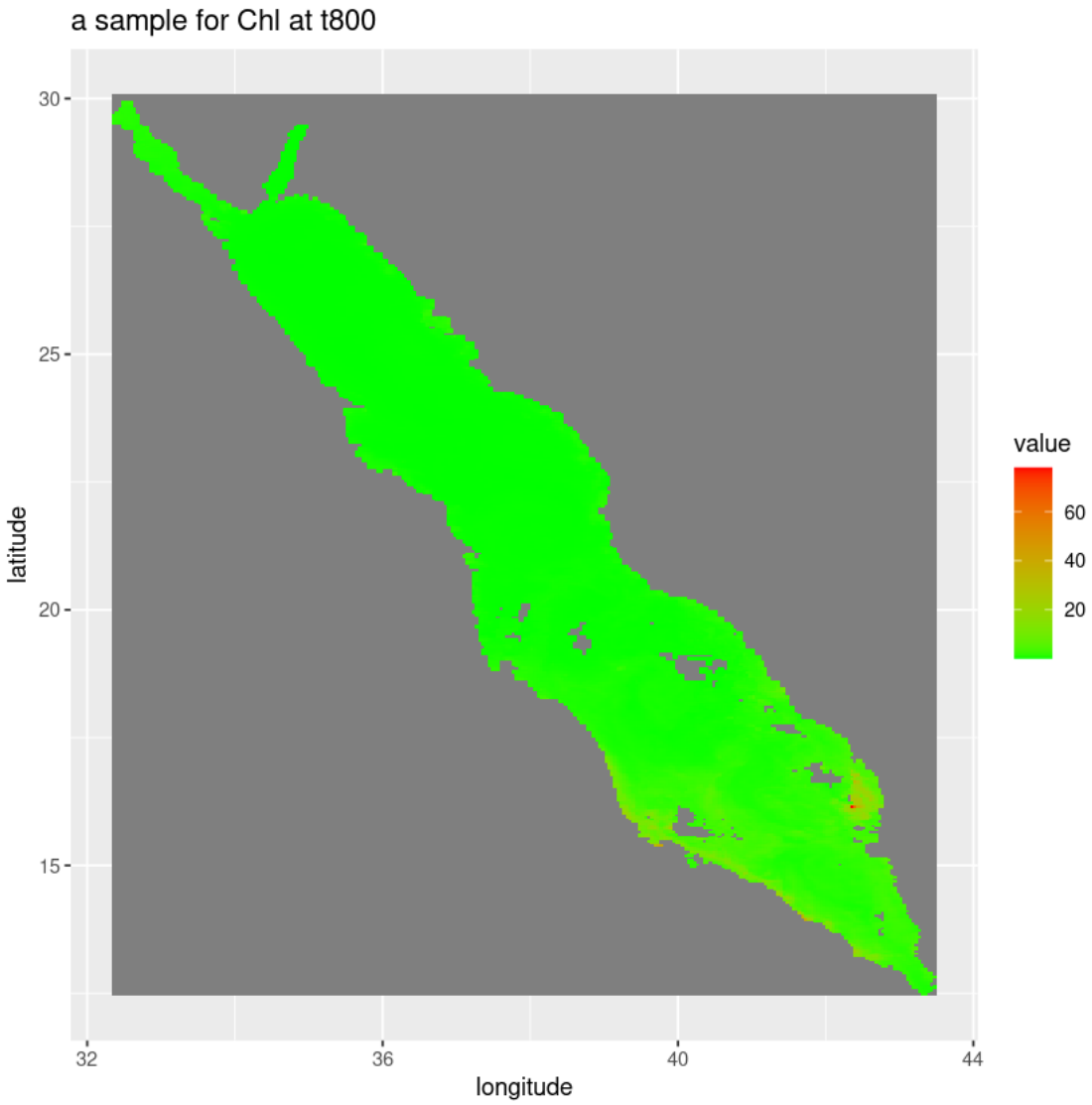


Min.	1st Qu.	Median	Mean	3rd Qu.
15	26	28	28	30
Max.	Valid.Ent	Valid.percent	Std	
40	20969523	21	3	

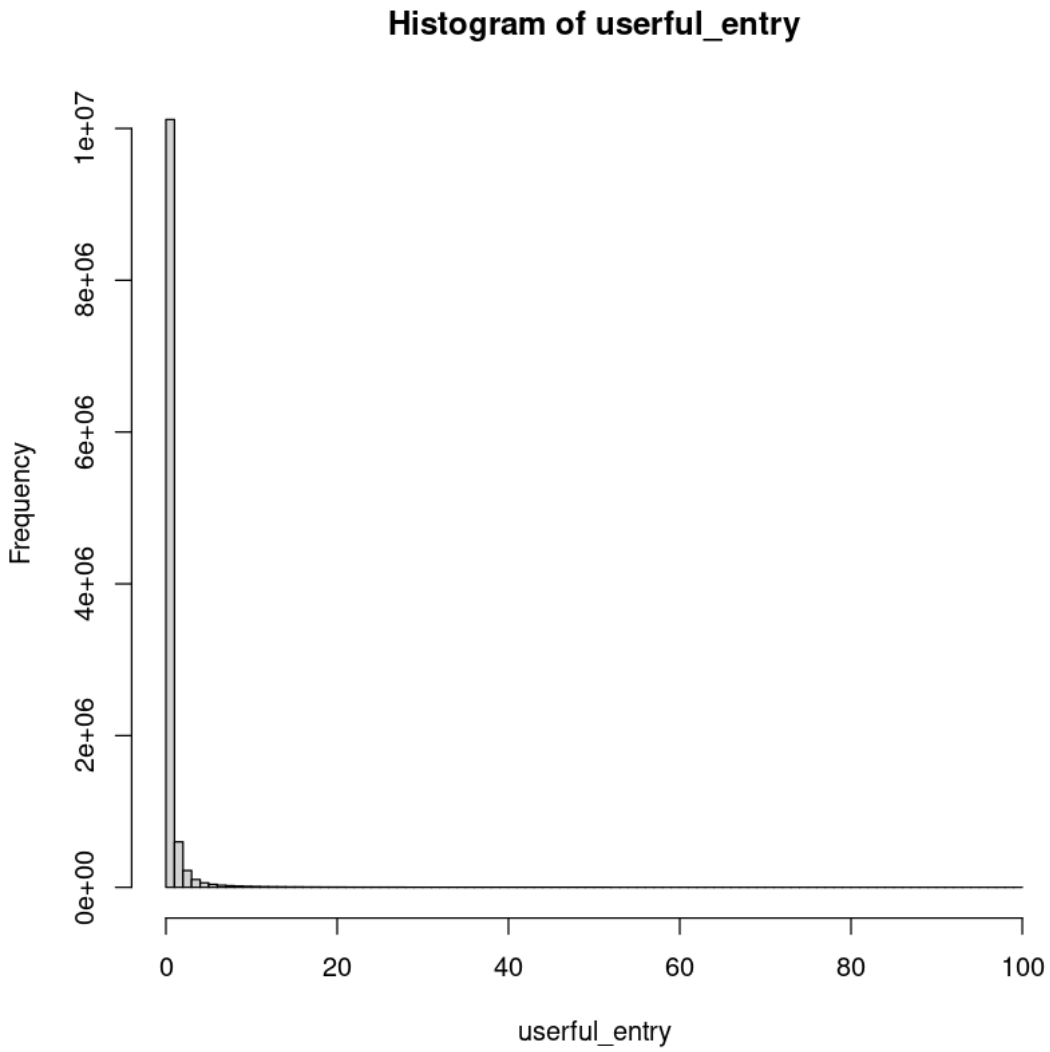


2.1.3 ChA(Before filter outlier)

[145]:
```
visualize_frame_ggplot(chl_T_array[,,819],latitude,longitude,title="a sample␣
↪for Chl at t800")
helper_describe(chl_T_array)
```



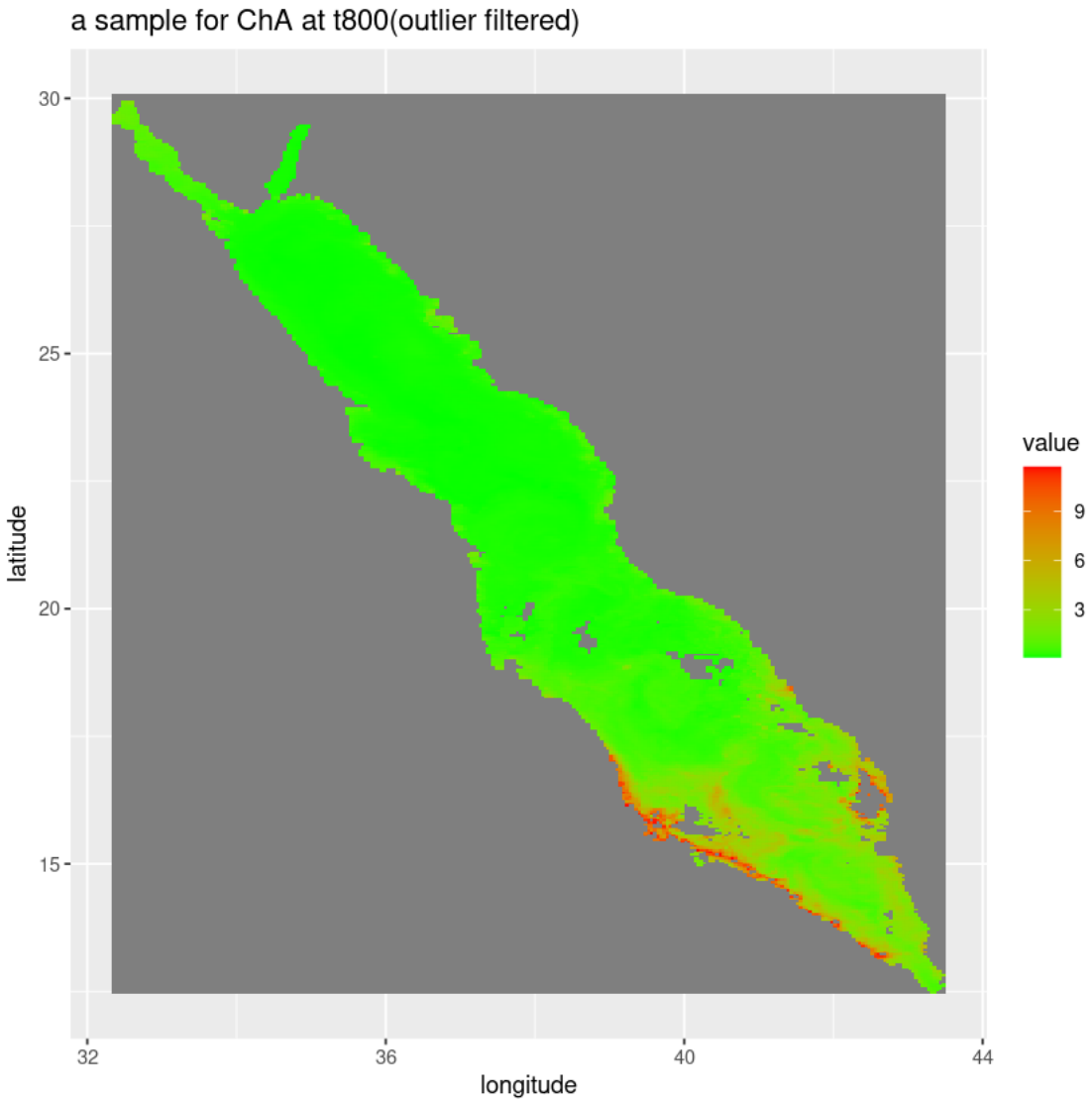
Min.	1st Qu.	Median	Mean	3rd Qu.
0	0	0	1	0
Max.	**Valid.Ent**	**Valid.percent**	**Std**	
100	11315119	11	2	



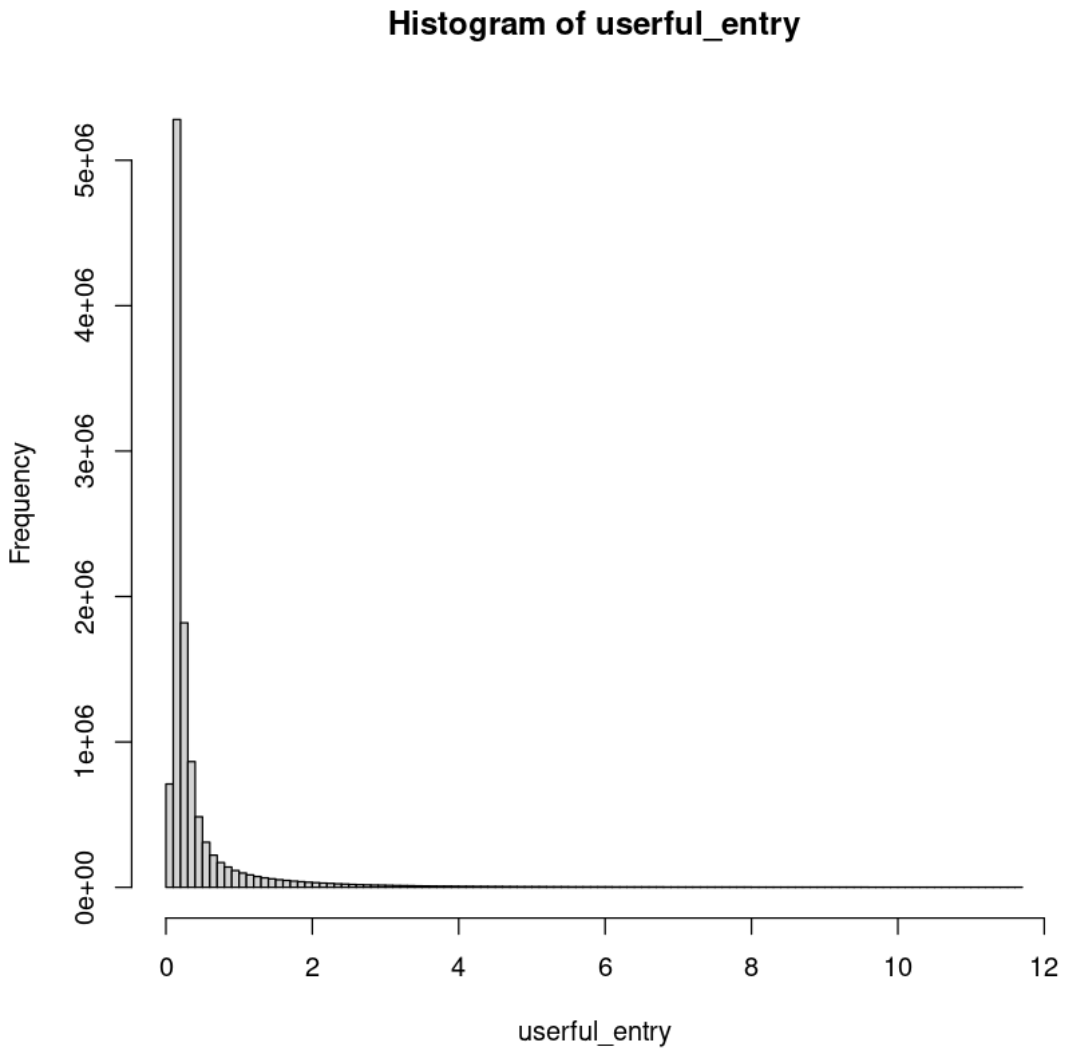
2.1.4 ChA(After filter outlier)

we can see from the plot, there is a lot of outlier in ChA data. from a source the range for ChA should be 0-50. Those outliers in Chl data distort the plot a lot.

[146]:
```
chl_T_array_filter_outlier<-chl_T_array
chl_T_array_filter_outlier[pipeline_filter_for_outlier(chl_T_array,5)]=NA
visualize_frame_ggplot(chl_T_array_filter_outlier[,,819],latitude,longitude,title="a␣
↪sample for ChA at t800(outlier filtered)")
helper_describe(chl_T_array_filter_outlier)
```



Min.	1st Qu.	Median	Mean	3rd Qu.
0	0	0	0	0
Max.	**Valid.Ent**	**Valid.percent**	**Std**	
12	11242030	11	1	

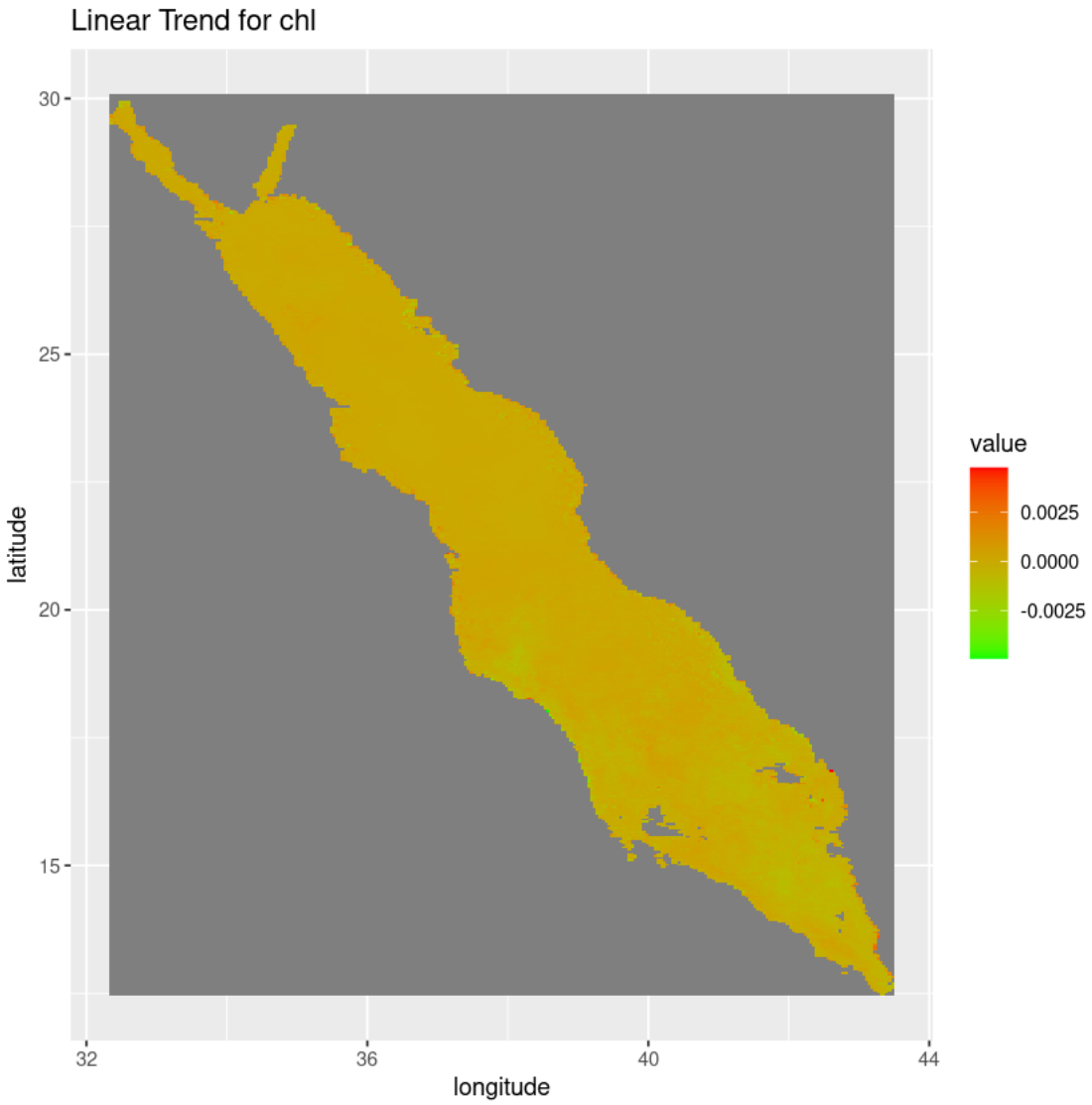


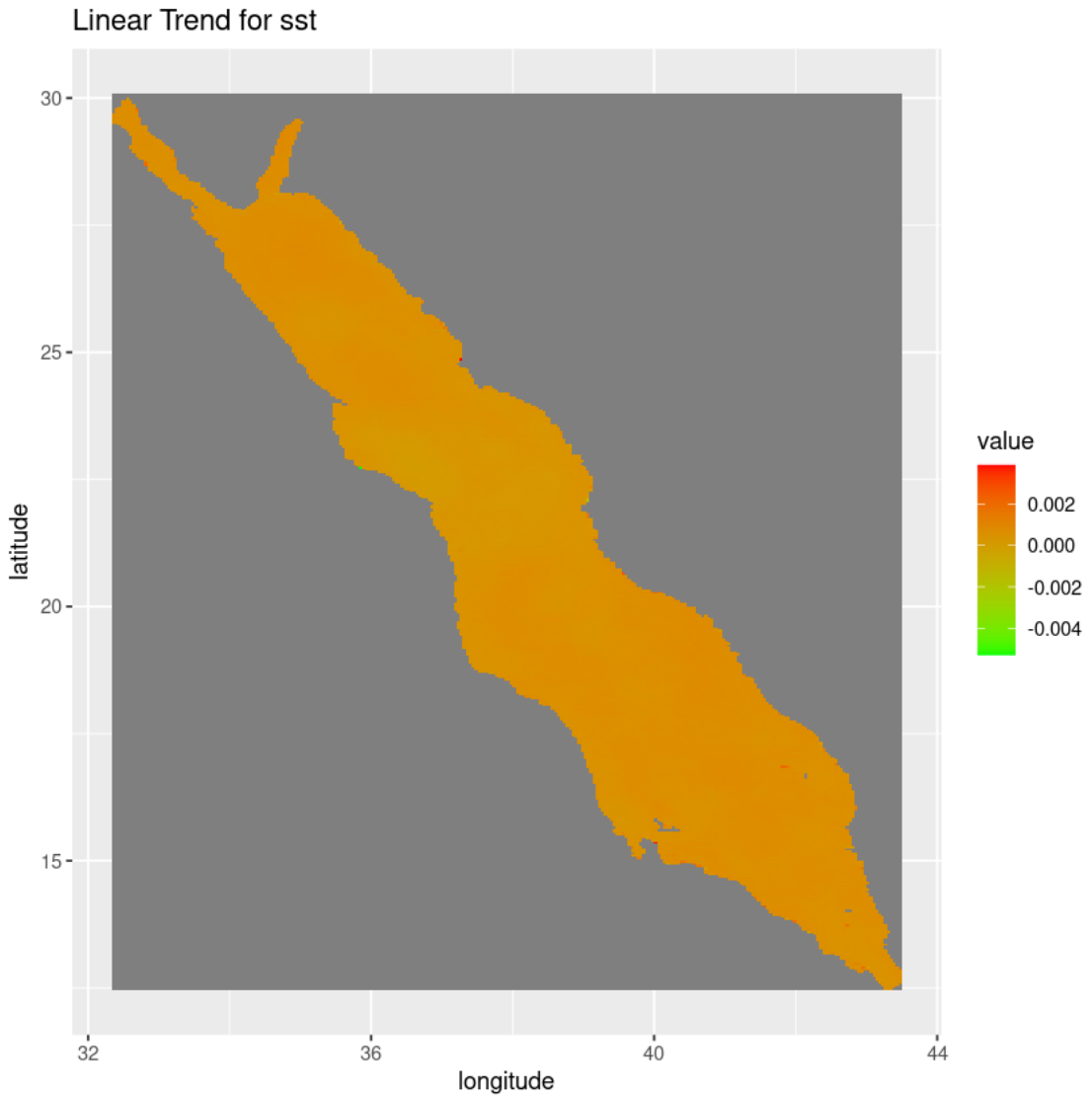
2.2 trend regression

to see the linear trend in last ten year, we do the linear regression. We can see global warming from the Linear trend on surface temperature. However, there is no consistent for the linear trend on ChlA which suggests the Chl's dynamic are more complicated.

[ ]:
```
chl_trend_matrix<-reducer_trend(chl_T_array_filter_outlier,"Chl",25)
sst_trend_matrix<-reducer_trend(sst_T_array_filter_outlier,"SST",25)
```

[142]:
```
visualize_frame_ggplot(chl_trend_matrix,latitude,longitude,title="Linear Trend␣
↪for chl")
visualize_frame_ggplot(sst_trend_matrix,latitude,longitude,title="Linear Trend␣
↪for sst")
```

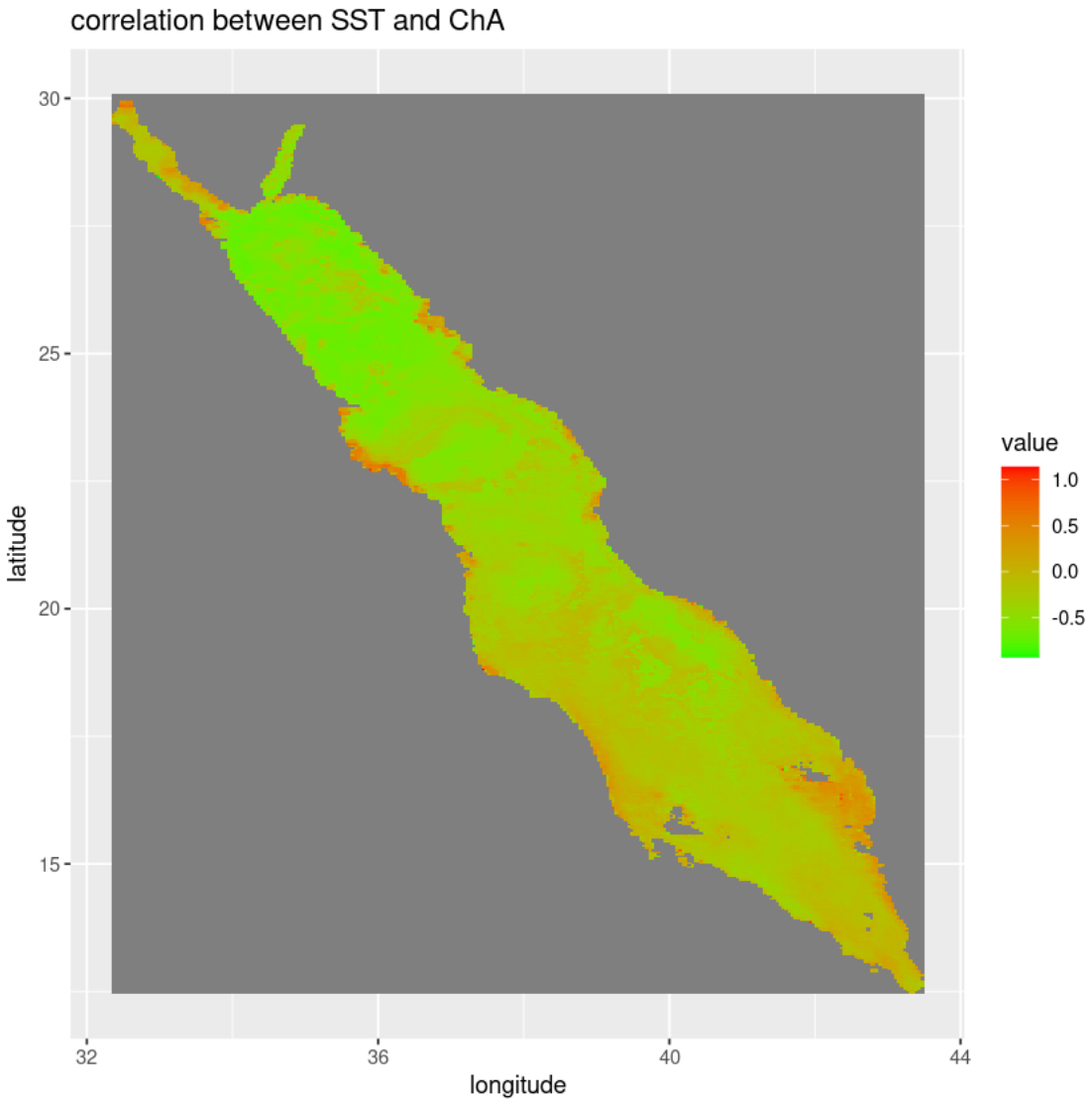

Linear Trend for chl
30
25
20
15
latitude
32
36
40
44
longitude
value
0.0025
0.0000
-0.0025



2.3 corelation between chl and sst

The correlation between Chl and sst is kind of strong. The correlation differ in regions and shed the light on how we design the feature to predict the Chl dynamic.

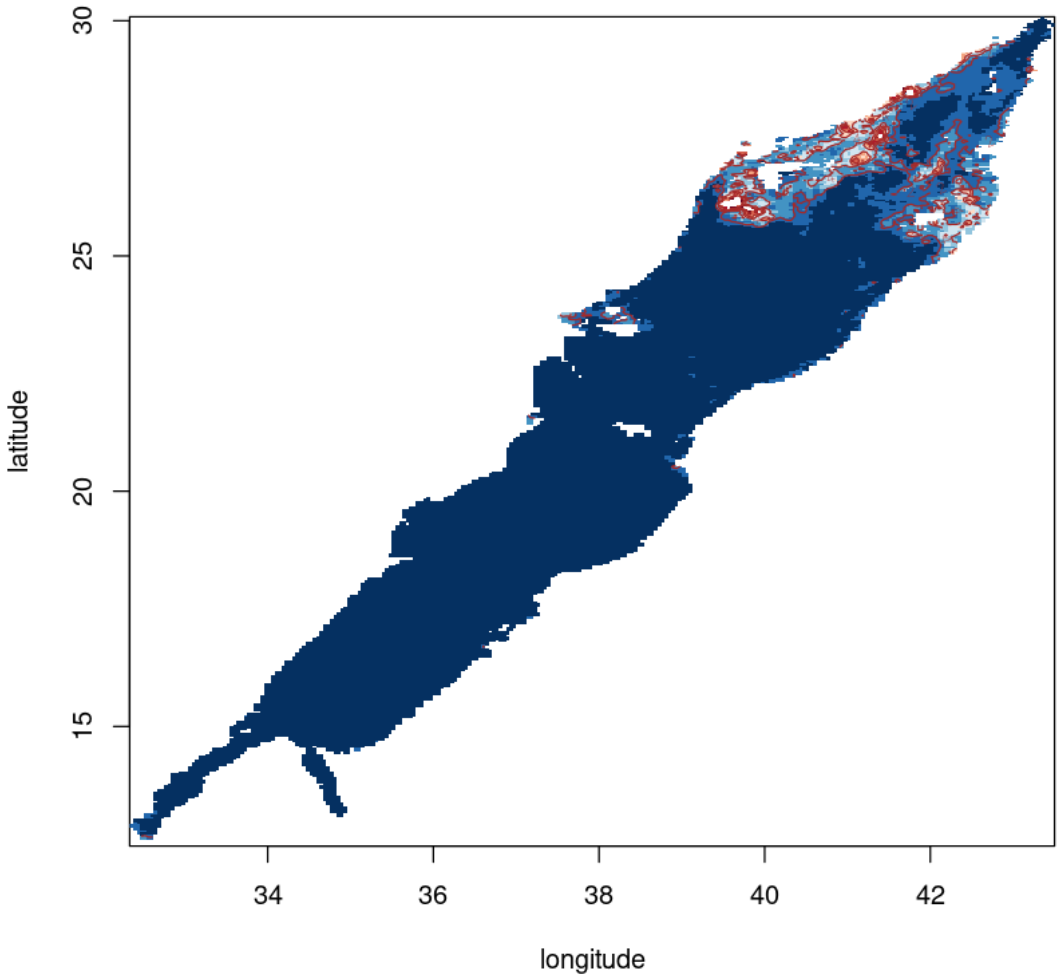
[141]:
```
correlation_matrix<-reducer2_correlation(chl_T_array_filter_outlier[,,1:700],
    sst_T_array_filter_outlier[,,1:700])
visualize_frame_ggplot(correlation_matrix,latitude,longitude,,title="correlation␣
 ↪between SST and ChA")
```



2.4 draw edge

draw edge in R just require one extra code(see this source)])

[149]:
```
visualize_frame_level(chl_T_array_filter_outlier[,,821],latitude,longitude,nlevel=5)
```



3 References

[1] Bellido J J, Baez J C, Souviron-Priego L, et al. Atmospheric indices allow anticipating the incidence of jellyfish coastal swarms[J]. Mediterranean Marine Science, 2020, 21(2): 289-297.

[2] Heitz D, Mémin E, Schnörr C. Variational fluid flow measurements from image sequences: synopsis and perspectives[J]. Experiments in fluids, 2010, 48(3): 369-393.