MAKING OF
SEA SURFACE SALINITY CONTRAST

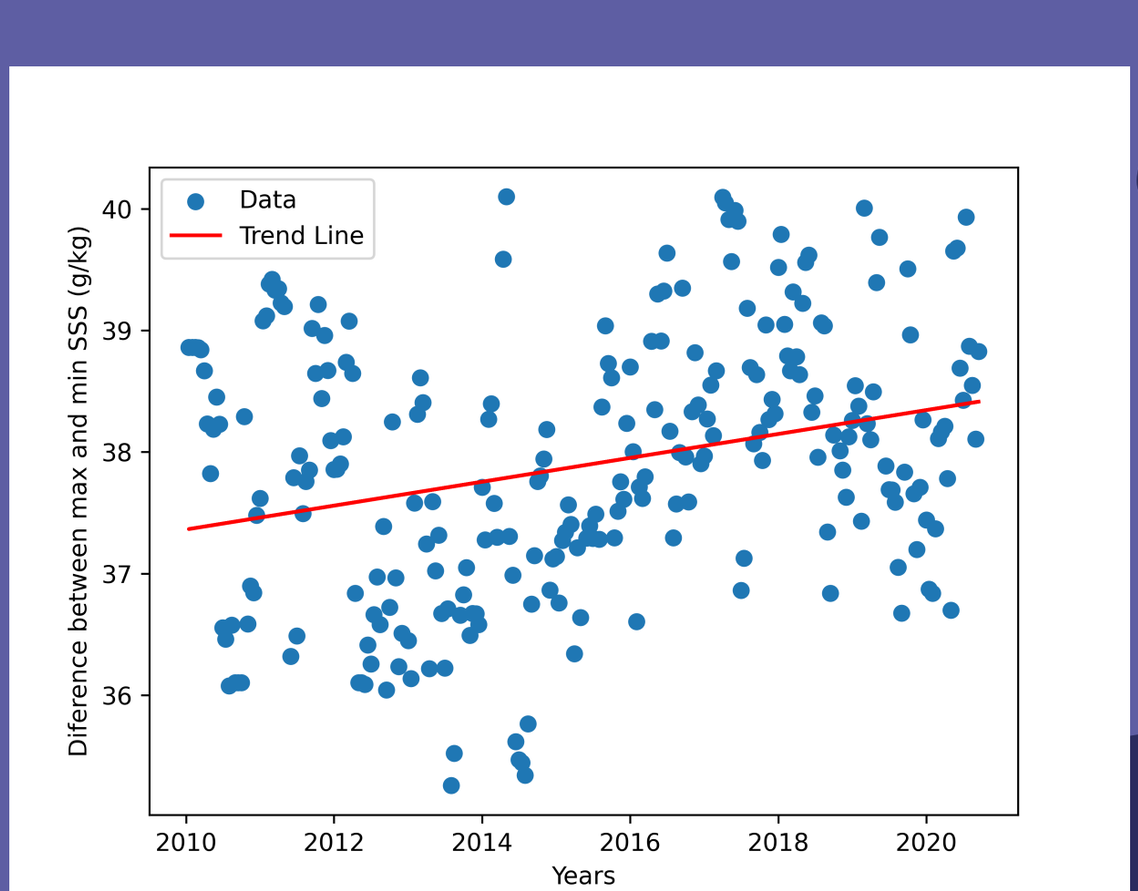
Little Pictures of climate competition 2023

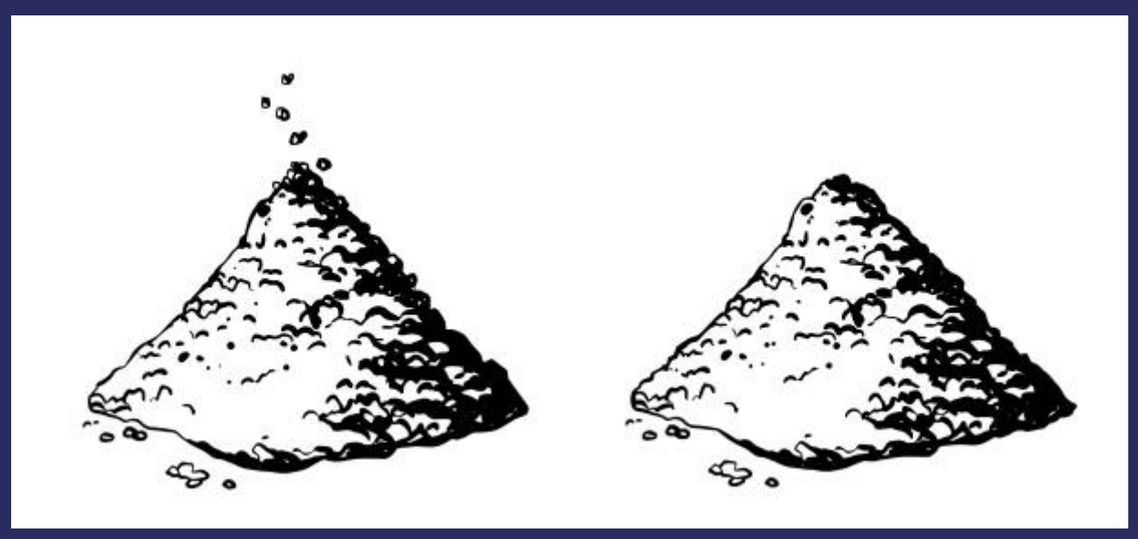
DATASET: ESA Sea Surface Salinity Climate Change Initiative (Sea_Surface_Salinity_cci): Monthly sea surface salinity product, v03.21, for 2010 to 2020

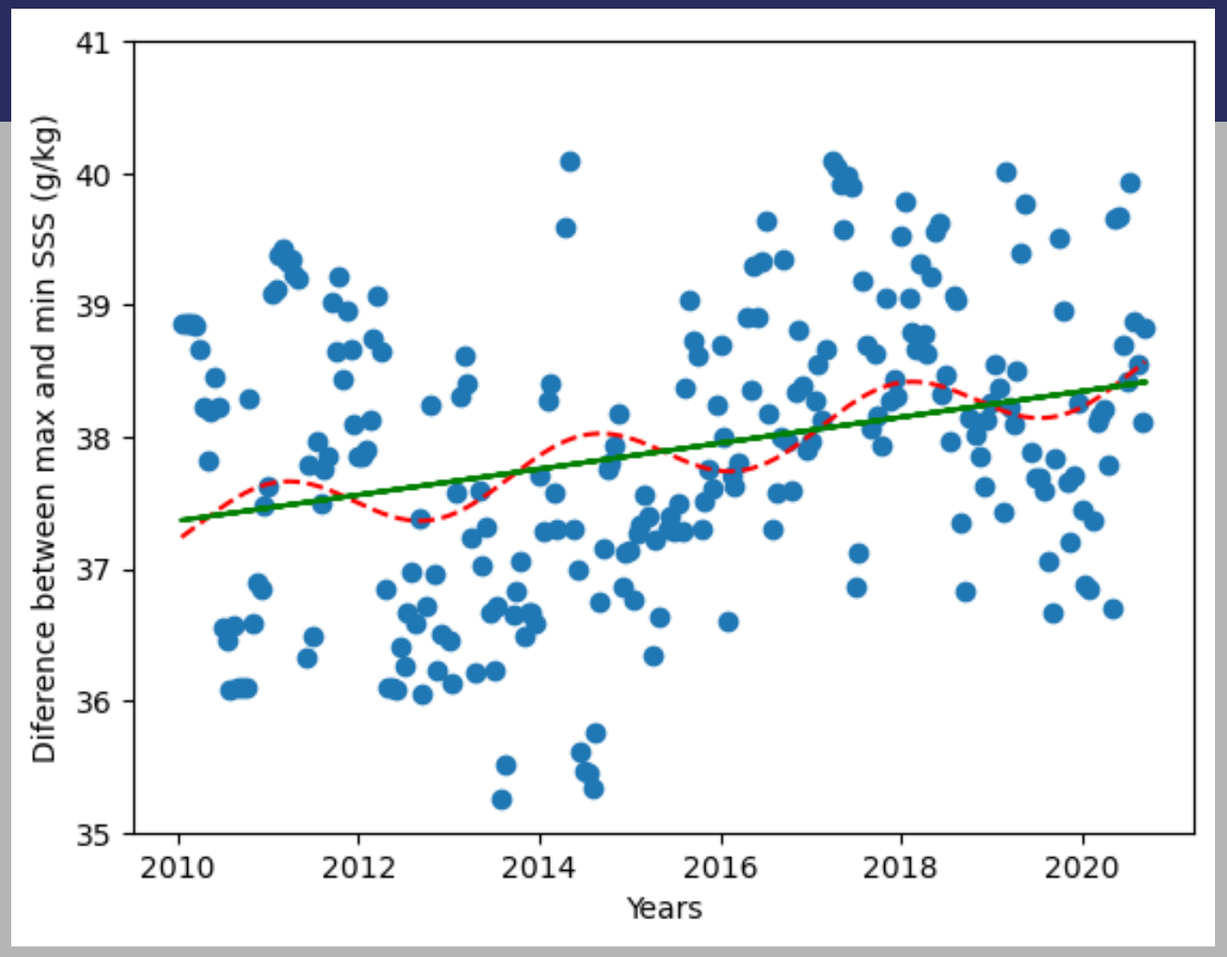
sea surface salinity contrast

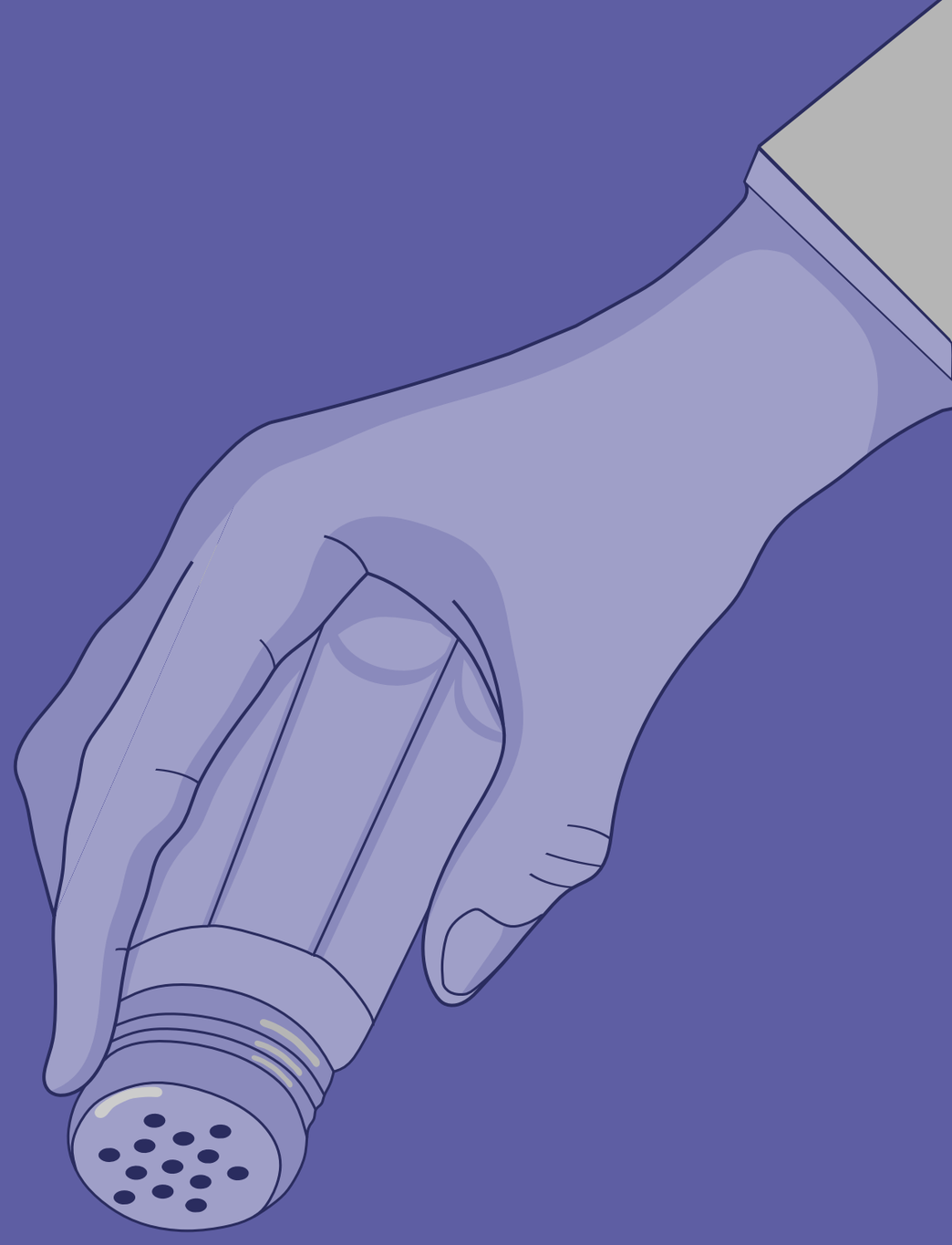
2010-2020

This illustration depicts the increase tendency in salinity contrast from 2010 to 2020. Projecting a 7.4% rise by 2050. This parameter represents the difference between the highest and lowest salinity values, playing a role in global warming, intensifying the global water cycle, and raising the risk of extreme rainfall events.


Data
Trend Line
Diference between max and min SSS (g/kg)
40
39
38
37
36
2010
2012
2014
2016
2018
2020
Years




Diference between max and min SSS (g/kg)
41
40
39
38
37
36
35
2010
2012
2014
2016
2018
2020
Years



sea surface salinity contrast

2010-2020

increment in salinity contrast

2010-2020

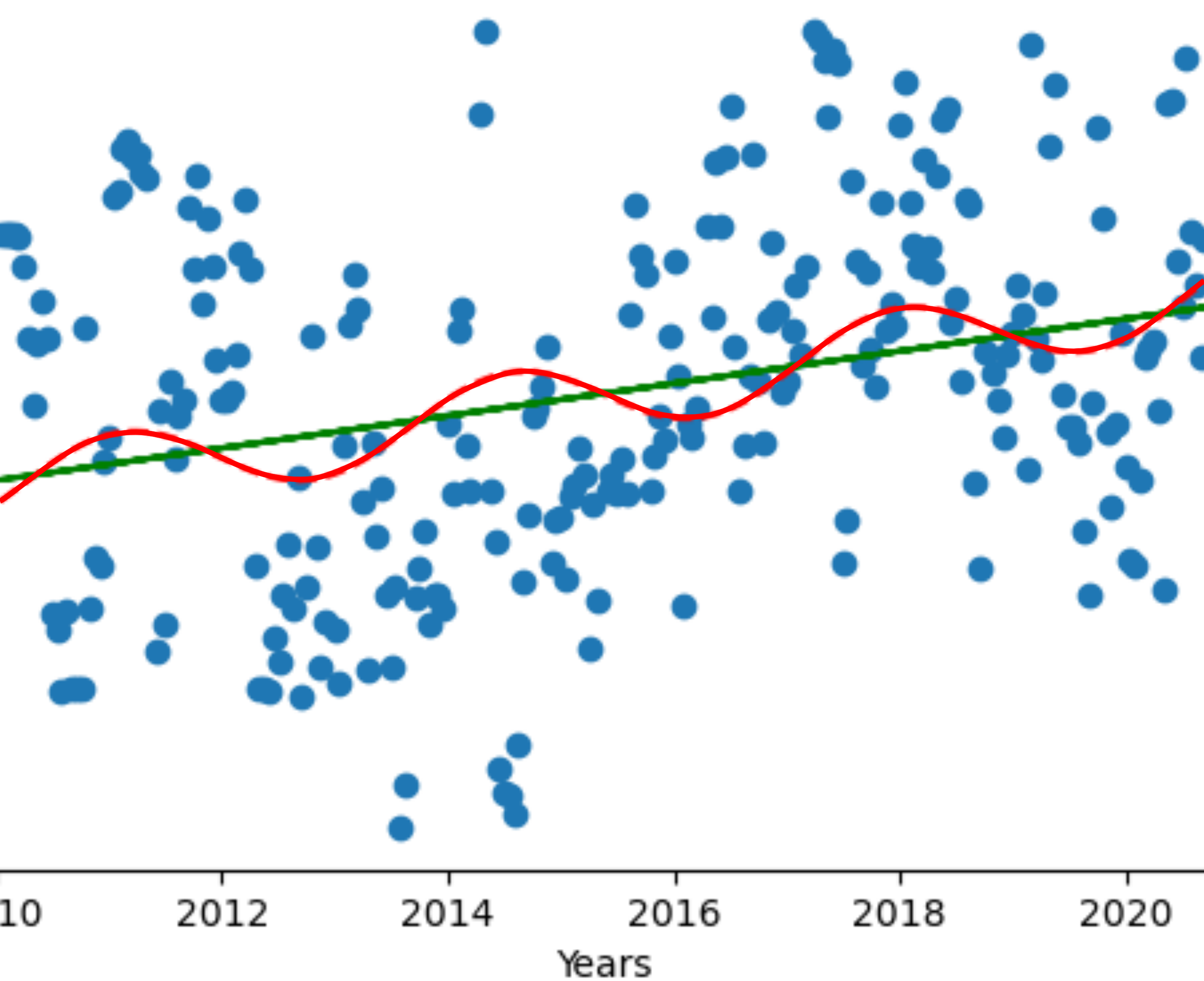
This illustration represents the increment of salinity contrast, showing a tendency with the background line of more salty oceans.

sea surface salinity contrast

2010-2020

This illustration depicts a 1.5% increase in salinity contrast from 2010 to 2020. Sea surface salinity contrast represents the difference between the highest and lowest salinity values, contributing to global warming, intensifying the global water cycle, and raising the risk of extreme rainfall events.

```
import netCDF4
import numpy as np
import re
from datetime import datetime
import matplotlib.pyplot as plt
import os
from matplotlib.dates import date2num, num2date
from scipy.optimize import curve_fit
import csv

dates_values = []
maximals = []
minimals = []
file_names = os.listdir('/home/home/Desktop/DATA/30days/2010')

for i in range(23):
    file_name = '/home/home/Desktop/DATA/30days/2010'+'/'+file_names[i]
    date = re.search("([0-9]{4}[0-9]{2}[0-9]{2})", file_name)
    date_value = datetime.strptime(date.group(), '%Y%m%d').date()
    dates_values.append(date_value)
    date_string = str(datetime.strptime(date.group(), '%Y%m%d').date())
    date_string = date_string.replace("-","")
    f = netCDF4.Dataset(file_name)
    sss = f.variables['sss']
    values_max = []
    values_min = []

    for ii in range(584):
        a = sss[0,ii,:]
        a = list(a)
        values_max.append(max(a))
        values_min.append(min(a))


    max_value = [v for v in values_max if v != '--']
    max_value = max(max_value)
    maximals.append(max_value)

    min_value = [v for v in values_min if v != '--']
    min_value = min(min_value)
    minimals.append(min_value)

print(2010)

years = ['2011','2012','2013','2014','2015','2016','2017',
         '2018','2019']

for j in range(9):

    file_names = os.listdir('/home/home/Desktop/DATA/30days/'+years[j])

    for k in range(23):
        file_name = '/home/home/Desktop/DATA/30days/'+years[j]+'/'+file_names[k]
        date = re.search("([0-9]{4}[0-9]{2}[0-9]{2})", file_name)
        date_value = datetime.strptime(date.group(), '%Y%m%d').date()
        dates_values.append(date_value)
        date_string = str(datetime.strptime(date.group(), '%Y%m%d').date())
        date_string = date_string.replace("-","")
        f = netCDF4.Dataset(file_name)
        sss = f.variables['sss']
        values_max = []
        values_min = []

        for kk in range(584):
            a = sss[0,kk,:]
            a = list(a)
            values_max.append(max(a))
            values_min.append(min(a))


        max_value = [v for v in values_max if v != '--']
        max_value = max(max_value)
        maximals.append(max_value)

        min_value = [v for v in values_min if v != '--']
        min_value = min(min_value)
        minimals.append(min_value)

    print(years[j])

file_names = os.listdir('/home/home/Desktop/DATA/30days/2020')

for l in range(18):
    file_name = '/home/home/Desktop/DATA/30days/2020'+'/'+file_names[l]
    date = re.search("([0-9]{4}[0-9]{2}[0-9]{2})", file_name)
    date_value = datetime.strptime(date.group(), '%Y%m%d').date()
    dates_values.append(date_value)
    date_string = str(datetime.strptime(date.group(), '%Y%m%d').date())
    date_string = date_string.replace("-","")
    f = netCDF4.Dataset(file_name)
    sss = f.variables['sss']
    values_max = []
    values_min = []

    for ll in range(584):
        a = sss[0,ll,:]
        a = list(a)
        values_max.append(max(a))
        values_min.append(min(a))


    max_value = [v for v in values_max if v != '--']
    max_value = max(max_value)
    maximals.append(max_value)

    min_value = [v for v in values_min if v != '--']
    min_value = min(min_value)
    minimals.append(min_value)


difference = np.array(maximals) - np.array(minimals)
plt.scatter(dates_values,difference)
plt.show()

# Convert datetime objects to numeric values
numeric_dates = date2num(dates_values)

difference = np.array(maximals) - np.array(minimals)

# Scatter plot
plt.scatter(num2date(numeric_dates), difference, label='Data')

# Add a trend line
coefficients = np.polyfit(numeric_dates, difference, 1)
trend_line = np.poly1d(coefficients)
plt.plot(num2date(numeric_dates), trend_line(numeric_dates),
         color='red', label='Trend Line')

# Show the legend
plt.legend()

plt.ylabel('Diference between max and min SSS (g/kg)')
plt.xlabel('Years')

# Display the plot
plt.savefig('filename2.png', dpi=600)
plt.show()

with open('data.csv', 'w', newline='') as file:
    # Step 4: Using csv.writer to write the list to the CSV file
    writer = csv.writer(file)
    writer.writerow(dates_values) # Use writerow for single list
    writer.writerow(minimals) # Use writerow for single list
    writer.writerow(maximals) # Use writerow for single list
    writer.writerow(difference) # Use writerow for single list

numeric_dates = date2num(dates_values)
date_plus_agenda = np.append(numeric_dates, date2num(datetime(2050, 1, 1)))
date_plus_agenda = list(date_plus_agenda)
del date_plus_agenda[248]
difference = np.array(maximals) - np.array(minimals)
difference_plus_agenda = np.append(difference, 39.320752)

# Scatter plot
plt.scatter(date_plus_agenda, difference_plus_agenda, label='Data')

# Add a trend line
coefficients = np.polyfit(numeric_dates, difference_plus_agenda, 1)
trend_line = np.poly1d(coefficients)
plt.plot(date_plus_agenda, trend_line(date_plus_agenda),
         color='red', label='Trend Line')

# Show the legend
plt.legend()

plt.ylabel('Diference between max and min SSS (g/kg)')
plt.xlabel('Years')

def objective(x, a, b, c, d):
 return a * np.sin(b - x/200) + c * x**2 + d


# choose the input and output variables
x, y = date2num(dates_values), difference
# curve fit
popt, _ = curve_fit(objective, x, y)
# summarize the parameter values
a, b, c, d = popt
print(popt)
# plot input vs output
plt.scatter(x, y)
# define a sequence of inputs between the smallest and largest known inputs
x_line = np.arange(min(x), max(x), 1)
# calculate the output for the range
y_line = objective(x_line, a, b, c, d)
# create a line plot for the mapping function
plt.plot(x_line, y_line, '--', color='red')
plt.plot(num2date(numeric_dates), trend_line(numeric_dates),
         color='green', label='Trend Line')
plt.ylabel('Diference between max and min SSS (g/kg)')
plt.xlabel('Years')
plt.ylim([35, 41])
plt.show()
```



2010-2020

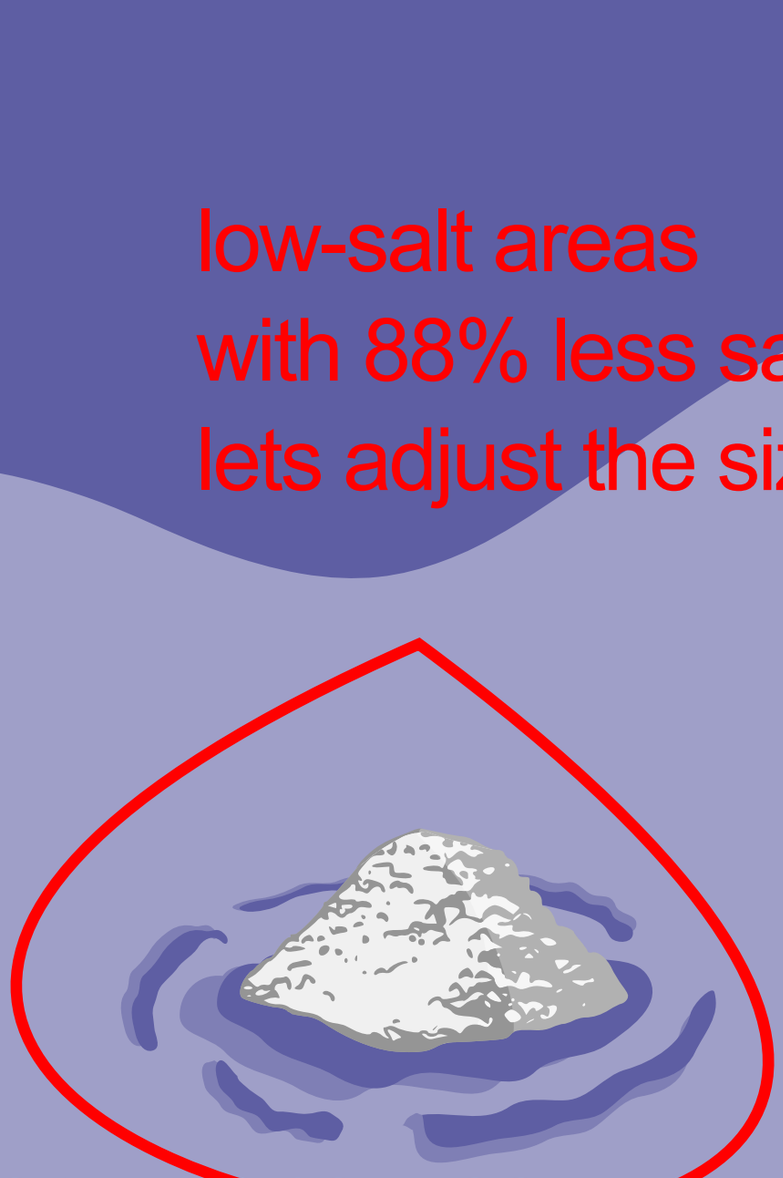
sea surface salinity contrast

2010-2020

sea surface salinity contrast

2010-2020

low-salt areas
with 88% less salinity,
lets adjust the sizes:



164px*0.12 = 20 px

size of the figure: 164px

sea surface salinity contrast

2010-2020

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