close all

clear

clc

oldpath=cd;

cd '\\hjemme.uib.no\cba063\Settings\Desktop\Station Labelling-Stage 2\FIXED STATION\Paloma-IT\Oxygen';

%% Load in situ data from text file

%[Station,Cond,Temp,Sal,Pres,Den,PotDen,SWTemp,DOml\_l,DOumol\_kg,a,DOumol\_l,flag]

fid=fopen('Paloma March through Nov 2017 Oxygen2.txt');

a=textscan(fid,'%s %s %s %f %f %f %f %f %f %f %f %f %f %f %u');

sts=fclose(fid);

c=datevec(char(a{3}), 'HH:MM:SS');

time=[c(:,4) c(:,5) c(:,6)]; %getting the proper time in HH MM SS

Decimal\_time=time(:,1)/24+time(:,2)/60/24+time(:,3)/60/60/24;

Sal=a{6}; %Salinity, PSU

Temp=a{5}; %Temperature, C

Press=a{7}; %Pressure, dbar

date=a{2};

date2=datenum(date, 'mm/dd/yyyy');

date3=datetime(date2+Decimal\_time,'ConvertFrom','datenum');

clear c

oxygen=a{14}; %oxygen data in umol/l

%% Load Winkler data from excel

[num, txt, raw]=xlsread('PALOMA DO winkler 2017.xlsx','A5:H36');

Date\_winkler=datenum(char(txt(:,1)), 'dd.mm.yyyy');

Date\_winkler2\_1=datetime(num(:,1)+num(:,2),'ConvertFrom','excel'); %Date and start time

Date\_winkler2\_2=datetime(num(:,1)+num(:,3),'ConvertFrom','excel'); %Date and end time

Date\_winkler2\_3=[Date\_winkler2\_1 Date\_winkler2\_2];

Date\_winkler2=datetime(num(:,1)+(num(:,2)+num(:,3))/2,'ConvertFrom','excel'); %Date and midpoint

Date\_winkler3\_1=datenum(Date\_winkler2\_1);

Date\_winkler3\_2=datenum(Date\_winkler2\_2);

Date\_winkler3=datenum(Date\_winkler2);

oxygen\_winkler=num(:,7); %Winkler oxygen data in umol/l

%% Plot data

figure

plot(date3,oxygen,'\*')

grid on

hold on

plot(Date\_winkler2,oxygen\_winkler,'ro', 'MarkerFaceColor', 'r', 'MarkerEdgeColor', 'k')

hold off

xlim([min(date3)-10 max(date3)+10]);

%% Check for linear drift

%Determine residuals

drift\_date=[];

drift=[];

index=find(Date\_winkler2>min(date3) & Date\_winkler2<max(date3));

for i=1:length(Date\_winkler3(index));

cp\_check=find(date3>Date\_winkler2\_1(index(i)) & date3<Date\_winkler2\_2(index(i))); %find in situ points closest to Winkler titration

drift\_date=[drift\_date; Date\_winkler2(index(i)) mean(date3(cp\_check)) Date\_winkler2\_1(index(i)) Date\_winkler2\_2(index(i))];

drift=[drift; mean(oxygen(cp\_check))-oxygen\_winkler(index(i)) Date\_winkler3(index(i))/10^5 mean(date2(cp\_check))/10^5 length(cp\_check) mean(Sal(cp\_check)) mean(Temp(cp\_check)) mean(Press(cp\_check)) std(oxygen(cp\_check)) std(Sal(cp\_check)) std(Temp(cp\_check)) std(Press(cp\_check))];

end

%Drift(:,2) is the residuals of in situ – winkler titrations

%Mean of sets of residuals

drift\_date2=[mean(drift\_date([1,2,3])); mean(drift\_date([4,5,6]));...

mean(drift\_date([7,8,9])); mean(drift\_date([10,11,12]));...

mean(drift\_date([13,14,15])); mean(drift\_date([16,17]))];

drift2=[mean(drift([1,2,3])); mean(drift([4,5,6]));...

mean(drift([7,8,9])); mean(drift([10,11,12]));mean(drift([13,14,15])); mean(drift([16,17]))];

mdl2=fitlm(drift(:,2)\*10^5-min(drift(:,2))\*10^5, drift(:,1)) %single linear regression

x=[ones(size(drift(:,1))) drift(:,5) (drift(:,6)+273.15) drift(:,7)]; %Sal, Temp, Press respectively for MLR

x2=[drift(:,5) (drift(:,6)+273.15) drift(:,7)];

multiple\_LR=regress(drift(:,1),x) %Multiple linear regression

multiple\_LR2=fitlm(x2,drift(:,1),'linear') %Multiple linear regression with analytics

%Plot residuals and average residuals

figure

plot(drift\_date(:,1), drift(:,1),'ro')

hold on

plot(drift\_date2(:,1), drift2(:,1),'go-')

hold off

%Plot residuals and SLR

figure

plot(drift(:,2)\*10^5-min(drift(:,2))\*10^5, drift(:,1),'ro')

hold on

plot(drift(:,2)\*10^5-min(drift(:,2))\*10^5, -0.017372\*(drift(:,2)\*10^5-min(drift(:,2))\*10^5)-2.9239, 'k-')

hold off

%% Plot in situ data with winkler titrations and corrections using SLR and MLR

%Try Multiple Linear regression (Sal, Temp, Press) correction with in situ oxygen data

figure

subplot(3,1,1)

%subplot(2,1,1)

plot(date3,oxygen,'g\*')

hold on

grid on

plot(Date\_winkler2,oxygen\_winkler,'ro','MarkerFaceColor', 'r', 'MarkerEdgeColor', 'k')

hold off

set(gca,'fontsize',20)

ylabel('Oxygen Concentratin (\mumol/L)')

legend('In-situ Oxygen (\mumol/L)','Winkler Oxygen (\mumol/L)')

text(min(date3)-5,290,'a)','FontSize',22)

xlim([min(date3)-10 max(date3)+10]);

subplot(3,1,2)

%subplot(2,1,2)

plot(date3,oxygen,'g\*')

hold on

grid on

plot(date3,oxygen-multiple\_LR(1)-multiple\_LR(2)\*Sal-multiple\_LR(3)\*(Temp+273.15)-multiple\_LR(4)\*Press,'\*')

plot(Date\_winkler2,oxygen\_winkler,'ro','MarkerFaceColor', 'r', 'MarkerEdgeColor', 'k')

hold off

set(gca,'fontsize',20)

ylabel('Oxygen Concentratin (\mumol/L)')

legend('In-situ Oxygen (\mumol/L)','MLR Corrected In-situ Oxygen (\mumol/L)','Winkler Oxygen (\mumol/L)')

text(min(date3)-5,290,'b)','FontSize',22)

xlim([min(date3)-10 max(date3)+10]);

subplot(3,1,3)

plot(date3,oxygen,'g\*')

hold on

grid on

plot(date3,oxygen+0.017372\*(date2-min(date2))+2.9239,'\*')

plot(Date\_winkler2,oxygen\_winkler,'ro','MarkerFaceColor', 'r', 'MarkerEdgeColor', 'k')

hold off

set(gca,'fontsize',20)

ylabel('Oxygen Concentratin (\mumol/L)')

legend('In-situ Oxygen (\mumol/L)','LR Corrected In-situ Oxygen (\mumol/L)','Winkler Oxygen (\mumol/L)')

xlim([min(date3)-10 max(date3)+10]);

%% Check for new Residuals-same process as above but using corrected in situ data

%MLR residual

MLR\_oxygen=oxygen-(multiple\_LR(1)+multiple\_LR(2)\*Sal+multiple\_LR(3)\*(Temp+273.15)+multiple\_LR(4)\*Press);

MLR\_drift\_date=[];

MLR\_drift=[];

index=find(Date\_winkler2>min(date3) & Date\_winkler2<max(date3));

for i=1:length(Date\_winkler3(index));

cp\_check=find(date3>Date\_winkler2\_1(index(i)) & date3<Date\_winkler2\_2(index(i)));

MLR\_drift\_date=[MLR\_drift\_date; Date\_winkler2(index(i)) mean(date3(cp\_check))];

MLR\_drift=[MLR\_drift; mean(MLR\_oxygen(cp\_check))-oxygen\_winkler(index(i)) Date\_winkler3(index(i))/10^5 mean(date2(cp\_check))/10^5 length(cp\_check) mean(Sal(cp\_check)) mean(Temp(cp\_check)) mean(Press(cp\_check)) std(MLR\_oxygen(cp\_check))];

end

MLR\_drift\_date2=[mean(MLR\_drift\_date([1,2,3])); mean(MLR\_drift\_date([4,5,6]));...

mean(MLR\_drift\_date([7,8,9])); mean(MLR\_drift\_date([10,11,12]));...

mean(MLR\_drift\_date([13,14,15])); mean(MLR\_drift\_date([16,17]))];

MLR\_drift2=[mean(MLR\_drift([1,2,3])); mean(MLR\_drift([4,5,6]));...

mean(MLR\_drift([7,8,9])); mean(MLR\_drift([10,11,12]));mean(MLR\_drift([13,14,15])); mean(MLR\_drift([16,17]))];

%SLR residual

SLR\_oxygen=oxygen-(-0.017372\*(date2-min(date2))-2.9239);

SLR\_drift\_date=[];

SLR\_drift=[];

index=find(Date\_winkler2>min(date3) & Date\_winkler2<max(date3));

for i=1:length(Date\_winkler3(index));

x=abs(date3-Date\_winkler2(index(i)));

y=min(abs(date3-Date\_winkler2(index(i))));

cp\_check=find(x==y); %find point closest to Winkler titration

SLR\_drift\_date=[SLR\_drift\_date; Date\_winkler2(index(i)) date3(cp\_check)];

SLR\_drift=[SLR\_drift; SLR\_oxygen(cp\_check)-oxygen\_winkler(index(i)) Date\_winkler3(index(i))/10^5 date2(cp\_check)/10^5 length(cp\_check) Sal(cp\_check) Temp(cp\_check) Press(cp\_check)];

end

SLR\_drift\_date2=[mean(SLR\_drift\_date([1,2,3])); mean(SLR\_drift\_date([4,5,6]));...

mean(SLR\_drift\_date([7,8,9])); mean(SLR\_drift\_date([10,11,12]));...

mean(SLR\_drift\_date([13,14,15])); mean(SLR\_drift\_date([16,17]))];

SLR\_drift2=[mean(SLR\_drift([1,2,3])); mean(SLR\_drift([4,5,6]));...

mean(SLR\_drift([7,8,9])); mean(SLR\_drift([10,11,12]));mean(SLR\_drift([13,14,15])); mean(SLR\_drift([16,17]))];

%Mean and stdev of offset, MLR correction, and SLR correction

Offset\_mean=mean(drift(:,1));

Offset\_stdev=std(drift(:,1)-Offset\_mean);

MLR\_mean=mean(MLR\_drift(:,1));

MLR\_stdev=std(MLR\_drift(:,1)-MLR\_mean);

SLR\_mean=mean(SLR\_drift(:,1));

SLR\_stdev=std(SLR\_drift(:,1)-SLR\_mean);

figure

subplot(3,1,1)

%subplot(2,1,1)

plot(drift\_date(:,1), drift(:,1),'ro')

hold on

grid on

plot(drift\_date2(:,1), drift2(:,1),'go-')

hold off

set(gca,'fontsize',20)

%title('In situ-Winkler Residuals')

ylabel('Residual (\mumol/L)')

text\_offset=['Mean=', num2str(Offset\_mean), ' \mumol/L'];

text\_offset2=['St Error=', num2str(Offset\_stdev/sqrt(length(drift))), ' \mumol/L'];

text(drift\_date(1),1.5,'a)','FontSize',22)

text(drift\_date(13), max(drift(:,1)), text\_offset,'FontSize',18)

text(drift\_date(13), max(drift(:,1))-1, text\_offset2,'FontSize',18)

subplot(3,1,2)

%subplot(2,1,2)

plot(MLR\_drift\_date(:,1), MLR\_drift(:,1),'ro')

hold on

grid on

plot(MLR\_drift\_date2(:,1), MLR\_drift2(:,1),'go-')

hold off

set(gca,'fontsize',20)

%title('MLR-Winkler Residuals')

ylabel('Residual (\mumol/L)')

%ylim([-5.5,5.5])

text\_offset=['Mean=', num2str(MLR\_mean), ' \mumol/L'];

text\_offset2=['St Error=', num2str(MLR\_stdev/sqrt(length(MLR\_drift))), ' \mumol/L'];

text(drift\_date(1),3.5,'b)','FontSize',22)

text(MLR\_drift\_date(13), max(MLR\_drift(:,1)), text\_offset,'FontSize',18)

text(MLR\_drift\_date(13), max(MLR\_drift(:,1))-1, text\_offset2,'FontSize',18)

subplot(3,1,3)

plot(SLR\_drift\_date(:,1), SLR\_drift(:,1),'ro')

hold on

grid on

plot(SLR\_drift\_date2(:,1), SLR\_drift2(:,1),'go-')

hold off

set(gca,'fontsize',20)

%title('SLR-Winkler Residuals')

ylabel('Residual (\mumol/L)')

text\_offset=['Mean=', num2str(SLR\_mean), ' \mumol/L'];

text\_offset2=['St Error=', num2str(SLR\_stdev/sqrt(length(SLR\_drift))), ' \mumol/L'];

text(SLR\_drift\_date(13), max(SLR\_drift(:,1)), text\_offset,'FontSize',18)

text(SLR\_drift\_date(13), max(SLR\_drift(:,1))-1, text\_offset2,'FontSize',18)

cd(oldpath);